Initial Environmental Examination

DRAFT

Project Number: 57232-01
20 May, 2025

Volume 1: Main Report
Final Draft

BAN: Power Transmission Strengthening and Integration of Renewable Energy (PTSIRE) Project

Prepared by Power Grid Company of Bangladesh for the Asian Development Bank.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

This initial environmental examination is a document of the borrower. The views expressed herein do not necessarily represent those of ADB's Board of Directors, Management, or staff, and may be preliminary in nature. Your attention is directed to the "terms of use" section on ADB's website.

In preparing any country program or strategy, financing any project, or by making any designation of or reference to a particular territory or geographic area in this document, the Asian Development Bank does not intend to make any judgments as to the legal or other status of any territory or area.

The document uses the former name and logo of Power Grid Bangladesh PLC (formerly known as Power Grid Company of Bangladesh-PGCB).

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH
MINISTRY OF POWER ENERGY AND MINERAL RESOURCES
POWER GRID COMPANY OF BANGLADESH LIMITED (PGCB)

FINAL REPORT

INITIAL ENVIRONMENTAL EXAMINATION (IEE) REPORT

for

"Power Transmission Strengthening & Integration of Renewable Energy (PTSIRE)" Project

FUNDED BY

ASIAN DEVELOPMENT BANK

SUBMITTED BY

JOINT VENTURE (JV) OF	
TECVY ENERGY LIMITED	FEEDBACK INFRA Making Infrastructure Happen
1.1 Tecvy Energy Limited 26, 27, 27/1, Green City Regency (4th Floor) Kakrail, Dhaka-1217, Bangladesh. +88 02 48317629 tecvyenergyltd@gmail.com www.tecvyenergy.com	• **Feedback Infra Private Limited (FIPL)** 77A, 1st Floor, Tower East, Sector 18, IFFCO Road, Gurugram- 122015 Haryana, India. +91 124 416 9100 biradha.rao@feedbackinfra.com www.feedbackinfra.com

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Table of Contents

EXECUTIVE SUMMARY XVII

1 INTRODUCTION 1

1.1 BACKGROUND OF THE PROJECT 1
1.2 OBJECTIVES OF THE PROJECT 2
1.3 SCOPE OF WORK FOR THE PROJECT 3
1.4 OBJECTIVES OF THE EIA/IEE 4
1.5 CATEGORY OF THE PROJECT 4
1.6 EIA/IEE STUDY TEAM 5
1.7 STRUCTURE OF THE EIA/IEE REPORT 6

2 LEGISLATIVE AND ADMINISTRATIVE FRAMEWORK 8

2.1 INTRODUCTION 8
2.2 ENVIRONMENTAL LEGISLATION FRAMEWORK 8
2.2.1 OVERVIEW OF THE ENVIRONMENTAL APPROVAL PROCESS 8
2.2.2 PROCEDURE FOR OBTAINING SITE CLEARANCE CERTIFICATE AND ENVIRONMENTAL CLEARANCE CERTIFICATE 9
2.2.3 GOVERNMENT ENVIRONMENTAL CATEGORIZATION 11
2.3 PROCEDURE FOR NO OBJECTION CERTIFICATE 12
2.4 ENVIRONMENTAL STANDARDS 14
2.5 ORGANIZATIONS RELATED TO ENFORCEMENT OF ENVIRONMENTAL, HEALTH AND SAFETY LEGISLATION 15
2.6 NATIONAL LEGISLATIONS RELEVANT TO ENVIRONMENT 16
2.7 NATIONAL LEGISLATIONS RELEVANT TO HEALTH AND SAFETY 28
2.8 ADB'S SAFEGUARD POLICY STATEMENT, 2009 30
2.8.1 ADB'S ENVIRONMENTAL SAFEGUARDS REQUIREMENTS 33
2.9 COMPLIANCE WITH PGCB HEALTH ENVIRONMENT AND SAFETY REQUIREMENTS 37
2.10 COMPARISON OF ENVIRONMENTAL SAFEGUARD PRINCIPLES BETWEEN ADB AND BANGLADESH 37
2.11 INTERNATIONAL AND REGIONAL TREATIES, AGREEMENTS AND CONVENTIONS 41
2.11.1 INTERNATIONAL BEST PRACTICE EQUIVALENCE 42

3 IEE APPROACH AND METHODOLOGY 43

3.1 APPROACH 43
3.2 METHODOLOGY 43
3.2.1 STEP 1: PROJECT DESIGN AND DESCRIPTION 44
3.2.2 STEP 2: ENVIRONMENTAL AND SOCIAL BASELINE 44
3.2.3 STEP 3: SCOPING 46
3.2.4 STEP 4: BOUNDING 46
3.2.5 STEP 5: MAJOR FIELD INVESTIGATION 46
3.2.6 STEP 6: ENVIRONMENT AND SOCIAL IMPACT ASSESSMENT 46
3.2.7 STEP 7: IMPACT QUANTIFICATION AND EVALUATION 47
3.2.8 STEP 8: ENVIRONMENTAL MANAGEMENT PLAN 47
3.2.9 STEP 9: PREPARATION OF EIA/IEE REPORT 47

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

3.3 ZONE OF INFLUENCE 47

4 DESCRIPTION OF THE PROJECT 49

4.1 PROJECT RATIONALE 49
4.2 TYPE OF PROJECT 50
4.3 MAJOR COMPONENTS OF THE PROJECT 50
4.3.1 COMPONENT 1 50
4.3.2 COMPONENT 2 50
4.4 PROJECT LOCATION 50
4.5 BRIEF SITE DESCRIPTION OF PROPOSED SUBSTATIONS AND BAY EXTENSION SITES 53
4.5.1 SALIENT FEATURES OF SUBSTATIONS 53
4.5.2 SALIENT FEATURES OF BAY EXTENSION 68
4.6 PHYSICAL FEATURES OF THE TRANSMISSION LINES 71
4.7 DETAILED DESIGN AND CONSTRUCTION WORKS 71
4.7.1 CONSTRUCTION EQUIPMENT AND MATERIALS 71
4.7.2 TEMPORARY FACILITY LOCATIONS 71
4.7.3 SITE SURVEY 72
4.7.4 TEMPORARY FACILITIES ESTABLISHMENT 73
4.7.5 CONSTRUCTION MANPOWER 75
4.7.6 DETAILED DESIGN AND CONSTRUCTION WORKS FOR SUBSTATIONS AND BAY EXTENSIONS 75
4.7.7 DETAILED DESIGN AND CONSTRUCTION WORKS FOR TRANSMISSION LINES 75
4.8 WORK SCHEDULE 76
4.9 MATERIALS/EQUIPMENT 80
4.9.1 CONSTRUCTION EQUIPMENT 80
4.9.2 CONSTRUCTION MATERIAL TRANSPORT 80
4.9.3 HAZARDOUS MATERIALS AND CONSTRUCTION WASTE 80
4.10 CONSTRUCTION ACTIVITIES 80
4.10.1 CONSTRUCTION OF SUBSTATIONS AND BAY EXTENSIONS 80
4.10.2 CONSTRUCTION WORK FOR TRANSMISSION LINES 84
4.10.3 TESTING AND COMMISSIONING OF EQUIPMENT 85
4.10.4 REINSTATING THE SITE 85
4.11 OPERATION AND MAINTENANCE OF SUBSTATIONS AND TRANSMISSION LINES 85
4.12 EXISTING AND ASSOCIATED FACILITIES 86
4.13 ESTIMATED COST OF THE PROJECT 89
MILLION USD 89

5 ENVIRONMENTAL AND SOCIAL BASELINE 90

5.1 INTRODUCTION 90
5.2 LOCATION SETTING AND EXTENT 90
5.3 PHYSICAL ENVIRONMENT 91
5.3.1 GEOLOGY AND SOIL 91
5.3.2 TOPOGRAPHY 94
5.3.3 MORPHOLOGICAL STUDY 95
5.3.4 METEOROLOGY 98
5.3.5 NATURAL HAZARDS (GEOLOGICAL AND CLIMATE) 117
5.3.6 WATER RESOURCES 124
5.3.7 ENVIRONMENTAL QUALITY 128
5.3.8 AGRICULTURE RESOURCES 151
5.4 BIOLOGICAL ENVIRONMENT 161
5.4.1 BIO-ECOLOGICAL ZONE 161
5.4.2 FORESTS AND LAND COVER 163

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

5.4.3 Biodiversity in the Project Areas 166
5.4.4 Diversity of Terrestrial and Aquatic Flora 167
5.4.5 Biodiversity/Environmentally Sensitive Areas 194
5.4.6 Ecologically Critical Area 198
5.4.7 ADB Defined Natural and Critical Habitat 198
5.5 Social Baseline 199
5.5.1 Administrative Bounding of the Study Area 199
5.5.2 Households and Population 201
5.5.3 Household Size 201
5.5.4 Age Composition 201
5.5.5 Dependency Ratio 202
5.5.6 Sex Profile of Affected HHs 202
5.5.7 Population by Religion 202
5.5.8 Education Level of Affected Population (7 Years and above) 202
5.5.9 Primary Occupation of Affected Population 203
5.5.10 Income Level of Affected Populations 203
5.5.11 Marital Status of Affected Population 204
5.5.12 Housing Infrastructure 204
5.5.13 Household Amenities 205
5.5.14 Household Assets 205
5.5.15 Land Ownership 206
5.5.16 Government Assistance 206
5.5.17 Foreign Remittance 207
5.5.18 Indebtedness 207
5.5.19 Health and Services 208
5.5.20 Energy Use 208
5.5.21 Indigenous Peoples/ Ethnic minorities 209
5.6 Sensitive Features Surrounding 10 Substations (5 km Radius) 209
5.6.1 400/230/132 kV AIS: Pekua/ Chakaria, Cox's Bazar 209
5.6.2 230/132/33 kV AIS: Madhabpur, Habiganj 210
5.6.3 230/132/33 kV AIS: Monohardi, Narshingdi 211
5.6.4 132/33 kV AIS: Tungipara, Gopalganj 212
5.6.5 132/33 kV AIS: Dupchanchia, Bogura 213
5.6.6 132/33 kV AIS: Matlab (N), Chandpur 213
5.6.7 132/33 kV AIS: Kumarkhali, Kushtia 214
5.6.8 132/33 kV AIS: Chatkhil, Noakhali 214
5.6.9 132/33 kV AIS: Paikgacha, Khulna 215
5.6.10 132/33 kV AIS: Mathbaria, Pirojpur 216
5.6.11 Proximity of Project to Sensitive Receptors 216

6 SUBSTATION ENVIRONMENTAL AUDITS 221

6.1 Introduction 221
6.2 Environmental Audit Requirements 221
6.3 Audit Methodology for Existing Substations 221
6.4 PGCB Substation Setting 222
6.5 Audit Report 225
6.6 Key Findings of Audit 230
6.7 Conclusions of Environmental Audit 230
6.8 Corrective Action Plan with Time Frame 231
6.9 Budget 239

7 ALTERNATIVE ANALYSES 240

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

7.1 INTRODUCTION 240
7.1.1 NO PROJECT SCENARIO 240
7.2 ALTERNATIVES FOR SUBPROJECT COMPONENTS 240
7.2.1 TRANSMISSION LINES 240
7.2.2 SUBSTATIONS 241
7.2.3 ALTERNATIVE TECHNOLOGIES FOR SUBSTATIONS 242
7.2.4 ALTERNATIVES FOR TRANSMISSION LINES 244
7.3 SUBSTATION LOCATION ALTERNATIVES 246
7.3.1 PEKUA 400/230/132KV SUBSTATION 246
7.3.2 MADHABPUR 230/132/33 KV SUBSTATION 249
7.3.3 MONOHARDI 230/132/33 KV SUBSTATION 252
7.3.4 TUNGIPARA 132/33 KV SUBSTATION 255
7.3.5 DUPCHANCHIA 132/33 KV SUBSTATION 258
7.3.6 MATLAB NORTH 132/33 KV SUBSTATION 261
7.3.7 KUMARKHALI 132/33 KV SUBSTATION 264
7.3.8 CHATKHIL 132/33 KV SUBSTATION 267
7.3.9 PAIKGACHA 132/33 KV SUBSTATION 270
7.3.10 MATHBARIA 132/33 KV SUBSTATION 271
7.4 ALTERNATIVES OF TRANSMISSION LINE ROUTES 274
7.4.1 ALTERNATIVE ROUTES FOR LILO OF MATARBARI PP – BANSKHALI PP 400KV LINE AT PEKUA TRANSMISSION LINE 275
7.4.2 ALTERNATIVE ROUTES FOR LILO OF ANWARA-COX'S BAZAR 230KV LINE AT PEKUA TRANSMISSION LINE 277
7.4.3 ALTERNATIVE ROUTES FOR LILO OF EXISTING MATARBARI – CHAKARIA 132KV LINE AT PEKUA TRANSMISSION LINE 278
7.4.4 ALTERNATIVE ROUTES FOR LILO OF SRIPUR-ASHUGANJ 230KV DOUBLE CIRCUIT LINE AT MONOHARDI TRANSMISSION LINE 280
7.4.5 ALTERNATIVE ROUTES FOR LILO OF CUMILLA(N) – SHAHJIBAZAR PP 230KV DOUBLE CIRCUIT LINE AT MADHABPUR TRANSMISSION LINE 281
7.4.6 ALTERNATIVE ROUTES FOR MONOHARDI-BAJITPUR 132KV DOUBLE CIRCUIT LINE TRANSMISSION LINE 283
7.4.7 ALTERNATIVE ROUTES FOR LILO OF SHAHJIBAZAR – BRAHMANBARIA 132KV DOUBLE CIRCUIT LINE AT MADHABPUR TRANSMISSION LINE 284
7.4.8 ALTERNATIVE ROUTES FOR GOPALGANJ-TUNGIPARA 132KV DOUBLE CIRCUIT LINE TRANSMISSION LINE 286
7.4.9 ALTERNATIVE ROUTES SATKHIRA-PAIKGACHA 132KV DOUBLE CIRCUIT LINE TRANSMISSION LINE 287
7.4.10 ALTERNATIVE ROUTES FOR KACHUA- MATLAB NORTH 132KV DOUBLE CIRCUIT LINE TRANSMISSION LINE 290
7.4.11 ALTERNATIVE ROUTES FOR LILO OF CHOWMUHANI-RAMGANJ 132KV DOUBLE CIRCUIT LINE AT CHATKHIL TRANSMISSION LINE 291
7.4.12 ALTERNATIVE ROUTES FOR LILO OF BOGURA(S)-NAOGAON 132KV LINE AT DUPCHANCHIA TRANSMISSION LINE 293
7.4.13 ALTERNATIVE ROUTES FOR LILO OF BHERAMARA – RAJBARI 132KV LINE AT KUMARKHALI TRANSMISSION LINE 294
7.4.14 ALTERNATIVE ROUTES FOR BHANDARIA- MATHABARIA 132KV DOUBLE CIRCUIT LINE TRANSMISSION LINE 297

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

7.4.15 RECONDUCTORING OF SHAHJIBAZAR-BRAHMANBARIA-ASHUGANJ DOUBLE CIRCUIT 132KV LINE 298

8 IMPORTANT ENVIRONMENTAL AND SOCIAL COMPONENTS 300

8.1 OVERVIEW 300
8.2 IESCS RELATED TO THE PROJECT AND THEIR RELATION 300

9 POTENTIAL IMPACT PREDICTION AND ANALYSIS 302

9.1 SCOPE OF THE ASSESSMENT 302
9.2 IMPACT ASSESSMENT METHODOLOGY 302
9.2.1 PROJECT ASPECTS 303
9.2.2 IDENTIFICATION OF SENSITIVE RECEPTORS 303
9.2.3 IDENTIFICATION OF SIGNIFICANT ENVIRONMENTAL 303
9.2.4 IMPACT SIGNIFICANCE RATING 305
9.2.5 MITIGATION, MANAGEMENT AND GOOD PRACTICE MEASURES 307
9.2.6 RESIDUAL IMPACTS 307
9.3 IMPACT ASSESSMENT AND MITIGATION MEASURES 307
9.3.1 PHYSICAL ENVIRONMENT 307
9.3.2 ECOLOGICAL ENVIRONMENT 332
9.3.3 SOCIO-ECONOMIC ENVIRONMENT 347
9.4 IMPACT MATRIX 366
9.5 CUMULATIVE AND INDUCED IMPACTS 384
9.5.1 CUMULATIVE IMPACT ON BIODIVERSITY 384
9.5.2 CUMULATIVE IMPACT ON ELECTRICITY SUPPLY 384
9.5.3 CUMULATIVE IMPACT OF RENEWABLE ENERGY INTEGRATION 385
9.6 TRANSBOUNDARY IMPACTS 389

10 STAKEHOLDER CONSULTATIONS 390

10.1 INTRODUCTION 390
10.2 REGULATORY/ REQUIREMENTS 390
10.2.1 BANGLADESH GUIDELINES 390
10.2.2 ASIAN DEVELOPMENT BANK REQUIREMENTS 390
10.3 OBJECTIVES AND PURPOSE OF STAKEHOLDER CONSULTATION 391
10.4 IDENTIFICATION OF STAKEHOLDERS 391
10.5 APPROACHES AND METHODOLOGY 391
10.6 MEANINGFUL STAKEHOLDER CONSULTATIONS 392
10.7 CONSULTATION DETAILS AND SUMMARIES 393
10.8 ISSUES IDENTIFIED AND SUGGESTED MEASURES THROUGH CONSULTATION 396
10.8.1 STAKEHOLDER CONSULTATION MEETINGS (SCM) 396
10.8.2 FOCUS GROUP DISCUSSIONS (FGDS) 400
10.8.3 KEY INFORMANT INTERVIEWS (KII) 405
10.8.4 PUBLIC CONSULTATION MEETING (PCM) 411
10.9 POSITIVE PERCEPTIONS 415
10.10 CONSULTATION OUTCOMES AND POLICY ISSUES 415
10.11 CONSULTATION AND PARTICIPATION DURING PROJECT IMPLEMENTATION 416
10.12 INFORMATION DISCLOSURE 416
10.12.1 ROLE OF ESU AND SIC IN DISCLOSURE OF PROJECT INFORMATION 417

11 GRIEVANCE REDRESS MECHANISM 418

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

11.1 INTRODUCTION 418
11.2 GRIEVANCE REDRESS MECHANISM 418
11.2.1 BACKGROUND: 418
11.2.2 PROJECT PROPONENT'S ROLE 419
11.3 OBJECTIVES OF GRIEVANCE REDRESS MECHANISM 419
11.3.1 GUIDELINES TO REDRESS GRIEVANCES 419
11.4 GRIEVANCES REDRESS COMMITTEES 420
11.4.1 LOCAL-LEVEL GRC 420
11.4.2 PROJECT-LEVEL GRC 422
11.4.3 CENTRAL-LEVEL GRC 422
11.5 GRIEVANCES RESOLUTION PROCESS 423
11.6 GRC'S SCOPE OF OPERATIONS AND DECISION REQUIREMENTS 424
11.7 PROCESSES FOR FILING GRIEVANCE CASES 424
11.8 GRIEVANCE REDRESS DOCUMENTATION AND MONITORING 425
11.9 APPROVAL OF GRCS AND ENTITLEMENTS OF GRC MEMBERS 427
11.10 GRIEVANCE REDRESS MONITORING 428

12 ENVIRONMENTAL MANAGEMENT PLAN 429

12.1 INTRODUCTION 429
12.2 EMP STRUCTURE 431
12.3 POTENTIAL IMPACTS AND RISKS 433
12.4 EXISTING FACILITY CORRECTIVE ACTION PLAN 433
12.5 CONTRACTORS SITE-SPECIFIC ENVIRONMENTAL MANAGEMENT PLANS (CSEMPS) 442
12.6 ENVIRONMENTAL CODES OF PRACTICE (ECPS) 447
12.7 ENVIRONMENTAL MITIGATION PLAN 447
12.7.1 PART 1 – GENERAL MITIGATION 449
12.7.2 PART 2 – NEW SUBSTATIONS AND BAY EXTENSIONS 483
12.7.3 PART 3 – TRANSMISSION LINES 579
12.8 ENVIRONMENTAL MONITORING PLAN (EMOP) 614
12.8.1 PART 1 – GENERAL (ALL WORKS) 615
12.8.2 PART 2 – NEW SUBSTATIONS AND BAY EXTENSIONS AT EXISTING SUBSTATIONS 620
12.8.3 PART 3- TRANSMISSION LINES/LILO LINES 634
12.9 SUPERVISION, MONITORING AND REPORTING ARRANGEMENTS 646
12.10 IMPLEMENTATION ARRANGEMENTS 649
12.10.1 GOVERNMENT OF BANGLADESH 649
12.10.2 PGCB'S MANAGEMENT, PMU, AND O&M STAFF 649
12.10.3 PGCB'S ENVIRONMENT AND SOCIAL UNIT (ESU) 649
12.10.4 SAFEGUARDS IMPLEMENTATION CONSULTANT (SIC) 650
12.10.5 CONTRACTOR AND SUBCONTRACTORS (IF ANY) 651
12.10.6 INSTITUTIONAL ARRANGEMENTS AND ROLES AND RESPONSIBILITIES 654
12.10.7 CAPACITY BUILDING AND TRAINING REQUIREMENT 660
12.10.8 IMPLEMENTATION SCHEDULE 663
12.10.9 COST ESTIMATE/EMP BUDGET 665

13 CONCLUSIONS AND RECOMMENDATIONS 666

13.1 CONCLUSION 666
13.2 RECOMMENDATIONS 669

List of Appendixes

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

In Volume 2.

List of Figures

Figure 2.1: Process for Getting Clearance Following the DoE Guidelines 12
Figure 2.2: Government of Bangladesh Environmental Assessment Process (as per ECR, 2023) 14
Figure 3.1: Steps for Initial Environmental Examination 44
Figure 4.1: Location Map of Proposed New AIS Substation 51
Figure 4.2: Locational Map of Proposed LILO/Transmission Line 52
Figure 5.3: Photographs of Proposed Pekua/Chakaria Substation Site (Dry Season) 58
Figure 4.4: Locational Map of Proposed Substation at Pekua 59
Figure 4.5: Photographs of Proposed Madhabpur Substation Site 59
Figure 4.6: Locational Map of Proposed Substation at Madhabpur 60
Figure 4.7: Photographs of Proposed Monohardi Substation Site 60
Figure 4.8: Locational Map of Proposed Substation at Monohardi 61
Figure 5.9: Photographs of Proposed Tungipara Substation Site 61
Figure 4.10: Locational Map of Proposed Substation at Tungipara 62
Figure 4.11: Photographs of Proposed Dupchanchia Substation Site 62
Figure 4.12: Locational Map of Proposed Substation at Dupchanchia 63
Figure 4.13: Photographs of Proposed Matlab Uttar Substation Site 63
Figure 4.14: Locational Map of Proposed Substation at Matlab Uttar 64
Figure 4.15: Photographs of Proposed Kumarkhali Substation Site 64
Figure 4.16: Locational Map of Proposed Substation at Kushtia 65
Figure 4.17: Photographs of Proposed Chatkhil Substation Site 65
Figure 4.18: Locational Map of Proposed Substation at Chatkhil 66
Figure 4.19: Photographs of Proposed Paikgacha Substation Site 66
Figure 4.20: Locational Map of Proposed Substation at Paikgacha 67
Figure 4.21: Photographs of Proposed Mathbaria Substation Site 67
Figure 4.22: Locational Map of Proposed Substation at Mathbaria 68
Figure 4.23: Location Map of Proposed Bay Extension Substations 70
Figure 5.24 : Location map of RE facilities and Pekua substation and lines 89
Figure 5.1: Precipitation Map of Bangladesh 99
Figure 5.2: Average Monthly Rainfall in a Year from 2011-2023 in Cox's Bazar 100
Figure 5.3: Average Monthly Rainfall in a Year from 2011-2023 in Habiganj 100
Figure 5.4: Average Monthly Rainfall in a Year from 2011-2023 in Narsinghdi 101
Figure 5.5: Average Monthly Rainfall in a Year from 2011-2023 in Gopalganj 101
Figure 5.6: Average Monthly Rainfall in a Year from 2011-2023 in Bogura 101
Figure 5.7: Average Monthly Rainfall in a Year from 2011-2023 in Chandpur 102
Figure 5.8: Average Monthly Rainfall in a Year from 2011-2023 in Kushtia 102
Figure 5.9: Average Monthly Rainfall in a Year from 2011-2023 in Naokhali 102
Figure 5.10: Average Monthly Rainfall in a Year from 2011-2023 in Khulna 103
Figure 5.11: Average Monthly Rainfall in a Year from 2011-2023 in Pirojpur 103
Figure 5.12: Average Monthly Rainfall in a Year from 2011-2023 in Kishoreganj 104
Figure 5.13: Average Monthly Rainfall in a Year from 2011-2023 in Brahmanbaria 104
Figure 5.14: Average Monthly Rainfall in a Year from 2011-2023 in Satkhira 105
Figure 5.15: Monthly (Maximum, Minimum, Average) Temperature (°C) in a Year from 2011-2023 in Cox's Bazar 106
Figure 5.16: Monthly (Maximum, Minimum, Average) Temperature (°C) in a Year from 2011-2023 in Habiganj 106
Figure 5.17: Monthly (Maximum, Minimum, Average) Temperature (°C) in a year from 2011-2023 in Narsinghdi 107
Figure 5.18: Monthly (Maximum, Minimum, Average) Temperature (°C) in a year from 2011-2023 in Gopalganj 107
Figure 5.19: Monthly (Maximum, Minimum, Average) Temperature (°C) in a year from 2011-2023 in Bogura 108
Figure 5.20: Monthly (Maximum, Minimum, Average) Temperature (°C) in a Year from 2011-2023 in Chandpur 108

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Figure 5.21: Monthly (Maximum, Minimum, Average) Temperature (°C) in a Year from 2011-2023 in Kushtia 109
Figure 5.22: Monthly (Maximum, Minimum, Average) Temperature (°C) in a Year from 2011-2023 in Noakhali 109
Figure 5.23: Monthly (Maximum, Minimum, Average) Temperature (°C) in a Year from 2011-2023 in Khulna 110
Figure 5.24: Monthly (Maximum, Minimum, Average) Temperature (°C) in a Year from 2011-2023 in Pirojpur 110
Figure 5.25: Monthly (Maximum, Minimum, Average) Temperature (°C) in a Year from 2011-2023 in Kishoreganj 111
Figure 5.26: Monthly (Maximum, Minimum, Average) Temperature (°C) in a Year from 2011-2023 in Brahmanbaria 111
Figure 5.27: Monthly (Maximum, Minimum, Average) Temperature (°C) in a Year from 2011-2023 in Satkhira 112
Figure 5.28: Temperature Map of Bangladesh 113
Figure 5.29: Humidity Map of Bangladesh 114
Figure 5.30: Wind Speed Map of Bangladesh 116
Figure 5.31: Seismic Zoning Map of Bangladesh Represents the Project Areas 118
Figure 5.32: Flood Hazard Map of Bangladesh Represents the Project Areas 121
Figure 5.33: Drought Map of Bangladesh Represents the Project Areas 123
Figure 5.34: Agro-ecological Zones Map of Bangladesh Represents the Project Areas 152
Figure 5.35: Bio-ecological Zones of Bangladesh 162
Figure 6.36: Bangladesh Forestry Inventory 165
Figure 5.37: Terrestrial Flora Around the Project Area 176
Figure 5.38: Aquatic Flora Around the Project Areas 176
Figure 5.39: Terrestrial Fauna (Aves) Around the Project Area 188
Figure 5.40: Location and size of IBAs 196
Figure 5.41: Summary Multi-Site Report for Proposed Substations Location (Within 50 Km) 197
Figure 5.42: Administrative Bounding of Study Area 200
Figure 5.43: Google Earth Image of Pekua SS 210
Figure 5.44: Google Earth Image of Madhabpur SS 211
Figure 5.45: Google Earth Image of Monohardi SS 212
Figure 5.46: Google Earth Image of Tungipara SS 212
Figure 5.47: Google Earth Image of Dupchanchia SS 213
Figure 5.48: Google Earth Image of Matlab Uttar SS 214
Figure 5.49: Google Earth Image of Kumarkhali SS 214
Figure 5.50: Google Earth Image of Chatkhil SS 215
Figure 5.51: Google Earth Image of Paikgacha SS 216
Figure 5.52: Google Earth Image of Mathbaria SS 216
Figure 6.1: Location of Existing SS in the Bangladesh 224
Figure 7.1: Google Map Location for Alternative Routes for LILO Of Matarbari PP – Banskhali PP Transmission Line 277
Figure 7.2: Google Map Location for Alternative Routes for LILO of Anwara-Cox's Bazar 230kV Transmission Line 278
Figure 7.3: Google Map Location for Alternative Routes for LILO of Existing Matarbari – Chakaria 132kV Transmission Line 280
Figure 7.4: Google Map Location for Alternative Routes for LILO of Sripur-Ashuganj 230kV Double Transmission Line 281
Figure 7.5: Google Map Location for Alternative Routes for LILO of Cumilla(N) – Shahjibazar PP 230kV at Madhabpur Transmission Line 283
Figure 7.6: Google Map Location for Alternative Routes for Monohardi-Bajitpur 132kV Transmission Line 284
Figure 7.7: Google Map Location for Alternative Routes for LILO of Shahjibazar – Brahmanbaria 132kV at Madhabpur Transmission Line 286
Figure 7.8: Google Map Location for Alternative Routes for Gopalganj-Tungipara 132kV Transmission Line 287
Figure 7.9: Google Map Location for Alternative Routes for the Satkhira-Paikgacha 132kV Transmission Line 290
Figure 7.10: Google Map Location for Alternative Routes for Kachua- Matlab North Transmission Line 291

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Figure 7.11: Google Map Location for Alternative Routes for LILO of Chowmuhani-Chandpur 132 at Ramganj Transmission Line 293
Figure 7.12: Google Map Location for Alternative Routes for LILO of Bogura(S)-Naogaon 132kV Transmission Line 294
Figure 7.13: Google Map Location for Alternative Routes for LILO of Bheramara – Rajbari 132kV line at Kumarkhali Transmission Line 297
Figure 7.14: Google Map Location for Alternative Routes for Bhandaraia-Mathbaria 132 kV Transmission Line 298
Figure 9.1: Impact Assessment Process 302
Figure 9.2: Solar Potential Map of Bangladesh 385
Figure 9.3: Proposed Renewable Energy Power Plants at Chattogram Area 386
Figure 9.4: Grid Map Showing Pekua 400/230/132 kV Substation Connection 388
Figure 10.1: Overall Process of Stakeholder Consultation Meetings 393
Figure 10.2: Advertisement of Public Consultation Meeting 412
Figure 11.1: Grievance Resolving Process (Formal Tiers) 427
Figure 12.1: Organogram for Environmental and Social Management of Project 655
Figure 12.2: Project Implementation Organogram 656

List of Tables

Table 1.1: EIA/IEE Study Team 5
Table 2.1: Relevant Bangladesh Policies and Legislation 17
Table 2.2: Relevant Health and Safety Laws and Rules 28
Table 2.3: Implication of ADB SPS 2009 to project 31
Table 2.4: ADB's Environmental Safeguards Categorization and Requirements 36
Table 2.5: Comparison of Environmental Safeguard Principles 37
Table 2.6: Relevant Environment Related International Convention, Treaties and Protocols signed by Bangladesh 41
Table 3.1: Variables and Associated Data Collection Techniques 46
Table 3.2: Zone of Influence for Resources Studied 47
Table 4.1: Salient Features of the New 400/230/132kV, 230/132/33kV Substations with TLs 54
Table 4.2: Salient Features of the New 132/33kV Substations with TLs 55
Table 4.3: Proposed Substations Name with Bay Extension Works 68
Table 4.4: Implementation Schedule 77
Table 4.5: Approximate Land Filling Volumes 81
Table 4.6 : Sanitation Facilities 83
Table 4.7: Renewable Energy Power Plant being set up at South Chattogram area 87
Table 4.8: Estimated Project Cost 89
Table 5.1: Geographical Distribution of Project Components 90
Table 5.2: Historical Background of Seismicity in the Project Areas 117
Table 5.3: Result of Ambient Air Quality Analysis 130
Table 5.4: Result of Noise Level Measurement 133
Table 5.5: Results of 1-hour L_{eq} for both Day and Night Time 135
Table 5.6: Results of Vibration Level Analysis 137
Table 5.7; Samples with high Fe and turbidity values 139
Table 5.8: Results of Groundwater Quality Monitoring 141
Table 5.9: Results of Surface Water Quality Monitoring 145
Table 5.10: Soil Quality Analysis Result 148
Table 5.11: EMF Monitoring Result 149
Table 5.12: Zonal Tree Density 166
Table 5.13: List of Flora Identified in Tungipara (Gopalganj) 167
Table 5.14: List of Flora Identified in Paikgacha (Khulna) 168
Table 5.15: List of Flora Identified in Kumarkhali (Kushtia) 168
Table 5.16: List of Flora Identified in Mathbaria (Pirojpur) 169
Table 5.17: List of Flora Identified in Chatkhil (Noakhali) 170
Table 5.18: List of Flora Identified in Kishoreganj 170
Table 5.19: List of Flora Identified in Satkhira 171
Table 5.20: List of Flora Identified in Brahmanbaria 171
Table 5.21: List of Flora Identified in Dupchanchia (Bogura) 172

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Table 5.22: List of Flora Identified in Matlab (N) (Chandpur) 172
Table 5.23: List of Flora Identified in Monohardi (Narshingdi) 173
Table 5.24: List of Flora Identified in Madhabpur (Habiganj) 174
Table 5.25: List of Flora Identified in Pekua/ Chakaria (Cox's Bazar) 174
Table 5.26: List of Fauna Identified in Tungipara (Gopalganj) 176
Table 5.27: List of Fauna Identified in Kishoreganj 177
Table 5.28: List of Fauna Identified in Satkhira 178
Table 5.29: List of Fauna Identified in Brahmanbaria 179
Table 5.30: List of Fauna Identified in Paikgacha (Khulna) 179
Table 5.31: List of Fauna Identified in Kumarkhali (Kushtia) 180
Table 5.32: List of Fauna Identified in Mathbaria (Pirojpur) 181
Table 5.33: List of Fauna Identified in Chatkhil (Noakhali) 183
Table 5.34: List of Fauna Identified in Dupchanchia (Bogura) 183
Table 5.35: List of Fauna Identified in Matlab (N) (Chandpur) 184
Table 5.36: List of Fauna Identified in Monohardi (Narshingdi) 185
Table 5.37: List of Fauna Identified in Madhabpur (Habiganj) 186
Table 5.38: List of Fauna Identified in Pekua/ Chakaria (Cox's Bazar) 187
Table 5.39: List of Aquatic Fauna Identified in and around Tungipara (Gopalganj) 189
Table 5.40: List of Aquatic Fauna Identified in and around Kishoreganj 189
Table 5.41: List of Aquatic Fauna Identified in and around Satkhira 189
Table 5.42: List of Aquatic Fauna Identified in and around Brahmanbaria 190
Table 5.43: List of Aquatic Fauna Identified in and around Paikgacha (Khulna) 190
Table 5.44: List of Aquatic Fauna Identified in and around Kumarkhali (Kushtia) 191
Table 5.45: List of Aquatic Fauna Identified in and around Mathbaria (Pirojpur) 191
Table 5.46: List of Aquatic Fauna Identified in and around Chatkhil (Noakhali) 192
Table 5.47: List of Aquatic Fauna Identified in and around Dupchanchia (Bogura) 192
Table 5.48: List of Aquatic Fauna Identified in and around Matlab (N) (Chandpur) 192
Table 5.49: List of Aquatic Fauna Identified in and around Monohardi (Narshingdi) 193
Table 5.50: List of Aquatic Fauna Identified in and around Madhabpur (Habiganj) 193
Table 5.51: List of Aquatic Fauna Identified in and around Pekua/ Chakaria (Cox's Bazar) 194
Table 5.52: IUCN Red List of Threatened Species including Critically Endangered (CR), Endangered (EN) or Vulnerable (VU) found within 50 km of each site as per area of occurrence from IBAT 197
Table 5.53: Demographics and Population 201
Table 5.54: Age-Sex Distribution of the Affected HHs 201
Table 5.55: Sex Profile of Affected HHs and Tenants 202
Table 5.56: Percentage of affected population by religion 202
Table 5.57: Level of Education of Affected Population 203
Table 5.58: Primary Occupation of Affected Population (15 years and above) 203
Table 5.59: Income Level of Affected Population 204
Table 5.60: Marital Status of Affected Population 204
Table 5.61: Housing Condition of Project Areas 204
Table 5.62: Source of Water 205
Table 5.63: Sanitation Types of The Study Areas 205
Table 5.64: Household Assets Status of HH 205
Table 5.65: Land Ownership Type 206
Table 5.66: Status of Government Assistance 206
Table 5.67: Percentage of Migrated Persons Working Abroad who sent Remittance by Division 207
Table 5.68: Source of Loan by Household 207
Table 5.69: Status of loan repay by household 208
Table 5.70: Medical Service Status (Multiple Response) 208
Table 5.71: Source of Energy Used by the HH for Lighting Purposes 208
Table 5.72: Energy Sources Used by the HH for Other Domestic Purposes 208
Table 5.73: Distance to Sub-project boundary/tentative alignment 217
Table 5.74: Details about lands for transmission lines 219
Table 5.75: Distances of Project Components from Biodiversity/Ecologically Sensitive Areas 219
Table 6.1: Proposed Substations Name with Bay Extension Works 222
Table 6.2: Audit Observations 225

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Table 6.3: Non-compliances observed 230
Table 6.4: Corrective Action Plan 232
Table 7.1: Comparative Analysis of GIS and AIS Substations 242
Table 7.2: Comparative Analysis of OHL/UG Transmission lines 244
Table 7.3: Comparative Analysis of Site Selection at Pekua 400/230/132kV AIS Substation 249
Table 7.4: Comparative Analysis of Site Selection at Madhabpur 230/132/33kV AIS Substation 251
Table 7.5: Comparative Analysis of Site Selection at Monohardi 230/132/33kV AIS Substation 254
Table 7.6: Comparative Analysis of Site Selection at Tungipara 132/33kV AIS Substation 257
Table 7.7: Comparative Analysis of Site Selection at Dupchanchia 132/33kV AIS Substation 260
Table 7.8: Comparative Analysis of Site Selection at Matlab North 132/33kV AIS Sub-Station 264
Table 7.9: Comparative Analysis of Site Selection at Kumarkhali 132/33kV AIS Sub-Station 266
Table 7.10: Comparative Analysis of Site Selection at Chatkhil 132/33kV AIS Substation 269
Table 7.11: Comparative Analysis of Site Selection at Paikgacha 132/33kV AIS Substation 271
Table 7.12: Comparative Analysis of Site Selection at Mathbaria 132/33kV AIS Substation 274
Table 7.13: Routing Options for LILO of Matarbari– Banskhali 400kV Transmission Line 275
Table 7.14: Routing Options for LILO of Anwara-Cox's Bazar 230kV Line 277
Table 7.15: Routing Options for LILO of Matarbari – Chakaria 132kV Transmission Line 279
Table 7.16: Routing Options for LILO of Sripur-Ashuganj 230kV Transmission Line 280
Table 7.17: Routing options for the LILO of Cumilla(N) – Shahjibazar PP 230kV double circuit Overhead transmission line 282
Table 7.18: Routing Options for Monohardi-Bajitpur 132kV Transmission Line 283
Table 7.19: Routing Options for LILO of Shahjibazar – Brahmanbaria Transmission Line 285
Table 7.20: Routing Options for Gopalganj-Tungipara Transmission Line 286
Table 7.21: Routing Options for Satkhira-Paikgacha 132kV Transmission Line 289
Table 7.22: Routing Options for Kachua- Matlab North Transmission Line 290
Table 7.23: Routing Options for LILO of Chowmuhani-Ramganj 132kV Transmission Line 291
Table 7.24: Routing Options for LILO of Bogura(S)-Naogaon 132kV Transmission Line 293
Table 7.25: Routing Options for LILO of Bheramara – Rajbari 132kV Transmission Line 296
Table 7.26: Routing Options for Bhandaria- Mathabaria 132kV Transmission Line 297
Table 8.1: IESCs on Physical Environment and Water Resources 300
Table 8.2: IESCs on Land Use and Agriculture Resources 300
Table 8.3: IESCs on Ecological Resources and Birds 301
Table 8.4: IESCs on Socio-economic Resources and Their Rationales 301
Table 9.1: Characteristics Used to Describe Impact 304
Table 9.2: Method for Rating Significance 306
Table 9.5: Sensitive Air Quality Receptors 309
Table 9.6: Project Air Quality and Greenhouse Gas Potential Impacts 312
Table 9.7: Project Air Quality and Greenhouse Gas Residual Impacts 312
Table 9.8: Construction Activities and Sound Levels 314
Table 9.9: Estimated Noise Levels for Various Construction Activities 314
Table 9.10: Electrical and Magnetic Fields from Transmission Line 316
Table 9.11: Noise and Vibration Potential Impacts 317
Table 9.12: Residual Noise and Vibration Impacts 317
Table 9.13: Potential Impacts to Soils 321
Table 9.14: Soils Residual Impacts 321
Table 9.15: Ground and Surface Water Receptors near substations 323
Table 9.16: Ground and Surface Water Receptors near Transmission Lines Angle Towers 323
Table 9.17: Potential Impacts to Hydrology, Water Resources and Water Quality 329
Table 9.18: Residual Impacts – Hydrology, Water Resources and Water Quality 329
Table 9.19: Potential Geohazard Impacts 332
Table 9.20: Residual Impacts – Geohazards 332
Table 9.21: Residual Impacts – Critical Habitat and Designated Sites 335
Table 9.22: Generic Construction Phase Impacts 337
Table 9.23: Trees to be affected by Transmission Lines 338
Table 9.24: Affected Trees on the Clearing Row on Private Land 338
Table 9.25: Affected Trees on the Clearing Row of TLs/LILO on Government Land 338
Table 9.26: Trees to be affected by Substations 339

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Table 9.27: Selected Trees for Plantation 342
Table 9.28: Potential Impacts to Flora and Fauna 345
Table 9.29: Residual Flora and Fauna Impacts 346
Table 9.30: Social Infrastructure Residual Impacts 348
Table 9.31: Land used for Substations and Transmission lines 349
Table 9.32: Potential Impacts due to land acquisition and Temporary Displacement 351
Table 9.33: Residual due to land acquisition and Temporary Displacement 351
Table 9.34: Potential Impacts due waste and spoil management 354
Table 9.35: Waste and Spoil Material Residual Impacts 355
Table 9.36: Potential Impacts on Community Health and Safety 359
Table 9.37: Community Health and Safety Residual Impacts 360
Table 9.38: Occupational health and safety issues during construction stage 360
Table 9.39: Potential Impacts on Worker safety 363
Table 9.40: Worker Residual Impacts 364
Table 9.41: Potential Impacts on PCR & Cultural Landscape 366
Table 9.42: Residual PCR & Cultural Landscape Impacts 366
Table 9.43: Impact Matrix 369
Table 9.44: Total Project Anticipated Impacts Before Mitigation 382
Table 9.45: Illustration of Residual Impacts with Mitigation Applied Post EMP Implementation 383
Table 9.46: Renewable Energy Power Plant Proposed List in Cox's Bazar Area 388
Table 10.1: Types of Stakeholders Engaged in the Project 391
Table 10.2: Summary Table for Stakeholder Consultation Meetings 394
Table 10.3: Venue, Date and Number of Participants of Stakeholder Consultation Meetings 394
Table 10.4: Summary of stakeholder consultation meetings 396
Table 10.5: Replies from PGCB for Avoidance and Safeguards 398
Table 10.6: Summary on Key Gender Consultations related to Environment during census 399
Table 10.7: Focus Group Discussion (FGD) (Local Community/Officials/Occupational Groups) by ADB TA Consultant Team 401
Table 10.8: Summary of Focus Group Discussion (FGD) 402
Table 10.9 : List of Key Informant interviews 405
Table 10.10 : Details of Key Informant interviews 406
Table 10.11: Questions and comments of Participants 413
Table 11.1: Process for Resolving the Grievance Issues 425
Table 12.1: List of Packages 430
Table 12.2: List of New Substations and Substation Bay Extensions under the Project 430
Table 12.3: Corrective Action Plan of Existing Substations 435
Table 12.4: Environment Management Plan 449
Table 12.5: Environment Monitoring Plan (EMoP) 615
Table 12.6: Main Documents Required from PGCB and Contractor 647
Table 12.7: Roles and Responsibilities for EMP Implementation 656
Table 12.8: Proposed Trainings 661
Table 12.9: Key EMP Milestones in Implementation Schedule 663
Table 12.10: EMP Implementation Budget for Substations Packages ..... **Error! Bookmark not defined.**
Table 12.11: EMP Implementation Budget for Transmission Lines Packages ..... **Error! Bookmark not defined.**
Table 12.12: EMP Implementation Budget for The Project ..... **Error! Bookmark not defined.**

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Abbreviations and Acronyms

AAS	Atomic Absorption Spectroscopy
ADB	Asian Development Bank
BBS	The Bangladesh Bureau of Statistics
BIWTA	Bangladesh Inland Water Transport Authority
BMD	Bangladesh Meteorological Department
CSEMP	Contractors Site-specific Environmental Management Plan
CSA	Canadian Standard Association
DG	Director General
DoE	Department of Environment
DOF	Department of Forest
EAAFP	East Asian-Australasian Flyway Partnership
ECC	Environmental Clearance Certificate
ECIL	Enviro Care International Limited
ECPs	Environmental Codes of Practices
ECR	Environmental Conservation Rules
EHS	Environment, Health, and Safety
EIA	Environmental Impact Assessment
EMP	Environmental Management Plan
EPA	Environmental Protection Agency
EQS	Environmental Quality Standards
ESMS	Environmental and Social Management System
ESU	Environment and Social Unit
FGD	Focus Group Discussions
FTA	Federal Transit Administration
GHG	Green House Gas
GoB	Government of Bangladesh
GRM	Grievance Redress Mechanism
IEE	Initial Environmental Examination
IEPMP	Integrated Energy and Power Master Plan
IFC	International Finance Corporation
LAP	Land Acquisition Plan
LGI	Local Government Institutions
MoEFCC	Ministry of Environment, Forest and Climate Change
NOC	No Objection Certificate
NWRD	National Water Resources Database
NYS	Not Yet Set
O & M	Operation and Maintenance
OHS	Occupational Health and Safety
PA	Protected Area
PAPs	Project Affected Persons
PCM	Public Consultation Meeting
PD	Project Director
PGCB	Power Grid Company Bangladesh
PIU	Project Implementation Unit
PPM	Parts Per Million
RCC	Reinforced Cement Concrete
RHD	Roads and Highways Department

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

RoW	Right of Way
RP	Resettlement Plan
SDG	Sustainable Development Goal
SES	Socio-Economic Survey
SIC	Safeguards Implementation Consultant
SOPs	Standard Operating Procedures
SPS	Safeguards Policy Statement
SRDI	Soil Resources Development Institute
TGNERE	Transmission Grid Network Expansion for Rural Electrification
TL	Transmission Line
ToR	Terms of Reference
UN	United Nations
USEPA	United States Environmental Protection Agency
WBG	World Bank Group
WHO	World Health Organisation

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

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 spells;
Cropping Intensity	It refers to raising a number of crops from the same field during one agriculture year. It can be expressed as: Cropping intensity = (Total cropped area / Net sown / Cultivated area) x 100;
COVID-19	Coronavirus disease;
Khal	A canal, usually with flowing water and sourced from a river or a big lake;
Kharif	Pre-monsoon and monsoon growing season. Cropping season linked to monsoon between March-October, often divided into Kharif-I (March-June) and Kharif-II (July-October);
Kharif-I	An agricultural season (March-June) characterized by the uncertainty of weather with alternating dry and wet spells. Some agricultural potential land remains fallow in this season;
Kharif-II	An agricultural season (July-October) comprises wet and cloudy environment and heavy rainfall but uneven distribution, low solar radiation, high temperature and humidity;
Mauza	It is a type of administrative boundary corresponding to a specific land area within which there may be one or more settlements; terminology used mainly in the Indian sub-content;
Net Cultivable Area	This represents the total area sown/cultivated with crops and orchards. Area sown/cultivated more than once in the same year is counted only once;
Rabi	An agricultural season (November-February) mainly dry with little to no rain and mainly marked with low sun intensity/daylight and low temperature;
Thana	May mean either a local police station or an Upazila (former name of);
Upazila	It is an administrative region (formerly known as 'thana') in Bangladesh. Multiple Upazila form a 'Zila' or a district. Upazila(s) function as sub-unit(s) of a Zila/ district;
Zila	A district, terminology used in Bangladesh. Bangladesh has 64 districts.

Weights and Measures

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

1 Acre	Unit of area, equals 3 Bigha, 100 Decimal, 60 Katha or 4046.86 square meters
1 Bigha	Equals 20 Katha or 33 Decimal
1 Decimal	Unit of area, equals 435.60 square foot or 40.47 square meter
1 Hectare	Unit of area, equals 2.47 Acre, 7.5 Bigha or 247 Decimal
1 Katha	Equals 1.653 Decimal
1 kg	Kilogram, SI unit of weight (1000 x gram)
1 Liter	Unit of volume in SI
1 m2	SI unit of area, equals 10.77 square foot
1 ton	Unit of weight, 1000 x kilogram
BDT	Currency of Bangladesh
dB	Decibel, Unit of loudness of sound
FY	The fiscal year (FY) of the Government of Bangladesh and its agencies ends on 30 June. "FY" before a calendar year denotes the year in which the fiscal year ends, e.g., FY2024 ends on 30 June 2024.
km	Kilometers, Unit of distance
kV	Kilo Volts, Unit of Voltage
Lac	100,000 units
m	Meters, Unit of length
mm	A thousandth of a meter
MT	Metric Ton, a unit of weight equal to 1,000 kilograms
MW	Mega Watt, 1,000,000 x Unit of Power
SI Unit	International System of Unit
$	Dollars - Currency of the United States
Tk	Taka – National currency of Bangladesh Tk1.00 = $0.0085 $1.00 = Tk117.20

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Executive Summary

Introduction

The proposed "POWER TRANSMISSION STRENGTHENING AND INTEGRATION OF RENEWABLE ENERGY (PTSIRE) PROJECT" planned by Power Grid Company of Bangladesh (PGCB) for rural parts of various districts in Bangladesh (Gopalganj, Khulna, Kushtia, Pirojpur, Noakhali, Bogura, Chandpur, Narshingdi, Habiganj, Brahmanbaria, Kishoreganj, Satkhira and Cox's Bazar) resulted in the current national Environmental Impact Assessment (EIA) study. The Asian Development Bank (ADB) will provide financial support to the Government of Bangladesh (GoB) and PGCB in order to carry out this project. The national EIA study is equivalent to the Initial Environmental Examination (IEE) report required by ADB to process the project and is henceforth referred to as the EIA/IEE. This EIA/IEE serves to guide development, implementation, and operation of the project in compliance with the requirements of the ADB's Safeguard Policy Statement (2009) and applicable GoB laws and regulations. This EIA/IEE also addresses unanticipated impacts due to the project that might result due to some changes in sitings or routings of project components at detailed design stage. The EIA/IEE presents the environment safeguards assessment and specific arrangements for management of the identified environmental impacts and risks (both negative and positive) including supervision, monitoring and reporting for the project.

Background

The GoB has committed itself to giving everyone in the nation—especially those living in rural areas—access to modern, affordable, dependable, and sustainable energy. This is in line with the Sustainable Development Goal (SDG) of guaranteeing that everyone has access to modern energy. Ensuring access to electricity is a crucial aspect of the government's efforts to promote development and reduce poverty in rural areas. By investing in infrastructure and services that enable the delivery of affordable and reliable electricity to all parts of the country, the government can help to create a more equitable and prosperous society.

Overall, the proposed project will help to meet the rapidly growing demands of electricity in the rural parts of Bangladesh. The project has three (3) outputs of which two outputs, i.e., Output 1 on 'Disaster and climate resilient and GESI-responsive power transmission infrastructure enhanced and modernized and Output 2 on 'Integration of Renewable Energy supported' will have environmental impact. Another output (Output 3 on Instutional Capacity of PGCB improved') relates to capacity development, including for safeguards, but, since it will have no impacts on the ground, is not considered further in this EIA/IEE. The project will be implemented over 5 years period from 2025 to 2030.

Scope of the Project/Project Description

The project components included in this EIA/IEE are:

- Output 1 – disaster- and climate-resilient and GESI-responsive power transmission infrastructure including (i) installation of 1,500 megavolt-amperes (MVA) of 230/132-kilovolt (kV) and 1,710 MVA of 132/33 kV transformers at nine newly constructed substations in the districts of Tungipara (Gopalganj), Paikgacha (Khulna), Kumarkhali (Kushtia), Mathbaria (Pirojpur), Chatkhil (Noakhali), Dupchanchia (Bogura), Matlab Uttar (Chandpur), Monohardi (Narshingdi), Madhabpur (Habiganj); (ii) installing 6.7 kilometers (km) (230 kV double circuit) and 141.30 km (132 kV double circuit) of new transmission lines, and 75.0 km (132 kV double circuit) of reconductored transmission line using high temperature and low sag conductors; and (iii) installing 10 numbers of 132 kV bay extensions at five existing substations.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

- Output 2 (i) installing 2,160 MVA of 400/230/132 kV transformer capacities in a new substation at Pekua (Chakaria, Cox's Bazar); and (ii) installing 6.75 km (400 kV double circuit), 0.5 km (230kV double circuit), and 1.30 km (132kV double circuit) of new transmission lines; this is to facilitate the integration of renewable energy generation from the VRE hub in southern Chattogram and enhance the reliability, resilience, and efficiency of national power grid.

Overview of Land Use/Land Requirements

The Project Area is mixed with urban and rural areas, characterized by a low to medium population density with all the associated environmental challenges: dust, noise, traffic and associated air pollution, and insufficient waste management. In the parts of the project location at rural area, pollution levels are less. Lands in predominantly agricultural areas were selected for all substations and alternatives were not identified, as these areas avoid the settlements, and individual homesteads. Only a few trees were found in most of lands chosen for construction of substations. The only substation site which is substantially different in character is the proposed substation at Pekua, Cox's Bazar. The setting is also a rural area, but the location is saltpan in character, still being used for salt farming during dry season and fish farming during monsoon, this is small-scale local fish and shrimp cultivation mainly for local consumption, with no large-scale commercial fishing or export activities. The substation site lies adjacent to a canal connected to a river which carries a lot of water during the rainy season but reduces in size during the dry season. This area has been heavily modified by the salt farmers. Initial desktop baseline investigations did not identify any particular biodiversity value of the site. However, local people and the orinothogists gave the impression migratory birds, which may also include threatened species, could be supported, so a bird survey will be conducted by an avifauna expert during the detailed design to confirm the situation. There are no indigenous people in the Project Area. The 232.55 km of transmission lines follow low lying lands which is extensively farmed (mainly with paddy and seasonal crops), and terrestrial lands with homesteads. The proposed transmission lines will cross several rivers. There will be 633 towers, of which 199 are angle towers and 434 are suspension towers to carry the transmission line conductors. Alternatives for the nine LILO lines and five transmission lines were studied.

The new substations of this proposed project are located on a combination of cultivated agricultural and saltpan land in rural areas of Tungipara (Gopalganj), Paikgacha (Khulna), Kumarkhali (Kushtia), Mathbaria (Pirojpur), Chatkhil (Noakhali), Dupchanchia (Bogura), Matlab Uttar (Chandpur), Monohardi (Narshingdi), Madhabpur (Habiganj), and Pekua/Chakaria (Cox's Bazar) respectively. One substation having 400/230/132 kV will be constructed in Pekua/Chakaria, Cox's Bazar. Two substations having 230/132/33 kV will be constructed in Madhabpur, Habiganj and Monohardi, Narshingdi. Seven substations having 132/33 kV will be constructed in Tungipara (Gopalganj), Dupchanchia (Bogura), Matlab (N) (Chandpur), Kumarkhali (Kushtia), Chatkhil (Noakhali), Paikgacha (Khulna) and Mathbaria (Pirojpur) respectively. For the construction of substations, PGCB will get the land according to the Resettlement Plan (RP) prepared.

The project will require an acquisition of total 78 acres (for Paikgacha substation, 5 acres of land have already been acquired by Power Grid) of agricultural and saltpan land for new substations affecting 909 landowners (affected households) and 116 sharecroppers and leaseholders. Land for transmission towers is not acquired, but 793 affected households will be impacted by installation. About 385.66 acres of cultivated land will be cleared for transmission lines during construction, of which 44.01 acres is for tower installation. Compensation will be provided per the RP with the help of the census and associated land data collected from the local land office. Once the tower construction is completed the area beneath the tower can still be utilized for cultivation of crops including paddy.

The total number of affected households for both substation and transmission line components are estimated to be 961, comprising of 3,748 affected persons, of which 23 are considered as vulnerable and 7 are severely affected. No transmission lines will be installed above or adjacent to residential properties

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

and locations intended for highly frequent human occupancy. 4 of 32 structures in the ROW [2 commercial, 1 residential cum commercial, and 1 community property] do not meet the horizontal safety distance (7.6m for 132 kV line, 9.2m for 230 kV line, and 12.8m for 400 kV line) requiring relocation per the RP provisions.

Sites and routes are away from ecologically sensitive areas, forest reserves, and protected areas in the country. A total of 11,211 trees of varying heights were counted under the right of way (RoW) of transmission lines in which 10,621 trees in ROW from private land and 590 trees along the government land along the construction of 232.55 km of transmission lines (including reconductoring of 75.00 km of 132kV transmission line) at 24 upazilas in 13 districts. Out of the 10 substations, only one new substation, Tungipara, and one existing substation bay extension, Bhandaria, will affect trees. A total of 128 trees have been counted in the substations area, and all these trees are located at the Tungipara, Paikgacha, and Bhandaria substation. Of the total trees at Tungparia, 43 are fruit trees, 59 are timber trees, and 12 are medicinal trees. At Paikgacha, 4 are fruit trees, and 3 are timber trees. At Bhandaria, 6 are fruit trees, and 1 is timber tree. The following tree clearing RoW widths are considered: 12.8 meters for 400 kV, 9.2 meters for 230 kV, and 7.6 meters for 132 kV. The full RoW widths of the transmission lines are: 46 meters for 400 kV, 40 meters for 230 kV, and 28 meters for 132 kV. The number of trees counted consists of trees that belong to various heights. For the project purpose, only trees in the tree clearing RoW width and above 5 meters will be cut along the transmission lines, whilst all trees may be lost at the substations. It is estimated that 4,079 number of trees will be cut for the transmission lines and 128 number of trees for the substations. For the trees that will be cut, according to the compensatory rules of Bangladesh, 12,237 and 384 (in 1:3 ratio) trees respectively for the transmission line and substations would be planted again in the project area to preserve the biodiversity and prevent the environmental degradation. No threatened species of or protected trees will need to be cut. The EMP includes a budget for planting of seedlings, and it is recommended that 3 trees be planted for every tree that is removed, or as directed by the Bangladesh Forest Department.

Once detailed designs are completed, all these figures will be updated and the IEE and the RP updated for ADB review, clearance and disclosure. Without these documents being updated and first identifying the impacted households, obtaining their approval, and providing full compensation, no project activity will be initiated.

Objectives of EIA/IEE

The objectives of EIA/IEE are (i) provide critical facts, significant findings, and recommended actions regarding environmental impacts and risks; (ii) present the national legal and institutional framework within which the environmental assessment has been carried out; (iii) provide information on existing geographic, physical, ecological, social and temporal context including associated facilities within the project's area of influence; (iv) assess the project's likely positive and negative direct and indirect impacts to physical, biological including flora, fauna, especially avifauna, socioeconomic, and physical cultural resources in the project's area of influence; (v) identify mitigation measures and any residual negative impacts that cannot be mitigated, especially related to biodiversity; (vi) describe the process undertaken during project design to engage stakeholders, the planned information disclosure measures and the process for carrying out consultation with affected people and facilitating their participation during project implementation; (vii) describe the project's grievance redress mechanism for resolving complaints about environmental performance; (viii) present the set of mitigation measures to be undertaken to avoid, reduce, mitigate, or compensate for adverse environmental impacts including flora, fauna and avifauna; (ix) describe the supervision, monitoring measures and reporting procedures to ensure early detection of conditions that necessitate particular mitigation measures; and (x) identify who is responsible for carrying out the mitigation and monitoring measures.

The scope of work of the EIA/IEE (as per Department of Environment (DOE) requirements) is: (a) Review of existing information (all relevant documents) from secondary sources, and identify gaps to be filled from primary surveys, relevant to the environmental screening and scoping needs (such as GOB

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

standards and good international industry practice (GIIP) guideline levels to be followed for analysing baseline investigations for air, water, soil, noise etc. ADB requires, if national regulations differ, that the more stringent requirement will be followed. If less stringent levels are appropriate in view of specific project circumstances, the EIA/IEE will provide full and detailed justification for this, including data on the physical, biological and socioeconomic characteristics of the subproject site along with the project area of influence). (b) Provide a description of the environment. (c) Represent the primary surveys which include baseline (air, noise, vibration, surface water, groundwater, soil) environmental quality and electromagnetic frequency (EMF) monitoring at representative and sensitive locations, and identification of all macro-level environmental issues within the project's influence area. (d) Survey the environmentally sensitive locations on and along the project sites and routings as well as within the project's influence area. (e) Arrange stakeholders' consultations with the local people from all professions to find out their opinion of the project. (f) Analysis of alternatives to the proposed project. (g) Identify and assess potential environmental impacts in the Project Impact Area (PIA), including on any protected area, critical habitat for flora, fauna (focus on migratory birds or avifauna) due to implementation of the project, and (h) Formulation of Environmental Management Plan (EMP).

Environmental policies, rules, regulations and standards

Relevant GOB Policies, Acts, Rules, Strategies and Guidelines are as follows: (1) Environmental Conservation Act (ECA), 1995 and Amendments (2010); (2) Environment Conservation Rules (ECR), 2023; (3) National Environment Policy, 2018**;** (4) National Environmental Management Plan (NEMAP), 1995; (5) Bangladesh Wildlife (Preservation) Order, 1973 (Amended in 1994); (6) National Water Policy, 1999; (7) National Water Management Plan, 2001 (Approved in 2004); (8) The National Fisheries Policy, 1999; (9) The Protection and Conservation of Fish Rules, 1985; (10) National Agricultural Policy, 1999; (11) The Embankment and Drainage Act, 1952; (12) Bangladesh Climate Change Strategy and Action Plan 2009; (13) DOE's EIA Guidelines for Industries, 2021; (14) Electricity Act, 2018 (15) Hazardous Waste Management Rules 2021, (16) Hazardous Waste (E-waste) Management Rules 2021; (17) Environment Threatened Area Management Rules, 2016; and (18) Solid Waste Management Rules 2021 amongst others.

According to the Environment Conservation Rules (ECR), 2023, the proposed Project regarding electricity transmission lines (>25 km) and sub-stations is likely to have environmental impacts especially during the construction phase, and it mainly falls under the RED category, as classified under the serial number 67. This project requires a Feasibility Study Report, national EIA, and No Objection Certificate (NOC) from the local authority to be submitted to receive a Site Clearance Certificate (SCC) and then Environmental Clearance Certificate (ECC) from the Department of Environment (DoE). The draft national EIA (Payment of applicable VAT and clearance fees as per Environment Conservation Rules 2023, 20 August 2024) has been undertaken for the purpose of obtaining environmental clearance from the DoE, Bangladesh. The Site Clearance Certificate (SCC) was secured on 22 October 2024.

According to the ADB's Safeguard Policy Statement (2009), this project meets the criteria for classification under category B as its potential adverse environmental impacts are site specific, few of them irreversible and in most cases mitigation measures can be designed more readily than category A projects. The national EIA study (September 2024) submitted to DoE was updated (March 2025) and is equivalent to the IEE report required by ADB. Once detailed designs are completed the EIA/IEE will be further updated for ADB review, clearance and disclosure. The most recent update will be submitted by PGCB to DOE with the renewal for ECC.

Environmental Baseline Conditions of the Project Area

This project falls in different locations across Bangladesh. The EIA/IEE considers the physical environment and ecological resources of these project areas. The meteorology, geology and soils,

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

topography, environmental quality (air, noise, vibration, EMF, soil, and water) and natural hazards baseline are discussed in the physical environment section. On the other hand, bio-ecological zones, flora, fauna, and ecologically sensitive areas, are discussed in the ecological resources section. Primary and secondary data sources were both used to finalize the EIA/IEE. For instance, environmental quality was assessed by primary data collected through field visits and environmental monitoring conducted in April 2024. The analysis report of air, noise (both 24-hour collection) soil, EMF, vibration, and water sampling have been incorporated in Appendix II. Sampling methodologies have been explained in detail in this report. Sampling locations and monitoring locations have been also illustrated with maps etc. In the methodology part, all the parameters with the analysis method have been shown in a tabular form and their laboratory certificates attached. On the contrary, other information (such as meteorology and natural hazards) have been determined according to the secondary data sources like Bangladesh Meteorological Department, etc.

Social Baseline Conditions of the Project Area

As per the discussion above, due to the geographical scope there is diversity in the existing social baseline condition. Socio-economic resources such as demography, household size, age structure, literacy, health facilities, migration, sanitation facilities, income and expenditure, indigenous people and so on have been identified in the EIA/IEE. Public utilities and cultural resources have also been identified. Both primary and secondary data sources were used such as socio-economic survey by Techvy and Bangladesh Bureau of Statistics (BBS) respectively.

Analyses of Alternative for Route and Substation Site Selection

For the selection of optimum sites and routes, alternatives were mapped and the following points were taken into consideration in selecting the preferred option: (i) the substation sites and route of the proposed transmission lines does not involve any human rehabilitation. (ii) Any monument of cultural or historical importance is not affected by the site or route. (iii) The site or route does not create any threat to the survival of any community with special reference to Indigenous People. (iv) The site or route does not affect any public utility services like playgrounds, schools, other establishments etc. (v) The site or route is not in or does not pass through any wildlife sanctuaries, national park etc. (vi) The site or route does not infringe on areas of natural resources. In order to achieve this, different alternatives were studied for all the substation sites and longer transmission lines with an understanding that minor alterations will be undertaken by the contractor during detailed design. According to the RP, a total of 32 structures, comprising 25 primary and 7 secondary structures, will be affected. Most structures were found to be at a safe distance from any direct impact, maintaining the following minimum safety clearances: 7.6 meters for the 132 kV line, 9.2 meters for the 230 kV line, and 12.8 meters for the 400 kV line. However, 4 of 32 structures in the ROW [2 commercial, 1 residential cum commercial, and 1 community property] do not meet the horizontal safety distance requiring relocation per the RP provisions. Similarly, forests have been avoided, but individual trees are present and will need to be cut. Salt pans and waterlogged areas also sought to be avoided for both financial and environmental reasons but this was not possible in case of Pekua, Paikgacha and other substation sites with year round low-level inundation as they are in low lying areas.

Existing Facilities

Environmental audit of five substations requiring bay extensions as existing facilities has been undertaken. A Corrective Action Plan (CAP) has been developed and will be implemented by PGCB before access is given to its contractors for the bay extension works.

Integration of Renewable Energy – Associated Facility

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

The project will facilitate the integration of renewable energy generation from the Variable Renewable Energy (VRE) Hub in Southern Chattogram. Promising opportunities for solar power generation have been identified in Pekua, Chakaria, Teknaf, and other areas of Cox's Bazar district. The VRE Hub generation sites will be developed by the private sector who will be required to obtain environmental clearance from the Department of Environment. Although not funded by PGCB the VRE Hub is associated with the project, by virtue of having a two-way relationship, so due diligence of the VRE Hub has been incorporated into the EIA/IEE based on currently available information with a focus on biodiversity impacts. Even if not associated, renewable energy generation in the Southern Chattogram area would have cumulative and induced impact on habitats and avifauna.

The coastal areas, particularly Sonadia and Moheshkhali islands as the last remaining mangrove habitat in South East Bangladesh, are sensitive and provide a critical habitat for migratory birds on the East Asian–Australasian Flyway. Consultation with flyway experts has not raised any concern regarding the impact of Pekua transmission lines; the proposed 6.75 km 400 kV LILO line from Pekua substation will connect to the Matarbari – Banaskhali 400 kV transmission line which starts from Matarbari Ultra Super Critical Coal-Fired Power Plant, Maheshkali. However, the substation will evacuate power generated from a group of renewable power plants around the Cox's Bazar area. To address habitat and avifauna risk, before connecting any project from the VRE hub with Pekua substation and the transmission network in South Chattogram, Power Grid will ensure the requisite environmental clearances have been obtained from DoE by the private sector developer, and work with other power and environment-related agencies to conduct ecological constraints mapping and to develop guidelines on avifauna assessment and management such that ecologically sensitive areas are avoided and no net loss of biodiversity is ensured.

Significant Environmental and Social Impact Assessment and Mitigation Measures

Environmental screening and assessment for the substation sites and transmission lines were carried out to identify the potential impacts and risks based on the collected baseline information/data by the safeguard survey team, during feasibility study. Most impacts are expected to occur during the construction phase and are considered to be temporary in nature.

Potentially significant impacts relate to construction, no significant impacts are anticipated during operation subject to confirmation following migratory bird surveys by ecologists to be hired by Contractors for Pekua and Paikgacha substations. Impacts and risks of the project are summarized as follows:

- Dust generation affecting the public and occupants of properties in immediately adjacent buildings due to land filling and levelling works, earthworks for construction, and transportation of materials.
- Noise and vibration causing disruption and disturbance to the public and occupants of properties in immediately adjacent buildings especially from piling work.
- Use of hazardous materials, including transformer oils and batteries, and the generation of solid and hazardous wastes including e-wastes for disposal during both construction and operation.
- Loss of trees and vegetation at substation sites and beneath the RoW of transmission lines including potential disturbance to nesting birds during site clearance and requiring 1:3 compensatory plantation, details to be set out in a Tree Plantation Plan to be prepared by the contractor(s) after contract award and prior to design approvals.
- Electrocution and collision of avifauna on the transmission lines especially where they cross waterbodies or run in proximity to the coast where habitat supports migratory and local bird populations including threatened species.
- No protected area, forest land or natural habitat is impacted. There are waterbodies (salt pans) around the Pekua and Paikgacha (naturally low-lying land inundated round the year) substations and transmission lines. These habitats are of local importance to non-threatened bird species

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

and fish and provide various ecosystem services to the local community – they also have the potential to support migratory birds based on consultations and must be subject to further study prior to detailed design. Most of the project components do not impact on critical habitat, however, the Pekua substation and VRE Hub area of analysis covering South Chattogram support critical habitat with spotted greenshank (endangered species) recorded in the coastal habitat near to the existing power plant. Additionally, there are some low-lying areas around the substations, which are inundated year around. Height of these lands will be raised up to the standard height of main access road during the construction stage according to the design.

- Occupational health and safety risks to workers including from working at height, lightening hazard, fall of materials from height and with electrical equipment.
- Community health and safety due to the presence of workers, electrical works in the public domain and crossing roads, due to construction traffic, structural safety of immediately adjacent buildings due to vibrations from piling work etc.
- Construction impacts that will adversely affect the baseline environment parameters already above national standards and/or international guidelines (e.g., particulate levels) such as the WHO guidelines must be minimized through targeted mitigation measures and regular monitoring of impacts.
- Concerns of the community and other key stakeholders regarding potential contractors' violations of the environmental management plan (EMP) that may affect them adversely as noted by the consultees (related to noise, dust, health and safety etc.) need to be incorporated into the detailed design and construction methods with supervision and monitoring to ensure compliance by the contractor

The potential impacts and risks of the project's construction phase on the physical, biological and social environment include soil erosion and sediment laden surface water runoff particularly close to rivers and khals; dust emissions caused by operation of machinery for earthworks, especially at the new substation sites requiring landfill to raise their level, and running vehicles on earthen tracks within the RoW and along the access routes; gaseous emissions and noise from construction vehicles, machinery, and generators; spills or leaks of fuels, oils and other hazardous materials, release of wastewater effluents and solid and hazardous wastes (spoil, piling mud, oil and sludge, domestic waste) from construction areas and camps causing soil and water contamination; discharge of piling mud causing surface water pollution; loss of or damage to agricultural lands; loss of vegetation and trees at one substation and in the RoWs; and finally, occupational health and safety (OHS) hazards for the construction staff and other project site personnel and community health and safety hazards for the public including access to construction works in the public domain, disruption, disturbance and traffic congestion adjacent to overhead power line works.

The potential impacts of the transmission lines and substations during the operation and maintenance stage include electrocution and collision risk to birds particularly in the vicinity of salt pans, pollution risk to soil and water from transformers, occupational health and safety risks for the operation and maintenance workers, community health and safety risks due to project infrastructure being within the public domain and accessible e.g., electromagnetic radiation, and solid and hazardous waste generation (sanitary waste, transformer oil and sludge, oil-laced wastewater) with limited waste management facilities available.

Mitigation Measures

To address the potentially negative environmental impacts of the project, and manage risks, mitigation will be through the application of good international industry practice (GIIP) measures per the International Finance Corporation Environmental, Health, and Safety (IFC EHS) Guidelines and ILO Safety and Health in Construction and worker accommodation guidance. Mitigation measures have been developed for all predicted adverse impacts and risks. Mitigation and monitoring measures are set out in

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

the EMP for implementation by PGCB and their contractors. PGCB will ensure their and the contractor's compliance.

Dust, noise and vibration during construction will be managed and the community will be kept informed through regular communication. Mitigation measures during construction will include water sprinkling to suppress dust emissions; using modern, maintained vehicles and machinery to minimize exhaust emissions and noise; and ensuring that no piling mud, untreated wastewater effluent, solid and hazardous wastes are released to the environment by using appropriate wastewater treatment mechanisms or suitably engineered waste management facilities for this purpose. The construction period will be kept to a minimum, night-time construction in residential areas will be avoided, temporary acoustically designed noise barriers will be used and only well-operated and maintained equipment will be employed. Water spraying and use of screens will help to manage dust at the construction sites. Contractors are to comply with all statutory requirements set out by domestic regulations as well as GIIP for the use of construction equipment, establishment of campsites, waste disposal, landfilling works, piling mud management, concrete batching if required, etc. To further elaborate on the mitigation, as part of their Contractor's site-specific environmental management plan (CSEMP) contractors will be required to prepare and implement waste management and pollution prevention plans; and undertake risk assessments before preparing and implementing an occupational and community health and safety plan.

To address the risk of bird collision and electrocution during operation, PGCB will attach bird divertors (suitably visible markers at 10m spacing) to the upper wire of overhead transmission line sections for the entire route of the three Pekua transmission lines, the entire length of the Satkhira-Paikgacha transmission line where it crosses over inundated areas, and for all transmission lines 500m either side of crossings of rivers or large waterbodies and other areas subject to the findings of ecology studies to be completed during detailed design. Furthermore, sufficient phase to phase and phase to ground spacing or insultation will be provided on transmission lines to avoid electrocution of birds found in the area (including migratory and/or local birds) owing to the size of their wingspan. No PCBs or asbestos must be used. Leakage of SF6, a potent greenhouse gas used extensively in substation switchgear, needs to be detected using SF6 meters. Maintaining SF6 equipment and ensuring its storage and handling follows international norms will minimize the risk of leakage. To ensure community safety no transmission lines will be installed above or adjacent to residential properties and locations intended for highly frequent human occupancy – all horizontal and vertical safety clearances and GIIP EMF levels will be met.

Environmental Management Plan

An Environmental Management Plan (EMP) has been prepared as part of the present EIA/IEE in order to define the implementation mechanism for the above-described mitigation measures reflecting national requirements and international good practice. The EMP includes a description of the institutional arrangements, a mitigation plan, a monitoring plan, a training and capacity building plan, budget, documentation protocols including semi-annual environment monitoring reporting to ADB reverting to annual following the completion of all construction works, and a grievance redress mechanism (GRM). It also includes the Corrective Action Plan informed by the environmental audit to address environment, health and safety management at existing substations.

The environmental management of the project will be achieved through implementation of a number of plans: a) Environmental Codes of Practices (ECPs); b) mitigation and monitoring plans; and c) Contractor's site-specific Environmental Management Plans (CSEMPs) including site-specific Biodiversity Management Plans and other subplans. The ECPs provide generic guidelines and control measures to address typical negative impacts encountered during the construction phase. The mitigation and monitoring plans, prepared on the basis of impact assessment carried out during the present EIA/IEE, provides project- and site-specific mitigation and monitoring measures and assigns implementation and

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

supervision responsibilities for these measures. The environmental monitoring plan will ensure that the mitigation measures are effective, including the monitoring of health and safety incidents with the requirement to submit regular environmental monitoring reports to ADB. The CSEMPs will be prepared by the construction contractor based upon the EMP included in the present EIA/IEE and will comprise a number of sub-plans including pollution prevention plan, waste management plan, traffic management plan, temporary facilities management plan, health and safety plan, emergency preparedness plan and others. The site-specific biodiversity management plans as part of the CSEMP will reflect measures for works affecting vegetation, trees, salt pan habitat, and year-round inundated low-lying land etc. These will be prepared based on ecology studies to be conducted during the detailed design, the EIA/IEE will be updated or an addendum produced, to incorporate the results of bird surveys and site-specific biodiversity management requirements, or if any unanticipated environmental impacts become apparent during project implementation.

Institutional Arrangement and Capacity Building

Institutional arrangements are essential to implement the suggested mitigation measures satisfactorily and to execute the monitoring plan at different project stages. The implementation of the EMP also requires capacity building of PGCB and the contractors through training and on-the-job support. PGCB is fully responsible to implement and follow up on all the relevant environmental safeguard requirements following the institutional arrangement. In addition, consultants, contractors, DoE and Forest Department (in respect of tree cutting requirements) also have a role in the institutional arrangement. PGCB's Project Management Unit (PMU at PGCB headquarters under the project director) and contract package team (comprising a team of engineers, a project manager and field team) will be supported by a Safeguards Implementation Consultant (SIC) and the environmental and social unit (ESU) of PGCB. Enhancement of the capacity of the PGCB's PMU and ESU is required for the effective implementation of proposed mitigation measures and monitoring requirements, training programs and awareness raising workshops will be provided by the SIC and under the capacity building component of the project. ESU staffs are to be supported by the Safeguards Implementation Consultants (SIC) on environment monitoring, health and safety, ecology etc. The SIC will therefore include an Environment Specialist, Health and Safety Specialist, Social Development Specialist (labor and stakeholder engagement) and Ecologist. Contractors will be required to have on site counterpart officers to the SIC. Any unanticipated impacts or requirements for corrective action during the implementation will be reported by PGCB to ADB.

Grievance Redress Mechanism

A GRM will be operationalized for affected communities and workers (including sexual harassment cases) with prompt resolution of all grievances raised. The GRM structure will have a first tier with the PGCB field teams for each project component and local (Upazila) level GRC, a second tier at project level with the PMU team, and a third tier with a grievance redress committee at corporate level as well as an informal tier with the contractors. Training will be provided under the project for all people involved in the GRM. Awareness will be raised with local communities and workers on ways to access it. Contact details of the GRM will be displayed at the construction sites. The GRM is to promptly record and address any informal and formal grievance received however minor and to keep adequate records and documentation of timely grievance resolution. Each safeguard-related grievance received is to be reported in the environment monitoring reports from the reporting period of receipt until the reporting period of closure. Records to include but are not limited to, name of the complainant and contact details, date the complaint was received, details of the complaint and status, minutes of meetings held, decisions made, and agreements reached up to the resolution of the complaint. The decision made by the project level GRC will be binding on the project. The GRC will handle cases related to land acquisition, resettlement, environmental quality of works on site, ownership and inheritance disputes, and compensation payment, and provide resolution to environment and social related complaints.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Overall, the grievance redress mechanism aims to ensure transparency, accountability, and fairness in the implementation of the project. The aggrieved party/affected persons can approach the country's judicial system any time during the project cycle independent of the GRM proposed for the Project. An aggrieved party can directly contact ADB's resident mission in Dhaka regarding a grievance or problem that the GRM has failed to resolve. The affected party can use the ADB's Accountability Mechanism by writing to the Complaint Receiving Officer at the ADB Headquarters in Manila as a last resort if they are not satisfied with decision and/or actions of the project GRM and resolution by the ADB.

Stakeholder Engagement, Public Consultation and Disclosure

A consultation process was undertaken during the present EIA/IEE, in accordance with national and ADB requirements. The key objectives of these consultations included informing stakeholders, particularly the local communities, about the proposed interventions and soliciting their views, concerns, and recommendations concerning the project and its impacts. A participatory approach was adopted to conduct consultations, particularly with the communities. A checklist was used to maintain uniformity and relevancy in discussion and in properly recording the opinions and views of the participants. During the consultations, the socio-economic, labor and gender issues, agricultural, hydrological, fisheries, and ecological issues were discussed in detail, including potential impacts of the interventions on the environmental parameters. Institutional issues were also discussed regarding which the participants provided their opinions and suggestions freely. A total of 825 people which includes 448 male and 377 women of affected people and other interested stakeholders were consulted between during the study leading up to preparation of this IEE/EIA report. A total of 32 project consultation meetings (PCMs) and gender consultations were carried out at 32 different locations of the project areas during June 2024. Participants comprised various occupation groups from the community including business persons, farmers, teachers, day labors, transport labors, service holders, masons and shopkeepers, etc. 27 focus group discussions (FGDs) and 21 Key Informant Interviews (KII) in one-on-one mode with affected persons of different occupations and gender-based groups who live near the substations and transmission line components plus one national consultation at PGCB headquarters were also conducted. In addition to affected persons other stakeholders such as Forest Department, NGOs, elected heads of local government and villages were consulted, informal consultations were also conducted during EIA/IEE preparation.

General support for the project was expressed, as the need for a stable electricity supply in Bangladesh is paramount. It was considered the project could support development of the area and potentially lead to more employment opportunities. The key concerns shared by the consultees during these consultations included managing traffic congestion caused by the construction activities, maintaining liaison and coordination with other departments and entities, minimizing blockage of access particularly for essential facilities such as hospitals, removal of excavated soil and other debris from the construction sites, and provision of employment opportunities to the local population. Concerns of the community and other key stakeholders regarding potential contractors' violations of the EMP that may affect them adversely as noted by the consultees (related to noise, dust, health and safety etc.) need to be incorporated into the detailed design and construction methods with supervision and monitoring to ensure compliance by the contractor.

Meaningful consultations and information disclosure will continue throughout project implementation by PGCB and the contractors. The present EIA/IEE will be locally disclosed along with any updates to it and copies of the environment monitoring report on the PGCB website, at PGCB and local government offices, and at the construction site offices once established with a translation of the Executive Summary into Bengali.

Conclusions and Recommendations

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

PGCB is working to create power transmission lines that will connect various regions and aid in the development of the country. People all along the route of the transmission line expressed keen interest in the project even after recognizing the fact that they will not get electricity directly from the transmission line. Local people along the transmission line alignments will be indirectly benefited and the project may also generate some employment opportunities for them during the pre-construction and construction phases. There will be negative impacts as a result of the project but implementation of the EMP will ensure they are managed to avoid, minimize and mitigate impacts to the extent possible with land acquisition and compensation for temporary damages paid per the RP and compensation planting for tree loss. Satisfactory EMP implementation will be assured by a program of environmental supervision and monitoring to be conducted by PGCB PMU during the construction and operation stages. The detailed design would ensure inclusion of any such environmental impacts that could not be specified or identified at the feasibility stage assessment are taken into account and mitigated where necessary.

This EIA/IEE report has been prepared for PTSIRE according to the environmental guidelines published by the DOE. Submission of IEE report is one of the requirements of the DOE for issuing necessary environmental clearances. It is mandatory in the Bangladesh Environmental Conservation Act (BECA), 2023 and The Environment Conservation Rules, 2023 for any new industrial set up or project. Mitigation and monitoring measures have been included in the Project Environmental Management Plan (EMP) incorporated into the IEE. PGCB will implement the EMP measures ensuring adequate budget and human resources are allocated to this. PGCB will also complete the activities outlined in the Corrective Action Plan (CAP) for existing substations.

Based on the findings of the EIA study (as per DoE) and IEE report (as per ADB) the following recommendations will be taken up by PGCB:

a) The EMP of the EIA (DOE) and IEE (ADB) including mitigation and monitoring programs will be included in the bid document of the civil works for all project components along with suitable experience, staffing and BOQ requirements and eventually become part of the civil works contract(s) – the definitive version of the EMP to be followed by contractors will be that disclosed on the ADB website. The Bid documents will state that the EPC Contractor will be responsible for the implementation of the requirements of the EMP allocated to them (including specific design phase actions) through their own CSEMP which will adopt all the conditions of the EMP and add site specific elements that are not currently known, such as the EPC Contractor's storage and camp locations. This will ensure that all potential bidders are aware of the environmental requirements of the Project and its associated environmental costs. The EMP and all its requirements will then be added to the EPC Contractor's Contract, thereby making implementation of the EMP a legal requirement according to the Contract.

b) The project components are falling in "red" category under the ECR 2023 and require environmental clearance. PGCB, through its consultant, shall obtain requisite environmental clearance from the Department of Environment for all components in a timely manner before contract award.

c) Pre-construction physical environment monitoring (air quality, noise, water and soil quality etc.) plus ecology surveys and, at Pekua and Paikgacha, bird surveys during the overwintering season will be conducted by SIC and the EPC contractors. The Contractors shall appoint a part-time ecologist to undertake ecology surveys at the substations and along the TL, prepare ecological survey reports and advise on implementation of ecological mitigation measures. The Safeguard Implementation Consultant team will also include an Ecologist, who will also conduct ecological surveys, oversee the contractor's survey work and construction activities, and prepare relevant reports. Considering the timing of the overwintering season in relation to the project schedule, it is recommended that the ecological survey be conducted by PGCB either prior to the awarding of

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

the contract or, if incorporated within the contractor's scope, prior to the approval of detailed designs.

d) The EIA/IEE will be updated or an addendum produced, to reflect any changes in sites or routes during detailed design, to incorporate the results of bird surveys and site-specific biodiversity management plans, or if any unanticipated environmental impacts become apparent during project implementation. The EIA/IEE update or addendum is to be reviewed, cleared and disclosed by ADB prior to the start of construction and will be submitted to DOE with the renewal of the ECC.
e) Based on the EMP of the EIA (DOE) and IEE (ADB) and any updates to it prior to construction, Contractor's Site-specific Environment Management Plan (CSEMP) to be prepared by the contractor for approval by PGCB prior to start construction, contractors to act accordingly during construction.
f) The mitigation measures for the negative impacts and enhancement measures for the positive impacts of the project, as well as monitoring requirements, capacity building activities and reporting, as mentioned in the EMP must be implemented by PGCB and the contractors in scheduled time with corrective action taken timely in the case of any non-compliances observed.
g) The main tool for the successful implementation of the EMP is the environment supervision and monitoring during various stages of the project, which must be carried out day-to-day by PGCB supported by the Safeguards Implementation Consultants (SIC) and other relevant organizations. To ensure compliance with the CSEMP the EPC Contractor is required to employ an a team of environment, health and safety experts to monitor and report on EMP activities throughout the project construction phase. Safeguards implementation consultants will also include environment, health and safety experts to support supervision and monitoring of Project EMP implementation and to build the capacity of PGCB.

h) Should PGCB note any non-conformance with the EMP (and CSEMP) the EPC Contractor can be held liable for breach of the contractual obligations of the EMP.

This EIA/IEE report, including EMP, is considered sufficient to meet national requirements and ADB's Safeguard Policy Statement (2009) requirements for the Category B project. In case of any scope, sites or routing change, and/or unanticipated impact during project implementation, the EIA/IEE and EMP will be updated as required by PGCB for review and clearance by DOE (as required by law) and ADB (as per ADB Safeguard Policy Statement (2009) requirements) before any related works commence or are allowed to continue. The EPC contractors will prepare their detailed designs and CSEMP which will be approved and monitored by PGCB and SIC. Notably since the transmission line routings assessed in this IEE/EIA report are only indicative and will not be finalized until the contractors are on board, during project implementation it will need to updated, reviewed and cleared with disclosure on the ADB website and locally before final routings are approved by PGCB and works commence.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

1 Introduction

1.1 Background of the Project

1. Bangladesh, with a population of 165 million, is the second-largest economy in South Asia and the 25th largest in the world by purchasing power parity. Its economy has achieved robust Gross Domestic Product (GDP) growth averaging 7.3% per annum during fiscal year (FY) 2016–2019.[1] Poverty levels have fallen consistently over the past decades, declining from 49.0% in FY2000 to 18.7% in FY2022. Post coronavirus disease (COVID-19) pandemic, Bangladesh is one of the fastest growing economies in the world with annual GDP growth at 3.4% in FY2020, 6.9% in FY2021, and 7.1% in FY2022.[2] Bangladesh's Eighth Five-Year Plan (FY2021−FY2025) targets attaining an annual 8.5% GDP growth, further reducing poverty, and raising living standards of people of Bangladesh with the long-term aim of becoming an upper-middle-income country by 2031 and a high-income country by 2041.[3]

2. Bangladesh's significant economic growth has been accompanied by a rapid increase in electricity consumption. Bangladesh's electricity consumption rose at a compound annual growth rate of 8.4% per annum from 36.5 terawatt- hours (TWh) in 2010 to 82.0 TWh in 2020,[4] and the power supply capacity has also increased four folds from 4.9 gigawatt (GW) in 2010 to 21.3 GW in 2022.[5] The government achieved its target of 100% electrification in March 2022.[6] However, the per capita electricity consumption in 2020 was only 498 kilowatt-hours (kWh), still among the lowest in Asia and the Pacific region.[7] To accommodate the country's steady population growth, rapid urbanization, and industrialization, and increasing demand for improved living standards, the government of Bangladesh has set a target of increasing the generation capacity to 40 GW by 2030 and 60 GW by 2041.[8] Further, the government of Bangladesh attaches high priority to agriculture and rural development to reduce poverty and improve food security for the country's poor. A reliable and uninterrupted power supply is essential for agriculture and rural development.

3. While the power generating capacity has substantially increased in the past decades, the corresponding power transmission and distribution network infrastructure remains aged and inadequate, resulting in frequent load shedding, power supply interruptions, voltage drops, and increased electricity losses that constrain economic activities, affect industrial productivity, and provide negative environmental and health effects.[9] The government has therefore placed a high priority on expanding and modernizing the power transmission infrastructure by employing advanced smart grid technologies to provide uninterrupted and reliable power supply across the country including rural areas, ensuring optimized grid operational efficiency.

[1] ADB. 2021. Country Partnership Strategy: Bangladesh, 2021–2025—Sustain Growth, Build Resilience, and Foster Inclusion. Dhaka.
[2] ADB. 2023. Asian Development Outlook. Manila.
[3] Government of Bangladesh. 2020. Eighth Five-Year Plan FY2021–FY2025. Dhaka.
[4] International Energy Agency. Bangladesh (accessed 14 September 2023).
[5] Bangladesh Power Development Board. 2022. Annual Report, 2021–2022. Dhaka.
[6] Government of Bangladesh. Ministry of Power, Energy, and Mineral Resources. Power Division. Power Cell. Bangladesh Power Sector at a Glance. Dhaka.
[7] International Energy Agency. (accessed 14 September 2023). In 2022, annual per capita electricity consumption was 2,880 kWh in Asia and the Pacific; 928 kWh in India; 980 kWh in Indonesia; 643 kWh in Sri Lanka; and 2,320 kWh in Viet Nam.
[8] Bangladesh Power Development Board. 2022. Annual Report, 2021–2022. Dhaka. 34 projects for a total capacity of 13,103 megawatts (MW) are under construction, 22 projects of 2,577 MW are in the signing process, and 4 projects of 550 MW are in the tendering stage. All of these (a total of 16.2 GW) will be implemented during the period of 2022-2027.
[9] During power outage, diesel generators are used as a back-up leading to GHG emissions and local pollution.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

4. Under its Updated Nationally Determined Contributions (NDC),[10] the government of Bangladesh elevated its unconditional emissions reduction target from 12 million tons of carbon dioxide (MtCO2) to 27 MtCO2 by 2030 compared to business as usual with identified climate mitigation actions that include increased uptake of renewable energy. In line with its climate and energy commitments under NDC, the government pledged to incorporate up to 40% clean energy sources into its power generation mix by 2041. To effectively support the goal, the government has embarked on building a Variable Renewable Energy (VRE) Hub in Southern Chattogram, aiming to develop approximately 1,500 megawatts (MW) of renewable energy generation projects, which requires significant investments to expand the associated transmission system to integrate the increased renewable energy generation into the national grid.

1.2 Objectives of the Project

5. The proposed "POWER TRANSMISSION STRENGTHENING AND INTEGRATION OF RENEWABLE ENERGY (PTSIRE) PROJECT" is planned by Power Grid Company of Bangladesh (PGCB) for rural parts of various districts in Bangladesh. The project is aligned with the following impacts: (i) reliable and efficient power transmission system for a high-income country established, and (ii) climate resilience of power infrastructure enhanced. The project will have the following outcome: quality, reliability, and efficiency of power supply system in the project area improved.

6. The objective of the proposed project is to support the government in (i) enhancing the reliability, resiliency, and efficiency of the power transmission grid in the rural areas of Gopalganj, Khulna, Kushtia, Pirojpur, Noakhali, Bogura, Chandpur, Narshingdi, Habiganj, Brahmanbaria, Kishoreganj, Satkhira, located in the Bangladesh Economic Corridor (BEC) region[11] and (ii) integrating the anticipated increase in renewable energy generation in the Variable Renewable Energy (VRE) Hub in Southern Chattogram.[12] This will serve the fast-growing demand for electricity in the BEC region, while reducing reliance on diesel generators, reduce transmission system losses, and facilitate the integration of renewable energy resources. The project will employ advanced smart grid technologies,[13] build the institutional capacity of the Power Grid Company of Bangladesh Limited (PGCB) by developing a roadmap and action plan for commercial borrowing for PGCB and training on operation and maintenance (O&M) and emergency management of transmission system, and support inclusiveness in PGCB's operations by strengthening and monitoring gender equality and social inclusion (GESI) requirements during and after project implementation.

7. The project will construct new substations, extend bays at existing substations, and lay transmission lines to upgrade the transmission grid in the middle and southern parts of Bangladesh to provide a reliable and efficient electricity supply and promote solar energy development. The project outputs will include: (i) construction of new 230/132/33 kilovolt (kV) sub-stations and transmission lines, augmentation of an existing 132 kV line (single circuit to double circuit enhancement) including High-Temperature Low Sag lines for enhanced reliability and loss reduction, to address voltage drops, losses, and frequent power interruptions in the rural area of Gopalganj, Khulna, Kushtia, Pirojpur, Noakhali, Bogura, Chandpur, Narshingdi, Habiganj, Brahmanbaria, Kishoreganj, Satkhira; and (ii) construction of a new 400/230/132 kV substation and transmission lines for the Variable Renewable Energy Hub in Southern Chattogram area. These new infrastructure will be designed to be resilient to extreme weather conditions contributing to climate adaptation and will also contribute to climate mitigation by reducing transmission losses and thereby lowering greenhouse gas (GHG) emissions.

[10] Government of Bangladesh. Ministry of Environment, Forest, and Climate Change. 2021. Nationally Determined Contributions (NDCs) 2021 Bangladesh (Updated). Dhaka.
[11] ADB. 2023. Bangladesh Economic Corridor Development Highlights. Manila
[12] The government of Bangladesh aims to encompass 1,500 MW renewable energy projects in the Pekua and Chakaria area by promoting public and private sector investments.
[13] It includes substation automation systems, digital fault and disturbance recorder, protective equipment to identify power fault locations, etc.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

8. The project will also strengthen the capacity of PGCB in inclusive development by setting up GESI-inclusive targets for education, training, and awareness-raising initiatives. The training programs will be expanded during the project implementation to include practical and comprehensive business skills training to provide employment opportunities for both skilled and unskilled workforce, including women and disadvantaged groups. PGCB is expected to continue applying GESI-responsive elements to its future projects. The project will also help develop a roadmap and action plan for strengthening PGCB capacity for accessing commercial borrowing including by identifying improvements in governance, internal financial control, operation efficiency, etc., and providing appropriate training on these.

1.3 Scope of Work for the Project

9. The project has three (3) outputs of which two output, i.e., Output 1 on 'Disaster- and climate-resilient and GESI-responsive power transmission infrastructure enhanced and modernized and Output 2 on 'Integration of Renewable Energy supported' will have environmental impact. Another output (Output 3 on Instutional Capacity of PGCB improved') relates to capacity development, including for safeguards, and, as it will not result in environmental impact on the ground, is not considered further in this EIA/IEE. The project will be implemented over 5 years period from 2025 to 2030.

Output 1: Disaster- and climate-resilient and GESI-responsive power transmission infrastructure enhanced and modernized. This output will support building disaster- and climate-resilient and GESI-responsive[24] power transmission infrastructure through (i) construction of 1,500 megavolt-ampere (MVA) of 230/132 kilovolt (kV) and 1,710 MVA of 132/33 kV transformers installed in 9 substations at Monohardi, Dupchachia, Tungipara, Kushtia, Mathbaria, Paikgacha, Matlab, Madhabpur, and Chatkhil, (ii) installing 6.70 km 230 kV double circuit and 141.30 km 132 kV double circuit of new disaster- and climate-resilient transmission lines, and 75.00 km (132 kV double circuit) of reconducting transmission lines by using high temperature and low sag conductors, and (iii) installing 10 numbers of 132 kV bay extensions. This output will improve reliability through constructing disaster- and climate-resilient power substations and transmission lines, which provide an extra component to complete a redundancy network system. [14]

Output 2: Integration of renewable energy supported. This output will facilitate the integration of renewable energy generation from the VRE hub in Southern Chattogram and enhance the reliability, resilience, and efficiency of the national power grid by (i) installing 2,160 MVA of 400/230/132 kV transformer capacities in a new disaster- and climate-resilient and GESI-responsive substation, and (ii) installing 6.75 km 400 kV, 0.50 km 230 kV and 1.30 km 132 kV new disaster- and climate-resilient transmission line.

Output 3: Institutional capacity of PGCB improved. This output will strengthen the capacity of PGCB by (i) increasing PGCB staff's (90% of relevant women staff) knowledge and capacity of advanced technologies including those related to climate risk-responsive design, operation and maintenance skills, emergency management of the power transmission system, and environmental and social safeguards; (ii) strengthening the in-house corporate environmental, gender and social unit, including in respect of corporate environmental and social safeguard procedures; (iii) developing a corporate GESI strategy; (iv) developing a roadmap and action plan for commercial borrowing for PGCB, and identifying areas where the capacity of PGCB can be improved; and (v) enhancing capacity for PGCB's fixed asset registry management.

[14] A redundancy network system ensures that if a component experiences an interruption or an outage, another source can supply that component to some capacity, maintaining continued operation and minimizing service disruptions.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

1.4 Objectives of the EIA/IEE

10. The proposed "POWER TRANSMISSION STRENGTHENING AND INTEGRATION OF RENEWABLE ENERGY (PTSIRE) PROJECT" resulted in the current national Environmental Impact Assessment (EIA) study. The Asian Development Bank (ADB) will provide financial support to the Government of Bangladesh (GoB) and PGCB in order to carry out this project. The national EIA study is equivalent to the Initial Environmental Examination (IEE) report required by ADB to process the project and is henceforth referred to as the EIA/IEE.

11. Safeguard requirements for all projects funded by ADB are defined under ADB's Safeguard Policy Statement (2009) which establishes an environmental screening, assessment and management process. All ADB projects must comply with its requirements and Operational Manual F1, 2013 to ensure the environmental soundness and sustainability of projects and to support the integration of environmental considerations into the project decision-making process. In accordance with its environmental assessment requirements, the IEE provides a road map to the environmental measures needed to avoid, minimize, and/or mitigate the adverse environmental impacts and risks associated with the project on biological, physical, social, and physical-cultural resources in the project area during the construction and O&M phases. More specifically, the IEE:

- Describes the project design, construction activities and operational parameters;
- Describes the existing socio-environmental conditions within the project area of influence;
- Describes the extent, duration and severity of potential direct, indirect, cumulative, and induced environmental impacts and risks;
- Analyzes all significant environmental impacts and risks; and
- Formulates the mitigation actions and presents it all in the form of an Environmental Management Plan (EMP) for implementation following project approval.

12. The scope of work of the EIA/IEE (as per Department of Environment (DOE) requirements) is: (a) Review of existing information (all relevant documents) from secondary sources, and identify gaps to be filled from primary surveys, relevant to the environmental screening and scoping needs (such as GOB standards and good international industry practice (GIIP) guideline levels to be followed for analysing baseline investigations for air, water, soil, noise etc. ADB requires, if national regulations differ, that the more stringent requirement will be followed. If less stringent levels are appropriate in view of specific project circumstances, the EIA/IEE will provide full and detailed justification for this, including data on the physical, biological and socioeconomic characteristics of the subproject site along with the project area of influence). (b) Provide a description of the environment. (c) Represent the primary surveys which include baseline (air, noise, vibration, surface water, groundwater, soil) environmental quality and electromagnetic frequency (EMF) monitoring at representative and sensitive locations, and identification of all macro-level environmental issues within the project's influence area. (d) Survey the environmentally sensitive locations on and along the project sites and routings as well as within the project's influence area. (e) Arrange stakeholders' consultations with the local people from all professions to find out their opinion of the project. (f) Analysis of alternatives to the proposed project. (g) Identify and assess potential environmental impacts in the Project Impact Area (PIA), including on any protected area, critical habitat for flora, fauna (focus on migratory birds or avifauna) due to implementation of the project, and (h) Formulation of Environmental Management Plan (EMP).

1.5 Category of the Project

13. According to the Environment Conservation Rules (ECR), 2023, the proposed Project regarding electricity transmission lines (>25 km) and sub-stations is likely to have environmental impacts especially during the construction phase, and it mainly falls under the RED category, as classified under the serial number 67. This project requires a Feasibility Study Report, national EIA, and No Objection Certificate (NOC) from the local authority to be submitted to receive a Site Clearance Certificate (SCC) and then

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Environmental Clearance Certificate (ECC) from the Department of Environment (DoE). The draft national EIA (Payment of applicable VAT and clearance fees as per Environment Conservation Rules 2023, 20 August 2024) has been undertaken for the purpose of obtaining environmental clearance from the DoE, Bangladesh.

14. For each ADB project, screening and categorization is conducted at the earliest stage of project preparation when sufficient information is available and is undertaken to (i) reflect the significance of potential impacts or risks that a project might present; (ii) identify the level of assessment and institutional resources required for the safeguard measures; and (iii) determine disclosure requirements. ADB uses a classification system to reflect the significance of a project's potential environmental impacts. A project's category is determined by the category of its most environmentally sensitive component, including direct, indirect, cumulative, and induced impacts in the project's area of influence. Each proposed project is scrutinized as to its type, location, scale, and sensitivity and the magnitude of its potential environmental impacts. Based on the ADB Safeguards Policy Statement (2009), this Project falls under ADB's environment Category B as the proposed environmental impacts are site-specific, few if any of them are irreversible, and in most cases mitigation measures can be designed more readily than for category A projects. This is due to the following facts: (i) components are located in semi-urban and rural areas which do not support high biodiversity values; and (ii) no protected areas or internationally or nationally recognized biodiversity areas or physical cultural resources will be passed by new overhead transmission lines, or reconductoring on one existing line; and (iii) construction of substations will the largest civil or structural works involved, the majority of the works will be electrical. As a result, significant adverse irreversible, diverse, or unprecedented environmental impacts are unlikely to arise. For a Category B project, an Initial Environmental Examination (IEE) including an EMP is required by the borrower.

1.6 EIA/IEE Study Team

15. This EIA/IEE has been prepared on behalf of PGCB by a team of ADB funded TA consultants, and the consultants appointed by PGCB and Environment & Social Unit (ESU) of PGCB to conduct the national EIA study.

Table 1.1: EIA/IEE Study Team

ADB Funded TA Consultants		
No.	**Name**	**Designation**
1	Rajat Jain	International Environmental Specialist
2	Raisin Akhter Feroz	Environmental Specialist (National)
Consultants Appointed by PGCB		
No.	**Name**	**Designation**
1	Engr. Md. Akhteruzzaman	Route Survey Expert
2	Muhammad Abul Foysal	Environmental Expert
3.	Md. Aminur Rahman	Social Development and Gender Expert
4	Mohammad Abul Hashem	Socio- Economist Resettlement Expert
5	Sharmin Sultana	Junior Social Expert
6	Md. Kamrul Hasan	Biodiversity Expert
7	Md. Mojibar Rahman	Agronomist
8	Md. Rajedul Islam	Water Resources Specialist
9	Shorove Roy	Pollution Control, Prevention and Monitoring Specialist
10	Md. Shamim Biswas	Junior GIS Expert
Environment & Social Unit (ESU) of PGCB		
No.	**Name**	**Designation**
1	Nafisa Sher	Manager
2	Tareque Ahmed Bhuiyan	Deputy Manager

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

3.	Tabassum Hasan Tanisha	Assistant Engineer
4	Kazi Md. Abir Aman Abed	Assistant Manager
5	Sumon Chandra Roy	Assistant Manager
6	Nusrat Jahan	Sub-Assistant Engineer
7	Md. Nur Alam Ziku	Sub-Assistant Engineer

1.7 Structure of the EIA/IEE Report

16. The report has been structured in compliance with the requirements of DOE and the ADB Safeguard Policy Statement (2009).

Chapter 1 Introduction:

The introduction chapter presents a brief overview of the EIA/IEE assignment along with the project background objectives and scope of work.

Chapter 2 Legislative and Administrative Framework:

Chapter 2 outlines policy and legislation on environment, health and safety issues.

Chapter 3: Approach and Methodology:

This chapter describes the approach and the methodology followed in conducting the EIA/IEE.

Chapter 4 Description of the Project:

Chapter 4 describes the project interventions including the project location, project components and various activities to be undertaken during different phases of implementation, work schedule and project costs.

Chapter 5: Environmental and Social Baseline:

This chapter describes the environmental baseline conditions (physical and biological) of the project area of influence. This chapter also describes the social baseline conditions (population, demographics, settlements, housing, traffic and transport, utilities, economy and employment etc.) and physical cultural resources of the project area of influence.

Chapter 6: Substation Environmental Audits:

Provides the findings of the environmental audits of existing substations and corrective actions required.

Chapter 7: Alternative Analysis:

This chapter outlines the alternative analysis of the main project components i.e., the substations and transmission lines.

Chapter 8: Important Environmental and Social Components:

Presents the environmental and social components likely to be impacted by the proposed project.

Chapter 9: Potential Impact Prediction and Analysis:

Presents the potential adverse impacts on the environmental and social components with mitigation measures to be adopted for the pre-construction, construction and operation and maintenance phases of the project.

Chapter 10: Stakeholder Consultations:

This chapter presents a description of the extent of stakeholder consultation that was undertaken and its outcome.

Chapter 11: Grievance Redress Mechanism:

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

The Grievance Redress Mechanism (GRM) which will be adopted by PGCB to address community and worker concerns is outlined in this chapter.

Chapter 12: Environmental Management Plan:

This chapter describes the environmental management, mitigation and monitoring measures that will be put in place to reduce the anticipated adverse environmental impacts of the Project to acceptable levels.

Chapter 13: Conclusions and Recommendations:

This chapter presents the findings, conclusions and recommendations of the EIA/IEE.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

2 Legislative and Administrative Framework

2.1 Introduction

17. This chapter is about the applicability of national laws and regulations, international agreements, and ADB safeguards requirements to the project. The chapter also lays out the various permissions required for the project from national authorities. All relevant environment, health and safety (labor) policies and legislation pertaining to the Government of Bangladesh (GoB), particularly the Environment Conservation Act (ECA), 1995 (with subsequent amendments) and the Environment Conservation Rules (ECR) 2023 were assessed. The ECA and ECR are the main legal instruments related to the environmental impact of project development, obliging all project activity to have the necessary clearance certificates in place. In the following sections, a summary of relevant policies and legislations is presented. PGCB will ensure adherence to all applicable regulations and standards for environmentally acceptable operation of this Project.

2.2 Environmental Legislation Framework

2.2.1 Overview of the Environmental Approval Process

18. Key legislation governing the environmental approvals process for the proposed project is the Bangladesh Environmental Conservation Act, 1995 (ECA, 1995) and the Environmental Conservation Rules (ECR, 2023). According to Rule 5 of ECR, 2023 proposed developments within Bangladesh are classified as one of four categories, as follows:

(i) Green;
(ii) Yellow;
(iii) Orange; and
(iv) Red.

19. The category of a project determines the procedure for issuance of an Environmental Clearance Certificate (ECC). All proposed industrial units and projects that are considered to be low polluting are classified under "Green" and shall be granted Environmental Clearance. For proposed industrial units and projects classified under the Yellow, Orange and Red Categories, a Site Clearance Certificate and a subsequent ECC are required from the DOE depending on geographical location of project, extent of project activities and pollution load, and possible adverse impacts on human health and the environment. A detailed description of the approval process for the four categories of industry/projects are documented in Schedule 1 of ECR, 2023.

20. Key milestones in the approvals process are outlined in Table 2.1. These comprise:

(i) **Site Clearance Certificate:** An SCC will be issued by DOE upon approval of all requirements. Compliance with the site selection requirements is all that is required for 'Yellow' category projects. In addition to compliance with the site selection requirements, an IEE study is required for 'Orange' category projects and an EIA study for 'Red' category projects; and
(ii) **Environmental Clearance Certificate:** The ECC will be issued by DOE upon approval of all requirements. ECC is issued to 'Green' category project upon approval of the General Description of the Project; to 'Yellow' projects after issuance of the SCC; and for 'Orange' and 'Red' category projects after issuance of the SCC and confirmation by DOE of compliance with SCC requirements, recommendations of the EIA etc.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

2.2.2 Procedure for Obtaining Site Clearance Certificate and Environmental Clearance Certificate

21. The environmental assessment process consists of three stages: screening, IEE, and detailed EIA per ECR, 2023. The ECR also contains the procedures for obtaining the SCC and ECC from the DOE for different categories of proposed industrial units or projects. Any person or organization wishing to establish an industrial unit or project must obtain an SCC and ECC from the Director General of DOE. The application for such certificate must be in the prescribed forms provided together with the prescribed fees laid down in Schedule 6 and Schedule 7, through the deposit of a Treasury Chalan in favor of the Director General of DOE. The procedure of getting the SCC and ECC of four categories of project are briefly described as follows.

(i) **Green:** Projects categorized as Green projects are listed in Schedule 1. The proponent has to submit an application in a prescribed format Form 3: Site Clearance/Environmental Clearance Certificate Application, Rule 9 Sub-Rule (1), Rule 10 Sub-Rule (1), Rule 11 Sub-Rule (1), Rule 12 Sub-Rule (1), Rule 14 Sub-Rule (1), and Rule 23 Sub-Rule (4) along with specified documents;

In addition, as per Schedule 9: Industry or Project Site Selection Guideline, Rule 8 Sub-Rule (kha), Rule 9 Sub-Rule (2), Rule 10 Sub-Rule (2), Rule 12 Sub-Rule (2), and Rule 14 Sub-Rule (2) must be followed by the proponent;

The proponent must deposit/pay the mentioned amount of fees to DOE per Schedule 7: Site Clearance or Environmental Clearance Certificate Received and its Renewal Fee; Rule 9 Sub-Rule (3), Rule 10 Sub-Rule (3), Rule 12 Sub-Rule (6), Rule 84 Sub-Rule (3), Rule 21 Sub-Rule (14), Rule 22 Sub-Rule (1), and Rule 23 Sub-Rule (4); and

DOE will provide the ECC to the applicant within seven (7) days of application subject to their site investigation and satisfaction on the submitted documents. The ECC needs to be renewed every 5 years.

(ii) **Yellow**: Projects categorized as Yellow are listed in Schedule 1. The proponent has to submit an application in a prescribed format Form 3: Site Clearance/Environmental Clearance Certificate Application, Rule 9 Sub-Rule (1), Rule 10 Sub-Rule (1), Rule 11 Sub-Rule (1), Rule 12 Sub-Rule (1), Rule 14 Sub-Rule (1), and Rule 23 Sub-Rule (4) along with specified documents;

The proponent must deposit/pay the mentioned amount of application processing fee to DOE per Schedule 6: Site Clearance or Environmental Clearance Certificate Application Process Fee, Rule 10 Sub-Rule (2), Rule 12 Sub-Rule (2), Rule 14 Sub-Rule (2), related documents and detail information and per Schedule 9: Industry or Project Site Selection Guideline, which shall be followed;

The relevant DOE office will conduct a site visit to the project and prepare a report with justification and opinion. Within 8 working days of receiving the application, the concerned DOE office will notify the applicant to pay the fee specified in Schedule-7, provided the information in the application is satisfactory and the on-site inspection is completed;

The proponent must deposit/pay the mentioned amount of site clearance fee to DOE per Schedule 7: Site Clearance or Environmental Clearance Certificate Received and its Renewal Fee; Rule 9 Sub-Rule (3), Rule 10 Sub-Rule (3), Rule 12 Sub-Rule (6), Rule 84 Sub-Rule (3), Rule 21 Sub-Rule (14), Rule 22 Sub-Rule (1), and Rule 23 Sub-Rule (4); and

After issuance of SCC, the Client submits its application for issuance of ECC to DOE. DOE will provide the ECC to the applicant within seven (7) days of application subject to their site investigation and satisfaction on the submitted documents. The ECC needs to be renewed every 2 years.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

(iii) **Orange**: Projects categorized as Orange require proponents to submit an application in a prescribed format Form 3: Site Clearance / Environmental Clearance Certificate Application for Site Clearance, along with deposit /payment of the mentioned amount of fees for the project to DOE per Schedule 6, related documents and detail information, submission of an Initial Environmental Examination (IEE) Study report, and compliance with Schedule 9: Industry or Project Site Selection Guideline. After approval, the proponent must deposit/pay the mentioned amount of fees for the project to DOE per Schedule 7 for obtaining the Site Clearance for the project;

The relevant DOE office will visit the project site and prepare a report. This report, along with the application, will be sent to the appropriate ECC committee based on the project's serial number listed in Schedule 1. The ECC committee will review the application and the report and make a decision. The applicant will then be notified to pay the fee listed in Schedule 7 for the SCC issuance; and

Within 21 days from payment of fees per Schedule 7, DOE issues the SCC. Upon obtaining the SCC, the proponent will apply for an ECC from the DOE. The DOE office will then perform a site visit to ensure SCC compliance and review relevant issues. A report justifying the issuance or rejection of the ECC will be prepared and forwarded, along with the application, to the appropriate ECC committee. The committee will make a decision within 20 working days of the application date and issue the ECC. If an initial environmental examination of an Orange Category project reveals significant pollution impacts, the ECC Committee may recommend an Environmental Impact Assessment (EIA). With approval from the Director General, the proponent must conduct the EIA. The ECC needs to be renewed every year.

(iv) **Red**: Projects categorized as Red Projects require proponents to submit an application in a prescribed format Form 3: Site Clearance/Environmental Clearance Certificate Application for Site Clearance, along with deposit /payment of the mentioned amount of fees for the project to DOE per Schedule 6, related documents, detail information, draft Terms of Reference (ToR) of Environmental Impact Assessment (EIA) compliance with Schedule 9: Industry or Project Site Selection Guideline;

Per Schedule 10, Environmental Impact Assessment Scope of Works Guidelines, Rule 14 Sub-Rule (3), a draft Terms of Reference (TOR) will be prepared for the conduct of an Environmental Impact Assessment and submitted to the DOE for approval;

The relevant DOE office will visit the project site to review the documents and all pertinent issues. A report with justifications and findings on the rationale for issuing the site clearance certificate and draft ToR for the EIA will be forwarded to the ECC Committee. Upon receiving the documents, the ECC Committee will review and evaluate them, then submit a report to the Director General (DG) for approval. With the DG's approval, the concerned office will approve the ToR for the EIA within 30 working days;

An EIA study shall be prepared based on DOE's approved TOR. An Environmental Management Plan should be prepared as an integral part of the EIA study according to Schedule 11: Industry or Project Environmental Impact Assessment Study Preparation Guidelines, and Rule 15 Sub-Rule (3). Public consultations for the EIA study shall be carried out; and

The proponent has to submit the EIA report to the ECC Committee as per Schedule 11. If the EIA is approved by the DG, the proponent has to pay the fee specified in Schedule-7 within a maximum of 7 working days and the SCC will be issued within 7 working days of submission of fee to the concerned DOE office. After issuance of the SCC, proponent will submit the application for issuance of ECC. The relevant DOE office will conduct a site visit to verify the conditions of the SCC and the recommendations of the EIA etc. A report will be prepared and forwarded to the ECC committee. Upon reviewing the reports and documents, the ECC

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Committee will make recommendations to the DG regarding the issuance of the ECC. Once the DG approves these recommendations, the concerned office will issue the ECC within 30 working days. The ECC needs to be renewed every year.

22. For any "Red" category project it is mandatory to obtain the Site Clearance Certificate (SCC) to start the construction work and later the Environmental Clearance Certificate (ECC) will need to be obtained to start the operation of the project from the Department of Environment (DoE). The first step is to get approval of the Terms of Reference (ToR) for preparation of the Environmental Impact Assessment (EIA) required for the project. Later after getting approval of the ToR for the EIA study, as well as obtaining the site clearance, the respective concerned authority will proceed for the construction activities. This site clearance will need to be renewed every year until the ECC is issued. Once issued the ECC will be valid for 1 year and requires renewal each year.

2.2.3 Government Environmental Categorization

23. Environmental Conservation Rules, 2023 clearly defines the classification of all industrial and project schemes into four broad categories. The categorization considers all the physical interventions in implementation of those projects or industries and operational procedures and risk associated therein. Susceptibility of the location where the projects would be implemented also determines the categories; sometimes stringent management issues are levied on the project implementation and operation. Since the project includes the construction of ten substations and 232.55 km of transmission lines (including reconductoring of 75.00 km of 132kV transmission line) according to the ECR 2023 categorization, the project involves electricity transmission lines (>25 km) and sub-stations and so mainly falls under the "RED" category under the serial number 67.

24. A "RED" category project is one which has an impact on the environment and human health and must reduce its environmental impact by protecting the environment and taking pollution control measures. This category requires mandatory submission of an Initial Environmental Examination (IEE) and an Environmental Impact Assessment (EIA) including EMP by the project proponent (PGCB) to the DoE for receiving the 'Site Clearance Certificate' (SCC) as well as the 'Environmental Clearance Certificate' (ECC) through approval of the EIA report. The following documents/materials are to also be submitted with the application:

- Feasibility Study Report for the Project (where applicable)
- No Objection Certificate from relevant Local Authority (where applicable)
- Other necessary information (where applicable)

25. The DoE has issued guidelines on undertaking the EIA for several industrial sectors and activities. Each Project Proponent shall conduct an EIA and is expected to consult and follow the DoE guidelines. The DoE has issued an application procedure for obtaining site and environmental clearances. Table 2.1 Figure 2.1 shows this procedure for obtaining the environmental clearance from the DoE for the "RED" category of projects under the Environment Conservation Rules 2023. Steps to be followed for obtaining the Environmental Clearance Certificate (ECC) for this Project are shown in Figure 2.2. The Site Clearance Certificate (SCC) was secured on 22 October 2024.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

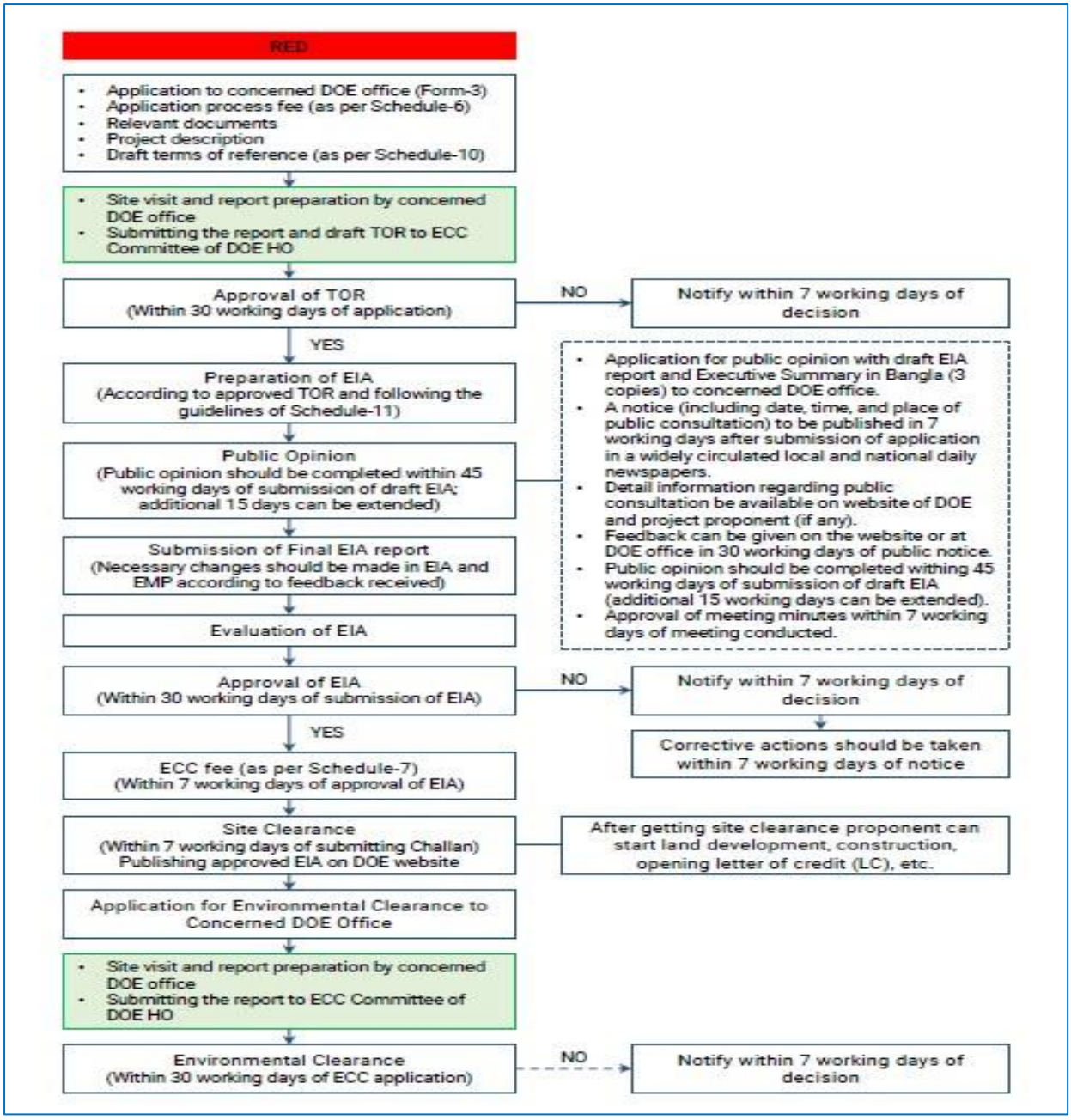


Figure 2.1: Process for Getting Clearance Following the DoE Guidelines

2.3 Procedure for No Objection Certificate

26. The No Objection Certificate (NOC) is a key document required while applying for the SCC and ECC online. This is required as part of the approval of the local government authorities (e.g., Union Parishad Chairman, Upazila Parishad Chairman, Pourashava Chairman etc.) in support of the project. This approval represents a commitment to environmental sustainability as well as the project's efficacy. Without the NOC, the DoE does not proceed for issuing ECC. The collected NOC needs to be attached in the EIA or separately, and submitted to the DoE both in hard and soft copies.

27. A NOC letter basically contains a description of the project including location, justification to obtain NOC from that agency, and proposed measures under the project. In this Project, PGCB will submit the NOC letter to the agencies mentioned above. Once obtained PGCB submits the NOC letter or submits the standard NOC form of DoE, as applicable. The steps are:

- PGCB sends letters to head of the agency;

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

- The requesting agency then evaluates the NOC request that may require field investigation for verification;
- PGCB will pursue this and it generally requires constant follow up to get a result; and
- Once the NOCs are received-signed, they are forwarded by PGCB to DOE.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

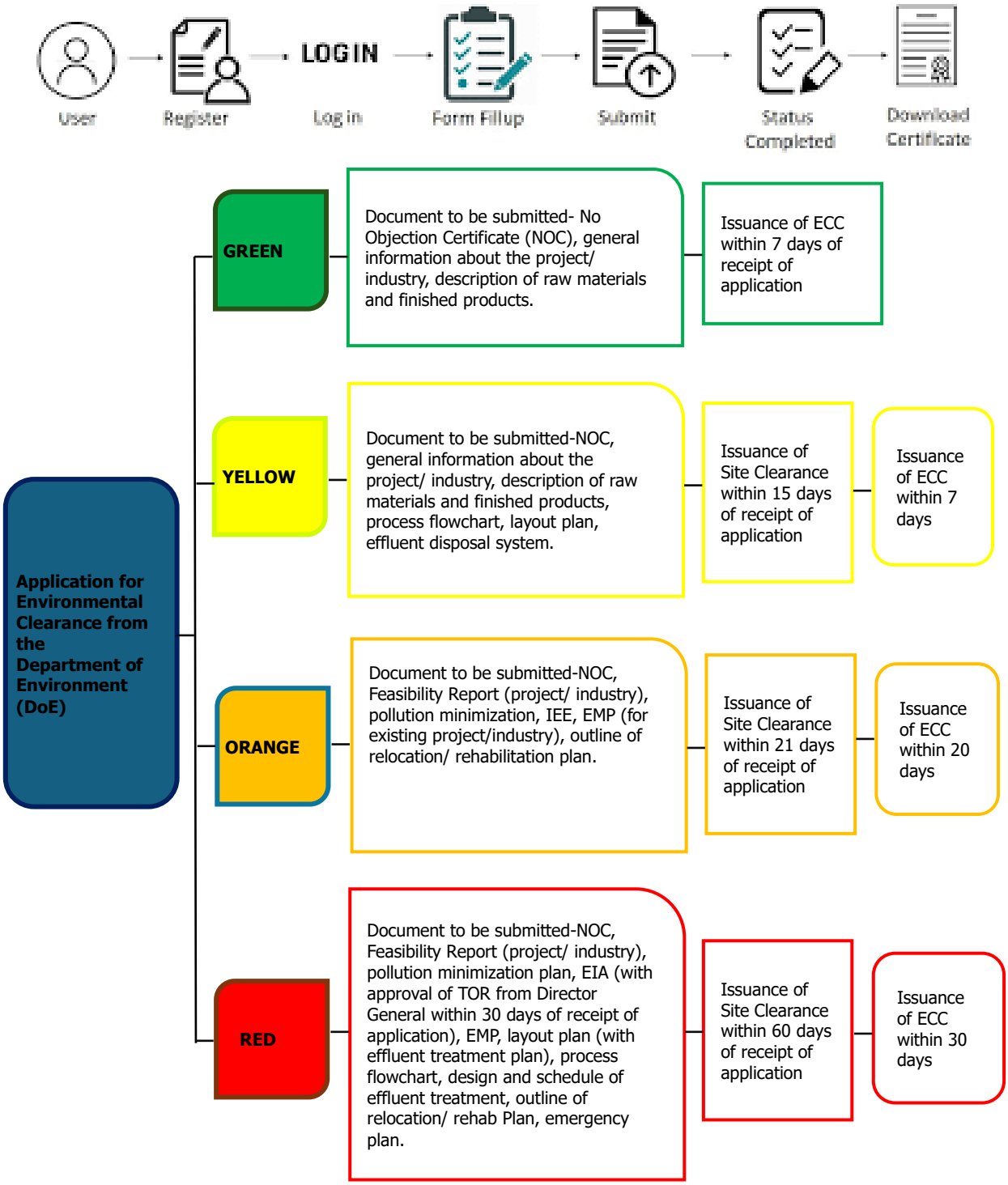


Figure 2.2: Government of Bangladesh Environmental Assessment Process (as per ECR, 2023)

2.4 Environmental Standards

28. Environmental quality standards of Bangladesh for varying water sources, industrial effluent, discharges and emissions are prescribed under the Environment Conservation Rules 2023. The standards intend to impose restrictions on the volume and concentration of liquid waste and emissions discharged into the environment. In addition, a number of surrogate pollution parameters (e.g., Biochemical Oxygen

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Demand or Chemical Oxygen Demand; Total Suspended Solids) are specified in terms of concentration and/or total allowable quality discharged in case of wastewater discharges. Additionally, specific parameters depending on the manufacturing process are specified such as Phenol, Cyanide, Copper, Zinc, Chromium etc. Air emission standards refer mostly to concentration of mass emission of various types of particulates, sulfur dioxide and oxides of nitrogen and in some cases volatile organic compounds and other substances. Whilst the previous version of the Environment Conservation Rules contained standards for ambient air quality, they do not anymore. Standards for ambient air were moved to the Air Pollution Control Rules (APCR) 2022. Similarly, the ambient noise standards are provided for within the Noise Pollution (Control) Rules 2006.

29. The Bangladesh standards, in general, are less stringent compared to the developed countries. This is to ensure that they are not too restrictive and thus hinder industrialization in the country. The Bangladesh standards are not for any specific period e.g., 1 hour, 24 hours meaning they cannot be directly compared to international environment quality guidelines. There is no provision for partial compliance either.

30. However, as per ADB SPS 2009 "during the design, construction, and operation of the project the borrower/client will apply pollution prevention and control technologies and practices consistent with international good practice, as reflected in internationally recognized standards such as the World Bank Group's Environment, Health and Safety Guidelines. These standards contain performance levels and measures that are normally acceptable and applicable to projects. When host country regulations differ from these levels and measures, the borrower/client will achieve whichever is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, the borrower/client will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in this document."

31. Applicable corresponding standards/guidelines for monitoring environment parameters for project activities is attached in Appendix X.

2.5 Organizations Related to Enforcement of Environmental, Health and Safety Legislation

32. Roles and responsibilities of various Ministries and Departments involved in the enforcement of environmental requirements are described below:

Ministry of Environment, Forest and Climate Change

33. The Ministry of Environment, Forest and Climate Change (MoEFCC) is the key Government institution in Bangladesh for all matters relating to national environmental policy and regulatory issues. Realizing the ever-increasing importance of environmental issues, the MoEFCC replaced the Ministry of Agriculture and Forest in 1989 and is at present a permanent member of the Executive Committee of the National Economic Council. This is the major decision-making body for economic policy issues and is also responsible for approving all public investment projects. The MoEFCC oversees the activities of the following technical and implementing agencies.

Department of Environment

34. In order to expand the scope of environmental management and to strengthen the power for achieving it, the Government adopted the Environmental Pollution Control Ordinance in 1977. The ordinance provided the opportunity for the establishment of an Environmental Pollution Control Board, which was assigned with the responsibility of formulating policies and proposing measures for their implementation. In 1982, the Board was renamed as the Department of Environmental Pollution Control (DEPC). Six divisional offices were established in Dhaka, Chattogram, Khulna, Barishal, Sylhet and Rajshahi. A special presidential order renamed the DEPC as the Department of Environment (DoE) and placed it under the newly formed MoEFCC in 1989.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

35. The DoE is a Department of the MoEFCC and is headed by a DG. The power of the DG, as given under the Act, may be outlined as follows:

- The DG has the power to close down activities considered harmful to human life or the environment. The operator has the right to appeal and procedures are in place for this. However, if the incident is considered an emergency, there is no opportunity for any appeal.
- The DG has the power to declare an area affected by pollution as an ecologically critical area. The DoE governs the type of work or process which can take place in such an area.
- Before undertaking any new development project, the project proponent must take Environmental Clearance Certificate (ECC) from the DoE. The procedures to take such clearance are in place.
- Failure to comply with any part of the Environment Conservation Act (ECA), 1995 with subsequent amendments may result in punishment by imprisonment or a fine of or both.

Forest Department

36. This department is responsible for the protection and management of all reserve forests in the country. Department personnel extend down to the union level in areas where there are reserve forests. The department has recently started some agroforestry programs and its officers are also responsible for the protection of wildlife in the forests.

Other Related Organizations

37. There are several other organizations which have certain social and environmental functions. These organizations include:

- Ministry of Land: Land Reform and Land Acquisition Directorate
- Ministry of Water Resources: Bangladesh Water Development Board
- Ministry of Fisheries and Livestock: Directorate of Fisheries
- Ministry of Labor and Employment: Department of Labor

2.6 National Legislations Relevant to Environment

38. National Policies, Legislation, Acts and Rules that are relevant to this proposed project are discussed in the following Table 2.1. Of these, the Environment Conservation Rules (ECR) 2023, are the key legislation.

39. In 2023, MoEFCC approved the ECR 2023 as a replacement to the ECR 1997, strengthening the requirements and clarifying the procedures for industries or projects to assess and manage environmental impacts associated with their activities. The ECR 2023 detail provisions for the environmental clearance process, such as on scoping, project categorization, site clearance, environmental assessment, cross-sector and stakeholder consultations, compliance monitoring of the conditions of the ECC, among others. Additionally, the ECR 2023 regulates access to information and stakeholder participation throughout the environmental clearance process, particularly for those activities that require a full EIA. This was absent from the previous ECR, 1997. The ECR 2023 has updated the water quality and sewerage standards, as well as waste emissions and liquid waste standards for industries and projects. However, the ECR 2023 do not include noise and odor standards, which were part of the ECR 1997. Standards for ambient air were moved to the Air Pollution Control Rules (APCR) 2022 and noise standards are contained in the Noise Pollution (Control) Rules 2006.

40. Although the ECR 2023 are expected to improve the ECC process, additional guidelines are required to clarify assessment criteria and procedures related to key themes, such as: screening of projects that are not pre-categorized in the ECR, analysis of project alternatives (including the “no-go”

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

option), mitigation hierarchy approach, monitoring program after ECC issuance, resource efficiency, occupational health and safety (OHS), labor and workers' rights, differentiated treatment of vulnerable groups in the assessment and management measures, among others.

41. Although the list of Ecologically Critical Areas has been removed from the ECR 2023, it has been regularly updated through gazette notifications (DoE, 2019). The ECR 2023, as in the 1997 version, kept limited provisions on DoE's responsibilities of policy formulation, data collection, environmental quality monitoring and enforcement (including, for example, the use of new technologies for oversight activities).

Table 2.1: Relevant Bangladesh Policies and Legislation

Policy/Act/Rules	Compliance Requirements	Applicability
National Environment Policy, 2018 and Action Plan	This policy provides a framework for establishment of legislation for protecting the environment. It outlines all the criteria for IEE and EIA approval as well as provides basic framework of environmental action for sustainable development.	The PGCB must follow the policy and comply with provisions while implementing the project.
National Environmental Management Action Plan, 1995	NEMAP 1995 is an environmental planning initiative aimed at improving natural and human environments, reducing environmental degradation and promoting sustainable development. It was developed in consultation with stakeholders across various sectors, aligning with the commitments made under Agenda 21. The plan addresses environmental issues such as pollution, deforestation, and sustainable resource management, proposing actionable interventions to mitigate these challenges.	NEMAP 1995 is applicable to the PGCB project as the project's activities, including construction of new substation, bay extension and transmission line may cause environmental impacts. Compliance with NEMAP ensures that the project aligns with national environmental goals, particularly those related to sustainable development, protection of natural resources and environmental impact mitigation
The Environment Conservation Act, 1995 and amended till October 5, 2010 (hereinafter referred as ECA).	This Act is the key legislation in relation to environment protection in Bangladesh. It is promulgated for environment conservation, standards, development, pollution control, and abatement. It has repealed the Environment Pollution Control Ordinance of 1977. The Act has been amended in 2000, 2002, 2007 and 2010. Failure to comply with any part of the Environment Conservation Act, 1995 may result in punishment to a maximum of 10 years imprisonment or a maximum fine of BDT 1,000,000 or both.	This project triggers this act because the project proposes for construction and the provisions of the act apply to all the project intervention phases during the project life cycle to ensure the environment is protected and conserved.
The Environment Conservation Rules, 2023 (hereinafter referred to as ECR)	These rules categorize all the industries and projects as well as the types of environmental assessments that should be conducted in relation to each category of industries or projects. Additionally, this regulation establishes national criteria for environmental quality in water quality and sewerage and waste emissions.	The proposed project falls into the RED category, for which SCC/ECC is required upon submission of IEE report and EMP. Moreover, PGCB needs to follow the guidelines presented in the ECR to prepare the documentation required to apply for and obtain the clearances required to initiate any intervening activities from the DoE. PGCB will follow the EMP mentioned in this EIA report and follow the environmental quality and other applicable standards mentioned in ECR. SCC/ECC will be valid for 1 year from the issuance date and

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Policy/Act/Rules	Compliance Requirements	Applicability
		shall be renewed at least 30 days prior to expiry. PGCB will notify the Director General (DG) of DoE in case of pollutant emission/ discharge in excess of prescribed standards or where there is a possibility of the same.
Solid Waste Management Rules, 2021	These rules require (i) source segregation of waste into dry and wet waste, (ii) standards for composting, (iii) anaerobic digestion and waste- to-energy projects, (iv) guidelines for landfilling, and (v) standards for the placement of secondary storage bins, and primary and secondary collection of waste.	Applicable as the project needs to manage solid wastes during construction and operation.
Hazardous Waste (e-waste) Management Rules, 2021	The E-waste rule covers the products listed in the Schedule (home appliances, monitoring and control equipment, medical equipment, automatic machines, IT and communication equipment), and establishes obligations for manufacturers, assemblers, collectors, sellers, and consumers of the products. The rule also sets provisions to limit the use of the 10 substances covered by the European Union (EU) Restriction of Hazardous Substances (RoHS) Directive. This regulation entered into force upon publication. The main provisions of this regulation are: i. Manufacturers, traders, sellers, transporters, repairers, collection centers, recyclers, dismantlers, etc. of the subject products are required to register with a prescribed form to the DoE. When applying for registration, they shall also submit the Waste Electrical and Electronic Equipment (WEEE) management plan; ii. Registered manufacturers, recyclers, etc. shall obtain environmental clearance in accordance with the Bangladesh Environmental Protection Rules, 1997 iii. Manufacturers must establish individual or joint collection centers and set aside funds for the implementation of the WEEE; iv. For fluorescent lamps and mercury incandescent lamps, if they cannot be recycled, they need to be handed over to collection centers for storage and disposal; v. Manufacturers, importers, etc. shall meet the collection targets for the WEEE as specified in the Schedule (10% in the first year of the implementation, 20% in the second year, 30% in the third year, 40% in the 4th year, and 50% in the fifth year and thereafter). vi. In order to facilitate the proper management of the WEEE, the name, address and contact information of the trader or seller as well as the information on the registered collection	Applicable as the project needs to manage e-wastes during construction and operation.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Policy/Act/Rules	Compliance Requirements	Applicability
	center shall be displayed on the product or on the product label, or this information shall be provided to consumers or large consumers; vii. Traders, sellers and collectors of the WEEE shall receive them from consumers at designated points and transport them to collection centers.	
Air Pollution Control Rules (APCR), 2022	APCR, 2022 contains air quality standards based on WHO Guidelines (Interim Goals); emissions limits and technical specifications for key sectors; mandates and coordination mechanisms among relevant line ministries to control both household and outdoor air pollution. The rules elevated the air quality management (AQM) dialogue and leadership beyond the environment sector, by establishing the National Committee on Air Pollution Control (NCAPC), a muti-sector decision-making body presided by the Cabinet Secretary to coordinate the APCR implementation and instruct relevant agencies on specific interventions to comply with the new rules. The NCAPC is mandated, for example, to impose emergency measures depending on the levels of air pollution, such as restricting activities of industries or projects, vehicles, or any source of air pollution in a certain area, and closure of educational institutions. APCR also envisage the objectives and minimum requirements of its implementation management tools, such as a National Air Quality Plan (also covering HAP interventions and targets); degraded airsheds declaration and management plan; publication of list of highly air polluting industries and activities; prevention plans; monitoring and control systems. Other relevant regulatory development for AQM refers to the 2019 Amendment of the Brick Manufacturing and Kiln Installation Act, 2013. The amendment set phased targets to reduce the use of clay-fired bricks in public works from 2019 to 2025, except for the construction of base/sub-base of the high-ways. However, implementation of this phased reform is delayed.	These rules are applicable to this project as it will involve emissions (primarily dust and exhaust emissions) during construction.
Electricity Act, 2018	Under the Electricity Act 2018, any individual or entity may obtain a license to supply electrical energy and to install electric supply lines, either above or below land. The licensee is required to provide prior written notice to landowners, allowing them a reasonable amount of time to respond before commencing any work. This process	PGCB, here the Licensee, shall need to obtain necessary permission, provide appropriate compensation following national laws/Act, and comply with all the requirements described in this Act.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Policy/Act/Rules	Compliance Requirements	Applicability
	is governed by the guidelines outlined in Section 13 (Right of Way). If land acquisition is necessary for such projects, the licensee must adhere to the existing land acquisition laws, as specified in Section 14 (Land Acquisition). In the course of their work, the licensee must seek permission from the appropriate authorities before disrupting or excavating public infrastructure such as streets, railways, tramways, or other similar facilities. This rule also applies to laying electric lines near or across canals, tunnels, or waterways, as per Section 6 of the Act. When working near other utility services (such as gas, water, or sewer lines), the licensee must obtain the necessary permissions and provide notice prior to the commencement of work, except in emergency situations, as outlined in Section 8. Additionally, the licensee is responsible for repairing any damage caused during their operations, including roads, pavements, or sewage systems. They must also refill any excavated areas and manage the disposal of waste generated by the work, in accordance with Section 9. If the work impacts telecommunications or internet infrastructure, the licensee is required to notify the relevant service providers before commencing work. In emergency situations, work can begin without prior notice, but notification must be given once the work is completed, as per Section 10. The construction of overhead power lines across or along roads, railways, canals, or waterways can only be carried out after obtaining prior approval from the government, as outlined in Section 11. Furthermore, the licensee is responsible for compensating for any damages, inconveniences, or disruptions caused by their activities or those employed by them, as per Section 12. This comprehensive structure ensures that the licensee operates within the legal framework, respects public and private property, and takes responsibility for any impact caused by their work.	
Acquisition and	Land acquisition and requisition in	The project requires both land

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Policy/Act/Rules	Compliance Requirements	Applicability
Requisition of Immovable Property Act, 2017	Bangladesh is governed by a) the Acquisition and Requisition of Immovable Property Act, 2017 (henceforth, the 2017 Act). The 2017 Act provides certain safeguards for the owners and has provision for payment of "fair value" for the property acquired. **Chapter-2: Acquisition** • The Deputy Commissioner (DC) in all cases, determines the "market value" of acquired assets on the date of notice of acquisition (notice under Section 9 of the 2017 Act). The assessment of this market value is done considering the average price of immovable properties of the same class, with similar facilities and within the vicinity of the "to be" permanently acquired land and assets. • The DC then adds 200% and 300% premium of the assessed value for cash compensation under law (CCL) of the land and assets including house for government and non-governmental acquisitions respectively. • For any other losses as specified above, i.e. from (b) to I[15], the DC adds 100% premium of the assessed value to pay as compensation. • If land acquired has standing crops cultivated by tenant (bargadar) under a legally constituted written agreement, the law requires that part of the compensation money be paid in cash to the tenants as per the agreement. If there is a dispute regarding the amount of compensation, there is an option for arbitration and the procedures for such is in place. **Chapter-3: Requisition** • When any property is required temporarily for a public purpose or in the public interest, the Deputy Commissioner can make a requisition of the property. • The Deputy Commissioner may take possession of the requisitioned property and use it for the purpose for which it was requisitioned. • The amount of compensation payable for the requisition of any property shall consist of: o A recurring payment, in respect of the period of requisition, of a sum	acquisition and land requisition for which clauses described in Chapter-2 and Chapter-3 are applicable for PGCB. PGCB must comply with these clauses for either or both acquisition or/and requisition.

[15] (b) loss of crops or trees; (c) loss of affected immovable property separated from existing immovable property; (d) loss of other immovable property or movable property or income; (e) transfer cost of affected residential and commercial properties.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Policy/Act/Rules	Compliance Requirements	Applicability
	equal to the rent which would have been payable for the use and occupation of the property o Such sum as may be found necessary to compensate the persons interested for all or any of the following matters, namely: ✓ Expenses on account of vacating the requisitioned property; ✓ Expenses on account of re-occupying the property upon release from requisitioned; and ✓ Damages, other than normal wear and tear, caused to the property during the period of requisition, including the expenses that may have to be incurred for restoring the property to the condition in which it was at the time of requisition. • If the persons entitled to compensation do not consent to receive or if there be no person competent to receive the compensation, or if there be any dispute as to the title to receive the compensation or as to the apportionment of it, the Deputy Commissioner shall keep the amount of the compensation in a deposit account in the Public Account of the Republic which shall be deemed payment of the compensation for the requisitioned property without any prejudice to the claim of the parties to be determined by the Arbitrator. • Where any requisitioned property is released from requisition, the Deputy Commissioner shall restore it to the person from whom the property was requisitioned or to his successor-in-interest or to such other person as may appear to the Deputy Commissioner to be entitled to such restoration.	
Wildlife (Conservation and Security) Act, 2012	This Act provides for the conservation and safety of biodiversity, forest and wildlife of the country by repealing the previous laws i.e., Wildlife (Preservation) Act of 1973. The Department of Forest (BFD) has the primary responsibility for implementing this Act. The key features of this Act are: • Prohibition made in relation to wild animals and plants that no person can hunt any wild animal without a license or willfully pick, uproot, destroy or collect any plant;	There is a possibility of damage and disruption of wildlife species and their habitats due to the proposed activities for which mitigation measures need to be implemented. Therefore, PGCB must comply with this Act for ensuring wildlife conservation and their security.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Policy/Act/Rules	Compliance Requirements	Applicability
	• Determination of vulnerable, endangered and critically endangered species of wild animals and plants; • Declaration of sanctuary for the conservation of forest and habitat of wildlife and prohibitions made on such sanctuary; • Requirement of license to cultivate, extract, manufacture, rear, export or import any wild animal or part of its body, meat, trophy, uncured trophy or any plant; and • Restriction on import, export and re-export of wild animals and plants.	
Bangladesh Water Act, 2013	The Water Act 2013 is based on the National Water Policy, and is designed for integrated development, management, extraction, distribution, usage, protection and conservation of water resources in Bangladesh. As per this Act, all forms of water (e.g. surface water, ground water, sea water, rainwater and atmospheric water) within the territory of Bangladesh belong to the government on behalf of the people. The private landowners will be able to use the surface water inside their property for all purposes in accordance with the Act. A worthwhile initiative is the requirement for permits/licenses for large scale water withdrawal by individuals and organizations beyond domestic use. Without prior permission issued by the Executive Committee, no individual or organization will be allowed to extract, distribute, use, develop, protect, and conserve water resources, nor they be allowed to build any structure that impedes the natural flow of rivers and creeks.	The proposed transmission lines will cross rivers, canals and waterbodies, and eventually may obstruct water use and deteriorate the water quality. Therefore, PGCB must comply with this Act as well as following the mitigation measures described in the IEE report during the construction and operation period of the project.
The Coastal Zone Policy, 2005	This policy provides a comprehensive framework for managing Bangladesh's coastal areas sustainably. It aims to balance development activities with environmental conservation, ensuring the protection of coastal ecosystems, including mangroves, wetlands, and beaches. The policy emphasizes community participation, integrated coastal zone management, and disaster risk reduction.	Pekua in Cox's Bazar located at the coastal zone in Bangladesh. These regulations and policies collectively form the legal and policy framework for managing the ecology and biodiversity in Pekua. Overall, implementation and enforcement are crucial for ensuring sustainable development, conserving coastal ecosystems, and enhancing resilience to climate change and natural disasters in coastal areas.
The Coastal Zone Management (CZM) Plan, 1996	The CZM Plan outlines strategies and measures for managing and developing the coastal zone while minimizing environmental degradation and addressing the needs of coastal communities. It identifies different coastal zones based on their vulnerability	

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Policy/Act/Rules	Compliance Requirements	Applicability
	and sensitivity to natural hazards and human activities.	
The Coastal Embankment Act, 1962	This act regulates the construction and maintenance of coastal embankments to protect coastal areas from tidal flooding and erosion. It aims to safeguard coastal communities and infrastructure while minimizing adverse environmental impacts.	
The Coastal Area Regulation Act, 1990	This act provides for the regulation of land use and development activities in coastal areas to prevent unplanned and haphazard development that could exacerbate environmental degradation and increase vulnerability to natural disasters.	
Bangladesh National Building Code (BNBC), 2020	The purpose of the Code is to establish minimum standards for design, construction, quality of materials, use and occupancy, location and maintenance of buildings within Bangladesh in order to safeguard, within achievable limits, life, limb, health, property and public welfare.	BNBC, 2020 is applicable as this project will involve construction of buildings along with substations.
The National Fisheries Policy, 1999 and Protection and Conservation of Fish Act, 1950 (as amended in February 16, 1995) and Rules, 1985.	The policy broadly aims at fisheries development, regulation of aquaculture, biodiversity conservation and formulation of laws to ban the disposal of any untreated industrial effluents into the water bodies. The act was promulgated for conservation of fish and their protection from indiscriminate fishing, poisoning due to industrial effluent disposal into water, oil spills, etc.	There are several waterbodies in the Project area. Most of these water-bodies are home to aquatic species. Therefore, the Protection and Conservation of Fish Act, 1950 and Rules, 1985 are both applicable for this Project. PGCB shall ensure that the aquatic species of this area are not adversely affected due to the project activities.
Noise Pollution (Control) Rules, 2006	The Noise Pollution Rules, 2006 addresses that the sound levels to be no more than 50dB in Silent Zones[16] during daytime (6 am to 9 pm) and 40 dB at night-time (9 pm to 6 am). In residential areas these levels are 55 dB and 45 dB, in mixed area[17] 60 dB and 50 dB, in commercial and industrial areas 70 dB and 60 dB and in industrial areas 75 dB and 70 dB for daytime and night-time respectively.	Material transportation, earthworks, piling and vehicle movements will generate noise in and around the construction sites. Most of the land along the RoW of the transmission lines –overhead – are residential in nature with some Silent Zones. Several of the substation sites are very close to residential receptors. PGCB should take these locations into consideration and abide by the Noise Pollution (Control) Rules, 2006 by implementing mitigation measures.
Environmental Court Act, 2000	The Environment Court Act, 2000 has been enacted in order to establish environmental courts in each administrative division of Bangladesh. This Act sets out policy for effective pursuance and completion of legal proceedings related to environmental crimes. Under this Act the Director General	According to this act, government can take legal actions if any environmental problem occurs due to project interventions.

[16] The area within 100 meters from hospital, academic institutions, or places identified/identifiable by the government.
[17] An area, which is primarily a residential area with either or both commercial and industrial parts in it.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Policy/Act/Rules	Compliance Requirements	Applicability
	of the DOE has the power to impose heavy penalties to industrial polluters who are dumping untreated wastewater into the environment or not operating their legally mandated ETPs.	
National Land Use Policy, 2001	The National Land Use Policy was adopted by Bangladesh government in 2001, setting out guidelines for improved land-use and zoning regulations. The main objectives of this policy are to ensure criteria-based uses of land and to provide guidelines for usage of land for the purpose of agriculture, housing, afforestation, commercial and industrial establishments, rail and highway and for tea and rubber gardens. Overall, this policy promotes sustainable and planned utilization of land. The main contents of this policy are: • Stopping the high conversion rate of agricultural land to nonagricultural purposes; • Utilizing agro-ecological zones to determine maximum land use efficiency; • Adopting measures to discourage the conversion of agricultural land for urban or development purposes; • Improving the environmental sustainability of land-use practices.	The proposed project must adhere to this policy so that environmental sustainability of land-use practices is assured.
National 3R (Reduce, Reuse & Recycle) Strategy, 2010	The 3Rs are considered in order of importance – 'reduce' followed by 'reuse' and then 'recycle', which classify waste management strategies according to their desirability. The National 3R goal for waste management is to achieve complete elimination of waste disposal on open dumps, rivers and floodplains by 2015 and promote recycling of waste through mandatory segregation of waste at source as well as create a market for recycled products and provide incentives for recycling of waste. Based on the guiding principles and key issues, four general strategies: i) raising public awareness; ii) engaging an affordable mix of technical options; iii) strategies for sustainability and iv) strategies for financing) and five sector specific strategies: i) domestic waste; ii) hazardous waste from manufacturing industry; iii) waste from agriculture; iv) medical waste and v) addressing occupational safety and health management) have been recommended to promote 3R in waste sector.	This policy is relevant as the project will generate different kind of wastes during construction and operation stages.
Wetland Protection Act, 2000	The Bangladesh Water Development Board Act, 2000 was enacted for the development	The project components will cross several canals and/khals which may

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Policy/Act/Rules	Compliance Requirements	Applicability
	and efficient management of water resources. The Water Development Board is established under the Act, with the power to control the flow of water in all rivers, channels and underground aquifers.	cause disturbance to the water flow.
National Forestry Policy, 2016	This policy specifically states the following relevant objectives (among many other objectives): (i) to arrest deforestation, and degradation of forest resources, enrich and extend areas under tree cover, through appropriate programmes and projects, to ensure that at least 20% of the country comes under tree cover by 2035, with at least a canopy density of 50%; and (ii) to significantly increase tree cover outside state forest, through appropriate mechanisms, in both public and private land including urban areas.	The development of project components will have potential tree cutting.
The Forest Act (1927) and the Forest (Amendment) Act (2000)	The Forest Act (1927) was enacted to control trespass, illegal resources extraction from forests and to provide a framework for the forestry revenue collection system. It is the main legislative context for forestry protection and management in Bangladesh. The Act allows for the notification of forest reserves in which the government, through the Forest Department, regulates the felling, extraction and transport of forestry produce in Bangladesh. The Act grants the government several basic powers, largely for conservation and protection of government forests, and limited powers for private forests.	The Act is relevant to the project as construction of the project will require cutting of trees.
Ecologically Critical Area Management Rules, 2016	The Rules provide different committee systems for the management of ECAs from the national to village level. The Rules at first provide for the establishment of a National Committee consisting of a Chairperson and 19 other members including academics and 2 NGO activists. The Department of Environment (DoE) provides the secretarial assistance to the National Committee. The Rules then describe responsibilities and functions of the National Committee. The National Committee plays a pivotal role in the management of ECAs. In recommending a site, the National Committee will consider existing natural conditions and biodiversity, forests, wildlife, protected areas, wetlands etc. and causes for ecological degradation, possible threats, and preventive measures for this. The Committee will also take into account livelihoods, religious and social culture of local inhabitants, and the presence of archeological sites. The National	PGCB shall ensure compliance with legal requirements under such provisions for ECAs.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Policy/Act/Rules	Compliance Requirements	Applicability
	Committee will also make recommendations regarding the generation of alternative livelihoods for the people dependent on an ECA.	
Bangladesh Climate Change Strategy and Action Plan 2009	The GoB prepared the Bangladesh Climate Change Strategy and Action Plan (BCCSAP) in 2008 and revised in 2009. This is a comprehensive strategy to address climate change challenges in Bangladesh. Bangladesh Climate Change Strategy and Action Plan built on and expanded the NAPA. It is built around the following six themes: • ***Food security, social protection, and health*** to ensure that the poorest and most vulnerable in society, including women and children, are protected from climate change and that all programs focus on the needs of this group for food security, safe housing, employment and access to basic services, including health. • ***Comprehensive disaster management*** to further strengthen the country's already proven disaster management systems to deal with increasingly frequent and severe natural calamities. • ***Infrastructure*** to ensure that existing assets (e.g., coastal and river embankments) are well maintained and fit for purpose and that urgently needed infrastructure (cyclone shelters and urban drainage) is put in place to deal with the likely impacts of climate change. • ***Research and Knowledge management*** to predict that the likely scale and timing of climate change impacts on different sectors of economy and socioeconomic groups; to underpin future investment strategies; and to ensure that Bangladesh is networked into the latest global thinking on climate change. • ***Mitigation and low carbon development*** to evolve low carbon development options and implement these as the country's economy grows over the coming decades. • ***Capacity building and Institutional strengthening*** to enhance the capacity government ministries, civil society, and private sector to meet the challenge of climate change. There are 44 specific programs proposed in the BCCSAP under the above six themes.	Relevant as the country is vulnerable to climate change and risks have been identified for the project.
National Adaptation	With an underlying objective of reducing	The project will deal with climate

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Policy/Act/Rules	Compliance Requirements	Applicability
Program (NAP), 2022	risks and vulnerabilities to climate change impacts, the NAP envisions building a climate resilient nation through effective adaptation strategies that foster a robust society and ecosystems and stimulate sustainable economic growth.	resilience structures and climate smart productions and technologies.
Balumohal and Soil Management Act, 2010	Balumahal and Soil Management Act, 2010 provides to overcome the hazards faced and extraction of sand/soil in a planned manner during leasing out of Balumahal. The act imposes the restriction of extraction of sand from specified areas on certain conditions. This act includes the illegal extraction of sand as an offence and subject to trial for penalty of such activities.	The Project will require extraction of sand and soil from existing licensed sources.

2.7 National Legislations Relevant to Health and Safety

42. During construction, the project will conform to the labour laws and occupational and health related rules as outlined in Table 2.2.

Table 2.2: Relevant Health and Safety Laws and Rules

Title	Overview
Bangladesh Labor Act, 2006	Provides for safety of work force during construction period. The act provides guidance of employer's extent of responsibility and the workman's right to compensation in case of injury caused by accident while working.
Social Security under the Act, 1923 and an amendment in 1980	According to the Act social impact assessment includes the processes of analyzing, monitoring and managing the intended and unintended social consequences, both positive and negative of planned interventions (policies, programs, plans, projects) and any social change processes invoked by those interventions.
Labor Relations under Labor Laws, 1996	General concerns during the project implementation state that the project manager must recognize labor unions.
Public Health (Emergency Provisions) Ordinance, 1994	Calls for special provisions regarding public health. In case of emergency, it is necessary to make special provisions for preventing the spread of disease, safeguarding the public health, and providing adequate medical service, and other services essential to the health of respective communities and workers during construction-related work.
The Employees State Insurance Act, 1948	Health, injury, and sickness benefit should be paid.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

<table>
<tr><th>Title</th><th>Overview</th></tr>
<tr><td>Electricity Rules, 2020</td><td>This rule has been formulated under section 59 of the Electricity Act 2018. It provides clear guidelines on electricity production, transmission and distribution. In addition to this, it also gives clear direction regarding maintenance and change in electricity line, cable etc.
RoW and safety clearance with voltage levels relevant to the Project are given below. There is no specification for 0.4 kV but as same poles are used as for 11 kV so 11 kV RoW and safety clearances used for 0.4 kV:

<table>
<tr><th>Voltage Level (kV)</th><th>Width of Right of way (on each side from the outer conductor) (Meter)</th><th>Minimum safe distance from conductive overhead wires (BS 7354) (Meter)</th></tr>
<tr><td>11</td><td>2.50</td><td>2.50</td></tr>
<tr><td>33</td><td>3.50</td><td>2.80</td></tr>
<tr><td>132</td><td>14.00</td><td>3.80</td></tr>
<tr><td>230</td><td>20.00</td><td>4.60</td></tr>
<tr><td>400</td><td>23.00</td><td>6.40</td></tr>
<tr><td>765</td><td>43.00</td><td>10.30</td></tr>
</table>
</td></tr>
<tr><td>Labor Act, 2006 (as amended through 2018)</td><td>The 2006 Labor Act (“Act”) amended up to 2018 and the 2015 Labor Rules (“Rules”). The laws and regulations prescribe working hours, weekly vacations, annual leave, medical leave etc. In addition, it also stipulates that children under 18 years are not allowed to be employed during the project life cycle in hazardous works.

Chapters pertaining to occupational health and safety, and compensation due to accidents are entailed below:

Health and hygiene - cleanliness of any facility, drinking water supply, ventilation, lighting, dust, etc.

Safety - issues regarding safety of building and machinery, precautions in case of fire, fencing of machinery, work on or near machinery in motion, hoist and lifts protection of eyes, explosive and inflammable dust/gas etc.

Special provisions related to health, hygiene, and safety for hazardous operations.

Welfare - provisions to be facilitated in the facility regarding first aid appliances, safety record books, washing facilities, canteens, shelters, room for children, etc.

Chapters pertaining to labor benefits and entitlements are as follows:

• Condition of Service and employment
• Employment of Adolescent
• Maternity Benefits
• Working Hours and Leave
• Wages and Payment
• Workmen’s Compensation for injury by Accidents
Trade Unions and Industrial Relations Regulation of Employment and Safety of Dock Workers</td></tr>
<tr><td>Disaster Management Act, 2012</td><td>The Act specifies the duties and responsibilities of relevant Ministries/Divisions of the Government and provides for establishment of high-level National Disaster Management Council (NDMC) headed by the Prime Minister and other committees at local levels.</td></tr>
</table>

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Title	Overview
Fatal Accident Act, 1885	This Act was promulgated to provide compensation to families for loss occasioned by the death of a person caused by actionable wrong. The company will be liable to pay compensation in case of death of any worker/employee or damages in case death has not ensued but such circumstances could have resulted in death.
Fire Prevention and Extinction Act, 2003; Fire prevention and Extinction Rules, 2014	Section 4 of the Fire Prevention and Extinction Act 2003 provides that if any person wants to use any building as warehouse or workshop, he shall have to take license from the Directorate General of Fire Service and Civil Defense. Contravention of this section will cause imprisonment for 3 years or fine and the building along with goods kept in it shall be forfeited. Section 7 depicts, notwithstanding anything contained in any other law, without approval of the Directorate General of Fire Service and Civil Defense regarding fire prevention or extinction, no structural design or layout of multi-storied commercial building shall be approved or amended. Section 18 connotes that contravention of section 7 shall be dealt with imprisonment for 6 months or fine. Section 8 (3) directs every owner of the building to take precautions and other measures necessary for public safety. The Fire Prevention and Extinction Act 2003 is supplemented by the Fire Prevention and Extinction Rules 2014 which enumerates that owner of the building shall have to apply for occupancy certificate of the building at the end of the construction (Rule 22). These enable the authority to inspect the building, to examine whether the owner met all the requirements of the building code for public safety or not.
The Employer's Liability Act, 1938	Covers accidents, risks, and damages with respect to employment injuries
Maternity Benefit Act, 1950	Framed rules for female employees, who are entitled to various benefits for maternity
Bangladesh Factory Act, 1979	Workplaces provisions: these Act and Labor Laws require medical facilities, first aid, accident and emergency arrangements, and childcare services to be provided to the workers at workplace.

2.8 ADB's Safeguard Policy Statement, 2009

43. ADB's environmental and social safeguards form the cornerstone of its support for inclusive economic growth and environmental sustainability in Asia and the Pacific. In July 2009, ADB's Board of Directors approved the new Safeguard Policy Statement (SPS) governing the environmental and social safeguards of ADB's operations. The key safeguard areas which must be addressed are (i) environmental; (ii) involuntary resettlement; and (iii) indigenous peoples.

44. The environmental objectives of the SPS are to ensure the environmental soundness and sustainability of projects and to support the integration of environmental considerations into the project decision- making process." The objectives also include helping borrowers strengthen their safeguard systems and develop the capacity to manage environmental and social risks.

45. ADB adopts a set of specific environment and social safeguard requirements that borrowers or clients are required to meet in addressing environmental and social impacts and risks associated with a specific project. ADB's environmental safeguards emphasize development and implementation of a comprehensive EMP. Key elements of EMPs are mitigation measures, monitoring programs, budgets, and institutional arrangements for implementation. In addition, the environmental assessment process emphasizes meaningful consultation, information disclosure, and consideration of alternatives.

46. ADB will not finance projects that do not comply with its safeguard policy statement, nor will it finance projects that do not comply with the host country's social and environmental laws and regulations. The safeguard policy statement applies to all ADB-financed and/or ADB-administered

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

sovereign and non-sovereign projects, and their components, regardless of the source of financing.

47. In line with Safeguards Requirements 1: Environment (Appendix 1 of SPS 2009 guidelines), Table 2.3 below summarizes the implications of ADB SPS 2009 for the project:

Table 2.3: Implication of ADB SPS 2009 to project

Sl. No.	SPS 2009 Principles	Description
1	Use a screening process for each proposed project, as early as possible, to determine the appropriate extent and type of environmental assessment so that appropriate studies are undertaken commensurate with the significance of potential impacts and risks.	The components with environmental implications have been identified under outputs 1 and 2 of the Project: (a) construction of 10 new substations; (b) bay extensions at existing 5 substations; and (c) construction of 232.55 km transmission lines. A rapid environmental assessment checklist was completed for these components, and the environment category based on SPS 2009, is category B requiring an IEE.
2	Conduct an environmental assessment for each proposed project to identify potential direct, indirect, cumulative, and induced impacts and risks to physical; biological; socioeconomic (including impacts on livelihood through environmental media, health and safety, vulnerable groups, and gender issues); and physical cultural resources in the context of the project's area of influence. Assess potential transboundary and global impacts, including climate change. Use strategic environmental assessment where appropriate.	An IEE following the requirements of SPS 2009 was conducted for the components with environmental impacts.
3	Examine alternatives to the project's location, design, technology, and components and their potential environmental and social impacts and document the rationale for selecting the particular alternative proposed. Also consider the "no project" alternative.	Alternative sites, where appropriate, were considered and included in the IEE.
4	Avoid, and where avoidance is not possible, minimize, mitigate, and/or offset adverse impacts and enhance positive impacts by means of environmental planning and management. Prepare an EMP that includes the proposed mitigation measures, environmental monitoring and reporting requirements, related institutional or organizational arrangements, capacity development and training measures, implementation schedule, cost estimates, and performance indicators. Key considerations for EMP preparation include mitigation of potential adverse impacts to the level of no significant harm to third parties, and the polluter pays principle.	An EMP is included in the IEE for each of the components with environmental impacts. The EMP will provide guidance to the construction contractor and their subcontractor (if any) who will be engaged during project implementation, as well as PGCB for the O&M stage to ensure compliance with the relevant provisions in SPS 2009.
5	Carry out meaningful consultation with affected people and facilitate their informed participation. Ensure women's participation in consultation. Involve stakeholders, including affected people and concerned	Several consultation events were undertaken during the preparation of the IEE. Consultations will continue through the PMU during project implementation.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Sl. No.	SPS 2009 Principles	Description
	nongovernment organizations, early in the project preparation process and ensure that their views and concerns are made known to and understood by decision makers and taken into account. Continue consultations with stakeholders throughout project implementation as necessary to address issues related to environmental assessment. Establish a grievance redress mechanism to receive and facilitate resolution of the affected people's concerns and grievances regarding the project's environmental performance.	A three-tiered grievance redress mechanism (GRM) is included in the IEE including the proposed composition of the grievance redress committee (GRC). The implementation of the GRM will be monitored by the PMU established under the PGCB.
6	Disclose a draft environmental assessment (including the EMP) in a timely manner, before project appraisal, in an accessible place and in a form and language(s) understandable to affected people and other stakeholders. Disclose the final environmental assessment, and its updates if any, to affected people and other stakeholders.	The IEE will be endorsed by the PGCB for public disclosure through the ADB website and locally.
7	Implement the EMP and monitor its effectiveness. Document monitoring results, including the development and implementation of corrective actions, and disclose monitoring reports.	At the construction phase, the contractor will primarily be responsible for implementing the EMP and will be supervised and monitored by the PMU to ensure this, whilst during operation PGCB will be responsible for EMP implementation. Environmental monitoring reports and corrective actions (if needed) will be prepared by the PMU and will be disclosed on the ADB website and locally.
8	Do not implement project activities in areas of critical habitats, unless (i) there are no measurable adverse impacts on the critical habitat that could impair its ability to function, (ii) there is no reduction in the population of any recognized endangered or critically endangered species, and (iii) any lesser impacts are mitigated. If a project is located within a legally protected area, implement additional programs to promote and enhance the conservation aims of the protected area. In an area of natural habitats, there must be no significant conversion or degradation, unless (i) alternatives are not available, (ii) the overall benefits from the project substantially outweigh the environmental costs, and (iii) any conversion or degradation is appropriately mitigated. Use a precautionary approach to the use, development, and management of renewable natural resources.	All the proposed project interventions with environmental impacts are located in modified habitats and away from any natural or critical habitats as defined by SPS 2009. However, presence of critical and natural habitats (mainly along the coastline-within 10 km) is considered in relation to associated facilities (proposed IPP based renewable energy plants and their evacuation lines) of the VRE hub.
9	Apply pollution prevention and control technologies and practices consistent with international good practices as reflected in internationally recognized standards such	Construction activities will generate waste and may increase ambient dust and noise levels. There will be fuel, oil and chemicals used in construction and operation with potential for

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Sl. No.	SPS 2009 Principles	Description
	as the World Bank Group's Environmental, Health and Safety Guidelines. Adopt cleaner production processes and good energy efficiency practices. Avoid pollution, or, when avoidance is not possible, minimize or control the intensity or load of pollutant emissions and discharges, including direct and indirect greenhouse gases emissions; waste generation; and release of hazardous materials from their production, transportation, handling, and storage. Avoid the use of hazardous materials subject to international bans or phaseouts. Purchase, use, and manage pesticides based on integrated pest management approaches and reduce reliance on synthetic chemical pesticides.	spills and leaks. Vegetation and land clearing will be done. No hazardous chemicals will be used in vegetation clearing. GIIP pollution prevention and control measures have been referred. Contractors will be required to comply with the EMP mitigation plan and implement the Environmental Codes of Practice. Compliance will be monitored by the SIC and PMU.
10	Provide workers with safe and healthy working conditions and prevent accidents, injuries, and disease. Establish preventive and emergency preparedness and response measures to avoid, and where avoidance is not possible, to minimize, adverse impacts and risks to the health and safety of local communities.	Construction works may cause hazardous conditions and injuries to workers or community members. Contractors will be required to comply with the EMP mitigation plan and implement the Environmental Codes of Practice. Compliance will be monitored by the SIC and PMU.
11	Conserve physical cultural resources and avoid destroying or damaging them by using field-based surveys that employ qualified and experienced experts during environmental assessment. Provide for the use of "chance find" procedures that include a pre-approved management and conservation approach for materials that may be discovered during project implementation.	The sites are located mostly in open agricultural land or within existing premises and are not known to have physical cultural resources found within the project footprint as defined by SPS 2009 but mosques within 500m may be disturbed. Chance find procedures will be adopted.

2.8.1 ADB's Environmental Safeguards Requirements

48. ADB's Safeguard Policy Statement (2009)[18] defines the requirements to be followed with regards to project screening and classification, information disclosure, consultation and participation, due diligence, monitoring and reporting, local grievance redress mechanisms, and ADB's Accountability Mechanism.

49. **Project Screening and Classification:** ADB's Safeguard Policy Statement (2009) requires screening as early as possible to (i) determine the significance of adverse impacts; and (ii) identify the level of assessment and institutional resources required; and (iii) determine disclosure requirements. A project's category is determined by its most environmentally sensitive component, including direct, indirect, cumulative, and induced impacts in the project's area of influence. Each project is scrutinized as to its type, location, scale, and sensitivity and the magnitude of its potential environmental impacts.

50. **Category of the Project:**

51. Table **2.4** presents ADB's system of Project Categorization. Accordingly, this project has been categorized 'B' as no significant irreversible, diverse or unprecedented adverse environmental impacts

[18] Full document at https://www.adb.org/sites/default/files/institutional-document/32056/safeguard-policy-statement-june2009.pdf

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

are anticipated. The projected environmental impacts are site-specific and mostly will occur during the construction phase. They can be readily mitigated through the implementation of an Environmental Management Plan following national requirements and good international industry practice.

52. **Environmental Audit of Existing Facilities:** For projects involving facilities and/or business activities that already exist or are under construction, the borrower/client will undertake an environment and/or social compliance audit, including on-site assessment, to identify past or present concerns related to impacts on the environment. The objective of the compliance audit is to determine whether actions were in accordance with ADB's safeguard principles and requirements for borrowers/clients and to identify and plan appropriate measures to address outstanding compliance issues. Where noncompliance is identified, a corrective action plan agreed on by ADB and the borrower/client will be prepared. The plan will define necessary remedial actions, the budget for such actions, and the time frame for resolution of noncompliance. The audit report (including corrective action plan, if any) will be made available to the public in accordance with the information disclosure requirements of the Safeguard Requirements 1. If a project involves an upgrade or expansion of existing facilities that has potential impacts on the environment, the requirements for environmental impact assessments and planning specified in Safeguard Requirements 1 will apply in addition to compliance audit.

53. **Information Disclosure:** ADB's Safeguard Policy Statement (2009) requires information about environmental safeguard issues to be made available in a timely manner, in an accessible place, and in a form and language(s) understandable to affected people and other stakeholders, including the general public, so they can provide meaningful inputs into project design and implementation. For illiterate people, suitable communication methods will be used. During project implementation PGCB will need to submit the following for posting on ADB's website: (i) final and updated IEE and corrective action plans upon receipt by ADB; and (ii) environment monitoring reports submitted by PGCB during project implementation upon receipt by ADB.

54. **Consultation and Participation:** ADB's Safeguard Policy Statement (2009) requires communities, groups, or people affected by proposed projects, and civil society to be engaged by PGCB through information disclosure, consultation, and informed participation in a manner commensurate with the risks to and impacts on affected communities. Meaningful consultation processes are defined as those that are, (i) beginning early in the project preparation stage and being carried out on an ongoing basis throughout the project cycle; (ii) providing timely disclosure of relevant and adequate information that is accessible to affected people; (iii) being free of intimidation and coercion; (iv) being gender inclusive and responsive; and (v) enabling the incorporation of all relevant views of affected people and other stakeholders in decision making. The consultation process and its results are to be documented and reflected in the IEE report.

55. **Unanticipated Environmental Impacts:** Where unanticipated environmental impacts become apparent during project implementation, the PGCB will update the environmental assessment and EMP to assess the potential impacts, evaluate the alternatives, and outline mitigation measures and resources to address those impacts.

56. **Occupational Health and Safety:** The PGCB will provide workers[19] with a safe and healthy working environment, taking into account risks inherent to the particular sector and specific classes of hazards in the PGCB's work areas, including physical, chemical, biological, and radiological hazards. The PGCB will take steps to prevent accidents, injury, and disease arising from, associated with, or occurring during the course of work by (i) identifying and minimizing, so far as reasonably practicable, the causes of potential hazards to workers; (ii) providing preventive and protective measures, including modification, substitution, or elimination of hazardous conditions or substances; (iii) providing

[19] Including nonemployee workers engaged by the borrower/client through contractors or other intermediaries to work on project sites or perform work directly related to the project's core functions.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

appropriate equipment to minimize risks and requiring and enforcing its use; (iv) training workers and providing them with appropriate incentives to use and comply with health and safety procedures and protective equipment; (v) documenting and reporting occupational accidents, diseases, and incidents; and (vi) having emergency prevention, preparedness, and response arrangements in place.

57. The PGCB will apply preventive and protective measures consistent with international good practice, as reflected in internationally recognized standards such as the *World Bank Group's Environment, Health and Safety Guidelines*[20].

58. **Community Health and Safety:** The PGCB will identify and assess the risks to, and potential impacts on, the safety of affected communities during the design, construction, operation, and decommissioning of the project, and will establish preventive measures and plans to address them in a manner commensurate with the identified risks and impacts. These measures will favor the prevention or avoidance of risks and impacts over their minimization and reduction. Consideration will be given to potential exposure to both accidental and natural hazards, especially where the structural elements of the project are accessible to members of the affected community or where their failure could result in injury to the community. The PGCB will avoid or minimize the exacerbation of impacts caused by natural hazards, such as landslides or floods, that could result from land use changes due to project activities.

59. The PGCB will inform affected communities of significant potential hazards in a culturally appropriate manner. The borrower/client will be prepared to respond to accidental and emergency situations. This preparation will include response planning document(s) that addresses the training, resources, responsibilities, communications, procedures, and other aspects required to respond effectively to emergencies associated with project hazards. Appropriate information about emergency preparedness and response activities, resources, and responsibilities will be disclosed to affected communities.

60. When structural elements or components, such as dams, tailings dams, or ash ponds, are situated in high-risk locations and their failure or malfunction may threaten the safety of communities, the PGCB will engage qualified and experienced experts, separate from those responsible for project design and construction, to conduct a review as early as possible in project development and throughout project design, construction, and commissioning.

61. **Bid and Contract Documents:** To ensure that contractors appropriately implement the agreed safeguards measures, the PGCB will include the safeguard requirements in bidding documents and civil works contracts. Where national safeguard policies and regulations differ from ADB's Safeguard Policy Statement including Safeguard Requirements 1–4, ADB[21] the PGCB will achieve whichever is more stringent. However, if any measures less stringent is requested, then both PGCB and ADB will formulate and agree on specific measures to ensure that ADB's safeguard policy principles and requirements are fully complied with.

62. **Conditions for Award of Contract and Commencement of Work:** The PGCB will ensure that if the project will have any changes, then a revised Initial Environmental Examination and Environment Management Plan will be prepared during the implementation of the project. Projects with potentially significant impacts will need adequate contingency funds to address impacts that are identified during project implementation. PGCB will ensure that such funds are readily available. ESU and SIC will prepare the update, and will submit it to ADB for review and clearance before any contracts are awarded, or for

[20] World Bank Group, 2007. *Environmental, Health, and Safety General Guidelines*. Washington, DC.

[21] Para 33 of SPS states" During the design, construction, and operation of the project the borrower/client will apply pollution prevention and control technologies and practices consistent with international good practice, as reflected in internationally recognized standards such as the World Bank Group's Environment, Health and Safety Guidelines. These standards contain performance levels and measures that are normally acceptable and applicable to projects. When host country regulations differ from these levels and measures, the borrower/client will achieve whichever is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, the borrower/client will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in this document."

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

design and build contracts before any works commence on site, including site establishment. SIC will help ESU update the EIA/IEE and the EMP.

63. **Monitoring and Reporting:** ADB's Safeguard Policy Statement (2009) requires that PGCB comply with national laws and regulations and implements the EMP as provided in the legal agreements, submitting periodic environment monitoring reports to ADB on their implementation performance. Given the Project is category B for environment, PGCB is required to (i) establish and maintain procedures to monitor EMP implementation and progress toward intended outcomes; (ii) document and disclose environmental monitoring results, identifying necessary corrective actions, in periodic environmental monitoring reports; (iv) follow up on these corrective actions to ensure progress toward the desired outcomes; and (v) submit the periodic environmental monitoring reports as agreed with ADB. In this case semi-annual environmental safeguards monitoring reports are required to be submitted up until the completion of construction reverting to annual throughout the operation period until project closure and issue of the ADB project completion report. ADB will also monitor projects on an ongoing basis until a project completion report is issued.

64. **Local Grievance Redress Mechanisms and ADB's Accountability Mechanism:** ADB's Safeguard Policy Statement (2009) requires that PGCB set up and maintain a GRM to receive and facilitate resolution of affected peoples' concerns and grievances about their environmental performance at project level. It should address affected people's concerns and complaints promptly, using an understandable and transparent process that is gender responsive, culturally appropriate, and readily accessible to all segments of the affected people. Affected people can also take complaints to ADB's Accountability Mechanism as a last resort, although they should approach the local GRM in the first instance, followed by BRM if unable to resolve; but the GRM should not impede access to the country's judicial or administrative remedies.

65. **Environmental Guidelines:** The project will follow the more stringent standards of national and international good practices related to environment, health and safety including those set out in the IFC Environment, Health and Safety (EHS) General Guidelines 30 (30 April 2007). Appendix X presents national standards and World Health Organization guidelines for noise and air quality referred to by these guidelines. The IFC EHS Guidelines for Electric Power Transmission and Distribution (30 April 2007) also need to be considered while designing the substations and transmission and distribution lines, and in undertaking the environmental assessment. These guidelines require consideration of terrestrial and aquatic habitat alteration, electric and magnetic fields, hazardous materials, occupational health and safety and community health and safety. The project is required to comply with these guidelines regarding assessment of potential impacts and management measures, performance indicators and monitoring guidelines. As a project proponent, PGCB shall follow the IFC EHS Guidelines for this project and shall also ensure that all appointed contractors and their subcontractors follow these guidelines.

66. ADB's prohibited investment activities list will also apply. Thus, any use of CFCs, PCBs, and asbestos containing materials will be prohibited. In relation to child labor, considering capacity for supervision, no under 18 years will be permitted to work on the construction site or in operational areas due to the hazardous nature of work involved.

Table 2.4: ADB's Environmental Safeguards Categorization and Requirements

Category	Definition	Assessment Requirement
A	Likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented, and may affect an area larger than the sites or facilities subject to physical works.	Environmental Assessment (EIA) Impact
B	Likely to have adverse environmental impacts that are less adverse than those of Category A. Impacts are site-specific, few if any of them irreversible, and in most cases mitigation measures can be designed more readily than Category A.	Initial Environmental Examination (IEE)
C	Likely to have minimal or no adverse environmental impacts.	No environmental

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Category	Definition	Assessment Requirement
		assessment is required but the environmental implications of the project will be reviewed.
FI	Project involves investment of ADB funds to or through a Financial Intermediary (FI).	FIs will be required to establish Environmental and Social Management System (ESMS) commensurate with the nature and risks of the FI's likely future portfolio to be maintained as part of the FI's overall management system.

Source: ADB. Safeguard Policy Statement 2009, p. 19. http://www.adb.org/sites/default/files/institutional-document/32056/safeguard-policy-statement-june2009.pdf

2.9 Compliance with PGCB Health Environment and Safety Requirements

67. PGCB has its own policy and requirements for compliance relating to environment, health and safety issues for its operations. The company is committed to managing its operations in a safe, efficient and environmentally responsible manner. The PGCB's Health, Environment and Safety (HES) manuals, guidelines, procedures, and plans are important tools indicating their commitment. HES manuals include:

- Environmental Impact Assessment Module;
- Guideline on Integrated Impact Assessment;
- Health Impact Assessment Module; and
- Social Impact Assessment Module.

68. In addition, the requirement for impact assessment is affirmed in the PGCB's Statement of General Business Principles. The PGCB is committed to:

- Pursuing the goal of no harm to people;
- Protecting the environment; and,
- Managing HES as any other critical business activity.

69. The mandatory company Operations Management System, Environmental Care Element/Standards, issued in March 1997, refers to Environmental Assessment indicating that "EIA (including a consideration of social impacts) shall be conducted prior to all new activities and facility developments, or significant modifications of existing ones."

2.10 Comparison of Environmental Safeguard Principles between ADB and Bangladesh

70. Table 2.5 presents a summary comparing the environmental safeguard principles/requirements of ADB and the government.

Table 2.5: Comparison of Environmental Safeguard Principles

SPS 2009			Government	Gaps (if any)
No.	**Principles**	**Delivery Process**		
1	Use of screening process to determine the appropriate	Uses sector-specific rapid environmental assessment checklist for screening and assigns	ECA, 1995 and ECR, 2023 set screening criteria to classify industries/projects based on potential environmental impacts as	No major gaps, the national EIA for Red

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

SPS 2009			Government	Gaps (if any)
No.	**Principles**	**Delivery Process**		
	environmental assessment	categories based on potential impacts: • EIA required (irreversible, diverse or unprecedented adverse environmental impacts) • B - IEE required • C - no environmental assessment required but a review of environmental implications • FI - ESMS required	follows: Green (pollution- free), Yellow, Orange and Red (environmental impacts). The screening criteria are based on project or industry type and do not consider the scale and location. The category determines the level of environmental assessment.	category project under ECR, 2023 is equivalent to an IEE for ADB category B project
2	Conduct an environmental assessment	• EIA and IEE - Identify potential impacts on physical, biological, physical cultural resources, and socioeconomic aspects in the context of the project's area of influence • Assess potential transboundary and global impacts, including climate change	Requirement for environmental assessment based on industry/project category. For Red category both IEE and EIA are required.	No major gaps, this EIA/IEE has been prepared to meet national and ADB requirements
3	Examine alternatives	• For Category A projects analyze alternatives to the project's location, design, and technology • Document rationale for selecting the project location, design, and technology • Consider "no project" alternative	Regulations (i.e., ECA, 1995 and ECR, 2023) do not require specifically the identification and analysis of alternatives[22].	Not required by law but the ToR for EIA approved by the DOE and the EIA/IEE includes a discussion on analysis of alternatives
4	Environmental planning and management	• Follow the mitigation hierarchy – avoid, minimise, mitigate, offset • Key considerations include no significant harm to third parties, polluter pays principle, the precautionary approach and adaptive management. • EMP to include	EMP and procedures for monitoring included in the IEE and EIA (i.e., for Red category projects)	No major gaps, the EMP has been prepared to meet national and ADB requirements

[22] Not required by Law but the TOR for EIA/IEE (Appendix I) approved by DOE now includes a discussion on analysis of alternatives.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

SPS 2009			Government	Gaps (if any)
No.	Principles	Delivery Process		
		mitigation, monitoring, performance indicators, emergency procedures, capacity development, schedule, budget and implementation arrangements.		
5	Carry out meaningful consultation and GRM	• Starts early and continues during implementation • Undertaken in an atmosphere free of intimidation • Gender inclusive and responsive • Tailored to the needs of vulnerable groups • Allows for the incorporation of all relevant views of stakeholders • Establish a grievance redress mechanism	• Public consultation is required as per ECR 2023 • Grievance redress mechanism is not mentioned in ECA1 1995 and ECR 2023 • EIA format required by DoE includes stakeholders' consultation	No major gaps for consultation, but no requirement for GRM. However, GRM is established per the ADB requirement
6	Timely disclosure of draft environmental assessment (including the EMP)	• Draft IEE prior to appraisal • Final or updated IEE upon receipt	No requirement for public disclosure of environmental reports but DOE posts the minutes of the meeting on the application for environmental clearance certificate to its website, http://www.doe.gov.bd. No requirement for public disclosure of environmental reports.	No requirement for public disclosure of environmental reports, but the EIA/IEE and environmental monitoring reports will be locally disclosed per the ADB requirement
7	Implement EMP and monitor effectiveness	• Monitor and document progress on EMP implementation. • Corrective action if non-compliance is identified. • Disclose environmental monitoring report submitted by borrowers upon receipt	Environmental clearance is subject to annual renewal based on compliance of the conditions set by DoE	No major gaps except disclosure, environmental monitoring reports will be locally disclosed per the ADB requirement
8	Biodiversity	• Avoid areas of critical habitats • Procedures for implementing projects in natural habitats, critical habitats, and	ECA, 1995 and ECR, 2023 identifies ecologically critical areas and the rules to protect them	No major gaps, biodiversity impacts are considered in the EIA/IEE

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

SPS 2009			Government	Gaps (if any)
No.	Principles	Delivery Process		
		Legally Protected Areas • Use of precautionary approach to the use, development and management of renewable natural resources		per national and ADB requirements
9	Pollution prevention and control	• Use pollution prevention and control technologies and practices consistent with international good practices • Refers to IFC/World Bank's Environmental Health and Safety (EHS) General Guidelines 2007 (or any update) • If national regulations differ, more stringent will be followed • If less stringent levels are appropriate in view of specific project circumstances, provide full and detailed justification	• Effluent standards, emission standards included in ECA1 1995 and ECR 2023 • Ambient air quality in Air Pollution Control Rules (APCR) 2022 • Ambient noise levels included in Noise Pollution Control Rules 2006	No major gaps but the most stringent levels will be applied to the project, pollution impacts are considered in the EIA/IEE per national and ADB requirements
10	Health and safety	Provide workers with safe and healthy working conditions Refers to IFC/WB EHS General Guidelines 2007 (or any update)	Occupational health and safety standards included in the Bangladesh Labor Law 2006 amended to 2018, and Bangladesh Labor Rules 2015.	No major gaps, health and safety risks are considered in the EIA/IEE per national and ADB requirements
11	Physical Cultural Resources (PCR)	• Conserve Physical Cultural Resources (PCR) and avoid destroying or damaging them • Use of field-based surveys and experts in the assessment • Consult affected communities on PCR findings • Use chance find procedures for guidance	Preservation and protection of cultural resources are within the Antiquities Act 1968.	No major gaps, PCR impacts are considered in the EIA/IEE per national and ADB requirements

ADB = Asian Development Bank, DoE = Department of Environment, EARF = Environmental Assessment and Review Framework, ECA1 = Environment Conservation Act, ECR = Environment Conservation Rules, EHS = Environmental Health and Safety, EIA = Environmental Impact Assessment, EMP = Environmental Management Plan, ESMS = Environmental and Social Management System, FI = Financial Intermediary, IEE = Initial Environmental

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Examination, NGO = Non-Governmental Organization, PCR = Physical Cultural Resources, ToR = Terms of Reference, WB = World Bank.

2.11 International and Regional Treaties, Agreements and Conventions

71. Bangladesh has signed and ratified most of the major international treaties, conventions and agreements. The Constitution of Bangladesh explicitly mandates to protect and improve the environment and to preserve and safeguard the natural resources, biodiversity, wetlands, forests and wildlife for the present and future citizens (Article 18A). A screening was carried out of these treaties regarding their applicability to this project. Key international/regional conventions and declarations agreements that Bangladesh is signatory to and relevant for the project are provided in Table 2.6. The interventions proposed under the project shall be implemented in compliance with the requirements of these applicable international regional conventions and declarations to which Bangladesh is a party.

Table 2.6: Relevant Environment Related International Convention, Treaties and Protocols signed by Bangladesh

International Convention and Treaties	Status and Remarks
International Labour Organization (ILO) conventions and protocol	ILO conventions and protocol conventions and protocol ratified by Bangladesh related to the core labor standards.
Occupational hazards due to air pollution, noise and vibration (Geneva), 1977Occupational health services (Geneva), 1985	To promote a safe and healthy working environment
United Nations Framework Convention on Climate Change (Rio De Janeiro, 1992)	Applicable as the proposed project might emissions GHG from project components from all GIS substations.
The Vienna Convention for the Protection of the Ozone Layer,1985	The Vienna Convention, concluded in 1985, is a framework agreement in which States agree to cooperate in relevant research and scientific assessments of the ozone problem, to exchange information, and to adopt “appropriate measures” to prevent activities that harm the ozone layer.
Basel Convention (1993)	Applicable; Bangladesh is a signatory to Basel Convention but it did not sign the Basel Ban Amendment that deals particularly with wastes and hazardous wastes management and its transboundary movement.
Stockholm Convention of Persistent Organic Pollutants (POPs) (1972)	This ensures environmentally sound management and the disposal of POPs including PCBs. Bangladesh singed this convention on 23 May 2001. The convention gives governments until 2025 to phase out "in–place equipment" such as electrical transformers containing PCBs, as long as the equipment is maintained in a way that prevents leaks. It grants them another three years to destroy the recovered PCBs. The recovered PCBs must be treated and eliminated by 2028.
‘The Rio Declaration’ and ‘Agenda 21’, 1992 United Nations Conference on Environment and Development	Bangladesh is a signatory, states that “in order to achieve sustainable development, environmental protection should constitute an integral part of the development process and cannot be considered in isolation from it
Convention on the Conservation of Migratory Species of Wild Animals, Bonn, 1979 (Amended 1988)	This provides a framework for agreements between countries important to the migration of species that are threatened
Convention on International Trade in Endangered Species of Wild Fauna and Flora, Washington, 1973 (popularly known as CITES)	This provides a framework for addressing over harvesting and exploitation patterns which threaten plant and animal species. Under this convention governments agree to prohibit or regulate trade in species which are threatened by unsustainable use patterns

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

International Convention and Treaties	Status and Remarks
On Protection of Birds (Paris) 1950	Protection of birds in wild state
Convention on Biological Diversity, 1992	Develop a National Biodiversity Strategy and Action Plan that incorporates the articles of the Convention into national law and statutes
International Plant Protection Convention (IPPC), Rome (1951)	The IPPC is the intergovernmental treaty that aims to protect the world's plants, agricultural products and natural resources from plant pests. Ratified by 185 contracting parties, the IPPC develops, adopts and promotes the application of International Phytosanitary Measures (ISPMs) as the main tool to safeguard global food security, facilitate safe trade and protect the environment.
The Convention concerning the Protection of the World Cultural and Natural Heritage, Paris (1972)	It has been ratified by 175 states. This defines and conserves the world's heritage by drawing up a list of natural and cultural sites whose outstanding values should be preserved for all humanity. Of the 730 total sites, there are currently 144 natural, 23 mixed, and 563 cultural sites that have been inscribed on the World Heritage List (distributed in 125 State parties)

2.11.1 International Best Practice Equivalence

72. The Project is required to meet the ADB SPS guidelines as well as international standards of the IFC, which is part of the World Bank Group. The international environmental and social safeguard policies of these organizations are outlined below.

- World Bank Group's Environment, Health and Safety (EHS) Guidelines, 2007 including Section 4 on Construction and Demolition.
- World Bank Group's EHS Guidelines for Electric Power Transmission and Distribution.
- International Labor Organization (ILO) Safety and Health in Construction, and worker accommodation guidelines.

73. The Environmental, Health and Safety (EHS) Guidelines of the World Bank Group (WBG)/International Finance Corporation (IFC), 2007 is the safeguard guidelines for environment, health and safety for the development of the industrial and other projects. They contain performance levels and measures that are considered to be achievable in new facilities at reasonable costs using existing technologies. When host country regulations differ from the levels and measures presented in the EHS Guidelines, projects are expected to achieve whichever is more stringent. If less stringent levels or measures than those provided in these EHS Guidelines are appropriate, in view of specific project circumstances, a full and detailed justification for any proposed alternatives is needed as part of the site-specific environmental assessment. This justification should demonstrate that the choice for any alternate performance levels is protective of human health and the environment.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

3 IEE Approach and Methodology

3.1 Approach

74. Environmental Impact Assessment (EIA) or Initial Environmental Examination (IEE) is a process for estimating potential environmental impact of a proposed project, done within a very short time based on preliminary information at hand or information which can be readily acquired through environmental reconnaissance and baseline surveys. The EIA/IEE report has been prepared based on the project activities supplied by PGCB as presented in Chapter 4. Environmental and social data from different sources (BBS, DoE, Bangladesh Meteorological Department, and other IEE/EIA reports) of the proposed project area were collected to prepare an environmental baseline profile as set out in Chapter 5. The ADB TA consultants and Feedback Infra-Tecvy Energy JV Consultant's multi-disciplinary IEE/EIA team of experts undertook exploratory and reconnaissance site visits to visualize the condition of the project site and its surroundings and to identify considerations for the assessment. The EIA/IEE study has been done based on both primary and secondary data. Primary environmental and social data was collected through field work and a questionnaire. A composite and interdisciplinary approach has been developed for this EIA/IEE study based on DOE and the ADB Safeguards Policy Statement, 2009 (SPS, 2009) requirements. The approach to impact identification includes the application of expert judgment, systematic and sequential approaches, spatial analysis through the application of satellite image analysis and GIS, and local community participation. The identification of interactions between the project activities and the important environmental and social components was made based on a checklist. This checklist was prepared considering ADB SPS, 2009, the DoE guidelines for selected industries (DoE, 2021), Environmental Guidelines for selected industrial and water development projects (ADB, 1990), ADB's REA Checklist, and the ADB TA consultants and Feedback Infra-Tecvy Energy JV Consultant's experience with similar projects. Public consultation was also undertaken to obtain the people's view, as suggested in the guidelines considered. The project components, environmental baseline, possible environmental impacts, mitigation measures and environmental management plan are presented in this report following ADB and DoE's guidelines. The EIA/IEE study has specifically followed the steps described below.

3.2 Methodology

75. The EIA/IEE study of the proposed project has followed a number of steps and the process shown in Figure 3.1. The activities undertaken at each of the steps of the EIA/IEE process are described in the following sections.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

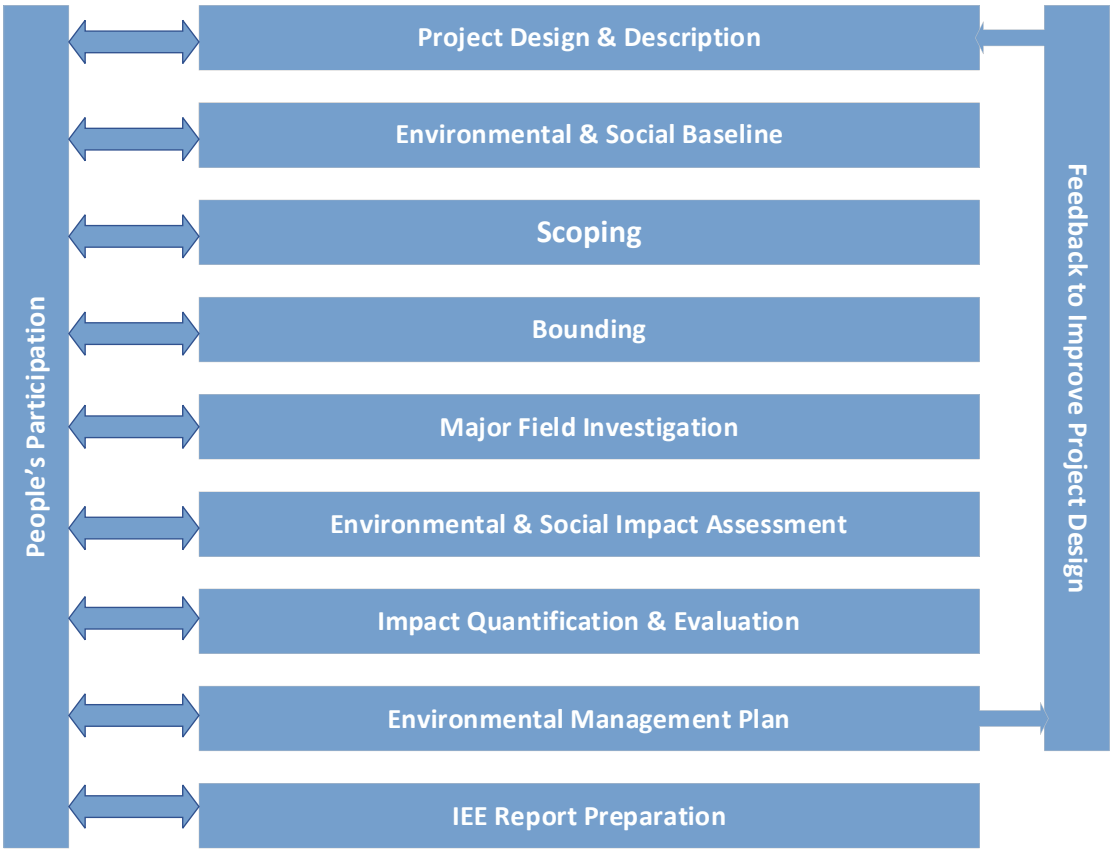


Figure 3.1: Steps for Initial Environmental Examination

3.2.1 Step 1: Project Design and Description

76. Environmental impacts are triggered by physical interventions in natural and human systems for which it is essential to understand the proposed interventions while conducting EIA/IEE studies. The multi-disciplinary EIA/IEE team members attained a thorough understanding of the proposed interventions and their possible environmental consequences by collecting detailed information about the project from PGCB. This information also helped in designing the baseline data collection and consultation programs.

77. The following issues have been included in the brief description of the project:

- Location of the project and its accessibility;
- Rationale of the project;
- Physical features and project activities;
- Use of raw materials, their quantities, characteristics, arrangements for transport to site, and storage facilities;
- List of main equipment and machinery, built-in pollution control equipment; and
- Description of the detailed construction process, operation and maintenance work.

3.2.2 Step 2: Environmental and Social Baseline

78. The study team conducted the baseline survey with the help of keyhole marked up zipped (KMZ) files and Google Earth maps of the proposed area to determine the exact routes and locations of various project components. At this stage only the substation locations and indicative routes for the transmission lines are available, so further baseline may need to be collected for the final transmission line routes during project implementation and the IEE updated. The IEE team has collected primary baseline data, both environmental and social, from the field during the field investigations. Secondary data have also been collected from government and non-government (with proper credentials)

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

organizations as well as from the data repository already available in the organization.

3.2.2.1 Physical Environment

79. The professional observations of the multi-disciplinary team members backed by feedback from the local community during field visits were the main tools for determining the physical environment of the area. The determination of the physical environmental conditions was backed by secondary data, high resolution recent satellite images and field observation. Primary data has been collected by the Feedback Infra-Tecvy Energy JV study team for air, soil, and water quality and noise levels as discussed in Chapter 4 and added in Appendix II.

80. The meteorological data such as rainfall, evapo-transpiration, temperature, sunshine hours, humidity, and wind speed and wind direction have been collected from different Bangladesh Meteorological Department (BMD) stations which are located near the proposed project sites. The general geological features and the seismicity of the project and its surrounding areas have been collected from available secondary literature and the Geological Survey of Bangladesh (GSB). Information on water resources have been collected from secondary sources. Data on specific fields of interest on special hydrological events such as drainage congestion, water logging, erosion – sedimentation etc. have been collected. The baseline for land resources has been developed by considering the criteria of Agro-Ecological Zone (AEZ), land type with net cultivable area (NCA), land use and soil texture. The AEZ of the proposed project area has been identified using information from secondary sources {Bangladesh Agriculture Research Council (BARC), 2012)}. Information on land type, soil texture, and soil nutrient status has also been collected from different publications of Soil Resource and Development Institute (SRDI). The secondary data on these parameters have been verified at field level through physical observations as well as through consultation with the local people during field visits.

3.2.2.2 Biological Environment

81. **Agricultural Resources:** Data was collected on agricultural resources include existing cropping patterns, crop variety, crop calendar, crop yield, crop damage and agricultural input. Agriculture data have been collected from primary sources through extensive field survey by developing questionnaires and in consultation with local people and relevant agricultural officials. Data on agricultural resources have also been collected from secondary sources.

82. **Ecological Resources:** Ecological data have been collected from primary and secondary sources. The primary sources were Line Transect Walks (LTWs) and Key Informant Interviews (KIIs). Secondary sources of information were the Forest Department, International Union for Conservation of Nature (IUCN), Bangladesh Asiatic Society's Encyclopedia of Flora and Fauna of Bangladesh, and other relevant sources through literature review. In addition, the Bio-Ecological Zone (BEZ) classification of Bangladesh by IUCN-Bangladesh (2002) has been used for the bio-ecological zoning of the study area, and an IBAT proximity report has been run.

83. **Fishery Resources:** Fisheries data have been collected for this IEE study by considering the seasonal variance of dry and wet seasons. Prior to data collection, a checklist/questionnaire was developed. The checklist included Fish Habitat, Fish Production, and Fish species diversity of the study area. The data have been collected by informal discussion with local communities, specific attention was paid to the fishing community in the larger waterbodies that are adjacent to the substation sites. Fisheries Resources Survey System (FRSS) of Department of Fisheries was the main source of secondary data.

3.2.2.3 Socio Economic Resources

84. To establish a baseline for this IEE study, socioeconomic data have been collected from different sources which can be grouped into two categories:

85. **Primary sources:** Data have been collected from the project area and concerned unions and

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

municipalities of the districts through rapid rural appraisal (RRA) tools such as mapping/diagramming/ranking, consultation meetings, and informal interviews.

86. **Secondary sources:** To prepare the baseline situation of the study area, information on some important socio-economic parameters was collected from the reports of the Bangladesh Bureau of Statistics (BBS), 2022.

87. **Technique of data collection:** Different techniques have been used to gather relevant information on the existing socio-economic condition of the study area. Quantitative and qualitative data have been collected from secondary and primary sources. Quantitative data have been collected through literature review, survey, group discussions (GDs) and key informant interviews (KIIs), informal interviews and consultation meetings (Table 3.1).

Table 3.1: Variables and Associated Data Collection Techniques

Variables	Techniques
Demographic and household information	Literature review
Quality of life	RRA, Survey
Safety net and poverty reduction measures	RRA, informal interview
People's perception	Consultation meetings, RRA

88. The data collected from consultation meetings, RRAs and informal interviews were analyzed using appropriate statistical tools and instruments. The sum and percentage of total values were used to specify the percentage of households containing different values on different variables.

3.2.3 Step 3: Scoping

89. A scoping process was followed for identifying Important Environmental and Social Components (IESCs), which are likely to be impacted by the transmission lines and substations. This was done in two stages. Individual professional IEE team members made a preliminary list of the components pertaining to their disciplines, which could be impacted by the project. The second stage included affected person-scoping sessions where stakeholder perceptions were obtained about the environmental and social components, which could be impacted by the project interventions. Professional judgment of the EIA/IEE team members as well as the stakeholder opinions obtained in the scoping sessions were considered in selecting the IESCs.

3.2.4 Step 4: Bounding

90. The geographical boundary of the "General Impact Area-"GIA" and the potential "Direct Impact Area - DIA" were delineated as a requirement of the EIA/IEE study. The DIA is the physical location of the proposed transmission lines (RoWs) and the substations of the project while the "GIA" covers the entire geographic extent of the environmental and socioeconomic impacts resulting from the implementation of the proposed project during construction and during operation and maintenance. DIA locations for Substations and transmission lines are also attached in Appendix XIII and also discussed on Chapter 5.

3.2.5 Step 5: Major Field Investigation

91. Further data on the IESCs were collected through RRA, Participatory Rural Appraisal (PRA), and FGD using checklists for water resources, agriculture, ecosystems and socio-economic components. Consultation with the local community was carried out in each case to obtain affected people's participation. The multidisciplinary EIA/IEE team members also made professional observations during the field visits. The historical status of the IESCs and the possible condition of the same against the proposed interventions was considered during this step.

3.2.6 Step 6: Environment and Social Impact Assessment

92. Once the potential impacts are identified, each potential impact was described in terms of its

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

various relevant characteristics (e.g., type, scale, duration, frequency, extent).

3.2.7 Step 7: Impact Quantification and Evaluation

93. The potential impacts were qualitatively assessed based on the above characteristics to determine whether they are potentially significant or not. The significance of potential impacts was assessed using an assessment methodology that considers impact magnitude and sensitivity of receptors. The potential implications of the project have been categorized as major, moderate, minor or minimal based on consideration of parameters such as i) duration of the effect; ii) spatial extent of the impact; iii) reversibility; iv) likelihood; and v) legal standards and established professional criteria. The detailed method of impact assessment is presented in Chapter 9.

3.2.8 Step 8: Environmental Management Plan

94. The environmental management plan (EMP) has been compiled once the impact assessment has been completed and mitigation measures have been identified. During the EMP compilation, institutional arrangements for environmental and social management of the project have been recommended, mitigation and monitoring plans have been formulated, documentation and reporting protocols have been defined, training needs have been assessed and the cost of EMP implementation has been estimated.

3.2.9 Step 9: Preparation of EIA/IEE Report

95. Finally, this EIA/IEE Report was prepared, based on the findings of the EIA/IEE Study.

3.3 Zone of Influence

96. Taking into consideration the baseline information reported earlier in this document, potential impacts were estimated for the following environmental resources/topic issues in their respective zones of influence in table below:

Table 3.2: Zone of Influence for Resources Studied

Impacts/Topic Issue	Zone of Influence
Land Use, Topography, Soil Erosion and Crop Production	Direct impacts within and immediately adjacent (50m) transmission line ROWs, substation boundaries, and all related project facilities such as temporary labor camps
Climate Change	Global concern
Air Quality and Noise	Receptors up to 500 m of transmission line ROWs, substations, and all related facilities such as temporary labor camps may be indirectly impacted by dust and noise, although greatest impact will be within about 50m
Surface and groundwater resources	Rivers/streams/irrigation canals/waterbodies/salt pans crossed by transmission lines and within up to 50m of substations Other surface and groundwater resources within up to 500 m of transmission line ROWs, substations and all related facilities such as temporary labor camps may be indirectly impacted by any pollution resulting from the project
Use of Natural Resources (materials)	National concern
Waste generation	Divisional concern
Habitat and vegetation	Direct impacts within and immediately adjacent transmission line ROWs (50m), substations (50m), and all related project facilities such as access and temporary labor camps
Protected areas/key biodiversity areas	Up to 10 km of subprojects
Threatened wildlife (ADB critical habitat triggers)	Over wider project area of analysis for project components

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Impacts/Topic Issue	Zone of Influence
Other wildlife	Direct impacts within and immediately adjacent transmission line ROWs (50m), substations (50m), and all related project facilities such as temporary labor camps; indirect impacts within up to 500m in relation to dust, noise, and other pollution resulting from the project
Occupational Health and Safety	Construction and maintenance workers including formally and informally employed
Community Health and Safety	Roads, drains, other utilities, structures and community facilities (e.g. schools) within and immediately adjacent transmission line ROWs (500m), substation (500m) boundaries, and boundaries of all related project facilities such as temporary labor camps Local communities within transmission line ROWs (500m), substations (500m), and all related facilities e.g. temporary labor camps but particularly those within 50m
World Heritage Sites and Nationally Important Monuments	Up to 10 km of subprojects
Local Physical Cultural Resources (PCR)	Receptors within up to 50m of transmission line ROWs, substations and all related facilities such as temporary labor camps; indirect impacts within up to 500m in relation to dust, noise, and other pollution resulting from the project
Socioeconomic development, including employment opportunities	National concern

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

4 Description of the Project

4.1 Project Rationale

97. In recent years, Bangladesh has made significant progress in its efforts to become a middle-income country. This progress is reflected in the strong growth of its economy over the past decade. One key factor contributing to this growth has been the country's electricity access expansion. In 2009, only 47% of people in Bangladesh had access to electricity, but today, that number has increased to 100% of people having access to electricity coverage. As a result, Bangladesh has joined a select group of countries in South Asia that have achieved universal electricity coverage, meaning that 100% of their populations have access to electricity. This is a significant achievement and has likely contributed to the overall economic development of the country.

98. The Government of Bangladesh places a high priority on agriculture and rural development to reduce poverty and improve food security for the country's poor. This focus is recognized in the country's constitution, which stipulates that the government should take effective measures to radically transform rural areas. These measures include promoting an agricultural revolution, providing rural electrification, developing cottage and other industries, and improving education, communication, and public health. These efforts aim to progressively eliminate the disparity in living standards between urban and rural areas.

99. Agriculture is a key sector of the economy in Bangladesh and plays a vital role in the livelihoods of many rural communities. By promoting agricultural development and providing support to rural areas, the government aims to improve the economic prospects and living standards of these communities, while also helping to reduce rural poverty. Additionally, by investing in infrastructure and social services in rural areas, the government hopes to create a more balanced and equitable society, with fewer disparities between urban and rural areas. Overall, the government's efforts to promote agriculture and rural development are an important part of its strategy for achieving sustained economic growth and reducing poverty in the country.

100. The Government of Bangladesh is committed to providing access to affordable, reliable, sustainable, and modern energy for all people across the country, particularly in rural areas. This aligns with the Sustainable Development Goal (SDG) target of ensuring access to modern energy for all. The use of modern machinery in agricultural production, particularly in rural areas, has increased in recent years and has created new opportunities for livelihoods in these areas. However, if affordable and uninterrupted electricity were more widely available in rural areas, it could further contribute to economic growth and improve the living standards of the rural population. Ensuring access to electricity is a crucial aspect of the government's efforts to promote development and reduce poverty in rural areas. By investing in infrastructure and services that enable the delivery of affordable and reliable electricity to all parts of the country, the government can help to create a more equitable and prosperous society.

101. The demand for high-quality electricity is increasing in Bangladesh due to the rapid adoption of modern technology-based crop production methods, which have replaced traditional farming techniques. To meet this growing electricity demand, robust transmission systems are crucial. These systems play a key role in delivering affordable and uninterrupted power to all parts of the country, including rural areas. In order to ensure a reliable electricity supply in these areas, it is necessary to build new grid substations and transmission lines. These infrastructure investments are necessary to support the transition to modern technology-based agriculture and to meet the increasing demand for electricity in Bangladesh. By investing in a strong and reliable transmission system, the government can help to support economic growth and improve living standards across the country.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

4.2 Type of Project

102. As mentioned in Chapter 2, this project is classified as "Red'' Category (ECR, 2023), which requires an Environmental Impact Assessment (EIA) study. As per the ADB's Safeguard Policy Statement 2009, the project is classified as category B, requiring an IEE with EMP. This document represents the required IEE, but it is referred to as the EIA per national requirements.

4.3 Major Components of the Project

103. The Power Transmission Strengthening and Integration of Renewable Energy Project (PTSIREP) contains two main components as listed below.

4.3.1 Component 1

104. 400/230/132 kV Air Insulated Substation (AIS) at Pekua/Chakaria, 230/132/33 kV AIS at Madhabpur, 230/132/33 kV AIS at Monohardi. The project will construct and commission substations with a total capacity of 4140 MVA, transmission lines and 2 x 132 kV AIS bay extension at Bajitpur Substation.

4.3.2 Component 2

105. 132/33 kV AIS at Tungipara, Dupchanchia, Matlab (N), Kumarkhali, Chatkhil, Paikgacha and Mathbaria. The project will construct and commission substations with a total capacity of 1,230 MVA, transmission lines and 132 kV AIS bay extension at Gopalganj, Kachua, Satkhira and Bhandaria Substations.

4.4 Project Location

106. This project is located in a combination of cultivated agricultural and salt pan land, in rural areas in Tungipara (Gopalganj), Paikgacha (Khulna), Kumarkhali (Kushtia), Mathbaria (Pirojpur), Patuakhali-Bakerganj, Chatkhil (Noakhali), Dupchanchia (Bogura), Matlab (N) (Chandpur), Monohardi (Narshingdi), Madhabpur (Habiganj), and Pekua/ Chakaria (Cox's Bazar) respectively. The location map of this project has been shown in the following Figure 4.1 and Figure 4.2.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

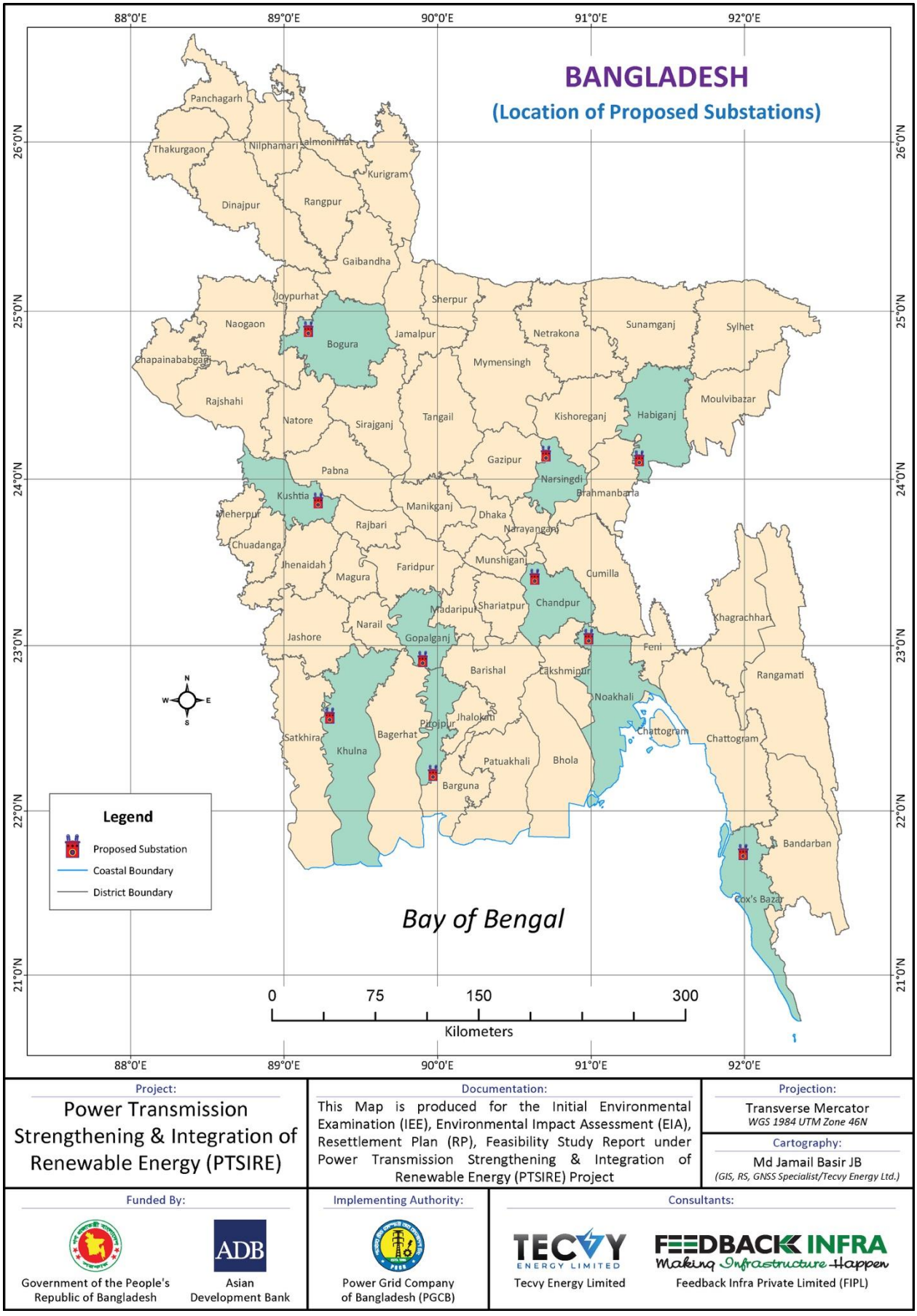
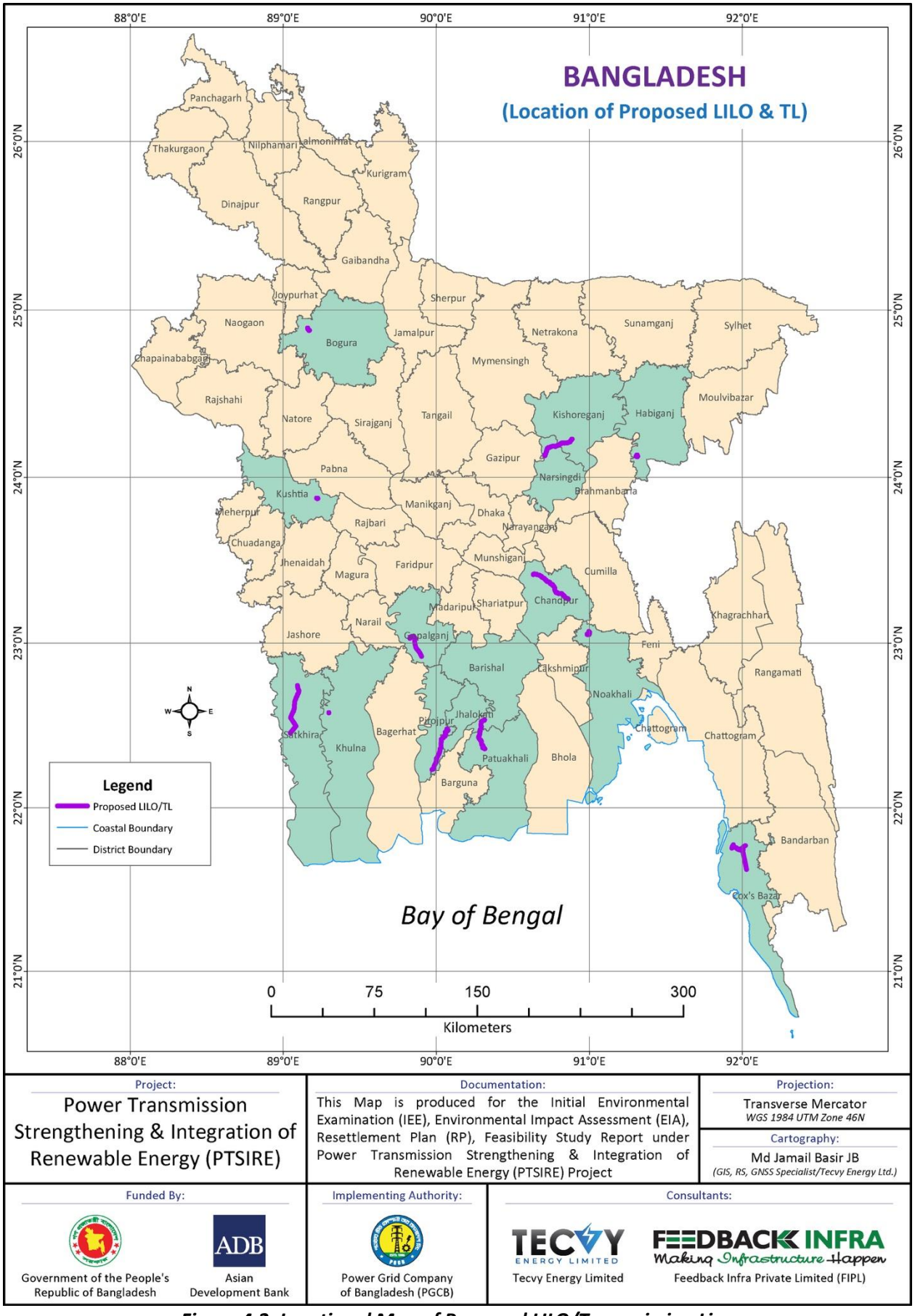


Figure 4.1: Location Map of Proposed New AIS Substation

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.



Project:	Documentation:	Projection:
Power Transmission Strengthening & Integration of Renewable Energy (PTSIRE)	This Map is produced for the Initial Environmental Examination (IEE), Environmental Impact Assessment (EIA), Resettlement Plan (RP), Feasibility Study Report under Power Transmission Strengthening & Integration of Renewable Energy (PTSIRE) Project	Transverse Mercator *WGS 1984 UTM Zone 46N* **Cartography:** Md Jamail Basir JB *(GIS, RS, GNSS Specialist/Tecvy Energy Ltd.)*

Funded By:	Implementing Authority:	Consultants:
Government of the People's Republic of Bangladesh Asian Development Bank	Power Grid Company of Bangladesh (PGCB)	Tecvy Energy Limited Feedback Infra Private Limited (FIPL)

Figure 4.2: Locational Map of Proposed LILO/Transmission Line

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

4.5 Brief Site Description of Proposed Substations and Bay Extension Sites

4.5.1 Salient Features of Substations

107. The proposed 10 AIS substations of 400/230/132/33 kV will be constructed in the districts of Cox's Bazar (Chakaria/Pekua), Habiganj (Madabhpur), Narsingdi (Monohardi), Gopalganj (Tungipara), Bogura (Dupchanchia), Chandpur (Matlab), Kushtia (Kumarkhali), Noakhali (Chatkhil), Khulna (Paikgacha), and Pirojpur (Mathbaria). Besides, 5 existing substations - Kishoreganj (Bajitpur), Gopalganj (Gopalganj Old), Chandpur (Kachua), Satkhira (Satkira) and Pirojpur (Bhandaria) will have new extension bays to accommodate additional transmission lines to provide connectivity to downstream substations.

108. A total 78 acres are required for the new substations, resulting in permanent impacts. For the Paikgacha substation, 5 acres of land have already been acquired by PGCB in 2021. For the remaining 9 substations, 73 acres of land will be acquired following ARIPA 2017 and the RP for the project. These 10 substations are crucial components of electrical power systems, serving as hubs for transmitting and distributing electricity from power plants to end-users. The salient features of 10 substations are in Table 4.1 and Table 4.2.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Table 4.1: Salient Features of the New 400/230/132kV, 230/132/33kV Substations with TLs

SN	Name of the proposed substation	Salient Features						
		Bus Type	Transformer Capacity (MVA)	Required Land/Type of Land (Acre)	Bay Extension at another end SS	Future Required Bay	Interconnection Details	Required Bays
1	400/230/132kV AIS: Pekua/Chakaria, Cox's Bazar GPS Location: 21°45'2.07"N 91°59'33.45"E	One and Half (400kV) & Double bus (230 kV, 132 kV)	3×520 MVA (400/230 kV) & 2×225/300 MVA (230/132 kV) =2,160 MVA maximum	32 Salt Pan Area	--	400kV: 4 230kV: 4 132kV: 4	LILO of Existing Matarbari PP – Banskhali PP 400kV line at Pekua: 6.75 km (Conductor: Quad ACSR Finch) LILO of Anwara – Cox's Bazar 230kV line at Matarbari: 0.50 km (Conductor: Twin ACSR Mallard) LILO of Existing Matarbari (132/33) – Chakaria 132kV line at Matarbari: 1.30 km (Conductor: ACSR Grosbeak)	400 kV: LB=4 (Matarbari PP-Banskhali: 4) TB=3 230 kV: LB=4 (Anwara: 2, Cox's Bazar:2) TB: 5 BCB:1 132 kV: LB: 4 (Chakaria: 2, Matarbari: 2) TB: 2 BCB:1
2	230/132/33 kV AIS: Madhabpur, Habiganj GPS Location: 24° 7'27.29"N 91°18'56.47"E	Double bus	2×225/300 (230/132 kV) = 900 MVA maximum & 2×80/120 (132/33 kV) = 240 MVA maximum	10 Paddy Field	--	230kV: 3 132kV: 3	LILO of Cumilla (N) – Shahjibazar PP 230kV double circuit line at Madhabpur: 1.20 km (Conductor: Twin ACSR Mallard) LILO of Shahjibazar-Brahmanbaria 132kV double circuit line at Madavpur: 1.20 km (Conductor: CFCC type HTLS equivalent to ACSR Grosbeak) Reconductoring of Shahjibazar-Brahmanbaria-Ashuganj 132kV line: (58+17) = 75.00 km) (Proposed Conductor: CFCC type HTLS equivalent to ACSR Grosbeak)	230 kV: LB=4 (Comilla (N): 2, Shahjibazar PP: 2) TB=3 BCB=1 132kV: LB: 4 TB=5 BCB=1 33kV: TB=2

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

SN	Name of the proposed substation	Salient Features						
		Bus Type	Transformer Capacity (MVA)	Required Land/Type of Land (Acre)	Bay Extension at another end SS	Future Required Bay	Interconnection Details	Required Bays
3	230/132/33kV AIS: Monohardi, Narshingdi GPS Location: 24° 9'1.10"N 90°42'24.54"E	Double bus	2×250/350 (230/132kV) = 700 MVA maximum and 2×80/120 (132/33kV) = 240 MVA maximum	10 Paddy Field	2×132 kV AIS bay extension at Bajitpur Substation	230kV: 3 132kV: 3	LILO of Sripur - Ashuganj 230kV double circuit line at Monohardi: 5.50 km (Conductor: Twin ACSR Mallard) Monohardi-Bajitput 132kV double circuit line: 21.00 km (Proposed Conductor: Twin ACSR Grosbeak)	230kV: LB=4 (Sripur:2, Ashuganj PP: 2) TB=2 BCB=1 132kV: LB=2 TB=4 BCB=1 33kV: TB=2

Table 4.2: Salient Features of the New 132/33kV Substations with TLs

SN	Name of proposed substation	Salient Features						
		Bus Type	Transformer Capacity (MVA)	Required Land (Acre)	Bay Extension at another end SS	Future Required Bay	Interconnection Details	Required Bays
1	132/33kV AIS: Tungipara, Gopalganj GPS Location: 22°55'7.12"N 89°54'14.12"E	Double Bus	2×80/120 = 240 MVA maximum	4 Paddy Field	2×132kV AIS bay extension at Gopalganj (Old) Substation	132kV: 3	Gopalganj–Tungipara 132kV double circuit line: 19.00 km (Proposed Conductor: ACSR Grosbeak)	132kV: LB=2 (Gopalganj: 2) TB=2 BCB=1 33kV: TB=2
2	132/33kV AIS: Dupchanchia, Bogura GPS Location: 24°53'31.60"N 89° 9'33.59"E	Double Bus	2×50/75 = 150 MVA maximum	3 Paddy Filed	--	132kV: 3	LILO of Bogura (S)–Naogaon 132kV line at Dupchanchia: 2.50 km (Existing Conductor: ACCC Grosbeak)	132kV: LB=4 (Bogura: 2, Naogaon: 2) TB=2 BCB=1 33kV: TB=2

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

SN	Name of proposed substation	Salient Features						
		Bus Type	Transformer Capacity (MVA)	Required Land (Acre)	Bay Extension at another end SS	Future Required Bay	Interconnection Details	Required Bays
3	132/33kV AIS: Matlab (N), Chandpur GPS Location: 23°24'47.28"N 90°38'2.24"E	--	2×50/75 = 150 MVA maximum	3 Paddy Field	2×132kV AIS bay extension at Kachua 230/132kV Substation	132kV: 3	Kachua–Matlab (N) 132kV double circuit line: 33.00 km (Proposed Conductor: ACSR Grosbeak)	132kV: LB=2 (Kachua: 2) TB=2 BCB=1 33kV: TB=2
4	132/33kV AIS: Kumarkhali, Kushtia GPS Location: 23°52'16.03"N 89°13'19.45"E	Double Bus	2×50/75 = 150 MVA maximum	4 Paddy Field	--	132kV: 3	LILO of Bheramara–Rajbari 132kV line at Kusthia (E): 0.60 km (Existing Conductor: ACCC Hawk)	132kV: LB=4 (Bharamara: 2, Rajbari: 2) TB=2 BCB=1 33kV: TB=2
5	132/33kV AIS: Chatkhil, Noakhali GPS Location: 23° 3'24.69"N 91° 4'51.40"E	Double Bus	2×80/120 = 240 MVA maximum	3 Paddy Field	--	132kV: 3	LILO of Chowmuhani–Ramganj 132kV double circuit line at Chatkhil: 2.00 km (Existing Conductor: ACSR Grosbeak)	132kV: LB=4 (Ramganj: 2, Chowmuhani: 2) TB=2 BCB=1 33kV: TB=2
6	132/33kV AIS: Paikgacha, Khulna GPS Location: 22°34'41.57"N 89°17'52.21"E	Double Bus	2×50/75 = 150 MVA maximum	5 (acquired) under PGCB ownership	2×132kV AIS bay extension at Satkhira Substation	132kV: 3	Satkhira-Paikgacha 132kV double circuit line: 30.00 km (Proposed Conductor: ACSR Grosbeak)	132kV: LB=2 (Satkhira: 2) TB=2 BCB=1 33kV: TB=2
7	132/33kV AIS: Mathbaria, Pirojpur GPS Location:	Double Bus	2×50/75 = 150 MVA maximum	4 Paddy Field	2x132kV AIS bay extension at Bhandaria Substation	132kV: 3	Bhandaria-Mathbaria 132kV double circuit transmission line: 32.00 km (Proposed Conductor: ACSR Grosbeak)	132kV: LB=2 (Bhandaria: 2) TB=2 BCB=1

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

SN	Name of proposed substation	Salient Features						
		Bus Type	Transformer Capacity (MVA)	Required Land (Acre)	Bay Extension at another end SS	Future Required Bay	Interconnection Details	Required Bays
	22°13'55.01"N 89°58'19.45"							33kV: TB=2

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

109. The ADB TA study team visited all of the ten new substation sites jointly with PGCB and the feasibility study consulting team. A brief description of the proposed sites is given below. In addition, the bay extension sites were visited as part of the environmental audit and a brief description of those sites is included in Appendix XII (Audit Report of Existing Facilities). Appendix III depicts proposed substation layouts.

A. 400/230/132kV New AIS Substation at Pekua/Chakaria, Cox's Bazar

110. The proposed AIS sub-station is located at Paschim Bara Bheola Union under Chakaria Upazila of Cox's Bazar District. It is located at 40 km away (aerial distance) from Cox's Bazar town. The proposed substation is located in Salt Pan area, the site is regularly flooded for salt production in the dry season. During the wet season it is extensively inundated and then used for local fish/local shrimp cultivation. The site is 2m from an existing paved road which can be used for access. It is 2-3 m below the road level so will need to be raised by sand fill to facilitate development with appropriate drainage facilities.



Figure 4.3: Photographs of Proposed Pekua/Chakaria Substation Site (Dry Season)

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

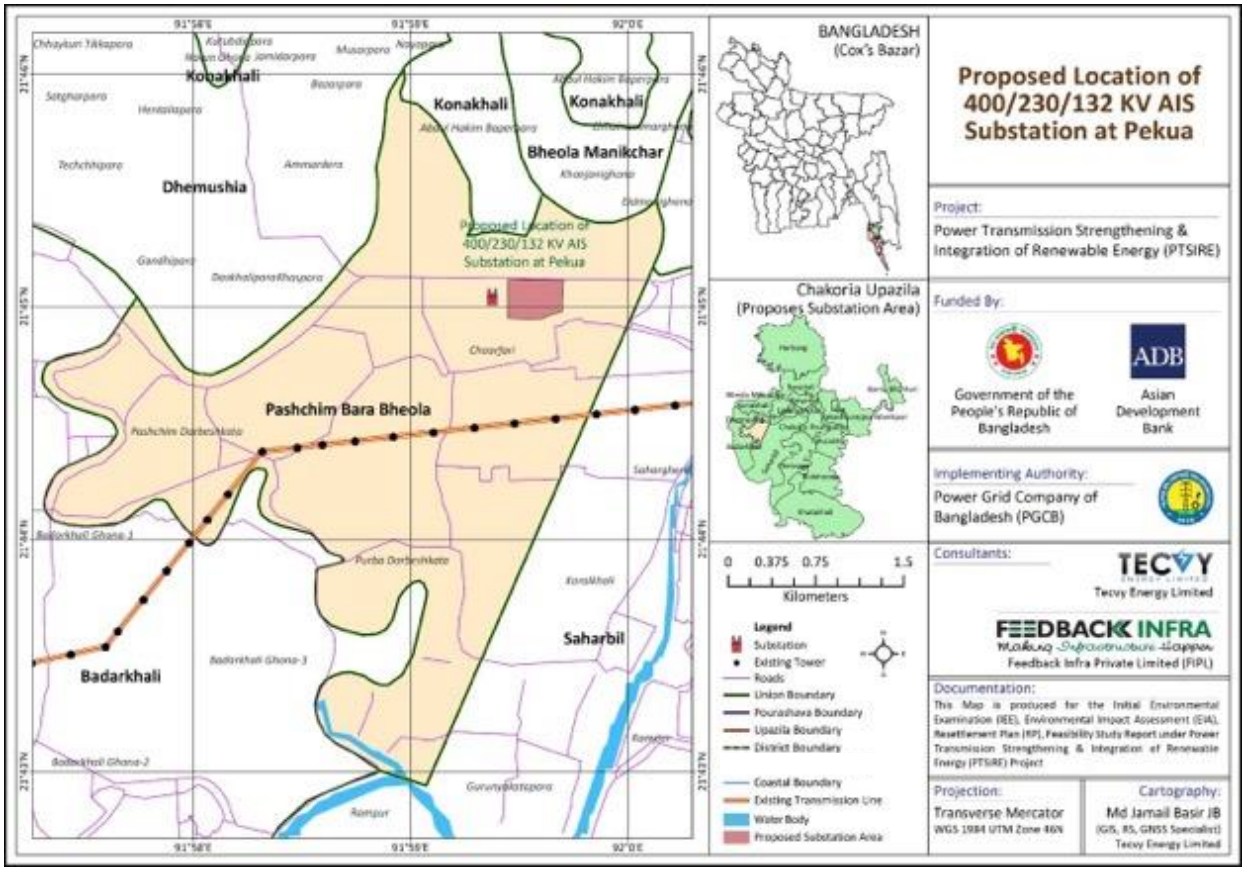


Figure 4.4: Locational Map of Proposed Substation at Pekua

B. 230/132/33 kV New AIS Substation at Madhabpur, Habiganj

111. The proposed AIS sub-station is located at Andiurauk Union under Madhabpur Upazila of Habiganj District. It is located at 30 km away (aerial distance) from Habiganj town. The proposed substation is located in Paddy Field area, it supports a low land (where water collects year around). The site is 7m from an existing paved road which can be used for site access. It is about 4m below the road level so will need to be raised by sand fill to facilitate development with appropriate drainage facilities.



Figure 4.5: Photographs of Proposed Madhabpur Substation Site

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

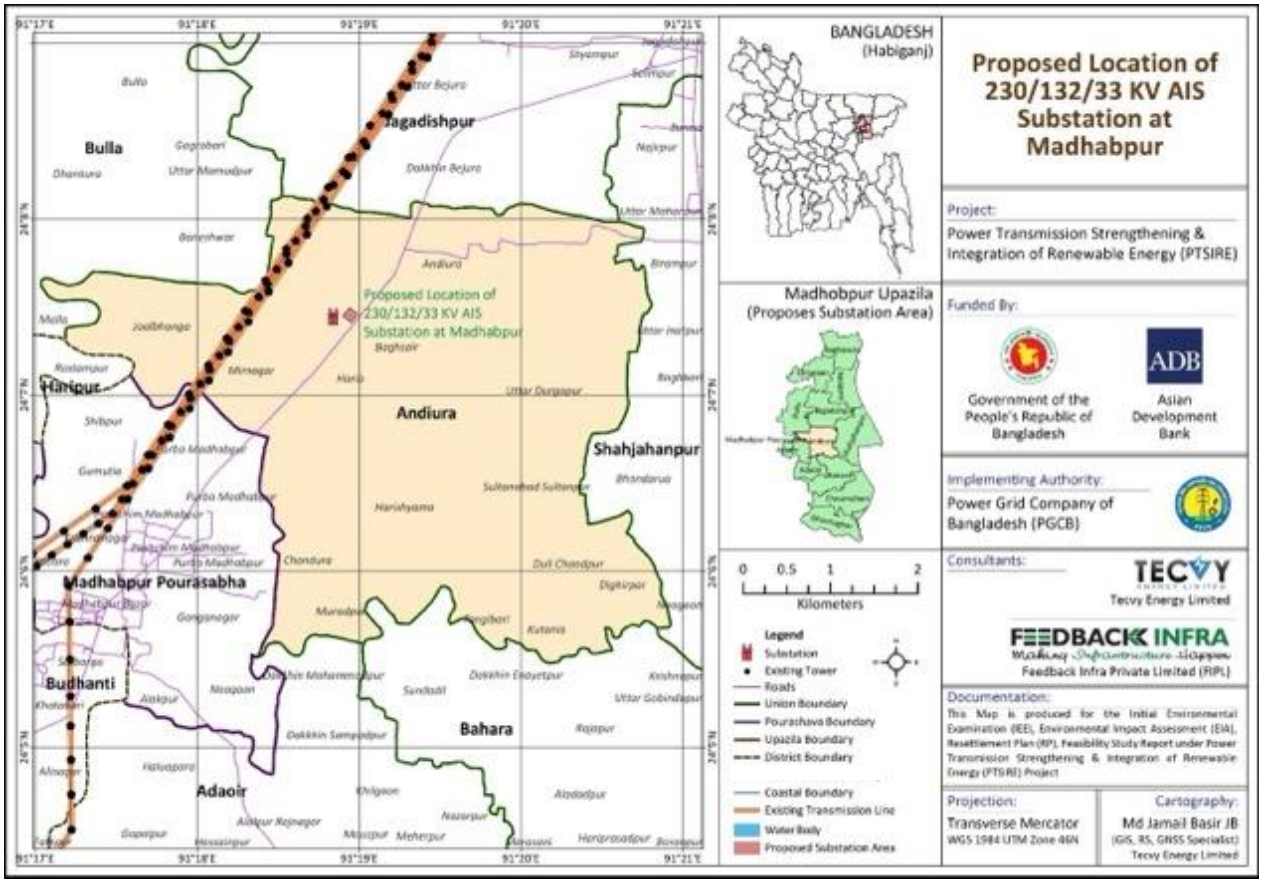


Figure 4.6: Locational Map of Proposed Substation at Madhabpur

C. 230/132/33 kV New AIS Substation at Monohardi, Narsingdi

112. The proposed AIS sub-station is located at Monohardi Paurashava under Monohardi Upazila of Narsingdi District. It is located at 25 km away (aerial distance) from district town. The proposed substation is located in Paddy Field area. The site is 7m from an existing paved road which can be used for access. It is 3-4m below the road level so will need to be raised by sand fill to facilitate development with appropriate drainage facilities.



Figure 4.7: Photographs of Proposed Monohardi Substation Site

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

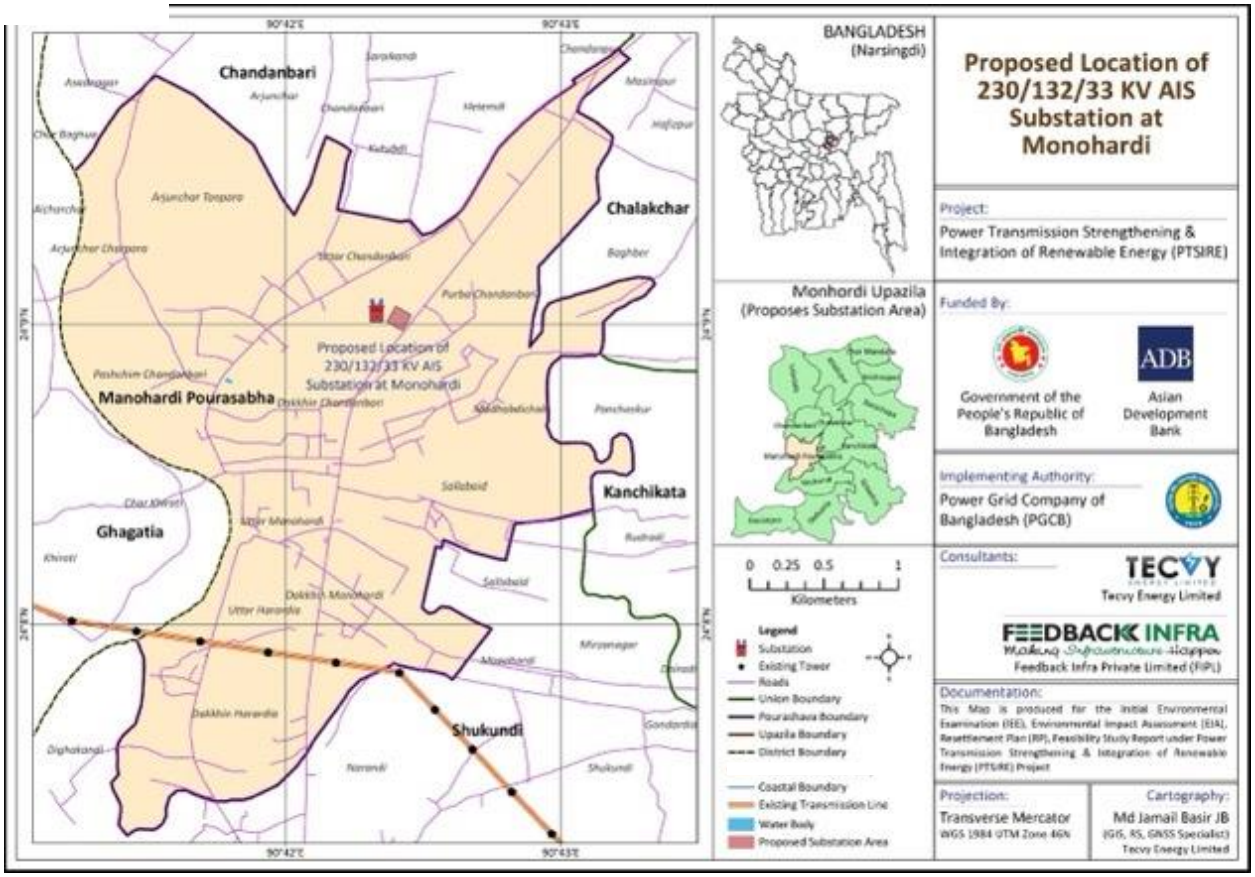


Figure 4.8: Locational Map of Proposed Substation at Monohardi

D. 132/33 kV New AIS Substation at Tungipara, Gopalganj

113. The proposed AIS sub-station is located at Patgati Union under Tungipara Upazila of Gopalganj District. It is located at 15 km away (aerial distance) from district town. The proposed substation is located in Paddy Field area, it supports a low land (where water collects year around). The site is adjacent an existing paved road which can be used for site access. It is 3-4m below the road level so will need to be raised by sand fill to facilitate development with appropriate drainage facilities. The site supports 114 trees.



Figure 4.9: Photographs of Proposed Tungipara Substation Site

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

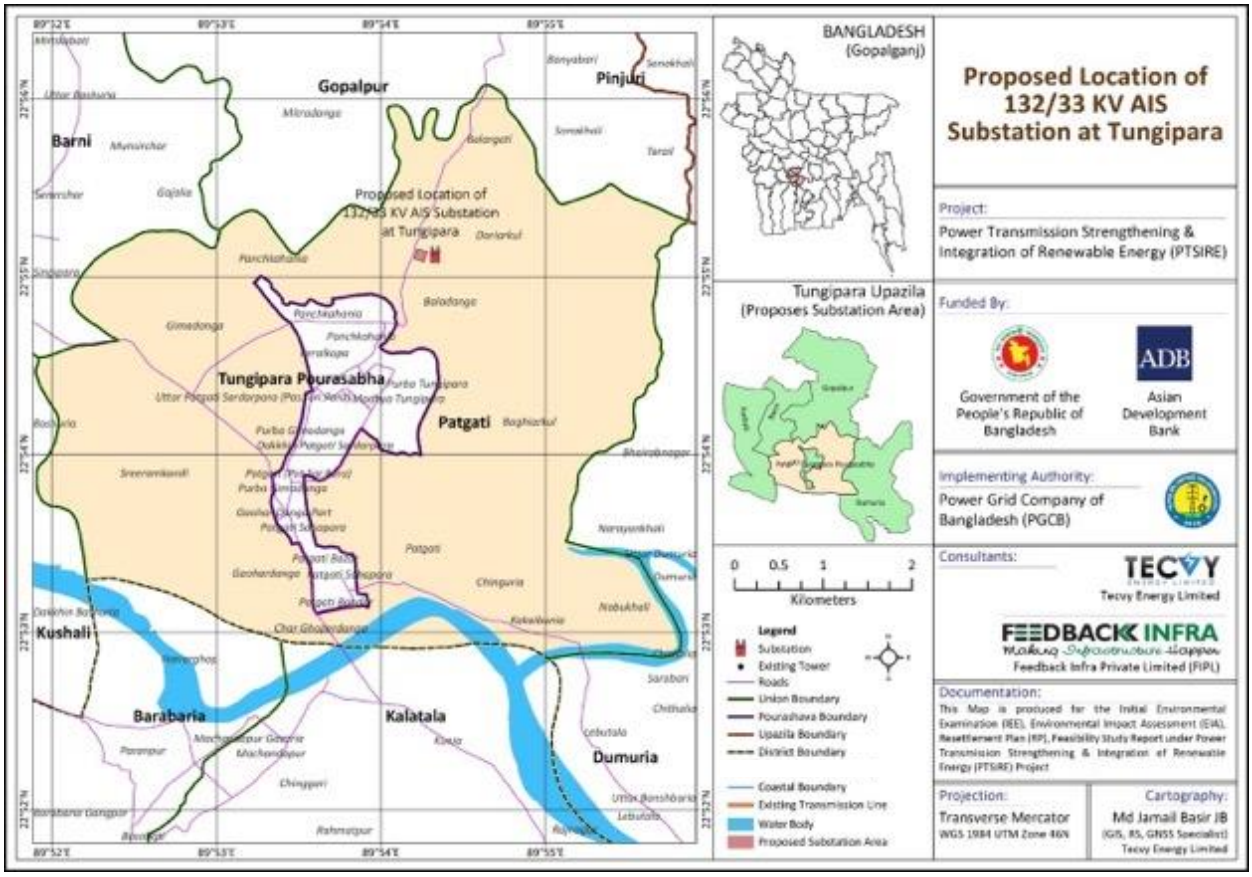


Figure 4.10: Locational Map of Proposed Substation at Tungipara

E. 132/33 kV New AIS Substation at Dupchanchia, Bagura

114. The proposed AIS sub-station is located at Dupchanchia Union under Dupchanchia Upazila of Bagura District. It is located at 22 km away (arial distance) from district town. The site is adjacent an existing paved road which can be used for site access. It is about 2m below the road level so will need to be raised by sand fill to facilitate development with appropriate drainage facilities.



Figure 4.11: Photographs of Proposed Dupchanchia Substation Site

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

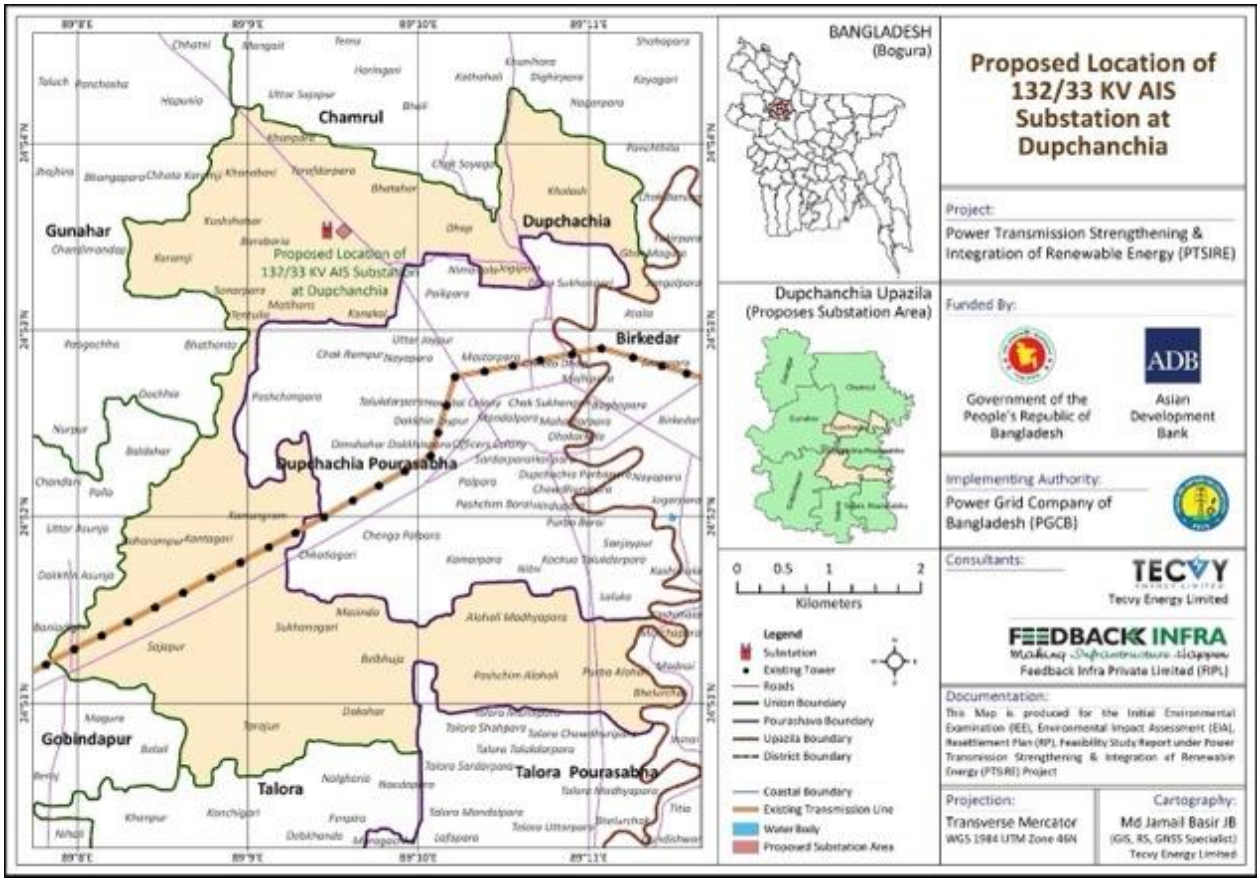


Figure 4.12: Locational Map of Proposed Substation at Dupchanchia

F. 132/33 kV New AIS Substation at Matlab Uttar, Chandpur

115. The proposed AIS sub-station is located at Gajra Union under Matlab Uttar Upazila of Chandpur District. It is located at 20 km away (aerial distance) from district town. The proposed substation is located in Paddy Field area. The site is 6m from an existing paved road which can be used for site access. It is approximately 2m below the road level so will need to be raised by sand fill to facilitate development with appropriate drainage facilities.



Figure 4.13: Photographs of Proposed Matlab Uttar Substation Site

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

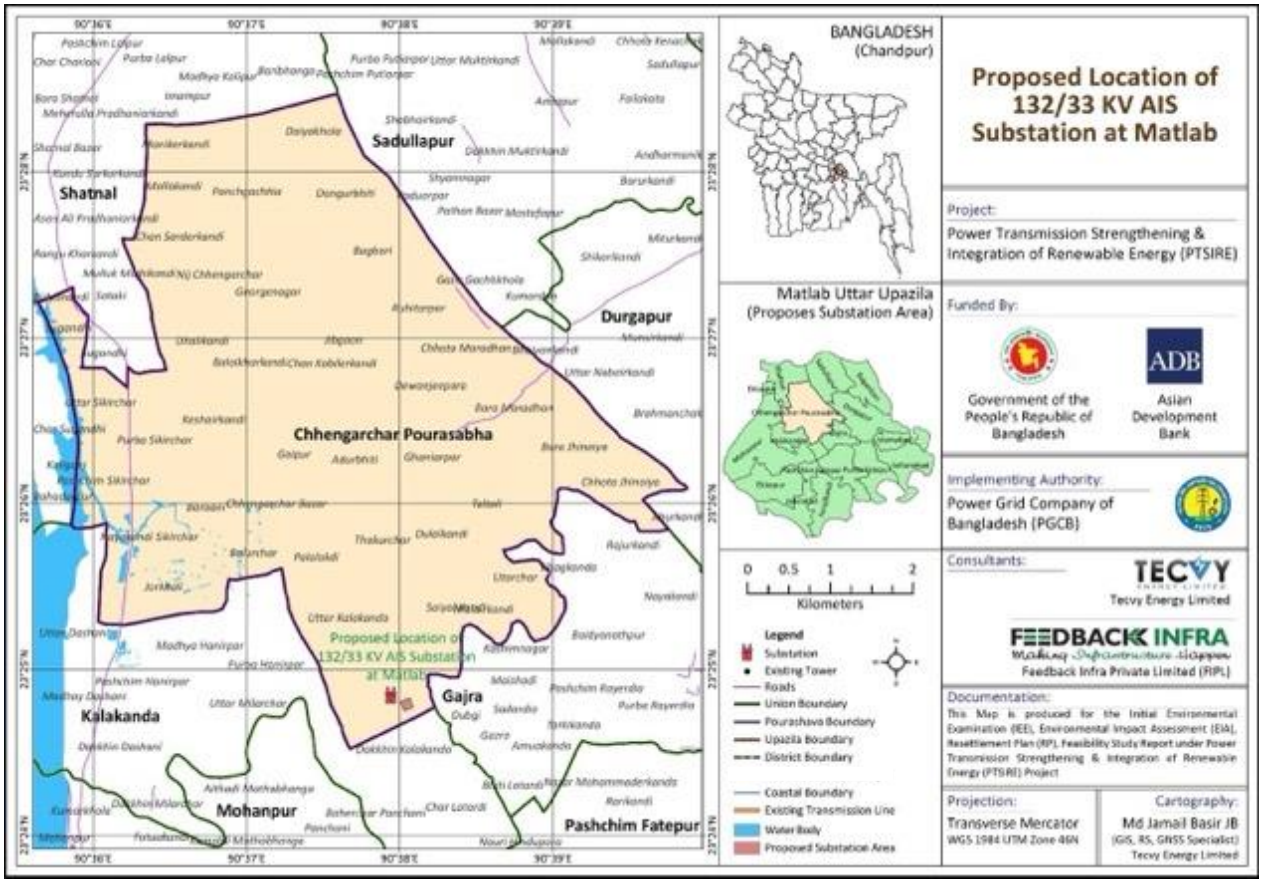


Figure 4.14: Locational Map of Proposed Substation at Matlab Uttar

G. 132/33 New AIS Substation at Kumarkhali, Kushtia

116. The proposed AIS sub-station is located at Nandalalpur Union under Kumarkhali Upazila of Kushtia District. It is located at 10 km away (aerial distance) from district town. The proposed substation is located in Paddy Field area. The site is adjacent to an existing paved road which can be used for site access. It is approximately 4 m below road level so will need to be raised by sand fill to facilitate development with appropriate drainage facilities.



Figure 4.15: Photographs of Proposed Kumarkhali Substation Site

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

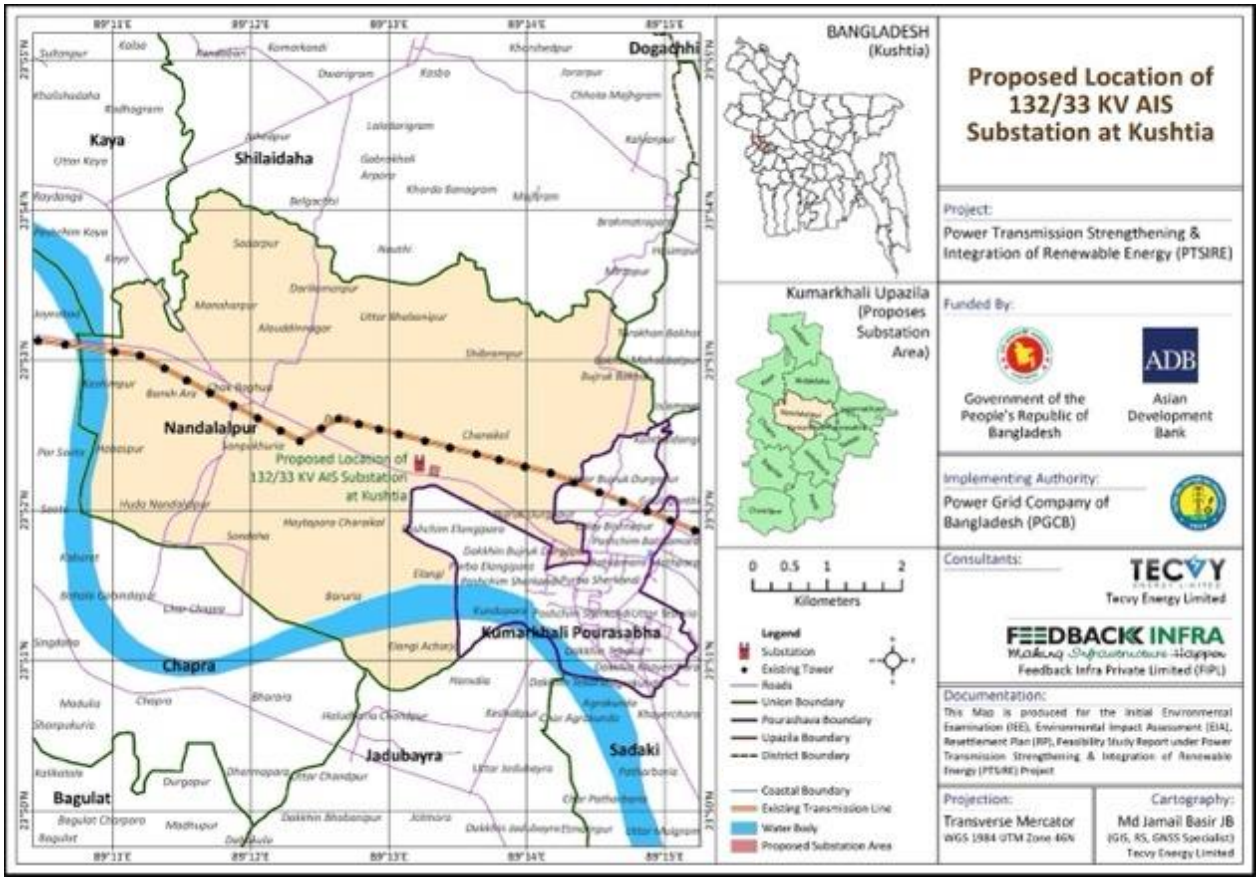


Figure 4.16: Locational Map of Proposed Substation at Kushtia

H. 132/33 New AIS Substation at Chatkhil, Noakhali

117. The proposed AIS sub-station is located at Chatkhil Paurashava under Chatkhil Upazila of Noakhali District. It is located at 10 km away (aerial distance) from district town. The proposed substation is located in Paddy Field area, it supports a low land (where water collects year around). The site is 35m from an existing paved road which can be used for site access; requiring a short stretch of access road to be built. It is 3-4m below the road level so will need to be raised by sand fill to facilitate development with appropriate drainage facilities.



Figure 4.17: Photographs of Proposed Chatkhil Substation Site

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

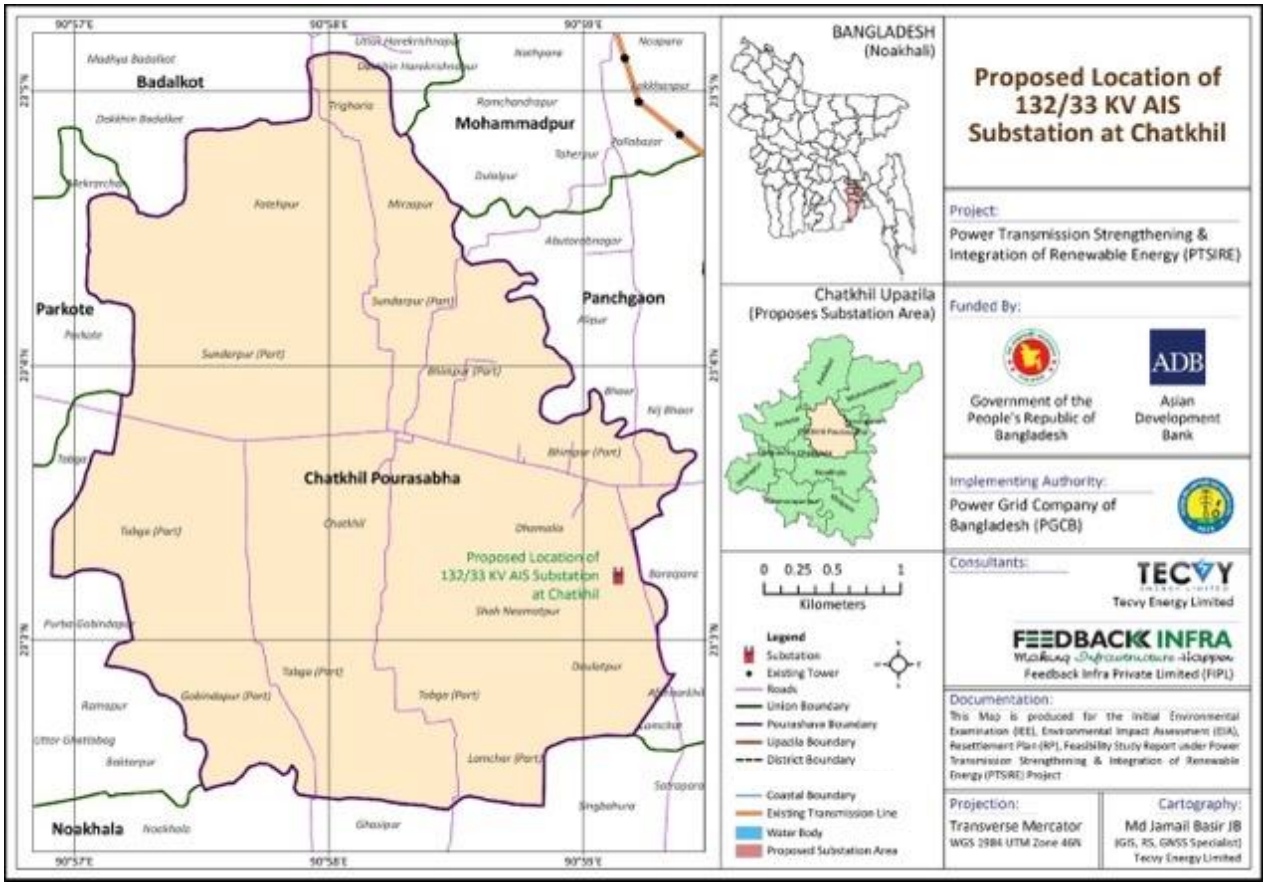


Figure 4.18: Locational Map of Proposed Substation at Chatkhil

I. 132/33kV New AIS Substation at Paikgacha, Khulna

118. The proposed AIS sub-station is located at Laskar Union under Paikgacha Upazila of Khulna District. It is located at 35 km away (aerial distance) from district town. The proposed substation is located in fishery area, waterlogged. The land is owned by PGCB since 2021, while the surrounding areas are used by local people for small-scale local fish and local varieties of shrimp cultivation using pumped water. The site is adjacent an existing paved road which can be used for site access. It is about 3 m below the road level so will need to be raised by sand fill to facilitate development with appropriate drainage facilities.



Figure 4.19: Photographs of Proposed Paikgacha Substation Site

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

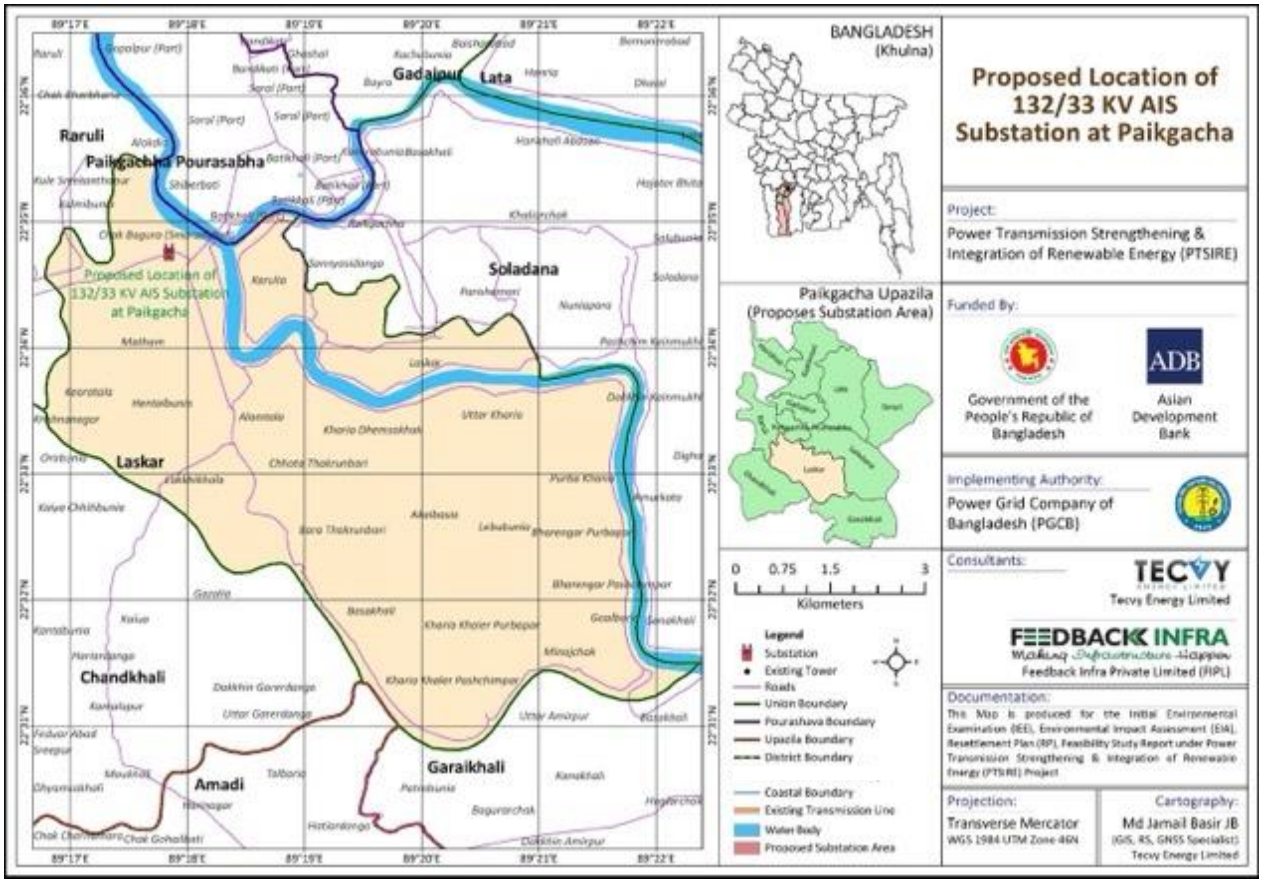


Figure 4.20: Locational Map of Proposed Substation at Paikgacha

J. 132/33 New AIS Substation at Mathbaria, Pirojpur

119. The proposed AIS sub-station is located at Gulishakhali Union under Mathbaria Upazila of Pirojpur District. It is located at 35 km away (arial distance) from district town. The proposed substation is located in Paddy Field area. The site is adjacent to an existing paved road which can be used for site access. It is about 2m below the road level so will need to be raised by sand fill to facilitate development with appropriate drainage facilities.



Figure 4.21: Photographs of Proposed Mathbaria Substation Site

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

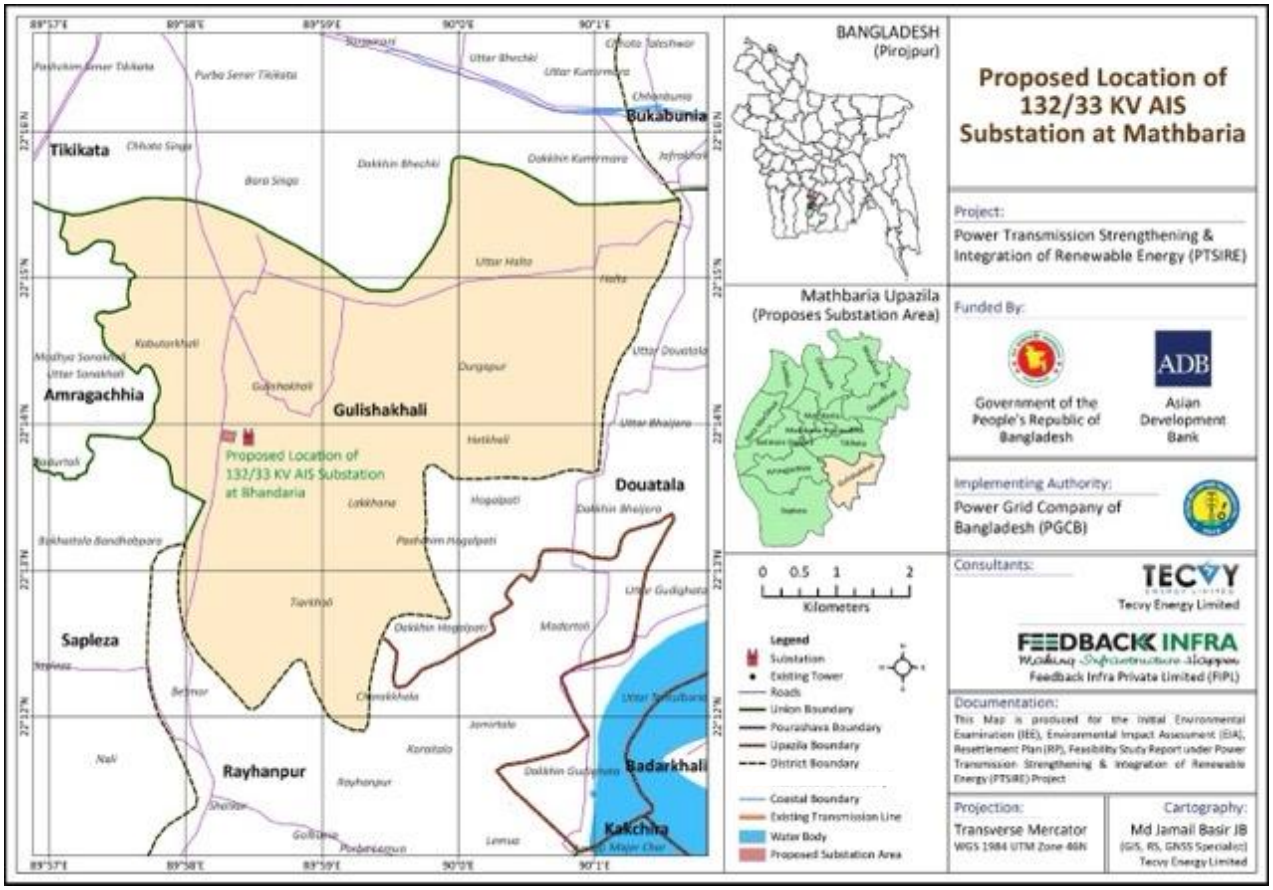


Figure 4.22: Locational Map of Proposed Substation at Mathbaria

4.5.2 Salient Features of Bay Extension

120. Total 5 substations have been proposed in this project for bay extension. The overall scenario of the proposed substations with their bay extension has been shown in the following Table 4.3:

Table 4.3: Proposed Substations Name with Bay Extension Works

SN	Name of the Existing Substation	Bay Extension Work		
		Bay Extension and Additional Land Requirement	Future Required Bay	Required Bays
1	Bajitpur Substation, Kishoreganj	2×132kV AIS bay extension Additional land: not required as per Substation Design Department, Power Grid	230kV: 3 132kV: 3	230 kV: LB=4 (Sripur: 2, Ashuganj PP: 2) TB=2, BCB=1 132kV: LB=2 TB=4 BCB=1 33kV: TB=2
2	Gopalganj (Old) Substation, Gopalganj	2×132kV AIS bay extension Additional land: not required as per Substation Design Department, Power Grid	132kV: 3	132kV: LB=2 (Gopalganj: 2) TB=2 BCB=1 33kV: TB=2

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

SN	Name of the Existing Substation	Bay Extension Work		
		Bay Extension and Additional Land Requirement	Future Required Bay	Required Bays
3	Kachua 230/132kV Substation, Chandpur	2×132kV AIS bay extension Additional land: not required as per Substation Design Department, Power Grid	132kV: 3	132kV: LB=2 (Kachua: 2) TB=2 BCB=1 33kV: TB=2
4	Satkhira Substation, Satkhira	2×132kV AIS bay extension Additional land: not required as per Substation Design Department, Power Grid	132kV: 3	132kV: LB=2 (Satkhira: 2) TB=2 BCB=1 33kV: TB=2
5	Bhandaria Substation, Pirojpur	132kV AIS bay extension: 2 nos Additional land: not required as per Substation Design Department, Power Grid	132kV: 3	132kV: LB=2 (Bhandaria: 2) TB=2 BCB=1 33kV: TB=2

121. The five substations that have been proposed in this project for bay extensions have been treated as Existing Facilities of the project on which some partial construction will take place. Accordingly, an existing facilities audit conforming to SPS 2009 has been conducted and all details are placed in Appendix XII and its corrective action plan has been added to the EMP in Section 12.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

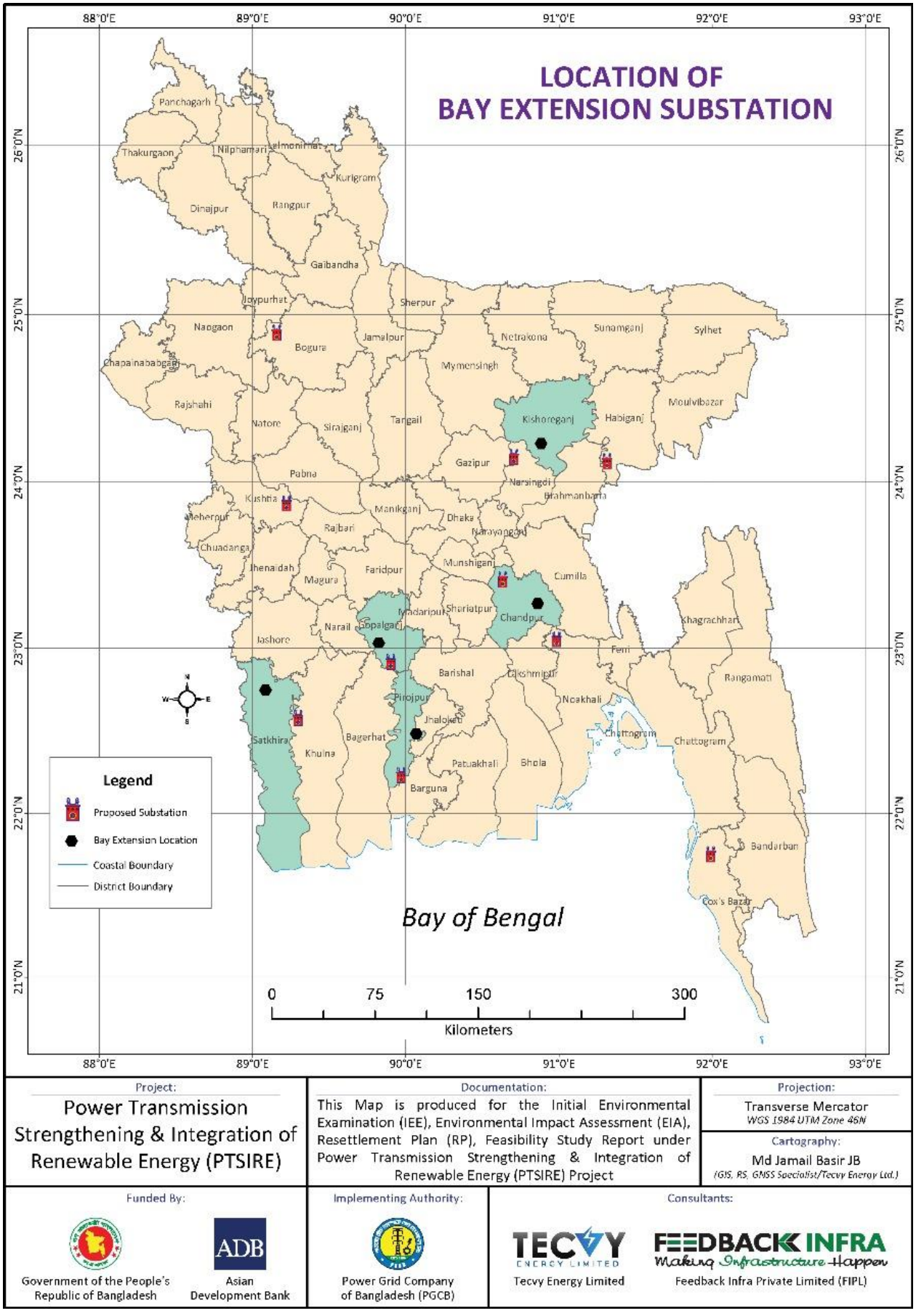


Figure 4.23: Location Map of Proposed Bay Extension Substations

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

4.6 Physical Features of the Transmission Lines

122. The proposed 232.55 km of 400 kV, 230 kV, and 132 kV double-circuit transmission lines will help to establish transmission infrastructure and evacuate bulk electricity. This will help meet the rapidly growing demands of residential, commercial, and industrial consumers in Dhaka, Chattogram, Sylhet, Barishal, Rajshahi, and Khulna divisions and adjacent areas.

123. The construction of 633 towers, of which 199 are angle towers and 434 are suspension towers. About 385.66 acres of cultivated land will be cleared for transmission lines during construction, although the land is not acquired. According to the RP, the total extent of land required for the tower footings at ground level for 199 angle towers is approximately 16.44 acre (17m×17m for 132kV, 19m×19m for 230kV and 20m×20m for 400kV and 10% has been added with total square meter) and around 27.57-acre land require for 633 suspension towers (15m×15m acre for 132kV, 17m×17m for 230kV and 18m×18m for 400kV and 10% has been added with total square meter). Around 44.01 acres of land will be required for construction of all transmission towers.

4.7 Detailed Design and Construction Works

124. Construction activities to be undertaken include the indicative steps listed in the following sections with the contractor responsible for developing the construction method statement.

4.7.1 Construction Equipment and Materials

125. A bulldozer, a motorized water truck, a piling machine, a sand-carrying vehicle, a concrete-mixing truck, a crane, a forklift, a cable drum, a trailer, a boom truck, a drum puller, a sagging dozer, a static wire reel, a trailer, and a dump truck are among the tools needed to build the proposed transmission lines. Augers, backhoe front loaders, concrete trucks, water trucks, dump trucks, excavators, trailers, crew trucks/car haulers, skid steer loaders, batching plants (PGCB usually does not use any batching plants in any substations as ongoing practice, but in future contractors may use batching plants if required), drill rig trucks with trailers, compressors, construction fork loaders, vibrating rollers, light pickups, cranes, bucket trucks, boom trucks, trailers, fork lifts, and overhead line rigs are among the construction equipment requirements for substations. The contractor will bring their own construction equipment and machineries including transport vehicles for workers and equipment, heavy materials handling facilities like mobile cranes, pile drivers, forklift, pile driving machine, temporary diesel generator etc. All equipment will be tested for pollution under control before bringing on to sites for construction.

126. Cement, coarse and fine aggregates, sand, reinforcement steel, rough-sawn lumber, checker-plate, anchor bolts, and electric cables are among the building materials used to build substations and transmission lines. All construction materials must be sourced from existing licensed sources and no new borrow pits, quarry or river dredging will be allowed under the project.

4.7.2 Temporary Facility Locations

127. All construction activities, including the identification and provision of temporary storage areas and other construction facilities, such as construction camps, sanitary and welfare facilities, will be the responsibility of the contractor who will be contractually bound to meet the requirements of the EMP in siting such related facilities. To avoid oil, concrete sludge etc. dripping from construction equipment, it needs to be parked on hardstanding area; and the washing of such equipment and draining of washing wastes needs to be separated from surface water drainage and sanitary wastewater streams. In cases where sufficient land is not available within the substation sites for related facilities the contractor will need to find and privately negotiate for the land required. Construction camps to contain all basic requirements (beds and beddings, lockers, mosquito nets, artificial lights, natural lights, windows and ventilation, fans, emergency exits, firefighting equipment, kitchen and dining halls, mobile charging

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

points, toilets and washing facilities connected to the sewerage system or septic tanks with soak ways, potable drinking water, recreational space) per ILO's guidance on worker accommodation and GoB requirements.

128. Construction equipment and materials may be kept on lands which will be requisitioned through Deputy Commissioner (DC) or lease land with negotiated settlement which may cause temporary impacts to the land owners and share croppers. Central stores will be used for cable reels etc. with required materials transported to site as needed. Construction camps will likely make use of existing buildings within the nearby residential areas.

4.7.3 Site survey

129. Environmental baseline surveys determined the characterization of the project area to inform this EIA/IEE prior the approval of the project and established the initial environmental status. Surveys will need to be repeated by the contractor particularly if there are changes to the sites and routes, or where information could not be collected to inform the draft EIA/IEE. Reconnaissance involving the map study, walkover survey and preliminary survey are conducted. It forms the most important aspect of a transmission line survey as the cost of the transmission line is influenced to a great extent by the route chosen.

130. **Topographical survey**: The geographical area maps will be used by the contractor which also cover the topography of the land at an additional distance of 10 km on both sides of the proposed line. The scale of these maps shall be 1:50,000, i.e., 1 cm. = 500 metres. These maps are also required for the purpose of obtaining various clearances for the line route. These maps give details of the location of villages, towns, cities, ponds, lakes, rivers, nalas, roads, unpaved roads, orchards, plantations, religious places, hilly area, sand dunes, etc. After a study of these maps, a tentative line route is selected based on the criteria developed by PGCB. This is also done for substation locations.

131. **Route Survey**: A walkover reconnaissance and route alignment survey is first carried out. Reconnaissance survey of the transmission line route is to be carried out for deciding upon the most economical line route and the most economical location of towers in view of the high cost per location. This is essentially carried out to verify the physical features on the ground which may not be clearly available in the survey maps due to developments that might have taken place subsequent to the preparation of the maps. The work of reconnaissance survey is essential for the purpose of establishing control points and collection of first-hand information of various important field data required for transmission line works. These are a) Crossing points of major EHV lines (66 kV and above) and details of the lines. b) Crossing points of Railway Tracks and details of such points. c) Crossing points of major rivers and details of such points. d) Type of terrain and nature of soil strata along the line route. e) Names of major towns. f) Important villages or towns coming enroute. The tentative line route is continuously examined and evaluated with reference to the criteria developed by PGCB. Changes are proposed / made in the line route wherever required. If necessary, alternative line routes are to be studied / surveyed keeping in view the fundamental considerations for selection of line route. The best route, modified or alternate, is then provisionally marked on the maps. This route shall form the basis for the detailed survey of the line. Receptor inventory and ecological walkovers are then conducted for transmission lines. This is also done for substation locations. This ensures that no significant environmental features that could preclude the development are present.

132. **Fixing of Route Alignment (Right Of Way)**: The alignment of the line route is carried out by survey using a theodolite. The width of the right of way should be kept as per the provisions of the applicable part / section of the Standard Code of Practice for right of way widths taking into consideration the theoretical requirement of right of way and transport requirements of maintaining statutory clearances (Bangladesh Electricity Rules, 2020 which prescribes the horizontal clearance which is to be maintained from buildings / parts of buildings). The horizontal clearance, on the basis of maximum deflection due to wind pressure, which should be maintained from buildings / parts of

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

buildings, shall not be less than the values prescribed on the rules.

133. **Details survey, sag template, tower spotting:** The line route worked out during the preliminary survey, with changes if any, is used as the reference. The measurements of the angle points are again done. These angles are indicated as Right (R) or Left (L) as per the direction of deviation with reference to the starting point. The levels of the ground profile along the route of the line are taken. A Sag Template is a very important tool with the help of which the position of towers on the Profile is decided so that they conform to the limitations of vertical and wind loads on any particular tower, and minimum clearances, as per Bangladesh Electricity Rules 2020, required to be maintained between the line conductor to ground, telephone lines, buildings, streets, navigable canals, power lines, or any other object coming under or near the line. A Sag Template is specific for the particular line voltage, the conductor used and the applicable design conditions. including seismic and wind loading requirements, climate risk and adaptation measures.

134. **Check survey, spotting and peg marking of substation boundary and tower locations** is carried out for the following purposes: a) To reconfirm the work carried out during detailed survey. b) To locate and peg mark the tower position on ground. c) To give direction pegs for excavation of tower foundation pits.

135. **Facilities planning**: Establishment of construction camps for the workers, establishment of temporary access routes (no new access roads, provision of signage etc.) as well as establishment of material storage areas and work sites. This is common for the transmission lines and substations before the start of works.

136. **Environmental parameter baseline survey**: An environmental parameter baseline study (i) to assess present environmental quality and monitor the environmental impacts against and (ii) to identify environmentally significant conditions that could affect the current impact assessment. The following parameters are notably measured: 1. Water Environment, 2. Air Environment, 3. Noise Environment, 4. Soil Environment. Besides, the topics such as 5. Land Environment, 6. Biological Environment, and 7. Socio-Economic Environment are also documented. This is common for both transmission lines and substations.

137. **Ecology survey**: The construction of new electricity transmission infrastructure and the upgrade of existing infrastructure have the potential to result in significant impacts on biodiversity. To ensure development of the transmission system is carried out with due regard for the environment, it is therefore crucial for ecological assessment and the implementation of appropriate mitigation measures to eliminate or reduce such impacts to acceptable levels. The ecological survey will be carried out to inform EIA/IEE finalization.

138. **Soil investigations**: The work involves drilling boreholes and conducting standard penetration test (SPT) up to required depths to accommodate type of tower foundation and equipment design. The field and laboratory tests are carried out to provide the subsoil profile and soil physical and chemical properties required for calculations for foundation soil bearing capacity and help in foundation design. This is common for transmission lines and substations. For existing substations, contaminated land testing is also needed.

4.7.4 Temporary Facilities Establishment

139. Temporary facilities play a crucial role in supporting the construction, maintenance, and operation of substations and associated lines. Here are some common temporary facilities and associated facilities used for substation and transmission line work:

- **Construction Camps:** Construction camps of contractor to provide temporary accommodation for workers, engineers, and staff involved in building or upgrading substations and installing

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

transmission lines. These camps may include temporary housing units, dining areas, sanitation facilities, and administrative offices.

- **Site Offices:** Site offices of contractor serve as command centers for overseeing construction activities, coordinating logistics, managing resources, and communicating with project stakeholders. They will provide workspace for project managers, engineers, supervisors, and support staff.

- **Storage and Warehousing:** Temporary storage facilities are essential for storing construction materials, equipment, tools, and spare parts needed for substation work. These facilities may include warehouses, laydown yards, and storage containers located near the construction site. Materials such as cement, sand, brick will be sourced direct from authorized suppliers/licensed sources and stored.

- **Workshops:** Temporary workshops of contractor are set up to facilitate the assembly, fabrication, and maintenance of equipment and components used in substation construction. These workshops may include facilities for welding, machining, painting, and equipment testing.

- **Temporary Access Roads:** Temporary access roads will be constructed to provide safe and efficient access to the substation site / transmission line route for construction vehicles, equipment transport, and personnel. These roads may be temporary gravel roads built to withstand heavy traffic during construction.

- **Temporary Power Supply:** Temporary power supply systems are installed to provide electricity to the construction site during the construction phase. This may involve setting up temporary generators, transformers, and distribution panels to power construction equipment, lighting, and temporary facilities.

- **Safety and Security Facilities:** Safety and security facilities will be implemented to ensure the well-being of workers and protect the construction site from unauthorized access, theft, vandalism, and accidents. This may include perimeter fencing, security guards, surveillance cameras, and safety signage.

- **Environmental Protection Measures:** Temporary facilities may include measures to minimize the environmental impact of construction activities, such as septic tanks, sedimentation ponds, and other pollution prevention practices.

- **Communication Infrastructure:** Temporary communication infrastructure, including telephone lines, internet connectivity, and radio communication systems, is established to facilitate communication and coordination among project teams, contractors, and local stakeholders.

- **Waste Management Facilities:** Temporary facilities for waste management, including waste collection bins, recycling stations, and sanitary wastewater treatment systems, are set up to ensure proper disposal and recycling of construction waste generated during substation and transmission line work.

- **Utilities**: The contractor will determine if they source piped or canned drinking water from an existing supplier (as the preferred option) or provide treated water for workers; all drinking water

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

provided will be regularly tested and confirmed to meet GoB drinking water standards. If the contractor provides their own construction water supply permissions for use of surface water or wells shall be obtained in advance along with the agreement of local communities using the water source.

140. These temporary facilities are essential for supporting the efficient and safe execution of construction, ensuring that all necessary resources, infrastructure, and support services are available to complete the work successfully.

4.7.5 Construction Manpower

141. PGCB usually employs engineering, procurement, and construction firms to build the transmission line and substations. The contractor will assign competent labor in accordance with their needs to finish the project. Excavators, pile drivers, laborers for the foundation and superstructure, carpenters, electricians, heavy equipment operators, ironworkers, masons, plasterers, plumbers, pipefitters, sheet metal workers, steel fixers, and welders will all be called upon as needed throughout the various stages of construction. The technical workforce will consist of supervisors, technicians from several trades, electrical and civil engineers, and technicians. To prevent a labor influx, unskilled labor will be employed from the nearby community. The exact size of the workforce including the number of unskilled, semiskilled, and skilled shall be determined by the contractor based on the project scheduling.

4.7.6 Detailed Design and Construction Works for Substations and Bay Extensions

- Contractor and construction worker recruitment (it is anticipated about 40-60 skilled and unskilled construction workers will be needed to build each substation or bay extension)
- Survey work
- Detailed design, including provision of seismic design, climate risk and adaptation, pollution control (e.g., 110% bunding of transformers, impermeable bunded oil and waste storage areas), safety (e.g., fire management) requirements
- Establishment of construction camps for the workers
- Establishment of temporary access routes (no new permanent access roads, provision of signage etc.)
- Establishment of material storage areas and work sites
- Site clearance
- Demolition works, where necessary (collection and removal of demolition waste)
- Land fill to achieve the required site level (sand fill)
- Earthworks to create development platform
- Sourcing and transport of materials and equipment to site
- Civil works (e.g., piling of building foundations, cable trenches etc.)
- Structural works (e.g., gantries, control buildings etc.)
- Electrical equipment installation
- First aid and firefighting arrangements
- Testing and commissioning of electrical equipment

4.7.7 Detailed Design and Construction Works for Transmission Lines

- Contractor and construction worker recruitment (it is anticipated about 15-20 skilled and unskilled workers will be needed to install a 1 km stretch of transmission line)
- Routing plans for construction of 400 kV, 230 kV, and 132 kV transmission lines including maintaining safety clearances

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

- Detailed design tower foundations, including seismic and wind loading requirements, climate risk and adaptation measures
- Establishment of construction camps for the workers
- Establishment of temporary access routes (no new access roads, provision of signage etc.)
- Establishment of material storage areas and work sites
- Clearing of RoW
- Sourcing and transport of materials and equipment to the sites
- Tower foundation and installation
- Conductor stringing and earthing
- Connection at the start and end points
- Testing and commissioning of transmission lines

4.8 Work Schedule

142. The project construction activities have been divided into two phases, namely preconstruction activities and construction activities. In pre-construction phase common activities viz, document preparation, tendering, evaluation and approval, contract negotiation and signing have been considered which are carried out by PGCB. The EMP must be included in the bid documents; for the Pekua contract package as this has already been bid out incorporating an initial draft EMP, the revised draft EMP as disclosed on the ADB website must be incorporated before contract award. The other five contract packages have yet to be bid out. Contracting is followed by pre-construction activities of the design and build contractor, including completion of detailed design, updating of the EIA/IEE report, and CSEMP preparation. Construction activities may comprise of 6 (six) packages. The detailed work program will be prepared by the contractor. Estimated implementation schedule for the project is attached in Table 4.4.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Table 4.4: Implementation Schedule

	Description of works	Q-1	Q-2	Q-3	Q-4	Q-5	Q-6	Q-7	Q-8	Q-9	Q-10	Q-11	Q-12	Q-13	Q-14	Q-15	Q-16	Q-17	Q-18	Q-19	Q-20
Pre-construction Activities																					
1	**Document Preparation**																				
2	**Tendering, Evaluation and Approval**																				
3	**Contract Negotiation and Signing**																				
Construction/Implementation Activities																					
Packages-1: Pekua 400/230/132 kV AIS Substation with 3x520 MVA (400/230 kV) and 2x225/300 MVA (230/132 KV) transformers, LILO of Matarbari Power Plant – Banskhali Power Plant double circuit 400kV line at Pekua Substation using double circuit towers (Quad ACSR Finch Conductor):13.5km, LILO of Anwara-Cox's Bazar 230kV line at Pekua Substation (Twin ACSR Mallard Conductor) :0.5km, LILO of Existing Matarbari – Chakaria 132kV line at Pekua Substation (Single ACSR Grosbeak Conductor):1.3km																				
1	***Site Preparation* (*land development, crop compensation)***																				
2	***Detailed Drawing, Design and Approval***																				
	2.1 Civil Work																				
	2.2 Equipment Design																				
3	Equipment & Materials Manufacturing																				
4	Stringing and Installation																				
	4.1 ***Stringing***																				
	4.2 ***Equipment Installation***																				
	4.3 Pile Foundation and Trench																				
	4.4 Tower Erection & Insulator Fitting																				
	4.5 Underground Cable																				
5	***Testing and Commissioning***																				
	5.1 ***Testing and pre-commissioning***																				
	5.2 Commissioning																				
Package-2: Madhabpur 230/132/33 KV AIS Substation with 3x225/300 MVA (230/132kV) and 2x80/120 MVA (132/33 KV) transformers, Monohardi 230/132/33 KV AIS Substation with 2x225/300 MVA (230/132kV) and 2x80/120 MVA (132/33 KV) transformers, 132 kV AIS Bay Extension at Bajitpur Substation:2nos, LILO of Cumilla(N) – Shahjibazar PP 230kV double circuit line at Madhabpur Substation(Twin ACSR Mallard Conductor):1.2km, LILO of Sripur-Ashuganj 230kV double circuit line at Monohardi Substation(Twin ACSR Mallard Conductor):5.5km, Monohardi-Bajitpur 132kV double circuit line (Single ACSR Grosbeak Conductor):21km																				
1	Site Preparation (land development, crop compensation)																				
2	Detailed Drawing, Design and Approval																				
	2.1 Civil Work																				
	2.2 Equipment Design																				
3	Equipment & Materials Manufacturing																				
4	***Stringing*** and Installation																				
	4.1 ***Stringing***																				
	4.2 ***Equipment Installation***																				
	4.3 Pile Foundation and Trench																				
	4.4 Tower Erection & Insulator Fitting																				

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

	Description of works		Q-1	Q-2	Q-3	Q-4	Q-5	Q-6	Q-7	Q-8	Q-9	Q-10	Q-11	Q-12	Q-13	Q-14	Q-15	Q-16	Q-17	Q-18	Q-19	Q-20
	4.5	Underground Cable																				
5	***Testing and Commissioning***																					
	5.1	***Testing and pre-commissioning***																				
	5.2	Commissioning																				
Package-3: Paikgacha 132/33 KV AIS Substation with 2x50/75 MVA (132/33 kV) transformers, Mathbaria 132/33 kV AIS Substation with 2x50/75 MVA (132/33 kV) transformers, 132 kV AIS Bay Extension at Satkhira Substation:2nos, 132 kV AIS Bay Extension at Bhandaria Substation:2nos																						
1	***Site Preparation (land development, crop compensation)***																					
2	***Detailed Drawing, Design and Approval***																					
	2.1	Civil Work																				
	2.2	Equipment Design																				
3	Equipment & Materials Manufacturing																					
4	Stringing and Installation																					
	4.1	***Stringing***																				
	4.2	***Equipment Installation***																				
	4.3	Pile Foundation and Trench																				
	4.4	Tower Erection & Insulator Fitting																				
	4.5	Underground Cable																				
5	***Testing and Commissioning***																					
	5.1	***Testing and pre-commissioning***																				
	5.2	Commissioning																				
Package-4: Dhupchanchia 132/33 kV AIS Substation with 2x50/75 MVA (132/33 kV) transformers, Kumarkhali 132/33 kV AIS Substation with 2x50/75 MVA (132/33 kV) transformers, Matlab North 132/33 kV AIS Substation with 2x50/75 MVA (132/33 kV) transformers, Chatkhil 132/33 kV AIS Substation with 2x80/120 MVA (132/33 kV) transformers, 132 kV AIS Bay Extension at Kachua Substation:2nos																						
1	Site Preparation (land development, crop compensation)																					
2	Detailed Drawing, Design and Approval																					
	2.1	Civil Work																				
	2.2	Equipment Design																				
3	Equipment & Materials Manufacturing																					
4	Stringing and Installation																					
	4.1	***Stringing***																				
	4.2	***Equipment Installation***																				
	4.3	Pile Foundation and Trench																				
	4.4	Tower Erection & Insulator Fitting																				
	4.5	Underground Cable																				
5	***Testing and Commissioning***																					
	5.1	***Testing and pre-commissioning***																				
	5.2	Commissioning																				
Package-5: Satkhira-Paikgacha 132kV double circuit line(Single ACSR Grosbeak Conductor):30km, BhandariaMathbaria 132kV double circuit line (Single ACSR Grosbeak Conductor):32km, Kachua- Matlab North 132kV double circuit line(Single ACSR Grosbeak Conductor):33km,LILO of Chowmuhani-Ramganj 132kV double circuit line at Chatkhil Substation(Single ACSR Grosbeak Conductor):2km, LILO of Shahjibazar – Brahmanbaria 132kV double circuit line at Madhabpur Substation(Single ACCC Grosbeak Conductor) :1.2km, LILO of Bogura(S)-Naogaon																						

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

	Description of works		Q-1	Q-2	Q-3	Q-4	Q-5	Q-6	Q-7	Q-8	Q-9	Q-10	Q-11	Q-12	Q-13	Q-14	Q-15	Q-16	Q-17	Q-18	Q-19	Q-20
132kV line at Dupchanchia Substation(Single ACCC Grosbeak Conductor) :2.5km, LILO of Bheramara – Rajbari 132kV line at Kumarkhali Substation(Single ACCC Grosbeak Conductor) :0.6km, Reconductoring of Shahjibazar-Brahmanbaria-Ashuganj double circuit 132kV line(Single ACCC Grosbeak Conductor) :75km																						
1	Site Preparation (land development, crop compensation)																					
2	Detailed Drawing, Design and Approval																					
	2.1	Civil Work																				
	2.2	Equipment Design																				
3	Equipment & Materials Manufacturing																					
4	Stringing and Installation																					
	4.1	***Stringing***																				
	4.2	***Equipment Installation***																				
	4.3	Pile Foundation and Trench																				
	4.4	Tower Erection & Insulator Fitting																				
	4.5	Underground Cable																				
5	***Testing and Commissioning***																					
	5.1	***Testing and pre-commissioning***																				
	5.2	Commissioning																				
Package-6: Tungipara 132/33 kV AIS Substation with 2x80/120 MVA (132/33 kV) transformers, 132 kV AIS Bay Extension at Gopalganj Substation:2nos, Gopalganj-Tungipara 132kV double circuit line (Single ACSR Grosbeak Conductor):19km																						
1	Site Preparation (land development, crop compensation)																					
2	Detailed Drawing, Design and Approval																					
	2.1	Civil Work																				
	2.2	Equipment Design																				
3	Equipment & Materials Manufacturing																					
4	Stringing and Installation																					
	4.1	***Stringing***																				
	4.2	***Equipment Installation***																				
	4.3	Pile Foundation and Trench																				
	4.4	Tower Erection & Insulator Fitting																				
	4.5	Underground Cable																				
5	***Testing and Commissioning***																					
	5.1	***Testing and pre-commissioning***																				
	5.2	Commissioning																				

Note: Activities Intermittent Activities

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

4.9 Materials/Equipment

4.9.1 Construction Equipment

143. A bulldozer, a motorized water truck, piling machine, a sand-carrying vehicle, a concrete-mixing truck, a crane, a forklift, a cable drum, a trailer, a boom truck, a drum puller, a sagging dozer, a static wire reel, a trailer, and a dump truck are among the tools needed to build the proposed transmission lines. Augers, backhoe front loaders, concrete trucks, water trucks, dump trucks, excavators, trailers, crew trucks/car haulers, skid steer loaders, batching plants, drill rig trucks with trailers, compressors, construction fork loaders, vibrating rollers, light pickups, cranes, bucket trucks, boom trucks, trailers, forklifts, and overhead line rigs are among the construction equipment requirements for substations.

4.9.2 Construction Material Transport

144. Cement, coarse and fine aggregates, sand, reinforcement steel, rough-sawn lumber, checker-plate, anchor bolts, and electric cables are among the building materials used to build substations and transmission lines. Equipment such as transformers, substation control, protection, and automation equipment, 400 kV, 230 kV, and 132 kV AIS switchgear with control panel, steel structures, conductors, insulators, connectors of 400 kV, 230 kV, and 132 kV, earthing and lightning protection, communication equipment, cables etc. will be required in equipment installations at various locations across the country. All these items will be transported to various sites and stored at locations designated by the contractors in agreement with PGCB at each site. Transformers are large, bulky devices. Contractors will submit CESMP and Traffic Management Plan, which will provide details on how the transformers will be transported to each site and materials will be stored. For this project, mechanical and electrical components will be imported, however, all local materials will be used for civil construction. As a result, less domestic resources will be required in the installation process; instead, local materials like bricks, sand, cement, rods, etc. will be employed. In finalizing the EIA/IEE the contractor will confirm the anticipated traffic movements for imports – especially the number of traffic movements for the sand fill.

4.9.3 Hazardous Materials and Construction Waste

145. Hazardous materials and inert, solid and hazardous waste produced during construction works needs environmentally safe and sound storage, handling, transportation and disposal in accordance with national regulations and the EMP. Non-hazardous waste (inert and solid) includes all domestic and kitchen waste, packaging wastes including plastics, paper, cardboard, wood, etc. construction waste such as concrete, brick, rubble, iron scrap etc. Hazardous waste includes used transformer oil, empty metal or plastic fuel/oil/chemical containers, transformer oil or solvent-soaked rags, used batteries, defunct solar PV panels, broken or used electrical equipment (e-waste) etc. All wastes will be stored onsite prior to offsite transport, ideally close to the site entrance for ease of loading. If off-site storage is used due to size restrictions of the site not allowing for temporary waste storage the location to be selected based on the EMP and with approval of PGCB and the appropriate authority. The on-site or offsite storage area should have an impermeable bunded surface with enclosed containers etc. For the reuse, recycling or disposal of solid and hazardous waste, licensed contractors will be used. PGCB's RTS department has its capacity to centrifuge the transmission oil when it is required as well as to add oil to transformers during operation. Disposal of malfunctioned or out of serviced transformers will be done through auction.

4.10 Construction Activities

4.10.1 Construction of Substations and Bay Extensions

A. Land Fill and Earthwork for Foundations

146. Landfill will be required at all the new substation sites to achieve the desired site level where

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

land is below the level of the adjacent access road. To infill the usual practice in Bangldesh is for wooden shutters to be installed around the site boundary into which sand is placed, the sand will be left to settle with any water in the sand matrix draining to the ground. In Table 4.5 below are approximate sand fill requirements for the substation sites. Details and the sand fill transport and method to be used (pipeline or road transport) will be updated in the final EIA/IEE by the contractor(s) after the contract award and detailed design.

147. Sand fill levels are ranging from 1.58 m to 4.35 m land filling depth required for all the substations. Once the desired site level is achieved, earthwork excavation for the foundation up to the necessary depth is necessary for the substation construction. Whilst foundation construction is undertaken, the excavated earth should be stored in a suitable empty location. Local soil and sand will be used to backfill the dug area. The design of substation yard and transformers to ensure consideration of the highest flood level allowing for climate change as well as the standard height from main access road.

148. Sourcing of sand which in Bangladesh is mostly dredged from rivers and soil/gravel for filling inside substations is important for this project. The contractor must ensure sourcing/selection of government licensed sand/gravel suppliers from legally permitted sites i.e. ensure no illegally extracted sand and gravel is used for the project which may negatively impact any aquatic life and hydrology of the adjoining river systems at the sites. The consultant team will identify the nearest government approved sand sourcing site as a part of their feasibility study.

Table 4.5: Approximate Land Filling Volumes

Sl. No.	**Substation Name**	**Elevation Type**	**Filling Level (m)**	**Average Elevation (m)**	**Filling Depth (m)**	**Volume (m^3)**	**Volume (cft)**	**Total Volume (cft) and Truck Movement (estimate 300 cft/truck)**
1.	400/230/132kV AIS: Pekua/Chakaria	Top Area	4.50	1.576	2.924	355744.366	12564891.021	12993819.700 (43,313)
		Slope Area				12144.074	428928.721	
2.	230/132/33kV AIS: Madhabpur	Top Area	13.904	9.657	4.247	143852.052	5080854.490	5575652.356 (18,586)
		Slope Area				14009.00	494798.181	
3.	230/132/33kV AIS: Monohardi	Top Area	7.50	4.101	3.399	116109.299	4100980.460	4482600.643 (14,942)
		Slope Area				10804.649	381620.205	
4.	132/33kV AIS: Tungipara	Top Area	10.50	7.032	3.468	44517.738	1572366.507	1777654.920 (5926)
		Slope Area				5812.243	205288.428	
5.	132/33kV AIS: Dupchanchia	Top Area	10.50	8.662	1.838	19455.746	687176.965	737807.179 (2460)
		Slope Area				1433.472	50630.257	
6.	132/33kV AIS: Matlab (N)	Top Area	10.50	8.920	1.580	17051.44	602256.881	640010.656 (2134)
		Slope Area				1068.907	37753.827	
7.	132/33kV AIS:	Top Area	10.50	6.149	4.351	52391.741	1213124.614	1531800.320

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Sl. No.	Substation Name	Elevation Type	Filling Level (m)	Average Elevation (m)	Filling Depth (m)	Volume (m^3)	Volume (cft)	Total Volume (cft) and Truck Movement (estimate 300 cft/truck)
	Kusthia/Kumarkhali	Slope Area				9022.529	318675.740	(5106)
8.	132/33kV AIS: Chatkhil	Top Area	10.50	7.108	3.392	30776.257	1087017.400	1087017.397 (3623)
		Slope Area				5211.292	184062.848	
9.	132/33kV AIS: Paikgacha	Top Area	12.369	9.130	3.239	54287.087	1917419.942	2116159.619 (7053)
		Slope Area				5626.832	198739.738	
10.	132/33kV AIS: Mathbaria	Top Area	3.262	1.529	1.733	25409.557	897465.586	1024393.836 (3415)
		Slope Area				3593.666	126928.305	

*Source: DPP of the PTSIRE Project (September- 2024): Topographical Survey of Proposed Substations, Appendix AB, Pages 281-290

B. Foundation Treatment

149. The design of the structure foundations will be aided by geotechnical research, which will determine whether or not foundation remediation is necessary. The type of treatment, in situ concrete piling, or pre-cast RCC piling, will be recommended by the contractor based on the findings of the geotechnical study. Given soil conditions in Bangladesh piles would likely be used in all new substation's buildings/equipment erection. Different soil types have led to different depths for piling ranging from 9–20 meters. The PGCB's standard design recommendations will help the accountable contractor determine the type of piling.

150. Following issues must be focused on while carrying out piling activities.

- Noise limits, method and timing near houses to enable compliance with 1-hour LAeq levels.
- Use noise-attenuating screens at the substation boundary if houses and schools are very close (e.g. Paikgacha).
- To avoid waste piling mud flowing to adjacent land and waterbodies.
- Drilling rig and the piling method must utilize modern equipment to manage health and safety risks

C. Back Filling with Local Sand

151. Back filling of the excavated area of the foundation and floor of the building will be carried out with local sand. As above, the contractor must ensure that government-licensed suppliers of sand and gravel are sourced from legally permitted sites.

D. RCC Work

152. The RCC (Reinforced Cement Concrete) works would be required for column, beam, floor, circuit breaker structure and steel structure, etc.

E. Brick Work up to Plinth Level and Superstructure

153. Brickwork will be done for the construction of substation buildings with first class bricks and coarse sand and cement up to roof level.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

F. Plastering and Finishing

154. Inside lux requirements for each site will be done and lights/bulbs and switchboards are to be provided. Plastering of walls inside and outside as well as the roof of the building will be done in accordance with curing for at least three weeks. Following that, distemper or plastic painting will be done on the walls and roof of the building.

G. Wood Works/ Aluminum, Windows and Glass Fittings

155. Wood/aluminum works are to be done on door shutters and windows of the building along with glass fittings.

H. Sanitary Works

156. Sanitary works such as lying of sewerage line (either PVC or RCC), installation, fittings and fixing of toilet accessories will be done in the substation buildings. The toilets will need to be connected to dedicated septic tanks with soakaways at substation sites as there is no sewerage system nearby any of the substations.

157. The size and design of the septic system will determine how many toilets it can accommodate. Three (3) toilets in an area with good soil percolation will need a 1,000-gallon septic tank and a soakaway. 6 toilets including 3 for male and 3 for female would be considered for each 230/132/33 kV substation. Therefore, minimum 2-3 septic tank is required to be built for each substation. 4 toilets including 2 for male and 2 for female would be considered for each 132/33 kV substation. Therefore, minimum 2 septic tank is required to be built for each substation. For the Pekua 400/230/132 kV substation, 8 toilets including 4 for male and 4 for female would be considered and minimum 3-4 septic tank need to be built there. A total of 21 or 23 septic tanks needs to be constructed on the project sites to accommodate all toilets.

Table 4.6 : Sanitation Facilities

SN	List of Substation	Toilet (Male)	Toilet (Female)	No. of Septic tank
01	230/132/33 kV AIS: Madhabpur, Habiganj	3	3	2-3
		Subtotal: 6		
02	132/33kV AIS: Paikgacha, Khulna	2	2	2
		Subtotal:4		
03	132/33kV AIS: Tungipara, Gopalganj	2	2	2
		Subtotal:4		
04	132/33kV AIS: Chatkhil, Noakhali	2	2	2
		Subtotal:4		
05	132/33kV AIS: Matlab (N), Chandpur	2	2	2
		Subtotal:4		
06	132/33kV AIS: Kumarkhali, Kushtia	2	2	2
		Subtotal:4		
07	132/33kV AIS: Mathbaria, Pirojpur	2	2	2
		Subtotal:4		
08	132/33kV AIS: Dupchanchia, Bogura	2	2	2
		Subtotal:4		
09	230/132/33kV AIS: Monohardi, Narshingdi	3	3	2
		Subtotal: 6		
10	400/230/132kV AIS: Pekua/ Chakaria, Cox's Bazar	4	4	3-4
		Subtotal:8		
TOTAL		**48**		**21 or 23**

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

I. Water Supply System

158. The water supply system where available will be activated for the workers and staff of the substation. Otherwise, submersible pumps could be set up where there is no supply system if permitted to drawing rights by local authorities and with local community agreement. The substations cannot take water from local surface water ponds as that is used by the local community and for paddy fields. If surface water is tapped, it can only be used by using a river source which may be nearby and if permitted to drawing rights by local authorities and with local community agreement. It is noted that, like other near-coastal regions of Bangladesh, Paikgacha faces challenges with groundwater containing high levels of iron and salinity. Residents depend on bottled water for drinking and surface water for bathing and washing. The salinity issue regarding drinking water quality will be taken care of by installing more extensive drinking water treatment facilities at substations like Paikgacha. All drinking water supplies will need to meet the GOB drinking water standards.

J. Boundary Fencing with Concrete Pillar and Barbed Wire

159. The substation areas will be protected from any unauthorized entrance of public by fencing the boundary with a six feet height wall with barbed wire fitted with concrete pillars three (3) meters apart.

K. Electrical Works

160. Circuit breakers, transformers, lightning arresters, panel boards, insulators for batteries and battery chargers, current transformers, potential transformers, etc. will all be installed at the connecting substations in accordance with design specifications and standards towards the completion of substation construction work.

4.10.2 Construction Work for Transmission Lines

A. Piling Works

161. The pile foundation will be located in the lattice tower's basement. Each leg of the tower will have piles and a pile cap at the top. A drilling rig will be used to bore a hole in the ground for the piling process. To stabilize the borehole, steel tube or bentonite slurry will be utilized. After putting in a reinforcement cage, concrete casting will be done. In general, four piles are cast for a pile foundation, though at least three are used. The outcome of the geotechnical study will determine the quantity and depth of piles. Following issues must be focused on while undertaking piling activities:

1. Noise limits, method and timing near houses to enable compliance with 1-hour LAeq levels.
2. Use noise attenuating screens around transmission tower sites if houses are very close to the drilling rig and piling activities.
3. To avoid waste piling mud flows to adjacent land and waterbodies.
4. Drilling rig and the piling method must utilize modern equipment to manage health and safety risks.

B. Excavation

162. After the completion of piling work, the topsoil will be excavated up to specified depth. The excavation work could be done using hand tools or using an excavator. To prevent soil erosion during the exavation work, environmentally sound storage of excavated top soil is needed using cotton meshes and side protection walls of tin etc.

C. Pile Cap Casting

163. At the finishing of excavation, top and bottom reinforcements will be placed. Then concreting of pile cap will be performed. The pile cap transfers load to the sub soil through the piles. Floods/rains can affect towers foundations in low-lying paddy fields/riverine areas/salt pans and therefore tower foundations need to be designed for flood/salt water resilience though increased height of foundations.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

D. Erection of Tower

164. The towers will be constructed to take the load of the tower itself, conductors, accessories as well as wind load and earthquake load. The towers in paddy fields will have adequate clearance to maintain sag (lowest point on line) per the standards. The steel sections of the tower will be joined by bolt to erect the tower. Crane may be used to lift the steel sections at different elevation.

E. Drawing of Transmission Lines

165. The transmission line will be drawn keeping suitable clearance at all locations. During stringing work, the lowest sag point will be maintained as per approved drawing and design. Stringing under OHL activities includes but not limited to pilot line, conductor, pulling, sagging, splicing, removing rollers, final insulators, etc. Transmission lines may cross irrigation canals that have a ribbon plantation of trees on both sides (of less than a few meters' width) and these will be crossed in conformance to Bangladesh Electricity Rules 2020 keeping prescribed vertical distance over the canals without any cutting or trimming of trees. However, the guard structures for OHL protection may be required in certain locations.

166. Pre-existing roads will be involved. Traffic management plan will be developed and implemented to manage interference with pre-existing roads and facilitate safe access and passage during ongoing works; traffic signs to be put up wherever a transmission line crosses the road network. Scaffolding will be used during stringing of transmission lines over running roads. If necessary, diversions to be put in place to ensure safety of drivers.

167. For reconductoring the existing conductors will be removed before restrining. Scaffolding will be used to ensure safety during removal.

4.10.3 Testing and Commissioning of Equipment

168. After installation of all the equipment, each and every piece of equipment will be tested as per specification and standard. The substations and transmission lines will be commissioned accordingly if all the tests are successful.

4.10.4 Reinstating the Site

169. Following construction of the substations and the laying and stringing of the transmission lines, site reinstatement will be undertaken including embankments and other areas around the boundary fence lines.

4.11 Operation and Maintenance of Substations and Transmission Lines

170. The contractor will hand over the assets to PGCB once the commissioning is done. However, they will be required to rectify, repair, or replace any defect/s in the design, engineering, materials, or workmanship found and notified during the defect liability period. PGCB has its own staff who will be posted to the substations to look after the O&M of the assets, undertake inspections, and any maintenance works.

171. The substation locations will be maintained to guarantee the substation's dependability and security. There are three types of maintenance work: yearly, weekly, and daily. Usually, a yearly assessment and inspection is done, and any necessary maintenance is completed. A substation can last between 40 and 50 years before needing a major overhaul. Periodically, it can be necessary to do refurbishment and replacement work. This could entail reconstructing certain substation parts, which could take several months, or replacing some aged equipment over the course of a few days or weeks. It is also necessary for substation staff to routinely monitor substation equipment on a weekly and daily basis, including transformers and related bay equipment, bus bar couplers, capacitor banks, batteries

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

and battery chargers, relays, and subterranean cables, following substation installation. Measurement of leakage in line current and neutral current of transmission lines, air cooler servicing and maintenance, refilling and maintenance of firefighting equipment, gardening, plantations, water supply and sanitation are also considered necessary for sound operation of substation. In addition, SF6 pressure will be monitored periodically by the O&M personnel at the substation. In case of low pressure, there will be arrangement of refilling SF6 from refilling bottle. Moreover, the SF6 will also be identified by SF6 leak detector.

172. The transmission line alignments are designed to pass at a safe distance away from habitation such that vertical and horizontal clearances in the Bangladesh Electricity Act 2018 will be maintained. There should be no household or other regularly occupied structure coming under the RoW of transmission lines. Anti-climbing devices are to be installed on each transmission tower to prevent injury to anyone climbing the structure. Transmission line operation and maintenance (O&M) operations rely heavily on the overhead cables integrated monitoring systems, which enable the detection of short circuit or open circuit issues. The most common cause of a short circuit is a damaged cable splice or insulation that exposes the conductors. When an end connector, splice, or conductor breaks, an open circuit ensues. Modern technology enables the malfunctioning line or lines to be automatically disconnected from the system in a matter of milliseconds. Following the disconnection, the fault's position is found by sending and receiving signals, and after the fault's cause and location have been established, personnel must be mobilized.

173. PGCB O&M will engage in information, education, and communication efforts to build awareness in the project area for population living in proximity to transmission infrastructure. Transmission infrastructure will be required to comply with the international EMF norms for general public exposure to protect communities. Communities need to be made aware on corona noise from conductors and precautions during breaking of conductor which may cause death without any safety awareness training.

4.12 Existing and Associated Facilities

174. Environmental audit of five substations requiring bay extensions as existing facilities has been undertaken. A Corrective Action Plan (CAP) has been developed and will be implemented by PGCB before access is given to its contractors for the bay extension works.

175. The only associated facility of the project is related to the proposed 400/230/132 kV Pekua substation.

176. ***400/230/132 kV Pekua Substation:*** The proposed 400/230/132 kV Pekua substation is located approximately 15 km away from the Bay of Bengal coastline. Presently the site is being used for salt cultivation by the local farmers. Usually, people produce salt in the land for four months in a year when the day has longer and intense sunshine. However, during the monsoon period the area is flooded with high tidal force and rainwater and people use the land for crab, and small-scale local fish and shrimp cultivation, mainly for local consumption, with no large-scale commercial fishing or export activities. The proposed site is a low land and approximately 2-3m (average) sand filling is required to raise the land up to the existing road surface.

177. There are three proposed 400/230/132 kV LILO lines associated with the Pekua substation. The proposed 6km 400 kV LILO will be connected existing Matarbari Power Plant (1200 MW)-Banskhali Power Plant (1320 MW) 400 kV line. Both the existing Matarbari and Banshkhali Power Plants are Coal Fired[23] but the LILO and substation are being proposed to evacuate power from 1140 MW of generation

[23] EIAs of both Matarbari and Banshkhali Coal-fired Power Plants were approved by DOE and are available – Matarbari- https://doe.portal.gov.bd/sites/default/files/files/doe.portal.gov.bd/npfblock//2023-05-31-07-52-9ce771dd5aac16a1d2b8e587c775f559.pdf and for Banshkhali-

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

from a group of renewable power plants to be developed around the Cox's Bazar area. None of the renewable energy power plants will connect directly with the substation, instead they will interconnect with the existing 400 kV and 132 kV and under construction 230 kV transmission system to enhance its capacity and N-1 contingency criteria of reliability of the 400 kV transmission line. However, since the Pekua substation is required for facilitating the VRE Hub to evacuate power from Southern Chattogram, and the VRE Hub is the rationale for the project and developing the substation it is an associated facility of the project.

178. Pekua substation will be used for solar and wind power evacuation from the Chittagong area and will facilitate the integration of renewable energy generation from the VRE Hub in Southern Chattogram area on the preliminary coordinates attached in Table 4.7. Promising opportunities for solar power generation have been identified in Pekua, Chakaria, Teknaf, and other areas of Cox's Bazar district. Of these site 10 (solar) has the highest potential to support migratory and/or local birds as it is in salt pan 1-2km from the coastline with sites 4 (wind) and 6 (solar) also in salt pan (inland) having medium potential. These power plants will be set up by IPP and will be required to obtain ECC from DOE. Based on currently available information, the VRE Hub would be away from the most sensitive coastal habitats, particularly Sonadia and Moheshkhali islands as the last remaining mangrove habitat in South East Bangladesh, which are sensitive and provide a critical habitat for migratory birds on the East Asian–Australasian Flyway.

179. Bangladesh Power Development Board (BPDB) is leading on development of the VRE Hub and RE power plants are only at the initial stages of preparation (no feasibility study prepared yet) and likely to connect after 2029. If the government approves the RE power plants listed, the Independent Power Producer (IPP) may start its activities like transmission line route selection, substation design, construction, etc. in 2028 after commissioning of Pekua substation. Even if not associated, renewable energy generation in the Southern Chattogram area would have cumulative and induced impact on habitats and avifauna.

Table 4.7: Renewable Energy Power Plant being set up at South Chattogram area

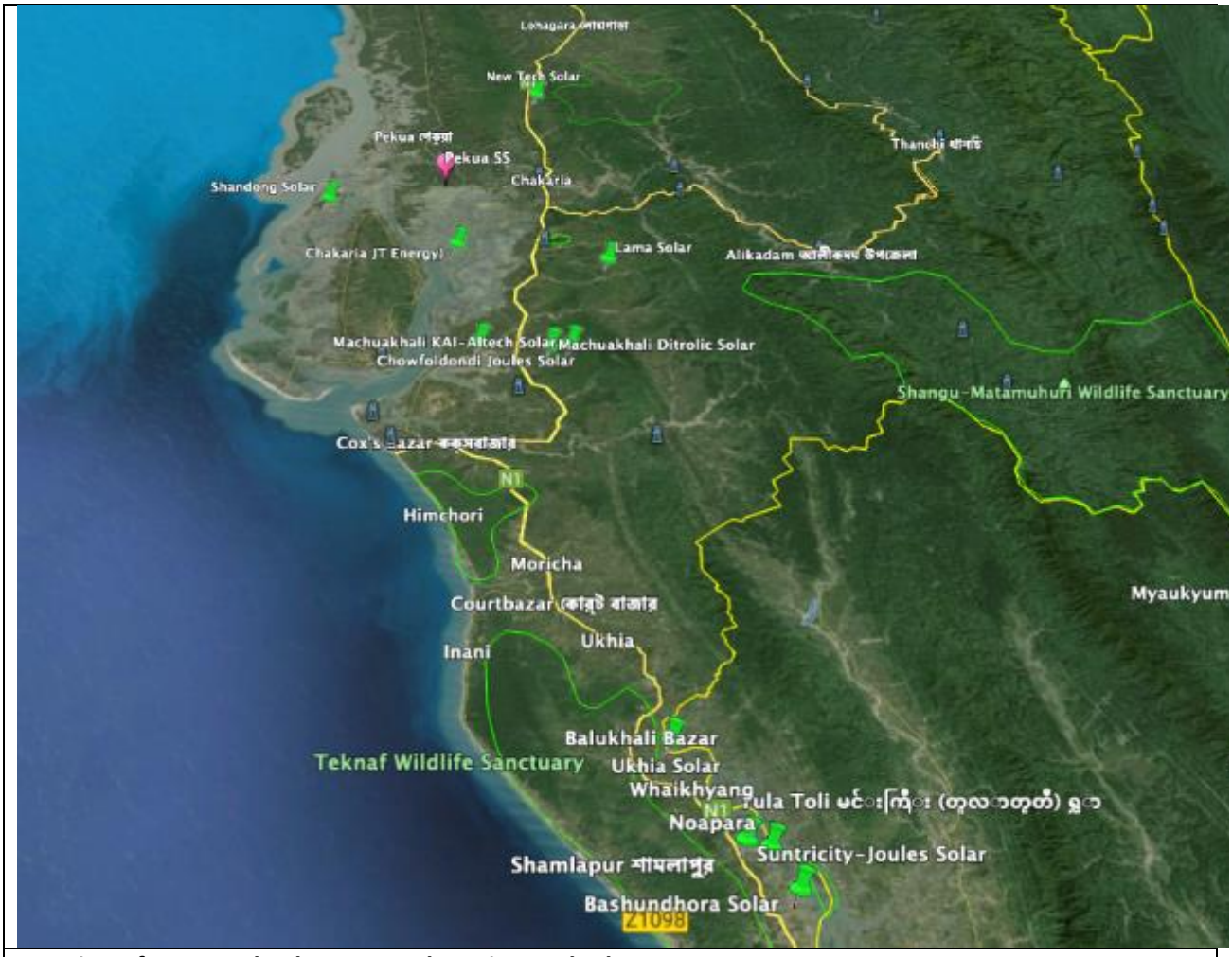
SL	Name of Power Plant	Sponsor/Company Name	Type of RE	Capacity (MW)	National Environment Category	District	Owner	Longitude	Latitude
1	Machuakhali Solar (Ditrolic), Machuakhali, Cox's Bazar	Ditrolic Sa International Pte.Ltd, Powernetic Energy Ltd	Solar	100	Orange	Cox's Bazar	IPP	92.089497	21.519536
2	Chowfoldondi Solar (Joules Power), Chowfoldondi, Cox's Bazar	Joules Power Limited, Bangladesh	Solar	50	Yellow	Cox's Bazar	IPP	92.034609	21.525043
3	Machuakhali Solar (KAI-Altech) Machuakhali, Cox's Bazar	Consortium of Kai Bangladesh Aluminium Ltd. and ALTECH Aluminium Industries Ltd.	Solar	100	Orange	Cox's Bazar	IPP	92.105611	21.522336
4	Chakaria Wind PP (JT Energy), Chakaria, Cox's Bazar	JT New Energy Company Ltd	Wind	220	There is no category for wind energy in ECR-2023	Cox's Bazar	IPP	92.0082	21.65085
5	Lama Solar Lama, Bandarban	Fujien Yongfu Power Engineering Co., Ltd	Solar	70	Orange	Bandarban	IPP	92.133396	21.629389

https://rpcl.portal.gov.bd/sites/default/files/files/rpcl.portal.gov.bd/publications/0ffb3830_3012_4f82_8f26_2f0b0bf5d751/EIA%20Report%20(Volume-I).pdf

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

SL	Name of Power Plant	Sponsor/Company Name	Type of RE	Capacity (MW)	National Environment Category	District	Owner	Longitude	Latitude
6	Chakaria Solar (NewTech) Chakaria, Cox's Bazar	NewTech Solar Energy BD Limited	Solar	30	Yellow	Cox's Bazar	IPP	92.064492	21.886189
7	Teknaf Solar (Suntricity-Joules) Teknaf, Cox's Bazar	Joint Venture of China Northest Electric Power Engineering & Services Co. Ltd., Joules Power Ltd. and Suntricity Renewables Limited	Solar	100	Orange	Cox's Bazar	IPP	92.214969	21.087087
8	Teknaf Solar (Bashundhora) Teknaf, Cox's Bazar	Consortium of Bashundhara Food and Beverage Industries Ltd. & Bashundhara LP Gas Ltd	Solar	100	Orange	Cox's Bazar	IPP	92.242976	21.055964
9	Ukhia Solar, Ukhia, Cox's Bazar	China Energy International Group Co. Ltd.	Solar	270	Yellow	Cox's Bazar	IPP	92.173548	21.154908
10	Maheshkhali Solar (Shandong), Maheshkhali, Cox's Bazar	Consortium of Shandong Hi-Speed International Pte. Ltd. and Renovo Limited	Solar	70	Orange	Cox's Bazar	IPP	91.891937	21.717225
11	Teknaf Solar (CPCL) Teknaf, Cox's Bazar	CPCL-PDL-GREENE JV	Solar	30	Yellow	Cox's Bazar	IPP	92.228559	21.082716
	Total Proposed			**1,140**					

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.



Location of Proposed Solar Power Plants in South Chattogram Area

Figure 4.24 : Location map of RE facilities and Pekua substation and lines

4.13 Estimated Cost of the Project

180. The estimated cost of the Project is stated in Table 4.8.

Table 4.8: Estimated Project Cost

Funding	Lac BDT	Million USD[24]
Government of Bangladesh	102,240	86.63
PGCB	62,162	52.68
ADB	236,000	200.00
Total	**400,402**	**339.32**

Source: DPP, PGCB, October2024

[24] 1$ = 118.00 BDT; As Per DPP

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

5 Environmental and Social Baseline

5.1 Introduction

181. This chapter discusses the current condition of the study area prior to any intervention. It is important to identify the environmental and social baseline conditions to comprehend the changes or impact due to the project interventions. The physical environment, the agricultural, ecological, fisheries and socio-economic resources of the study area are investigated and their current statuses are captured in this chapter.

182. The current state of the environment surrounding the proposed Project sites is known as the environmental baseline. It has been examined by evaluating environmental features such as the physical and biological state of the study location as well as environmental components such as air, water, land, noise, and soil. By gathering information from secondary as well as primary sources, the baseline state of the research area's water and land resources, agriculture, fisheries, and natural resources has been established. The Bangladesh Bureau of Statistics (BBS), Bangladesh Meteorological Department (BMD), Bangladesh Water Development Board (BWDB), National Water Resources Database (NWRD), and Bangladesh Inland Water Transport Authority (BIWTA) were among the secondary sources. To specify the socio-economic resources of the project areas, various elements and factors within the project area's community that contribute to its social and economic well-being such as administrative bounding of the project area, demography, household size, age structure, literacy rate and so on have been identified.

5.2 Location Setting and Extent

183. The PTSIRE components and subprojects are located in different regions of the country stretching over a number of districts in Bangladesh. The project components are distributed in 13 districts, namely Cox's Bazar, Habiganj, Narsingdi, Gopalganj, Bogura, Chandpur, Kushtia, Noakhali, Khulna, Pirojpur, Kishoreganj, Satkhira, and Brahmanbaria. The adjacent districts are characteristically almost same in terms of ecology, biodiversity, and geology. The small physiographical differences among the districts are mentioned and explained in the baseline section as appropriate. The geographical distribution and its similarity according to the component and subproject locations is given in the below Table 5.1.

Table 5.1: Geographical Distribution of Project Components

Sl. No.	Components	Districts	Division
New Substations and Bay Extension			
1	400/230/132kV AIS: Pekua/Chakaria	Cox's Bazar	Chattogram
2	230/132/33kV AIS: Madhabpur	Habiganj	Sylhet
3	230/132/33kV AIS: Monohardi	Narsingdi	Dhaka
4	132/33kV AIS: Tungipara	Gopalganj	Dhaka
5	132/33kV AIS: Dupchanchia	Bogura	Rajshahi
6	132/33kV AIS: Matlab (N)	Chandpur	Chattogram
7	132/33kV AIS: Kumarkhali	Kushtia	Khulna
8	132/33kV AIS: Chatkhil/	Noakhali	Chattogram
9	132/33kV AIS: Paikgacha	Khulna	Khulna
10	132/33kV AIS: Mathbaria	Pirojpur	Barishal
11	2×132 kV AIS Bay Extension at Bajitpur Substation	Kishoreganj	Dhaka
12	2×132kV AIS Bay Extension at Kachua 230/132kV Substation	Chandpur	Chattogram
13	2×132kV AIS Bay Extension at Satkhira 230/132kV Substation	Satkhira	Khulna
14	2×132kV AIS Bay Extension at Bhandaria 230/132kV Substation	Pirojpur	Barishal
15	2×132kV AIS Bay Extension at Gopalganj (Old) 230/132kV Substation	Gopalganj	Dhaka

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Sl. No.	Components	Districts	Division
	LILO & Transmission Lines		
1	LILO of Existing Matarbari PP – Banskhali PP 400 kV Line at Matarbari: 6.75 km (Conductor: Quad ACSR Finch)	Cox's Bazar	Chattogram
2	LILO of Anwara – Cox's Bazar 230 kV Line at Matarbari: 0.50 Km (Conductor: Twin ACSR Mallard)	Cox's Bazar	Chattogram
3	LILO of Existing Matarbari (132/33) – Chakaria 132 kV Line at Matarbari: 1.30 Km (Conductor: ACSR Grosbeak)	Cox's Bazar	Chattogram
4	LILO of Cumilla (N) – Shahjibazar PP 230kV Double Circuit Line at Madhabpur: 1.20 km (Conductor: Twin ACSR Mallard)	Habiganj	Sylhet
5	LILO of Shahjibazar-Brahmanbaria 132kV Double Circuit Line at Madavpur: 1.20 km (Conductor: CFCC type HTLS equivalent to ACSR Grosbeak)	Habiganj	Sylhet
6	Reconductoring of Shahjibazar-Brahmanbaria-Ashuganj 132kV Line: (58+17) = 75.00 km) (Proposed Conductor: CFCC type HTLS equivalent to ACSR Grosbeak)	Brahmanbaria, Habiganj	Chattogram, Sylhet
7	LILO of Sripur - Ashuganj 230kV Double Circuit Line at Monohardi: 5.50 km (Conductor: Twin ACSR Mallard)	Narsingdi	Dhaka
8	Monohardi-Bajitput 132kV Double Circuit Line: 21.00 km (Proposed Conductor: Twin ACSR Grosbeak)	Narsingdi, Kishoreganj	Dhaka
9	Gopalganj – Tungipara 132kV Double Circuit Line: 19.00 km (Proposed Conductor: ACSR Grosbeak)	Gopalganj	Dhaka
10	LILO of Bogura (S) – Naogaon 132kV Line at Dupchanchia:2.50 km (Existing Conductor: ACCC Grosbeak)	Bogura	Rajshahi
11	Kachua – Matlab (N) 132kV Double Circuit Line: 33.00 km (Proposed Conductor: ACSR Grosbeak)	Chandpur	Chattogram
12	LILO of Bheramara – Rajbari 132kV Line at Kusthia (E): 0.60 km (Existing Conductor: ACCC Hawk)	Kusthia	Khulna
13	LILO of Chowmuhani – Ramganj 132kV Double Circuit Line at Chatkhil/ Chatkhil: 2.00 km (Existing Conductor: ACSR Grosbeak)	Noakhali	Chattogram
14	Satkhira-Paikgacha 132kV Double Circuit Line: 30.00 km (Proposed Conductor: ACSR Grosbeak)	Satkhira, Khulna	Khulna
15	Bhandaria-Mathbaria 132kV Double Circuit Transmission Line: 32.00 km (Proposed Conductor: ACSR Grosbeak)	Pirojpur	Barishal

5.3 Physical Environment

5.3.1 Geology and Soil

184. Bangladesh is situated to the east of the Indian sub-continental plate. Nearly 85% of Bangladesh is underlain by deltaic and alluvial deposits of the Ganges, Brahmaputra, and Meghna River systems. Geologically Bangladesh sediments belong to the Recent (floodplains), Plio-Plaistocene (terraces) and Mio-Pliocene (hills) periods. About 10% of the land consists of Pleistocene sediments with an average elevation of more than 15m above sea level.

185. Bogura is predominantly composed of sedimentary deposits. These deposits are primarily from the Pleistocene and Holocene epochs. The area is characterized by fertile alluvial plains formed by the deposition of sediments brought down by rivers, particularly the Brahmaputra and Jamuna rivers. The predominant soil type in Bogura is alluvial soil. Alluvial soil is known for its fertility and is ideal for agriculture due to its high nutrient content, especially nitrogen, phosphorus, and potassium. Alluvial soil in Bogura typically consists of varying proportions of silt and clay, with some sand content. The presence of silt and clay contributes to the soil's moisture-retaining capacity and fertility.

186. Narshingdi lies within the Bengal Basin, which is a sedimentary basin formed by the accumulation of sediments eroded from the Himalayas over millions of years. The region is primarily composed of alluvial deposits brought by the numerous rivers originating from the Himalayas, such as

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

the Ganges, Brahmaputra, and Meghna River. These rivers have been depositing sediment for centuries, shaping the landscape and contributing to the fertility of the soil. The predominant soil type in Narshingdi is alluvial soil, which is highly fertile and suitable for agriculture. Alluvial soil is formed by the deposition of silt, clay, and sand carried by rivers during floods. It is known for its richness in nutrients, making it ideal for cultivating a variety of crops.

187. Khulna is a large sedimentary basin formed by the accumulation of sediments from the Himalayas over millions of years. Khulna is crisscrossed by numerous rivers, including the Ganges, Brahmaputra, and Meghna, which contribute to the deposition of alluvial sediments and influence the region's geology. The dominant soil type in Khulna is alluvial soil, similar to Narshingdi. Alluvial soil is highly fertile, rich in nutrients, and well-suited for agriculture. It is formed by the deposition of sediment carried by rivers, resulting in a soil texture that varies from sandy loam to clay loam.

188. Kushtia, like much of Bangladesh, lies within the Bengal Basin, which is characterized by extensive sedimentary deposits. These deposits have accumulated over millions of years and consist of layers of sand, silt, clay, and gravel. The district is influenced by the Ganges River and its tributaries, which have contributed to the deposition of alluvial sediments. Fluvial processes, including erosion and sedimentation, play a significant role in shaping the region's geological features. The predominant soil type in Kushtia is alluvial soil. Alluvial soil is highly fertile and well-suited for agriculture due to its rich nutrient content and good drainage properties. It is formed from the deposition of sediments carried by rivers and streams. Alluvial soil in Kushtia typically consists of a mixture of sand, silt, and clay, with varying proportions depending on the specific location within the district. The composition of the soil influences its texture, fertility, and water retention capabilities.

189. Noakhali, a district located in southeastern Bangladesh, has geological and soil characteristics influenced by its location in the Bengal Basin and its proximity to the Bay of Bengal. Noakhali lies within the Bengal Basin, a vast sedimentary basin formed by the accumulation of sediments from the Himalayas over millions of years. This basin extends across much of Bangladesh and parts of India. The predominant soil type in Noakhali is alluvial soil, similar to other regions in Bangladesh. Alluvial soil is highly fertile, rich in nutrients, and well-suited for agriculture. It is formed by the deposition of sediment carried by rivers, resulting in a soil texture that varies from sandy loam to clay loam.

190. Pirojpur is situated within the Bengal Basin, a geological region characterized by extensive sedimentary deposits. These deposits have accumulated over millions of years and consist of layers of sand, silt, clay, and gravel. The predominant soil type in Pirojpur is alluvial soil. Alluvial soil is highly fertile and well-suited for agriculture due to its rich nutrient content and good drainage properties. It is formed from the deposition of sediments carried by rivers and streams. Alluvial soil in Pirojpur typically consists of a mixture of sand, silt, and clay, with varying proportions depending on the specific location within the district. The composition of the soil influences its texture, fertility, and water retention capabilities.

191. Chandpur lies within the Bengal Basin, a geological region characterized by extensive sedimentary deposits. These deposits have accumulated over millions of years and consist of layers of sand, silt, clay, and gravel. The district is situated in the delta region formed by the confluence of the Ganges, Brahmaputra, and Meghna rivers. As a result, Chandpur experiences the deposition of deltaic sediments, contributing to its geological formation. The predominant soil type in Chandpur is alluvial soil. Alluvial soil is highly fertile and well-suited for agriculture due to its rich nutrient content and good drainage properties. It is formed from the deposition of sediments carried by rivers and streams. Alluvial soil in Chandpur typically consists of a mixture of sand, silt, and clay, with varying proportions depending on the specific location within the district. The composition of the soil influences its texture, fertility, and water retention capabilities.

192. Gopalganj lies within the Bengal Basin, a geological region characterized by extensive sedimentary deposits. These deposits have accumulated over millions of years and consist of layers of sand, silt, clay, and gravel. The district is intersected by several rivers and waterways, including the

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Padma (Ganges) and its distributaries. Fluvial processes such as erosion, sedimentation, and channel shifting play a significant role in shaping the region's geological features. The predominant soil type in Gopalganj is alluvial soil. Alluvial soil is highly fertile and well-suited for agriculture due to its rich nutrient content and good drainage properties. It is formed from the deposition of sediments carried by rivers and streams. Alluvial soil in Gopalganj typically consists of a mixture of sand, silt, and clay, with varying proportions depending on the specific location within the district. The composition of the soil influences its texture, fertility, and water retention capabilities.

193. Habiganj, a district located in northeastern Bangladesh, exhibits geological and soil characteristics influenced by its location within the Bengal Basin and its proximity to the Meghalaya Plateau and the Surma Basin. Habiganj lies within the Bengal Basin, a large sedimentary basin formed by the deposition of sediments from the Himalayas and other geological formations over millions of years. This basin covers much of Bangladesh and parts of India. The predominant soil type in Habiganj is alluvial soil, typical of regions within the Bengal Basin. Alluvial soil is formed by the deposition of sediments carried by rivers, resulting in fertile soils rich in nutrients. It is well-suited for agriculture and supports a variety of crops.

194. Kishoreganj is part of the Bengal Basin, characterized by sedimentary deposits from the Ganges and Brahmaputra rivers. This geological setting includes layers of alluvial sediments that have been shaped over millennia. The region's geology consists primarily of soft, unconsolidated sediments like clay, silt, and sand, resulting from riverine processes. The subsurface layers affect groundwater movement and surface water interactions, playing a crucial role in the region’s hydrology. The dominant soil type is alluvial, formed by the deposition of sediments during floods. This soil is rich in nutrients, making it highly fertile and ideal for agriculture. The soil typically features a loamy texture, which balances sand, silt, and clay. This composition allows for good water retention while ensuring adequate drainage, essential for crop growth. Farmers in Kishoreganj often use traditional practices, such as crop rotation and organic fertilizers, to maintain soil health and fertility.

195. Satkhira, located in the southwestern part of Bangladesh. It is situated in the Ganges Delta, characterized by a low-lying landscape with proximity to the Sundarbans, the largest mangrove forest in the world. The region is primarily composed of young alluvial deposits from the Ganges River system. These sediments include a mixture of sand, silt, and clay, shaped by historical river dynamics and tidal influences from the Bay of Bengal. The geological formation consists of unconsolidated sediments that are rich in organic material, affecting local hydrology and drainage patterns. The predominant soil types in Satkhira are alluvial and clayey soils, often influenced by saline conditions due to proximity to the coastal areas and tidal influences. The soil in this region tends to be heavy clay, which can retain moisture but may also pose drainage challenges. This texture supports various crops but requires careful management to prevent waterlogging.

196. Brahmanbaria lies within the Ganges Delta, characterized by a low-lying, flat landscape with a network of rivers and water bodies. The region is predominantly composed of alluvial sediments deposited by the Ganges and Meghna rivers. These sediments consist of a mix of clay, silt, and sand, shaped by both riverine processes and seasonal flooding. The geological formation typically includes unconsolidated layers, which contribute to the area's hydrology, affecting groundwater movement and surface water drainage. The primary soil types in Brahmanbaria are alluvial and clayey soils. These soils are rich in nutrients due to the periodic deposition of sediments from flooding. The soil is generally fertile, with a loamy texture that balances sand, silt, and clay. This texture promotes good water retention while ensuring adequate drainage for crops.

197. Cox's Bazar, a district located in southeastern Bangladesh, is known for its extensive coastline along the Bay of Bengal and the world's longest natural sandy sea beach. Cox's Bazar is situated within the Bengal Basin, a large sedimentary basin formed by the accumulation of sediments from the Himalayas over millions of years. The district's geological formations primarily consist of sedimentary rocks, including sandstone, siltstone, and shale, deposited by ancient rivers and marine processes. The

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

predominant soil type in Cox's Bazar is alluvial soil, characteristic of coastal areas within the Bengal Basin. Alluvial soil is formed by the deposition of sediments carried by rivers and coastal processes, resulting in fertile soils rich in nutrients. However, the soil composition may vary across different parts of the district due to factors such as topography, drainage patterns, and proximity to the coastline.

5.3.2 Topography

198. Bangladesh's topography is made up of roughly 12.5% hilly terrain in the north-east and south-southeast, 8.5 percent terrace land free of flooding in the north center and north west, and 79 percent level land subject to varying depths of seasonal flooding. A 600 km long, highly uneven deltaic coastline lies to the south, split wide open by numerous estuary rivers and channels that pour into the Bay of Bengal. The Lower Gangetic Plain, often known as the Bengal Plain, is the bigger plain that includes the alluvial plain. Less than 10 meters separate the plains' elevations from sea level, and in the coastal south, these elevations even lower to almost sea level.

199. In the context of the project area, Khulna, and Pirojpur falls in Ganges tidal flood plain. The boundary between this unit and the Ganges flood plain is traditional. The tidal landscape has a low ridge and a basin relief crossed by innumerable tidal rivers and creeks. Local differences in elevation generally are less than 1m compared with 2-3m on the Ganges floodplain. The sediments are mainly non-calcareous clays, but they are silty and slightly calcareous on riverbanks.

200. Gopalganj and Kushtia falls in Low Ganges River Floodplain. Ganges alluvium is calcareous when deposited, but most basin clays and some older ridge soils have been decalcified and acidified in their upper layers; lime is found only in the subsoil or substratum.

201. Chandpur and Habiganj falls in the Middle Meghna River Floodplain. The main channel of the Meghna upstream from its junction with the Dhaleshwari and Ganges as far as Bhairab Bazar is known as the middle Meghna. The sediments are mainly silty and clays and sandy Brahmaputra sediments occur at the surface on some ridges in the north. Seasonal flooding from the Meghna is mainly deep. Basin sites are submerged early and drain late.

202. Noakhali falls in Old Meghna Estuarine Floodplain. The landscape in this extensive unit is quite different from that on river and tidal floodplains. The relief is almost level, with little difference in elevation between ridges and basins. Natural rivers and streams are far apart in the southern part and drainage is provided by a network of man-made canals (*Khal*).

203. Bogura falls in Barind Tract, between the Ganges and Brahmaputra. In the south, the Barind Tract is an older Pleistocene terrace forming a small plateau with a flat or - in some sectors - a slightly undulating surface. The Barind unit is comparatively at higher elevation than the adjoining floodplains. The contours of the tract suggest that the rear two terrace levels -one at 40m and the other between 19.8 and 22.9m.

204. Narshingdi falls in Old Meghna Estuarine Floodplain. The relief is almost level, with little difference in elevation between ridges and basins. The sediments are predominantly deep and silty, but a shallow clay layer in some basin centers overlies them. Seasonal flooding is mainly deep, but it is shallow in the southeast. Some basin centers stay wet throughout the dry season.

205. Kishoreganj is predominantly flat, typical of the Ganges Delta. This flatness contributes to the area’s extensive agricultural land and influences water drainage patterns. Kishoreganj is crisscrossed by numerous rivers, including the Meghna River and its tributaries. These rivers not only provide water for irrigation but also contribute to the fertility of the soil through periodic flooding and sediment deposition. The elevation in Kishoreganj is relatively low, often ranging from a few meters above sea level.

206. Satkhira is predominantly flat and low-lying, with an elevation generally ranging from 1 to 5 meters above sea level. This flatness makes the region susceptible to flooding, especially during the

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

monsoon season. The district is crisscrossed by numerous rivers, including the Kobadak, Ichamati, and Bhairab, which play a crucial role in its ecosystem and agriculture.

207. Brahmanbaria, located in eastern Bangladesh, features a predominantly flat and low-lying landscape, typical of the Ganges Delta region. The topography is characterized by gentle undulations, with elevations generally ranging from a few meters above sea level to around 15 meters in some areas. The district is intersected by several rivers, including the Meghna and the Titas, which are essential for irrigation and transportation. Brahmanbaria is also home to numerous wetlands and marshes, which support diverse flora and fauna.

208. Cox's Bazar falls in the Chittagong Coastal Plain. Flooding is mainly shallow and fluctuates in depth with the tide (except where this is prevented by river or coastal embankments). The average daily rise in the tide is about two meters. Some soils on tidal and estuarine floodplains become saline in the dry season.

209. Overall, there are a lot of depressions, natural khals, bounded by the rivers in the project area according to the topography's cluster. However, the topography of the project area consists of various surface features including relief, vegetation cover, waterbodies, with the inclusion of the locations of hats (market-places), petrol-pumps, education institutes, rural narrow roads, etc. Besides, the general topography of the proposed project areas comprises floodplains in the majority of the road and terraces.

5.3.3 Morphological Study

210. A morphological study of the Khulna and Pirojpur regions in the Ganges tidal floodplain involved analyzing of the topography, sediment composition, river channels, erosion patterns, and land use. The topography of the Khulna and Pirojpur regions in the Ganges tidal floodplain is characterized by low-lying flatlands with subtle elevation changes influenced by the river systems and tidal dynamics. The sediment composition of the Khulna and Pirojpur regions in the Ganges tidal floodplain is predominantly alluvial in nature, consisting of a mixture of fine-grained particles such as silt, clay, and sand. The river channels and erosion patterns in the Khulna and Pirojpur regions of the Ganges tidal floodplain are dynamic and influenced by a combination of natural processes and human activities.

- **Gopalganj and Kushtia falls in Low Ganges River Floodplain:** In Gopalganj and Kushtia, situated within the Low Ganges River Floodplain, several key geomorphic features and processes shape the landscape: Gopalganj and Kushtia are located within the Low Ganges River Floodplain, characterized by relatively flat terrain. The topography is generally low-lying, with elevations close to sea level. The landscape may feature subtle variations in elevation, including riverbanks, levees, and natural depressions. The sediment composition in Gopalganj and Kushtia is predominantly alluvial, consisting of fine-grained particles such as silt, clay, and sand. Sediments are primarily sourced from upstream areas and transported by the Ganges River and its tributaries. Organic matter from vegetation and wetlands also contributes to the sediment composition, particularly in marshy and swampy areas. The Low Ganges River Floodplain is crisscrossed by an extensive network of river channels, including distributaries, tributaries, and meandering main river channels. These channels serve as primary drainage pathways and are essential for sediment transport, water flow, and navigation. Channel morphology varies, with widths ranging from narrow distributaries to broader main river channels, influenced by sediment deposition, erosion, and human interventions. Erosion is a significant geomorphic process in Gopalganj and Kushtia, driven by factors such as river flow, sediment load, and human activities. Riverbanks, unprotected coastlines, and embankments are vulnerable to erosion, especially during high-flow events, monsoon floods, and tidal surges. Erosion patterns may vary spatially and temporally, with some areas experiencing gradual bank erosion, while others may be subject to rapid erosion during extreme weather events or anthropogenic disturbances.
- **Chandpur and Habiganj falls in Middle Meghna River Floodplain:** In Chandpur and Habiganj, situated within the Middle Meghna River Floodplain, several key geomorphic features and

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

processes influence the landscape: Chandpur and Habiganj are located within the Middle Meghna River Floodplain, characterized by relatively low-lying terrain. The topography is generally flat to gently undulating, with subtle variations in elevation across the region. Low-lying areas are susceptible to inundation during periods of high flow and monsoon floods, contributing to the dynamic nature of the landscape. The sediment composition in Chandpur and Habiganj is predominantly alluvial, comprising fine-grained particles such as silt, clay, and sand.

Sediments are primarily sourced from upstream areas and transported by the Meghna River and its tributaries. Organic matter from vegetation and wetlands also contributes to the sediment composition, particularly in marshy and swampy areas. The Middle Meghna River and its tributaries form an extensive network of river channels that traverse the floodplain. These channels serve as primary drainage pathways and are vital for sediment transport, water flow, and navigation. Channel morphology varies, with widths ranging from narrow tributaries to broader main river channels, influenced by sediment deposition, erosion, and tidal dynamics. Erosion is a significant geomorphic process in Chandpur and Habiganj, driven by factors such as river flow, tidal forces, and land use practices. Riverbanks, unprotected coastlines, and embankments are vulnerable to erosion, especially during high-flow events and tidal surges. Erosion patterns may vary spatially and temporally, with some areas experiencing gradual bank erosion, while others may be subject to rapid erosion during extreme weather events or anthropogenic disturbance.

- **Noakhali falls in Old Meghna Estuarine Floodplain:** In Noakhali, situated within the Old Meghna Estuarine Floodplain, several key geomorphic features and processes shape the landscape: Noakhali falls within the Old Meghna Estuarine Floodplain, characterized by low-lying terrain close to sea level. The topography is generally flat with subtle elevation changes, influenced by sediment deposition from the Meghna River and its distributaries. Low-lying areas are prone to inundation during high tides and monsoon floods, contributing to the dynamic nature of the landscape. The sediment composition of Noakhali is predominantly alluvial, consisting of fine-grained particles such as silt, clay, and sand. Sediments are primarily sourced from the erosion of upstream areas and transported by the Meghna River and its distributaries. Organic matter derived from mangroves and wetlands also contributes to the sediment composition, particularly in coastal areas. The Meghna River and its distributaries form a complex network of river channels that traverse the floodplain. These channels serve as primary drainage pathways and are vital for sediment transport, water flow, and navigation. Channel morphology varies, with widths ranging from narrow distributaries to wider main river channels, influenced by tidal dynamics and sediment deposition. Erosion is a significant geomorphic process in Noakhali, driven by factors such as tidal forces, river flow, and human activities. Riverbanks and unprotected coastal areas are vulnerable to erosion, especially during high-flow events, tidal surges, and cyclonic storms. Erosion patterns may vary spatially and temporally, with some areas experiencing gradual bank erosion, while others may be subject to rapid erosion during extreme weather events
- **Bogura falls in Barind Tract:** Bogura, located within the Barind Tract, typically exhibits a gently undulating topography. The terrain is characterized by low hills, shallow depressions, and flat plains, with elevations ranging from relatively low to moderate. The topography is predominantly flat to gently sloping, with subtle variations in relief across the region. The sediment composition in Bogura is largely influenced by the geological characteristics of the Barind Tract. Sediments consist mainly of residual deposits, including sandy and silty soils with varying degrees of clay content. The sediment composition may also include alluvial deposits from nearby rivers and streams, contributing to the soil fertility of the region. Bogura is not directly situated along major river channels; however, it may be influenced by nearby rivers such as the Atrai and the Karatoya. River channels in the vicinity of Bogura may exhibit varying

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

morphological features, including meandering courses, braided channels, and occasional sandbars. While Bogura itself may not have extensive river channels, nearby water bodies and drainage systems play a role in the region's hydrology and sediment transport. Erosion patterns in Bogura are primarily influenced by rainfall, soil characteristics, and land use practices. Areas with sandy soils and low vegetation cover are more susceptible to erosion, especially during heavy rainfall events. Erosion may lead to the loss of fertile topsoil, degradation of agricultural land, and sedimentation in nearby water bodies.

- **Narshingdi falls in Old Meghna Estuarine Floodplain:** Narshingdi falls within the Old Meghna Estuarine Floodplain, characterized by low-lying terrain close to sea level. The topography is generally flat with subtle elevation changes, influenced by sediment deposition from the Meghna River and its distributaries. Low-lying areas are prone to inundation during high tides and monsoon floods, contributing to the dynamic nature of the landscape. The sediment composition of Narshingdi is predominantly alluvial, consisting of fine-grained particles such as silt, clay, and sand. Sediments are primarily sourced from the erosion of upstream areas and transported by the Meghna River and its tributaries. Organic matter derived from mangroves and wetlands also contributes to the sediment composition, particularly in coastal areas. The Meghna River and its distributaries form a complex network of river channels that traverse the floodplain. These channels serve as primary drainage pathways and are vital for sediment transport, water flow, and navigation. Channel morphology varies, with widths ranging from narrow distributaries to wider main river channels, influenced by tidal dynamics and sediment deposition. Erosion is a significant geomorphic process in Narshingdi, driven by factors such as tidal forces, river flow, and human activities. Riverbanks and unprotected coastal areas are vulnerable to erosion, especially during high-flow events, tidal surges, and cyclonic storms. Erosion patterns may vary spatially and temporally, with some areas experiencing gradual bank erosion, while others may be subject to rapid erosion during extreme weather events.
- **Kishoreganj, located in central Bangladesh**, features a diverse and dynamic morphology shaped by its geographical and hydrological characteristics. The region is predominantly flat, with some low-lying areas and a few elevated parts. It is situated within the Ganges-Brahmaputra delta, which influences its topography and soil composition. Kishoreganj is intersected by several rivers, including the Meghna, which contribute to the region’s hydrology. These waterways play a critical role in drainage, irrigation, and transportation, impacting both the landscape and local agriculture. The area primarily consists of alluvial soil, rich in nutrients and suitable for agriculture. Soil fertility varies across the region, influenced by the proximity to rivers and historical sedimentation processes. The morphology supports diverse vegetation, including agricultural crops, trees, and wetlands. Agriculture is the dominant land use, with rice, jute, and various fruits and vegetables being the primary crops. The region supports various ecosystems, including wetlands and agricultural landscapes, which are vital for local biodiversity and wildlife.
- **Satkhira, Khulna, Pirojpur falls in Ganges Tidal Floodplain:** This region occupies an extensive area of tidal floodplain land in the southwest of the country. The greater part of this region has smooth relief having large areas of salinity. Riverbanks generally stand about a metre or less above the level of adjoining basins. Non-calcareous grey floodplain soil is the major component of general soil types. acid sulphate soil also occupies a significant part of the area, where it is extremely acidic during the dry season. Most of the topsoils are acidic and subsoils are neutral to mildly alkaline. Soils of the Sundarbans area are alkaline. General fertility level is high, with medium to high organic matter content.
- **Brahmanbaria falls in Old Meghna Estuarine Floodplain:** This region occupies a large area, mainly low-lying land between the south of the Surma-Kushiyara floodplain and the northern edge of the young Meghna estuarine floodplain. Silt loam soils predominate on highlands and silty clay to clay on lowlands. Organic matter content of the soils is moderate. Topsoils are moderately acidic, but subsoils neutral in reaction. General fertility level is medium. The

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

floodplain is predominantly low-lying and is formed by sediment deposits from the nearby rivers, including the Meghna and its tributaries. This landscape can vary in elevation, with some areas more prone to flooding than others. The soil is primarily alluvial, rich in fertility, supporting diverse agricultural practices. However, some areas may experience challenges related to salinity and erosion. The floodplain supports diverse ecosystems, including wetlands, marshes, and aquatic habitats. This biodiversity is vital for maintaining ecological balance and supporting fish populations, which are important for local livelihoods.

5.3.4 Meteorology

211. The project entails building transmission lines and substations. The Tungipara (Gopalganj), Paikgacha (Khulna), Kumarkhali (Kushtia), Mathbaria (Pirojpur), Chatkhil (Noakhali), Dupchanchia (Bogura), Matlab (N) (Chandpur), Monohardi (Narshingdi), Madhabpur (Habiganj), and Pekua/Chakaria (Cox's Bazar) areas would be the construction sites respectively. As a result, a variety of meteorological data were gathered from the adjacent BMD stations within the study region, including rainfall, temperature, relative humidity, wind speed, evaporation, and sunshine hours. The following sections provide a brief discussion of the data state following analysis.

A. Rainfall

212. The single most dominant element of the climate of Bangladesh is the rainfall. Because of the country's location in the tropical monsoon region, the amount of rainfall is very high. Therefore, the annual rainfall is about 1,600 mm (63.0 in), most parts of the country receive at least 2,300 mm (90.6 in) of rainfall per year. About 80% of Bangladesh's rain falls during the monsoon season. However, according to the project area's context, this proposed project falls in different places in Bangladesh. Figure 5.1 depicts the average monthly rainfall throughout the time period (2011-2023) in the project area.

213. In Khulna, maximum rainfall is recorded during May and the lowest rainfall occurs in December during winter season. In Narshingdi, maximum rainfall is recorded during July and the lowest rainfall occurs in December during winter season. In Bogura, maximum rainfall is recorded during May and the lowest rainfall occurs in November, December, and February respectively during winter season. In Habiganj, maximum rainfall is recorded during April and the lowest rainfall occurs in December during winter season. In Cox's Bazar, the maximum rainfall is recorded during July and the lowest rainfall occurs in December during winter season. The overall scenario of rainfall in the project area has been portrayed in the map given below.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

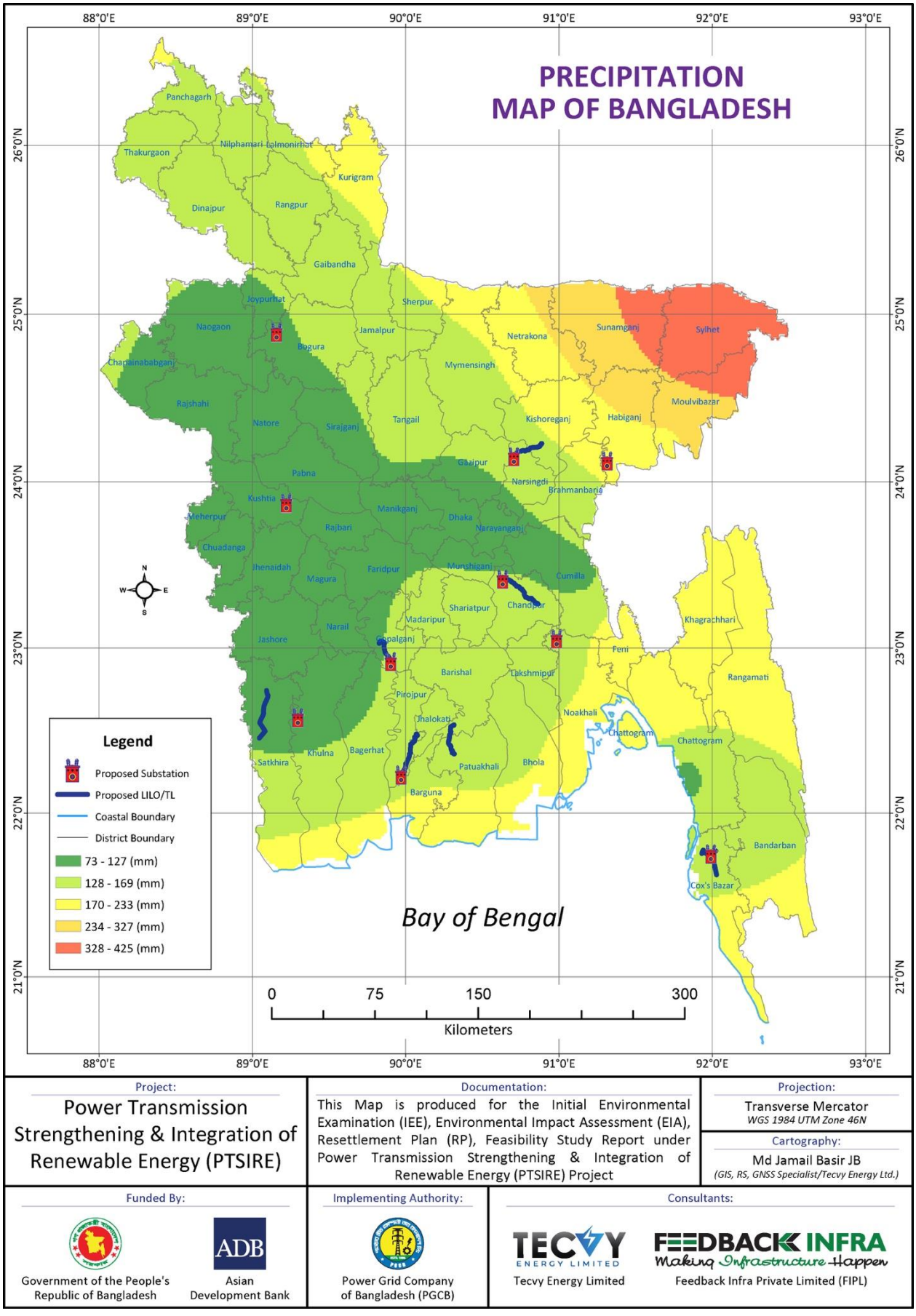


Figure 5.1: Precipitation Map of Bangladesh

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

214. In Gopalganj and Noakhali, Maximum rainfall is recorded during July and the lowest rainfall occurs in December during winter season respectively. In Kushtia, maximum rainfall is recorded during June and the lowest rainfall occurs in December during winter season respectively. In terms of the intensity of rainfall in Pirojpur and Chandpur, the rainfall pattern is about similar and the maximum rainfall is recorded during August and the lowest rainfall occurs in December during winter season.

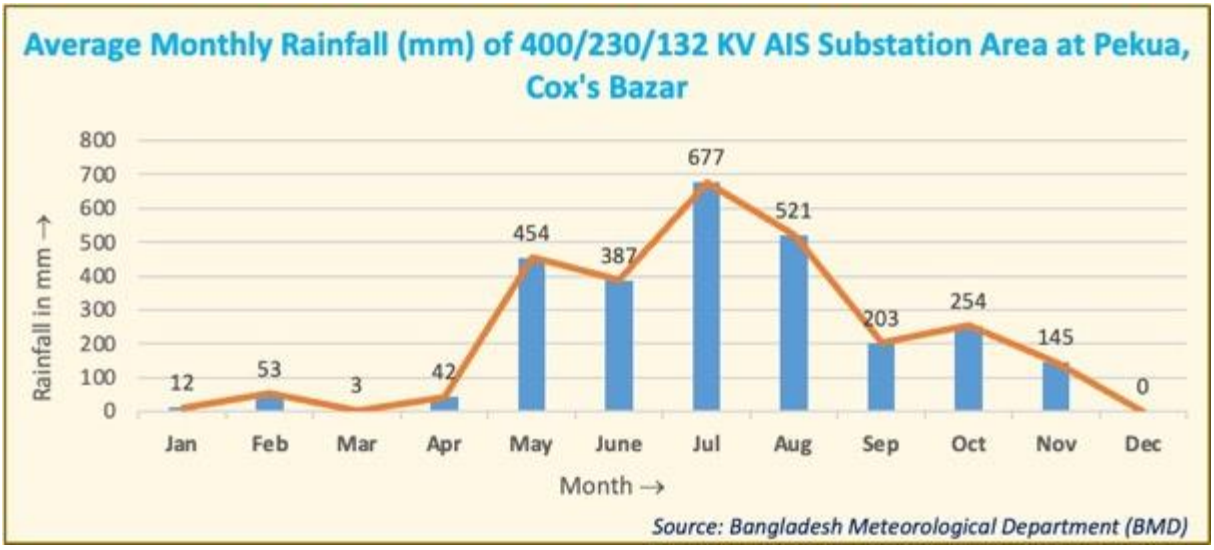


Figure 5.2: Average Monthly Rainfall in a Year from 2011-2023 in Cox's Bazar

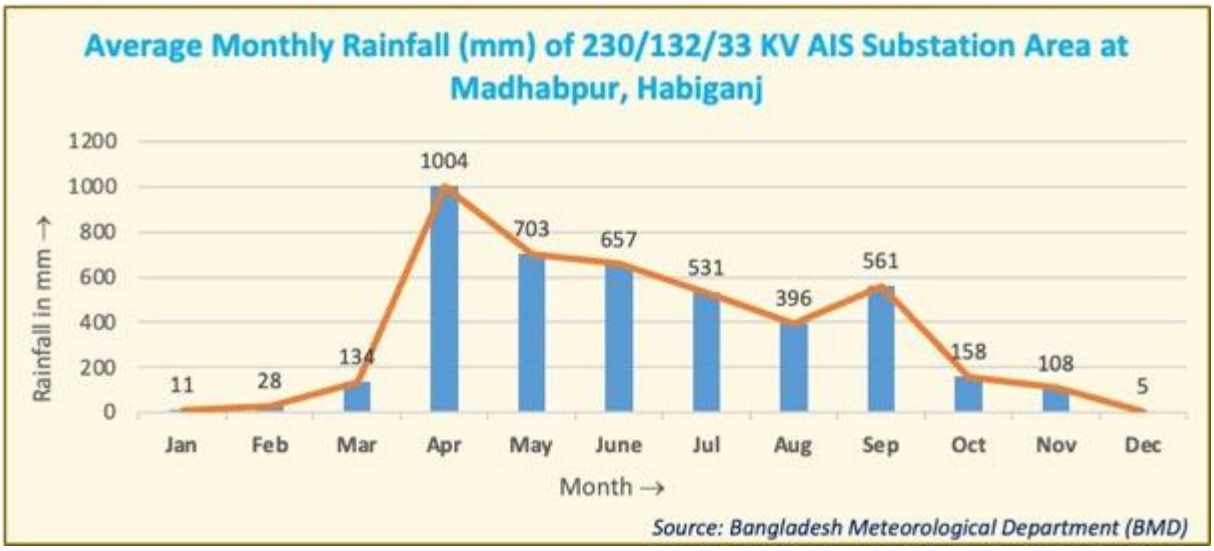


Figure 5.3: Average Monthly Rainfall in a Year from 2011-2023 in Habiganj

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

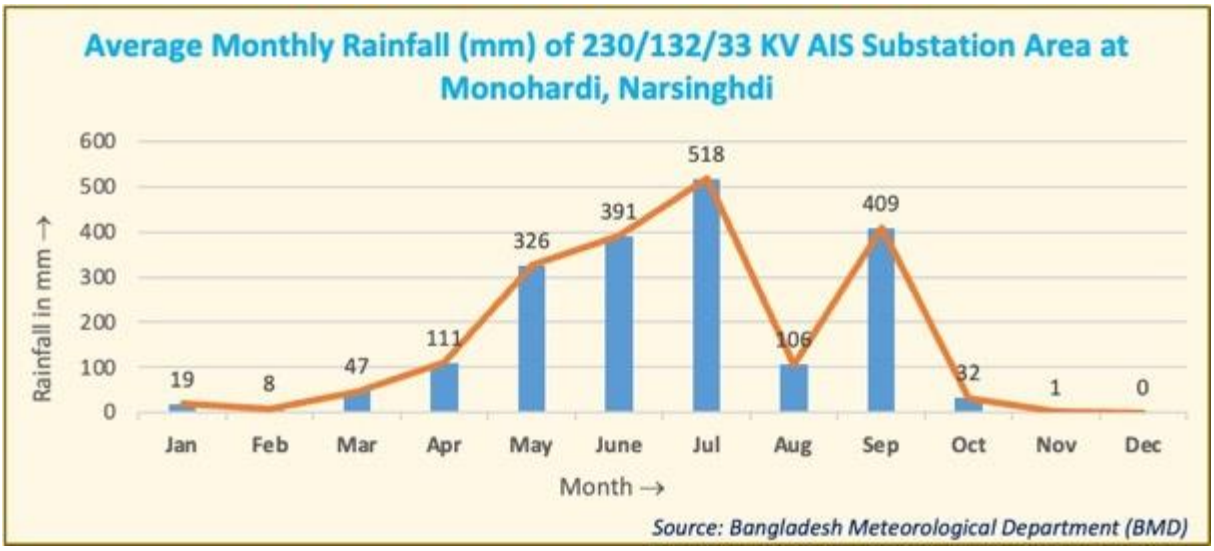


Figure 5.4: Average Monthly Rainfall in a Year from 2011-2023 in Narsinghdi

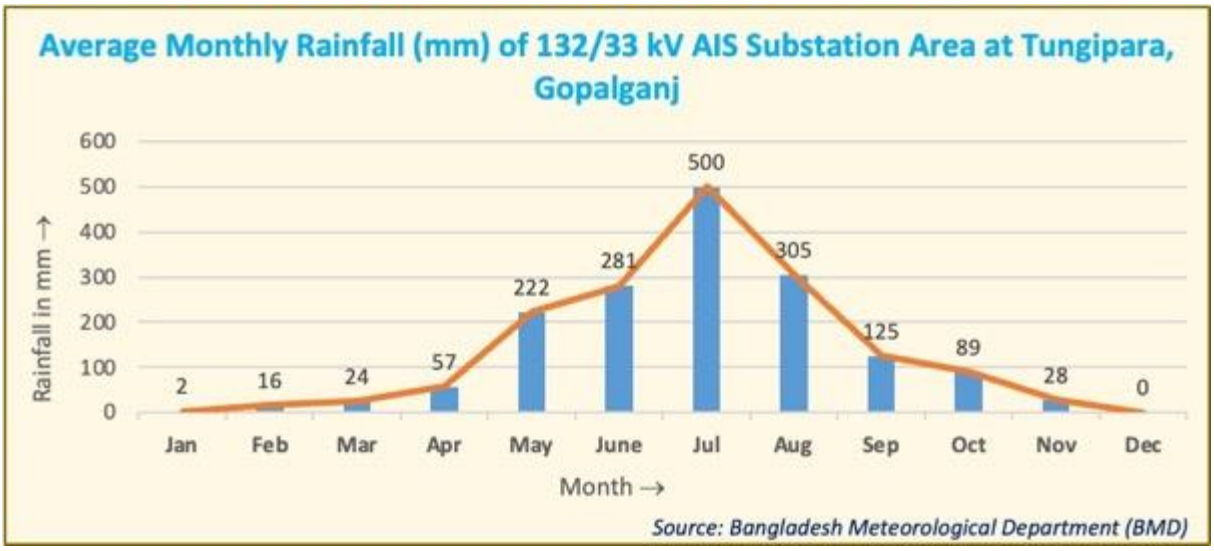


Figure 5.5: Average Monthly Rainfall in a Year from 2011-2023 in Gopalganj

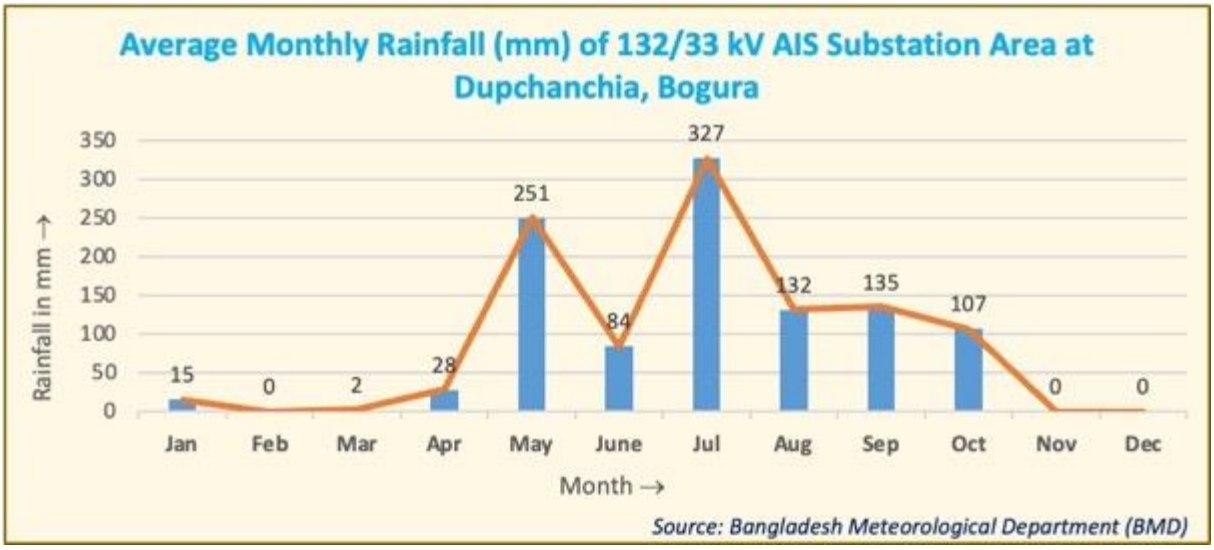


Figure 5.6: Average Monthly Rainfall in a Year from 2011-2023 in Bogura

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

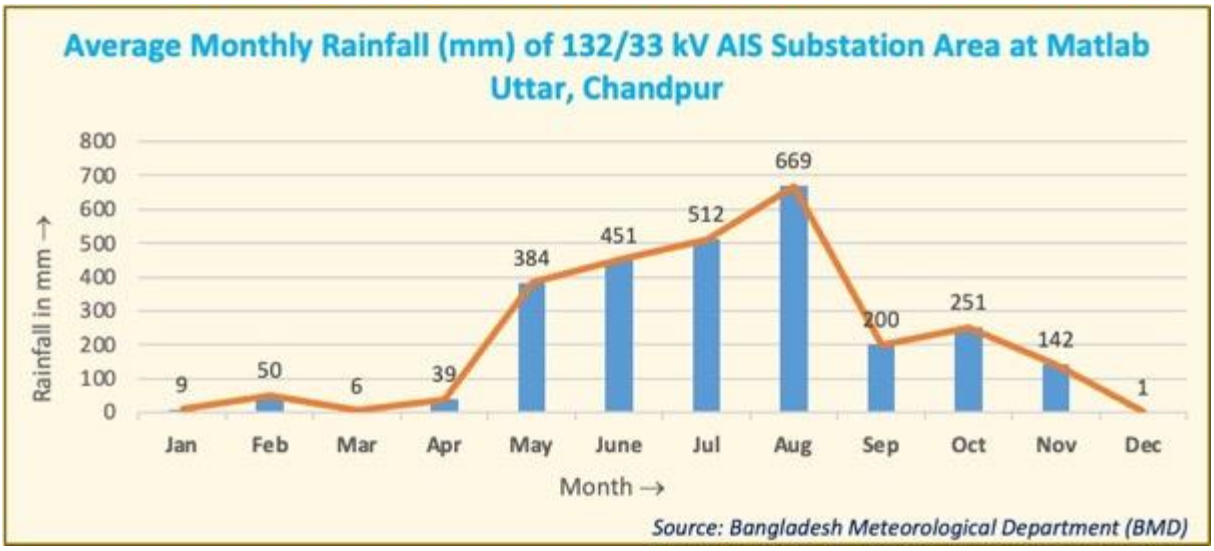


Figure 5.7: Average Monthly Rainfall in a Year from 2011-2023 in Chandpur

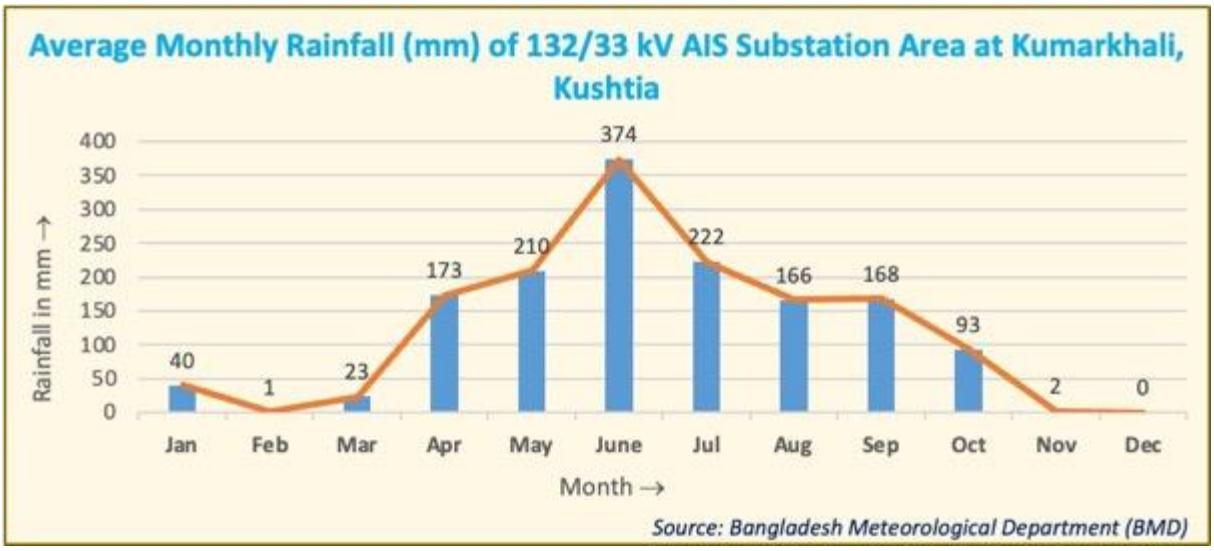


Figure 5.8: Average Monthly Rainfall in a Year from 2011-2023 in Kushtia

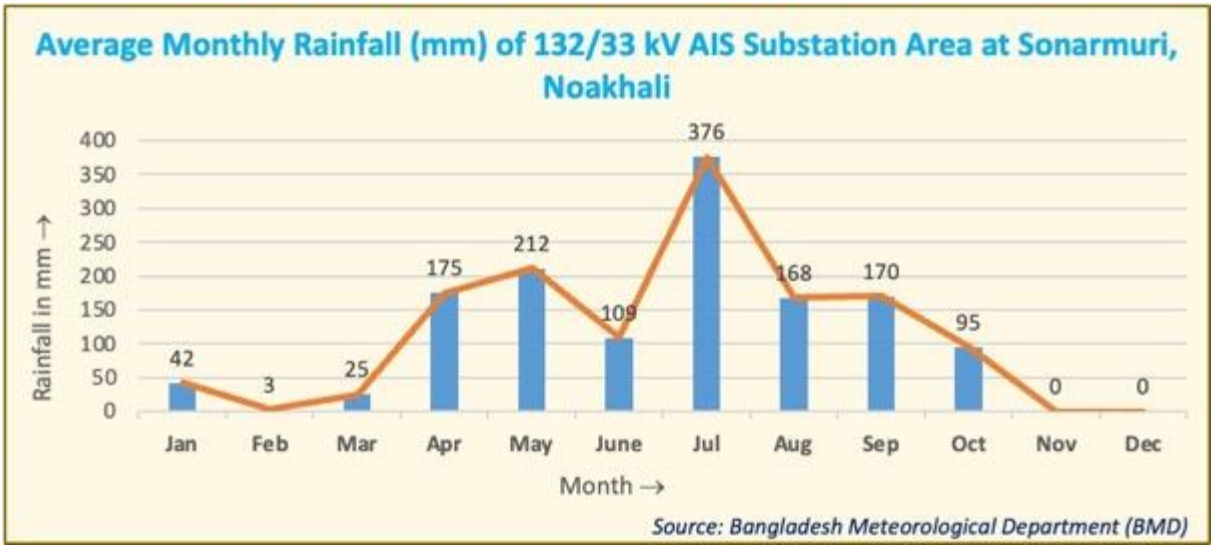


Figure 5.9: Average Monthly Rainfall in a Year from 2011-2023 in Naokhali

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

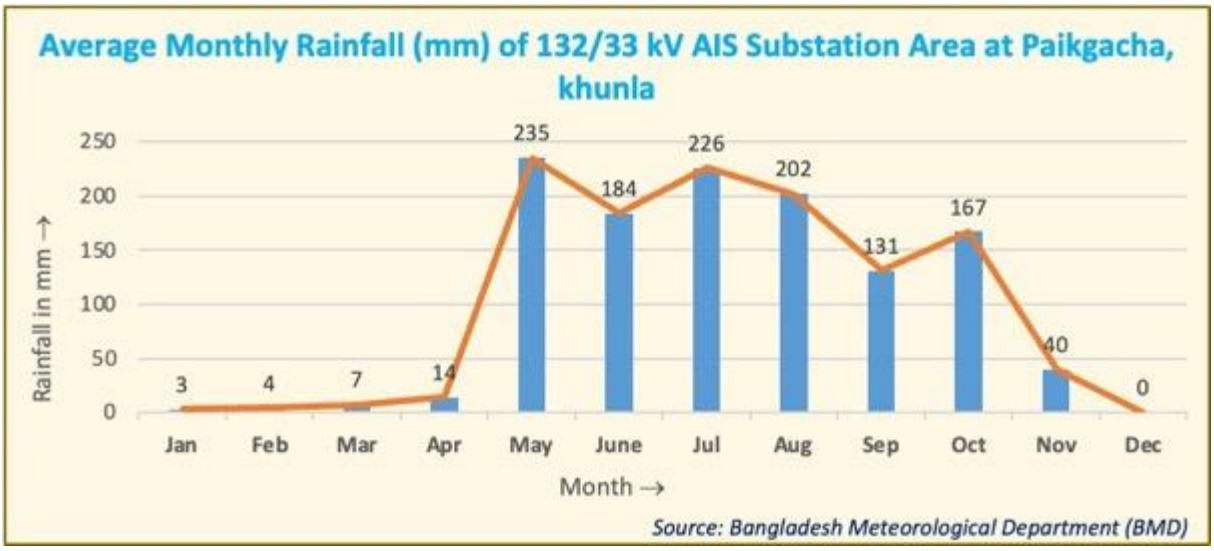


Figure 5.10: Average Monthly Rainfall in a Year from 2011-2023 in Khulna

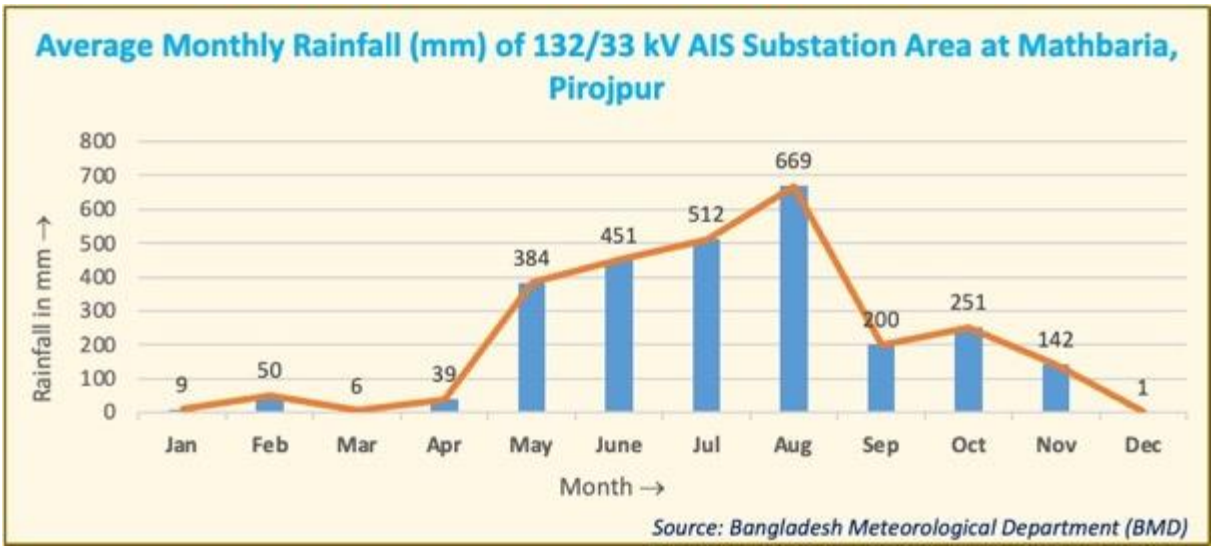


Figure 5.11: Average Monthly Rainfall in a Year from 2011-2023 in Pirojpur

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

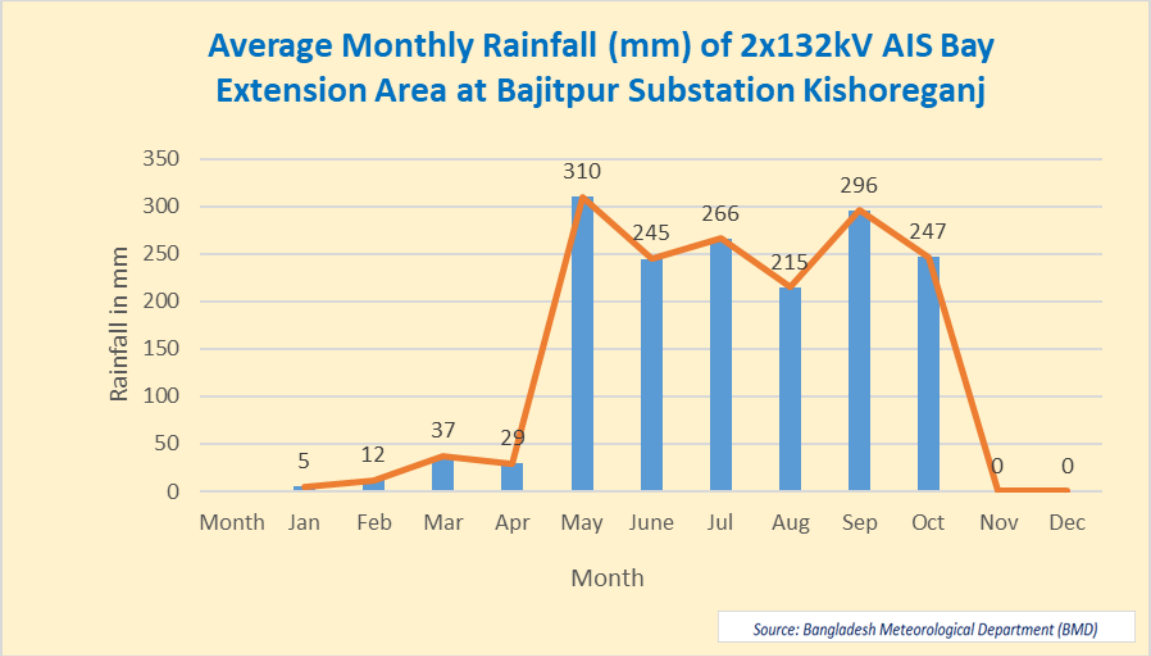


Figure 5.12: Average Monthly Rainfall in a Year from 2011-2023 in Kishoreganj

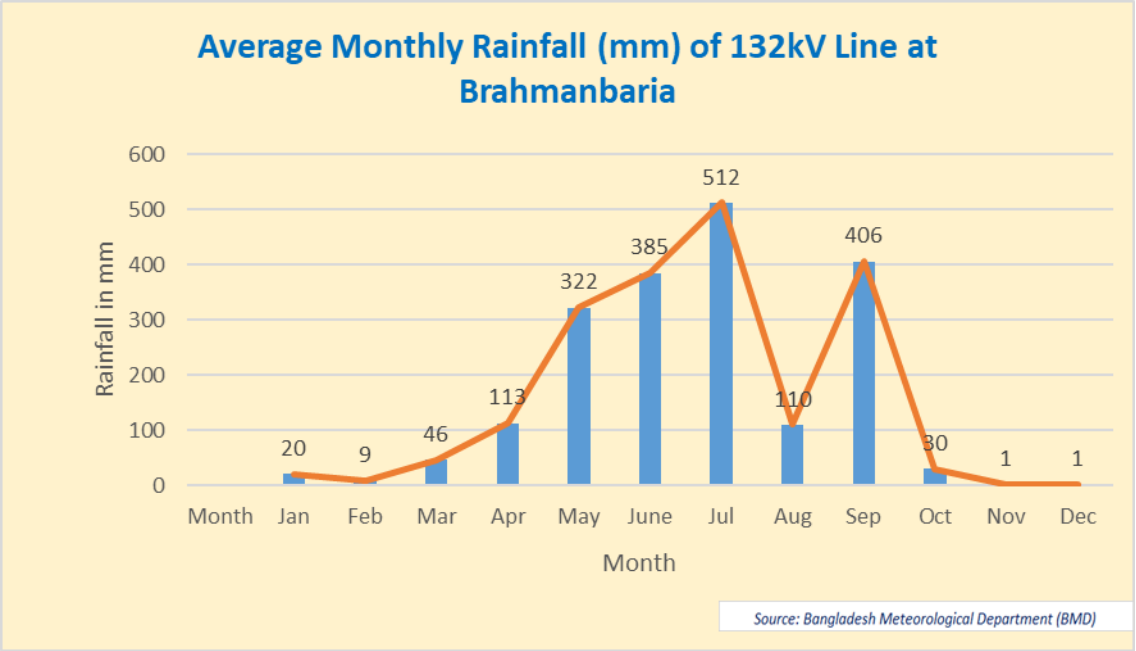


Figure 5.13: Average Monthly Rainfall in a Year from 2011-2023 in Brahmanbaria

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

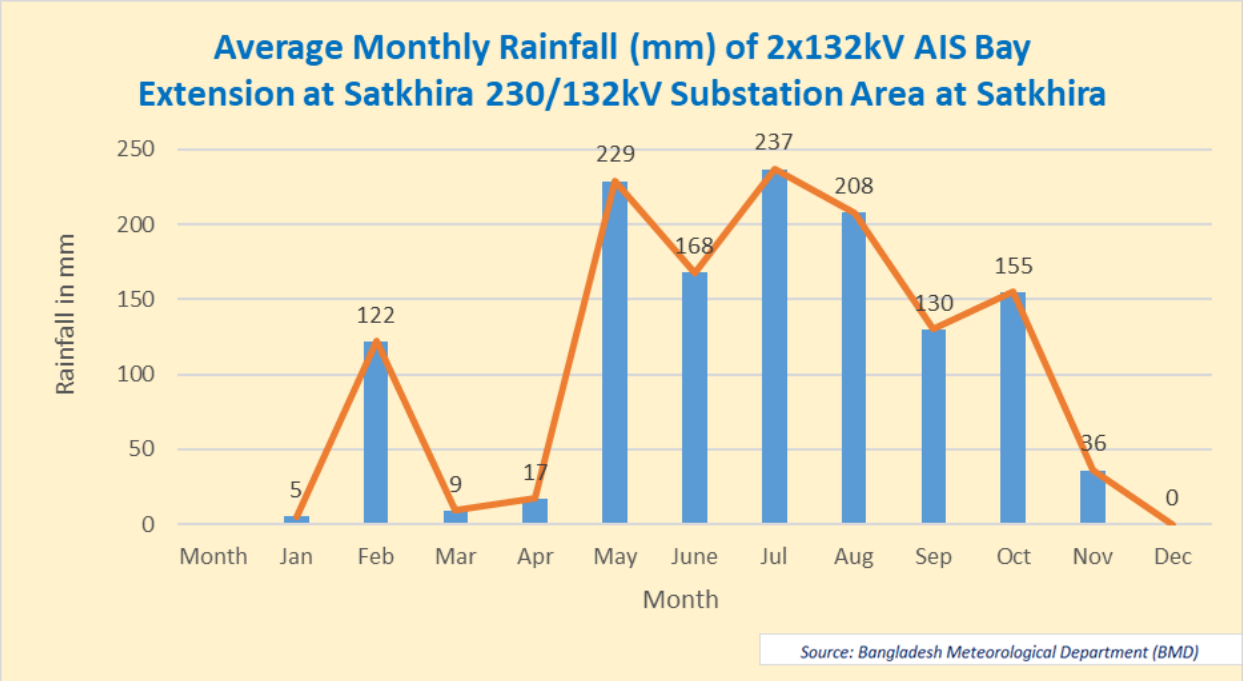
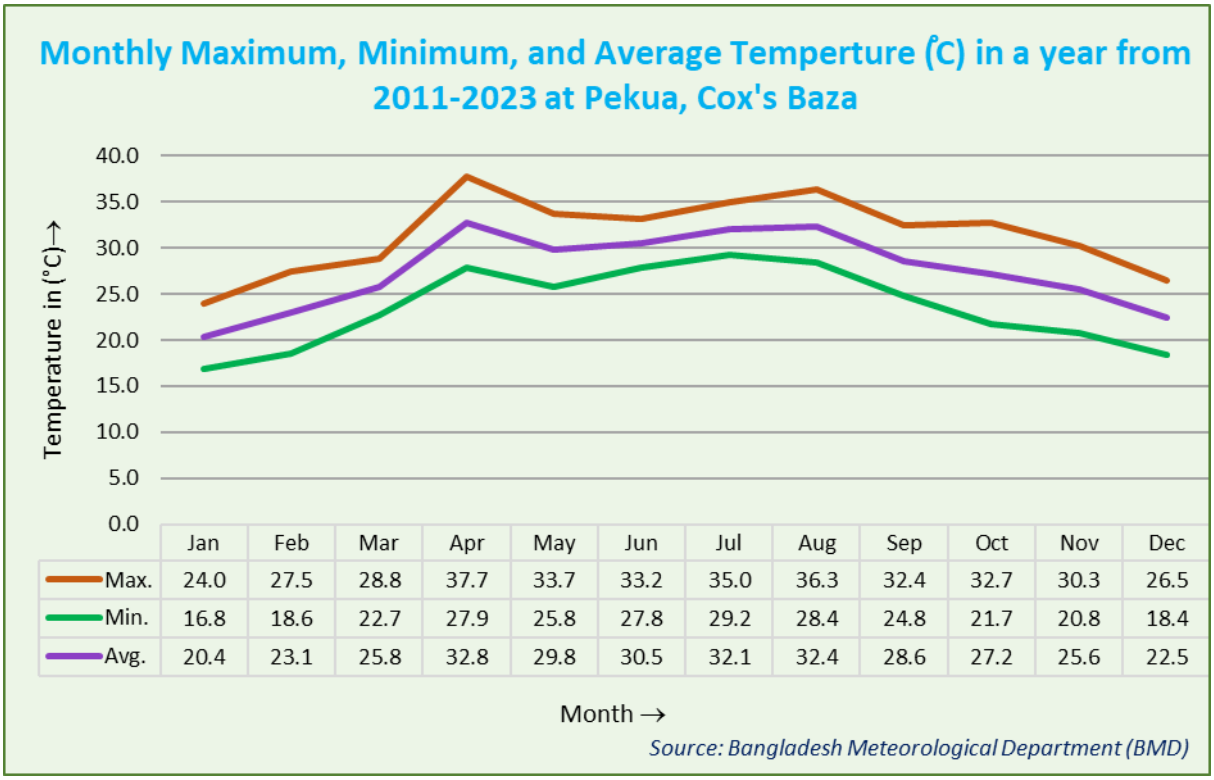


Figure 5.14: Average Monthly Rainfall in a Year from 2011-2023 in Satkhira

B. Temperature

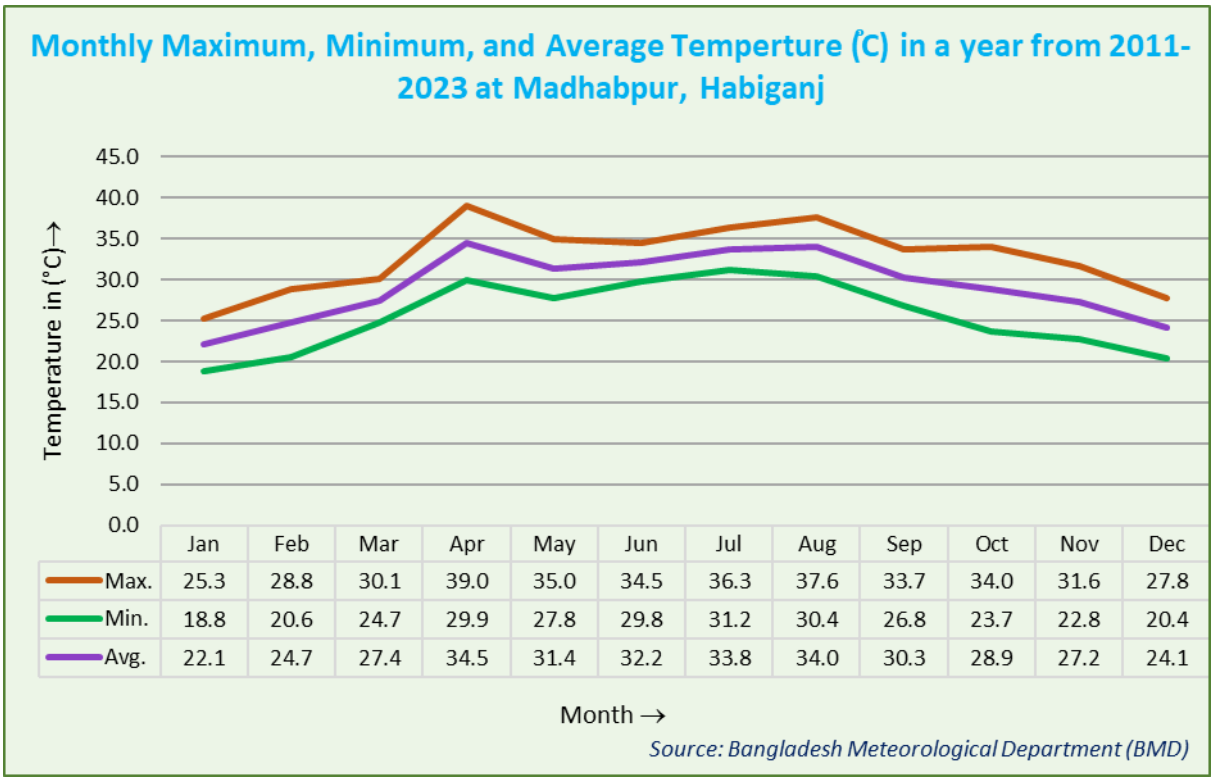
215. January is the coldest month in Bangladesh, averaging temperature varies from 17° C to 20-21° C. On the other hand, April the warmest with temperatures from 33° C to 36° C. However, Figures 5.15 to 5.27 illustrates the monthly maximum, minimum and average temperatures in all the project implemented areas. Maximum, minimum, and mean temperature was observed the most in April at all the project areas throughout the time period. On the other hand, similarly as Bangladesh climatic perspectives, January experienced the least value of temperature in all segments such as maximum, minimum, and mean.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Max.	24.0	27.5	28.8	37.7	33.7	33.2	35.0	36.3	32.4	32.7	30.3	26.5
Min.	16.8	18.6	22.7	27.9	25.8	27.8	29.2	28.4	24.8	21.7	20.8	18.4
Avg.	20.4	23.1	25.8	32.8	29.8	30.5	32.1	32.4	28.6	27.2	25.6	22.5

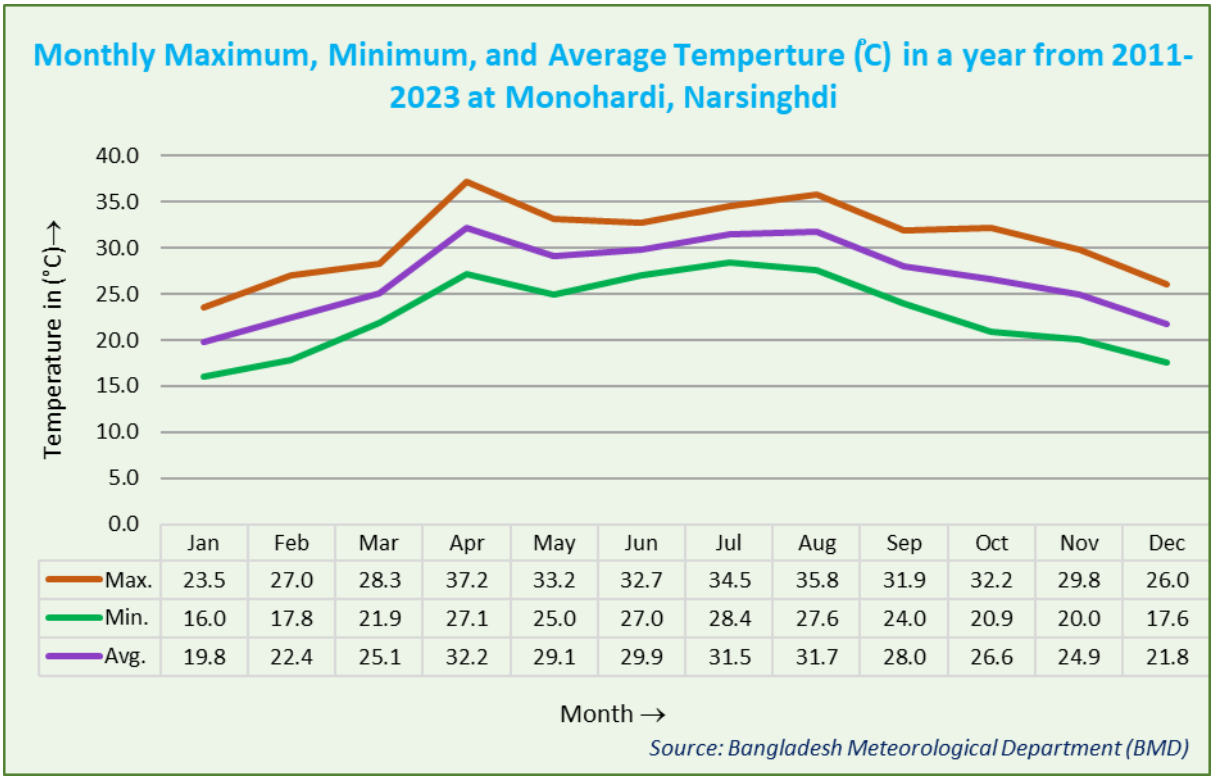
Figure 5.15: Monthly (Maximum, Minimum, Average) Temperature (°C) in a Year from 2011-2023 in Cox's Bazar



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Max.	25.3	28.8	30.1	39.0	35.0	34.5	36.3	37.6	33.7	34.0	31.6	27.8
Min.	18.8	20.6	24.7	29.9	27.8	29.8	31.2	30.4	26.8	23.7	22.8	20.4
Avg.	22.1	24.7	27.4	34.5	31.4	32.2	33.8	34.0	30.3	28.9	27.2	24.1

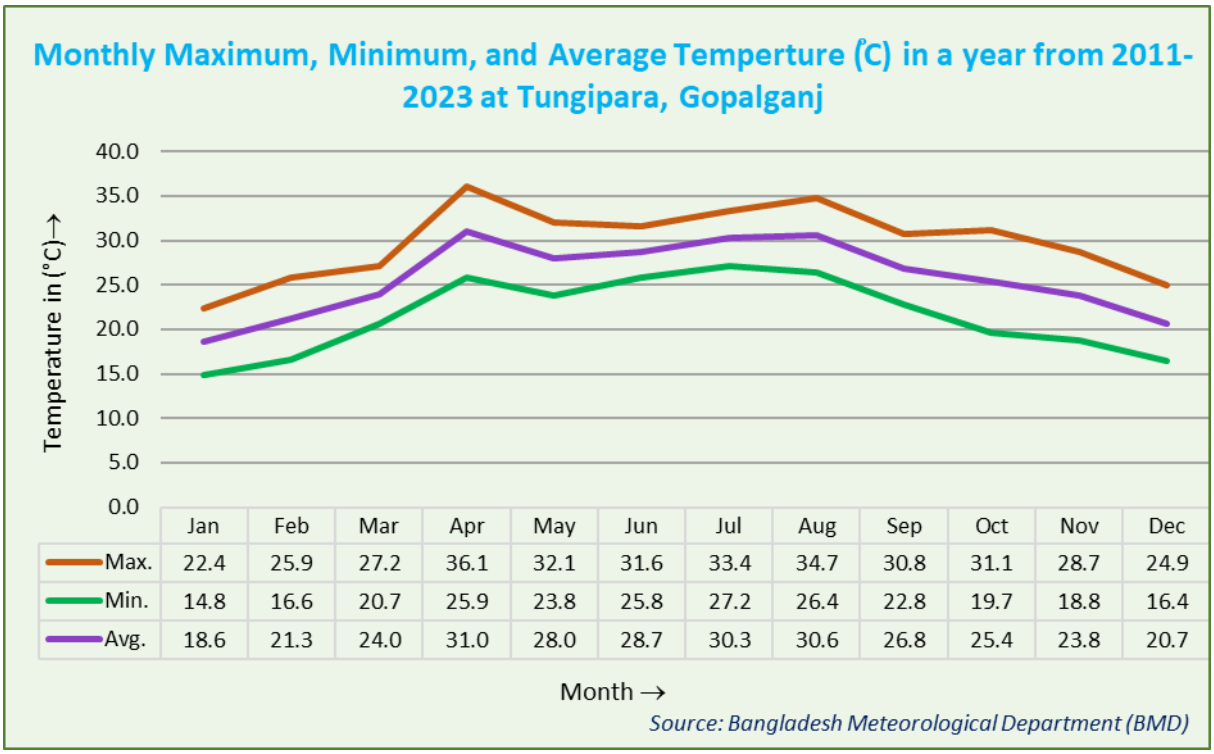
Figure 5.16: Monthly (Maximum, Minimum, Average) Temperature (°C) in a Year from 2011-2023 in Habiganj

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Max.	23.5	27.0	28.3	37.2	33.2	32.7	34.5	35.8	31.9	32.2	29.8	26.0
Min.	16.0	17.8	21.9	27.1	25.0	27.0	28.4	27.6	24.0	20.9	20.0	17.6
Avg.	19.8	22.4	25.1	32.2	29.1	29.9	31.5	31.7	28.0	26.6	24.9	21.8

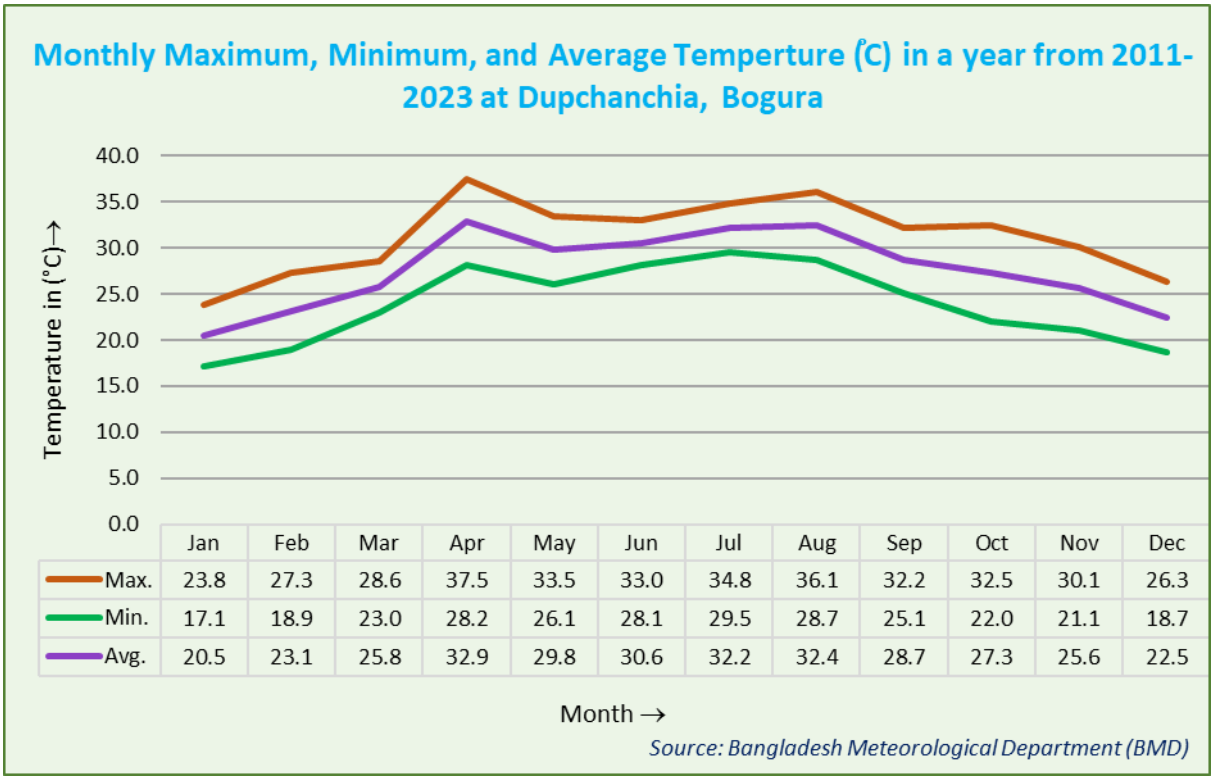
Figure 5.17: Monthly (Maximum, Minimum, Average) Temperature (°C) in a year from 2011-2023 in Narsinghdi



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Max.	22.4	25.9	27.2	36.1	32.1	31.6	33.4	34.7	30.8	31.1	28.7	24.9
Min.	14.8	16.6	20.7	25.9	23.8	25.8	27.2	26.4	22.8	19.7	18.8	16.4
Avg.	18.6	21.3	24.0	31.0	28.0	28.7	30.3	30.6	26.8	25.4	23.8	20.7

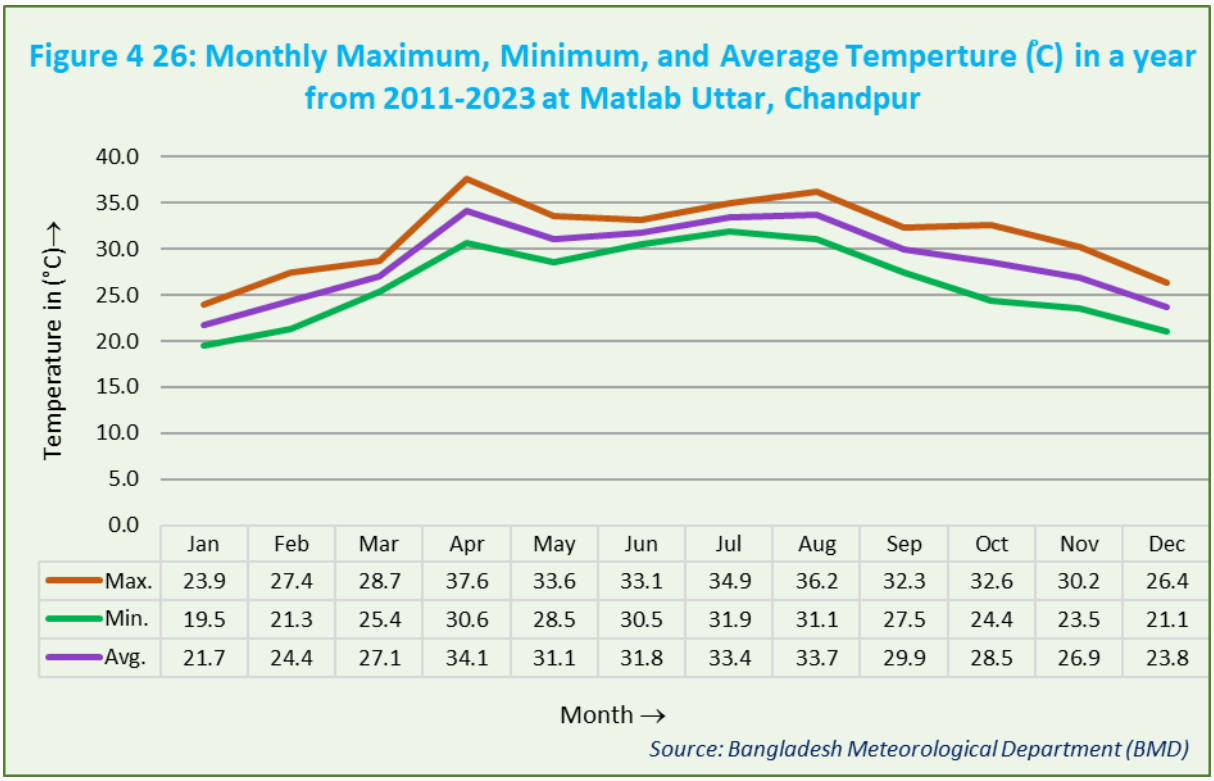
Figure 5.18: Monthly (Maximum, Minimum, Average) Temperature (°C) in a year from 2011-2023 in Gopalganj

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Max.	23.8	27.3	28.6	37.5	33.5	33.0	34.8	36.1	32.2	32.5	30.1	26.3
Min.	17.1	18.9	23.0	28.2	26.1	28.1	29.5	28.7	25.1	22.0	21.1	18.7
Avg.	20.5	23.1	25.8	32.9	29.8	30.6	32.2	32.4	28.7	27.3	25.6	22.5

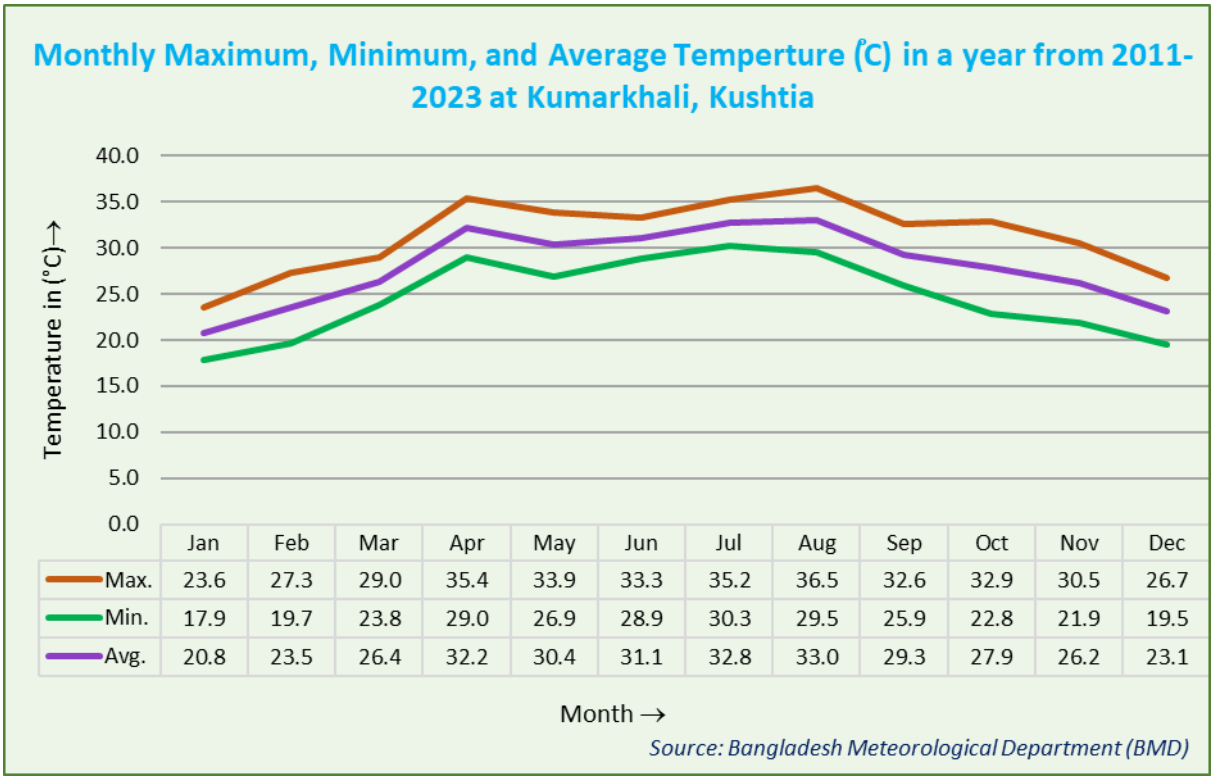
Figure 5.19: Monthly (Maximum, Minimum, Average) Temperature (°C) in a year from 2011-2023 in Bogura



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Max.	23.9	27.4	28.7	37.6	33.6	33.1	34.9	36.2	32.3	32.6	30.2	26.4
Min.	19.5	21.3	25.4	30.6	28.5	30.5	31.9	31.1	27.5	24.4	23.5	21.1
Avg.	21.7	24.4	27.1	34.1	31.1	31.8	33.4	33.7	29.9	28.5	26.9	23.8

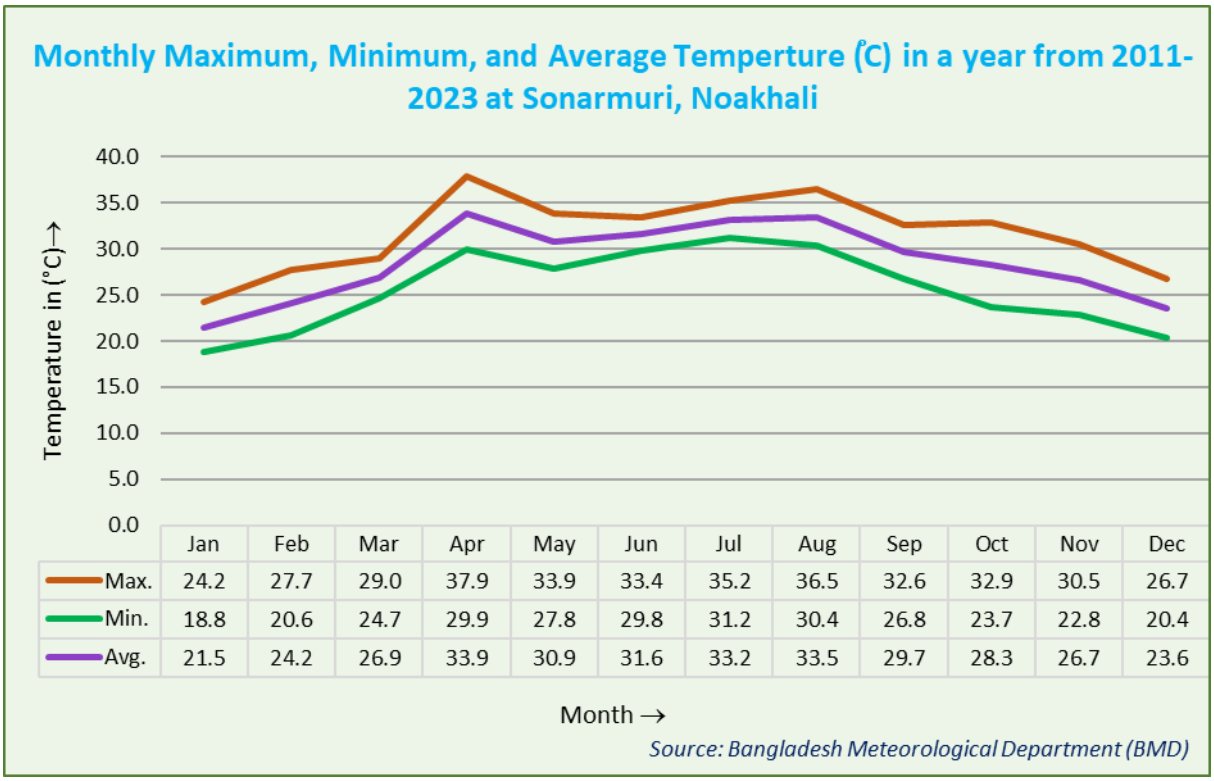
Figure 5.20: Monthly (Maximum, Minimum, Average) Temperature (°C) in a Year from 2011-2023 in Chandpur

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Max.	23.6	27.3	29.0	35.4	33.9	33.3	35.2	36.5	32.6	32.9	30.5	26.7
Min.	17.9	19.7	23.8	29.0	26.9	28.9	30.3	29.5	25.9	22.8	21.9	19.5
Avg.	20.8	23.5	26.4	32.2	30.4	31.1	32.8	33.0	29.3	27.9	26.2	23.1

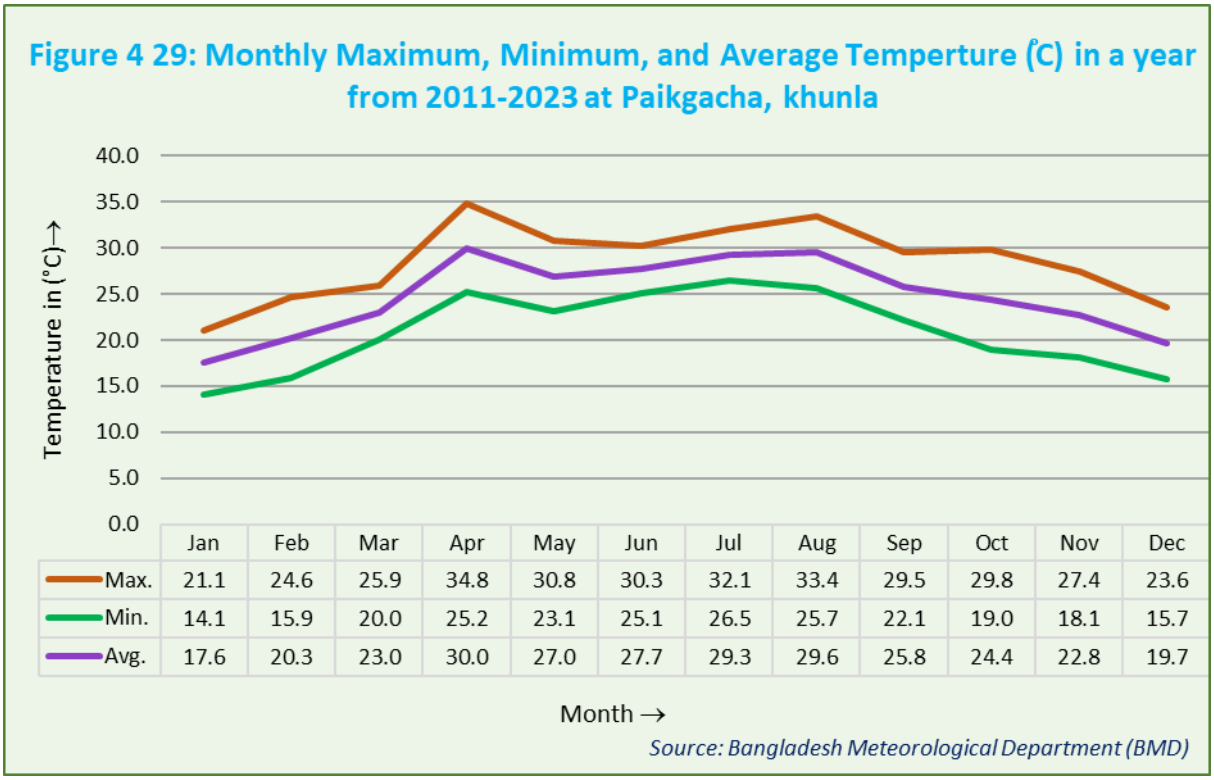
Figure 5.21: Monthly (Maximum, Minimum, Average) Temperature (°C) in a Year from 2011-2023 in Kushtia



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Max.	24.2	27.7	29.0	37.9	33.9	33.4	35.2	36.5	32.6	32.9	30.5	26.7
Min.	18.8	20.6	24.7	29.9	27.8	29.8	31.2	30.4	26.8	23.7	22.8	20.4
Avg.	21.5	24.2	26.9	33.9	30.9	31.6	33.2	33.5	29.7	28.3	26.7	23.6

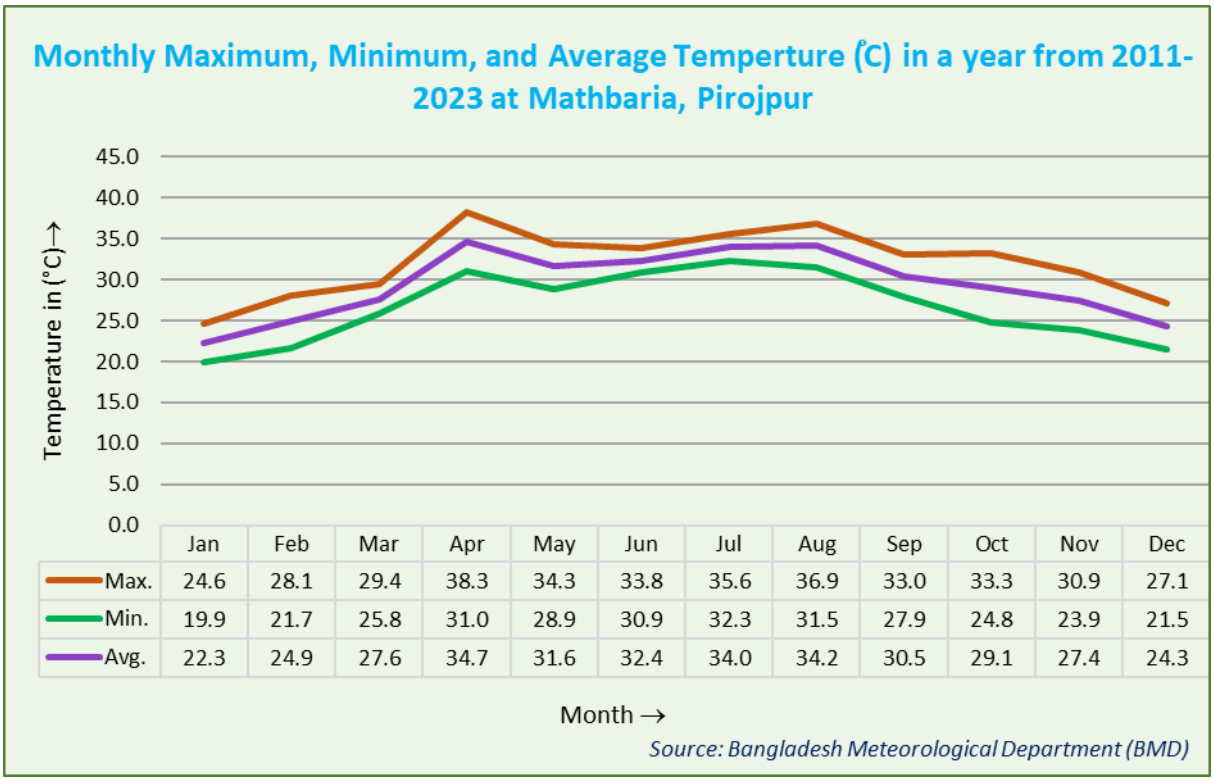
Figure 5.22: Monthly (Maximum, Minimum, Average) Temperature (°C) in a Year from 2011-2023 in Noakhali

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Max.	21.1	24.6	25.9	34.8	30.8	30.3	32.1	33.4	29.5	29.8	27.4	23.6
Min.	14.1	15.9	20.0	25.2	23.1	25.1	26.5	25.7	22.1	19.0	18.1	15.7
Avg.	17.6	20.3	23.0	30.0	27.0	27.7	29.3	29.6	25.8	24.4	22.8	19.7

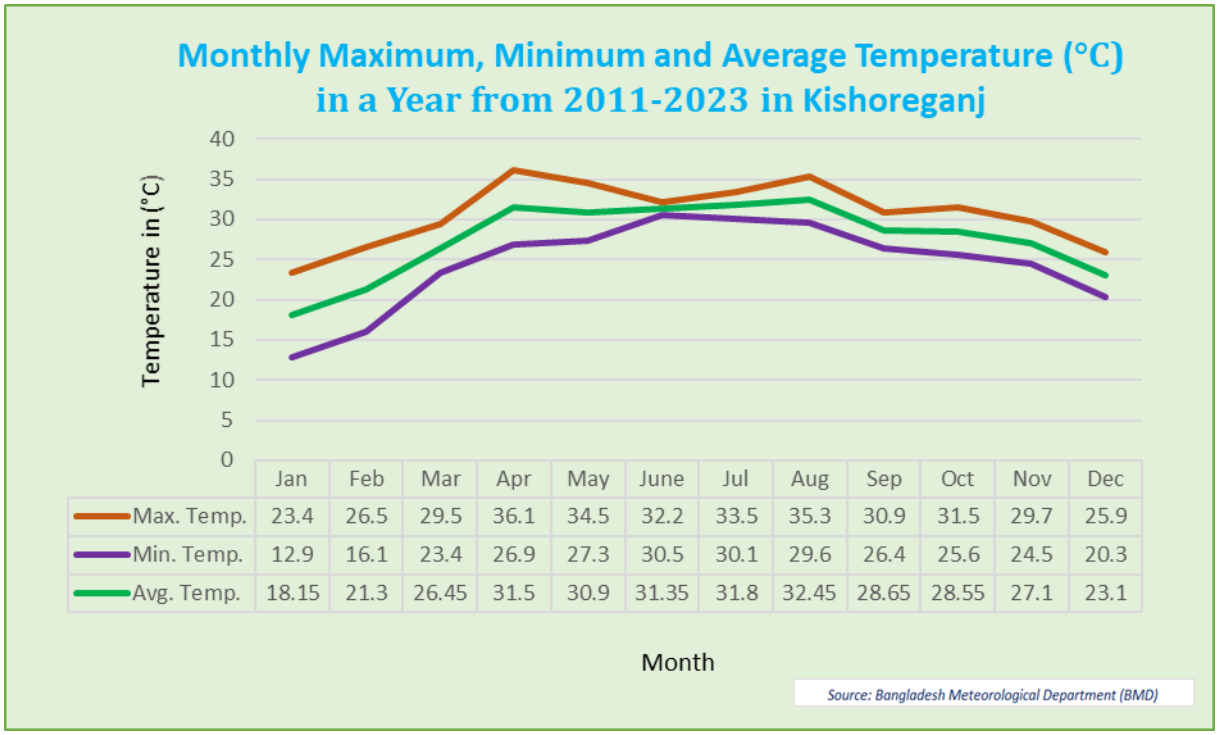
Figure 5.23: Monthly (Maximum, Minimum, Average) Temperature (°C) in a Year from 2011-2023 in Khulna



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Max.	24.6	28.1	29.4	38.3	34.3	33.8	35.6	36.9	33.0	33.3	30.9	27.1
Min.	19.9	21.7	25.8	31.0	28.9	30.9	32.3	31.5	27.9	24.8	23.9	21.5
Avg.	22.3	24.9	27.6	34.7	31.6	32.4	34.0	34.2	30.5	29.1	27.4	24.3

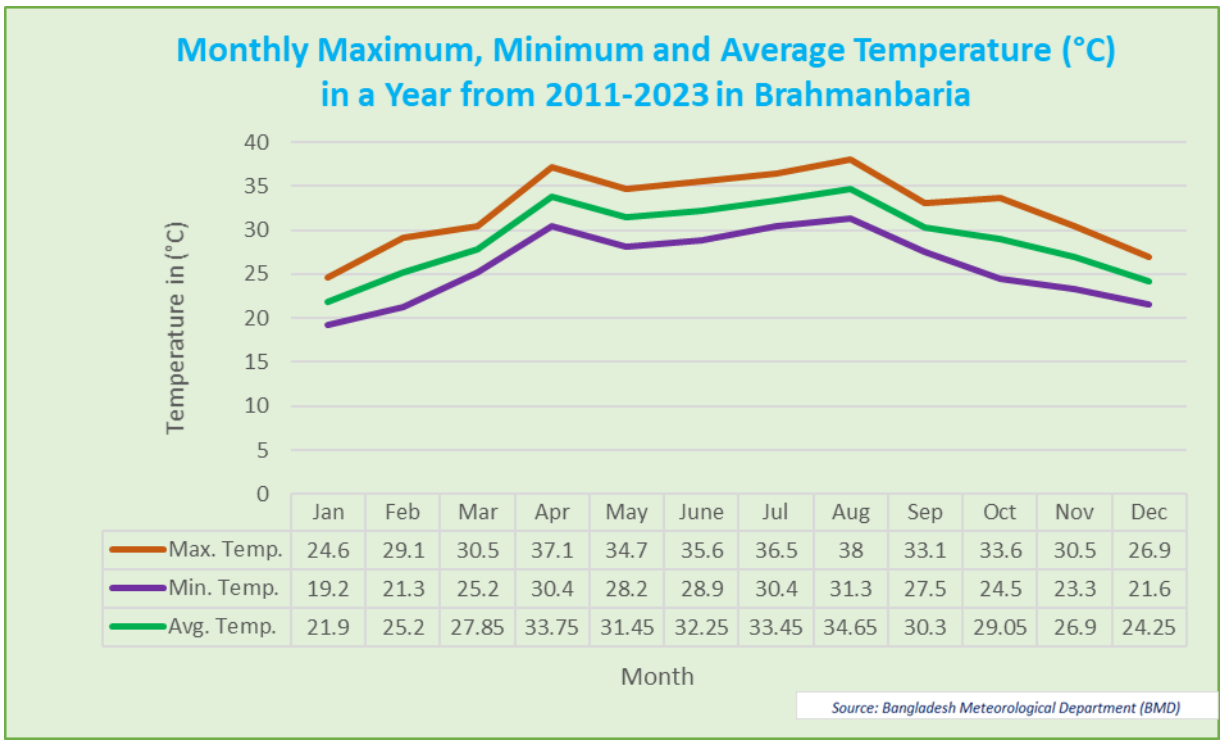
Figure 5.24: Monthly (Maximum, Minimum, Average) Temperature (°C) in a Year from 2011-2023 in Pirojpur

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.



	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sep	Oct	Nov	Dec
Max. Temp.	23.4	26.5	29.5	36.1	34.5	32.2	33.5	35.3	30.9	31.5	29.7	25.9
Min. Temp.	12.9	16.1	23.4	26.9	27.3	30.5	30.1	29.6	26.4	25.6	24.5	20.3
Avg. Temp.	18.15	21.3	26.45	31.5	30.9	31.35	31.8	32.45	28.65	28.55	27.1	23.1

Figure 5.25: Monthly (Maximum, Minimum, Average) Temperature (°C) in a Year from 2011-2023 in Kishoreganj



	Jan	Feb	Mar	Apr	May	June	Jul	Aug	Sep	Oct	Nov	Dec
Max. Temp.	24.6	29.1	30.5	37.1	34.7	35.6	36.5	38	33.1	33.6	30.5	26.9
Min. Temp.	19.2	21.3	25.2	30.4	28.2	28.9	30.4	31.3	27.5	24.5	23.3	21.6
Avg. Temp.	21.9	25.2	27.85	33.75	31.45	32.25	33.45	34.65	30.3	29.05	26.9	24.25

Figure 5.26: Monthly (Maximum, Minimum, Average) Temperature (°C) in a Year from 2011-2023 in Brahmanbaria

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

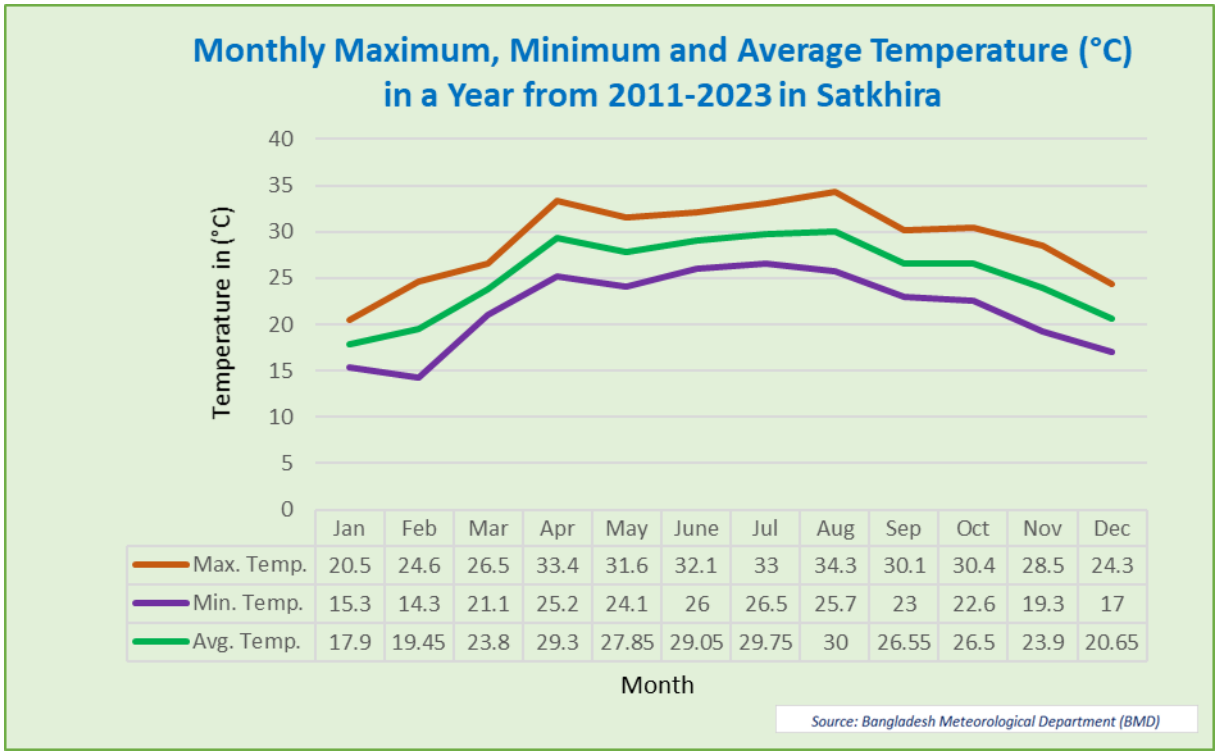


Figure 5.27: Monthly (Maximum, Minimum, Average) Temperature (°C) in a Year from 2011-2023 in Satkhira

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

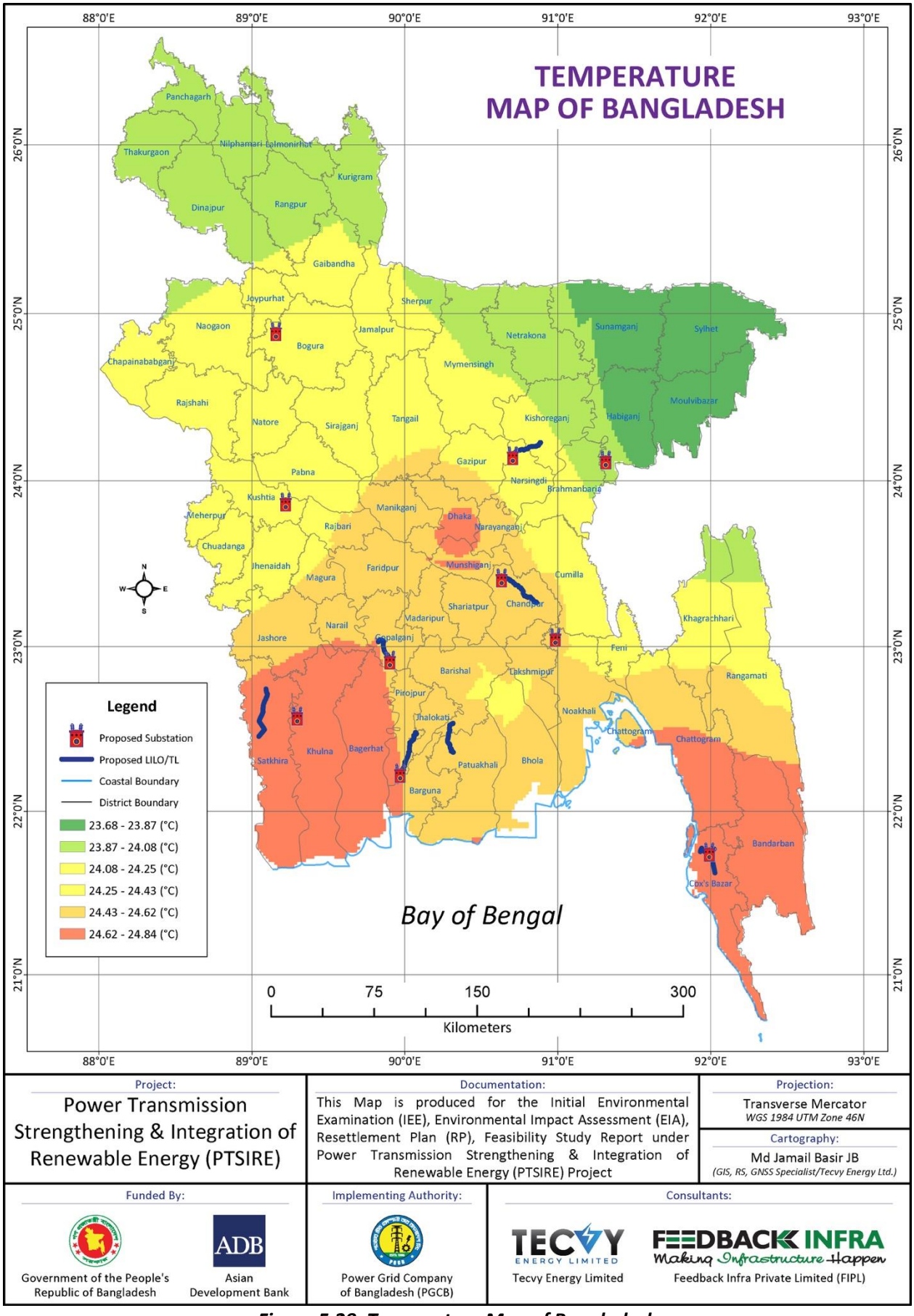


Figure 5.28: Temperature Map of Bangladesh

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

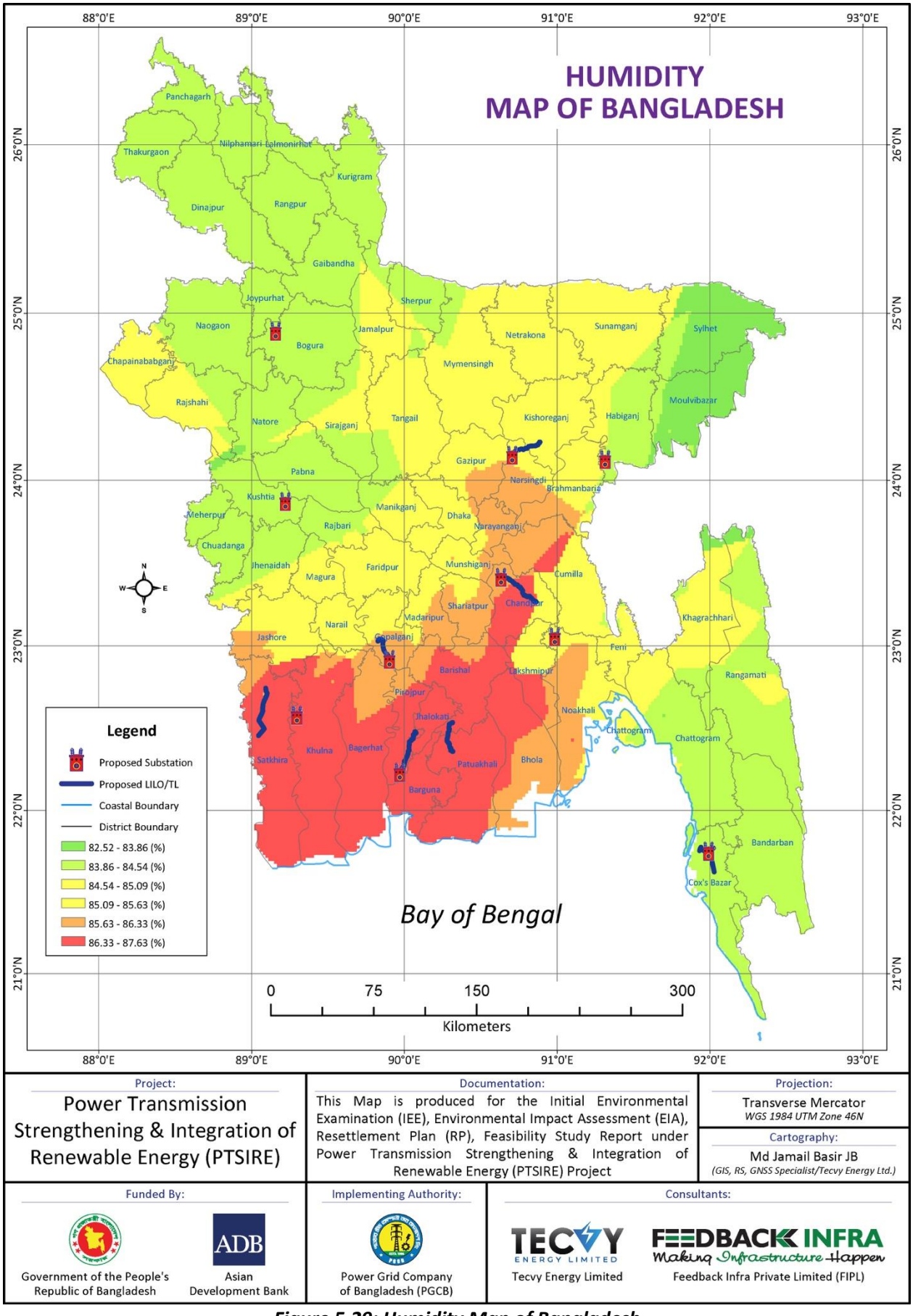


Figure 5.29: Humidity Map of Bangladesh

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

C. Wind Speed and Direction

216. In all the project implemented areas, wind speed and wind direction has been collected from Bangladesh Meteorological Department (BMD) and presented in the graphical from which has been added below. The wind speed and wind direction have been observed in an optimum condition, although some fluctuations have been also observed (Figure 5.30).

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

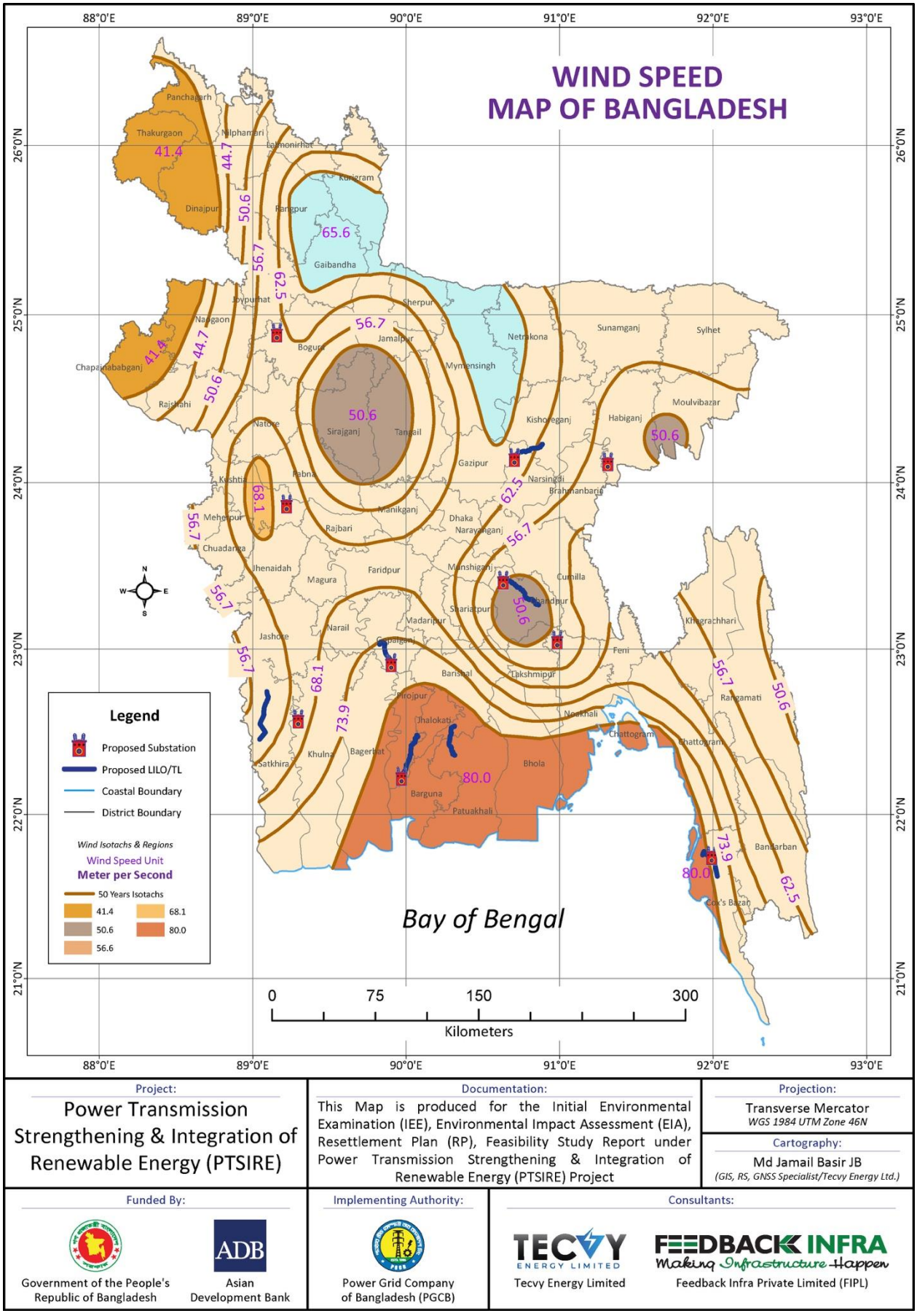


Figure 5.30: Wind Speed Map of Bangladesh

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

D. Humidity

217. Humidity levels are usually higher during the monsoon season (June to October), often exceeding 80%. During the dry season (November to April), humidity tends to be somewhat lower but still remains relatively high compared to many other regions. The relative humidity in the project areas typically ranges from about 70% to 85% annually.

E. Sunshine Hour

218. Sunshine hours tend to be higher during the dry season (November to April) and lower during the monsoon season (June to October), when cloud cover and rainfall are more frequent. Pekua, Gopalganj typically receives around 2,000 to 2,200 hours of sunshine per year, Habiganj typically receives around 1,800 to 2,000 hours of sunshine annually. Narsingdi, Dupchanchia, Kumarkhali and Paikgacha typically receives around 2,000 to 2,300 hours of sunshine annually. Matlab Uttar, Sonarmuri and Pirojpur typically receives around 1,900 to 2,200 hours of sunshine annually.

F. Evaporation

219. Evaporation rates can be approximated using climate data and empirical models. For tropical regions similar to Pekua, annual evaporation typically ranges between 1,200 mm to 1,800 mm (47 inches to 71 inches), depending on local factors like temperature, wind speed, and specific humidity. Annual evaporation in subtropical and tropical regions can be influenced by various factors such as temperature, humidity, and wind. Based on regional data and similar climates, the approximate range for annual evaporation in such areas is typically between 1,000 mm to 1,500 mm (39 inches to 59 inches).

5.3.5 Natural Hazards (Geological and Climate)

A. Seismicity

220. Bangladesh is situated in one of the most tectonically active regions in the world. Here is where three major plates meet. As per the National Seismic Zoning Map the project areas fall under all the seismic zones, the high-risk zone (Zone I) with a basic seismic coefficient 0.08 g, moderate-risk zone (Zone II) with a basic seismic coefficient 0.05 g and low risk zone with a basic seismic coefficient 0.04 g. Details of seismic intensity and the historical records of earthquake in and around the project corridor that occurred between 1950 and 2023 are presented in the following Table 5.2.

Table 5.2: Historical Background of Seismicity in the Project Areas

Year	Details
1950	Known as the Assam Earthquake. Occurred on 15 August with a magnitude of 8.4 with the epicenter in Assam, India. The tremor was felt throughout all the project areas but no damage was recorded.
2008	Known as Chandpur Earthquake. An earthquake with couple of aftershocks jolted Dhaka on the evening of 20 September 2008 just before Iftar Mahfil. It caused tremendous panic among the city dwellers. The epicenter was 50 km southeast of Dhaka near Kachua of Chandpur. The magnitude was 4.5 on the Richter scale.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

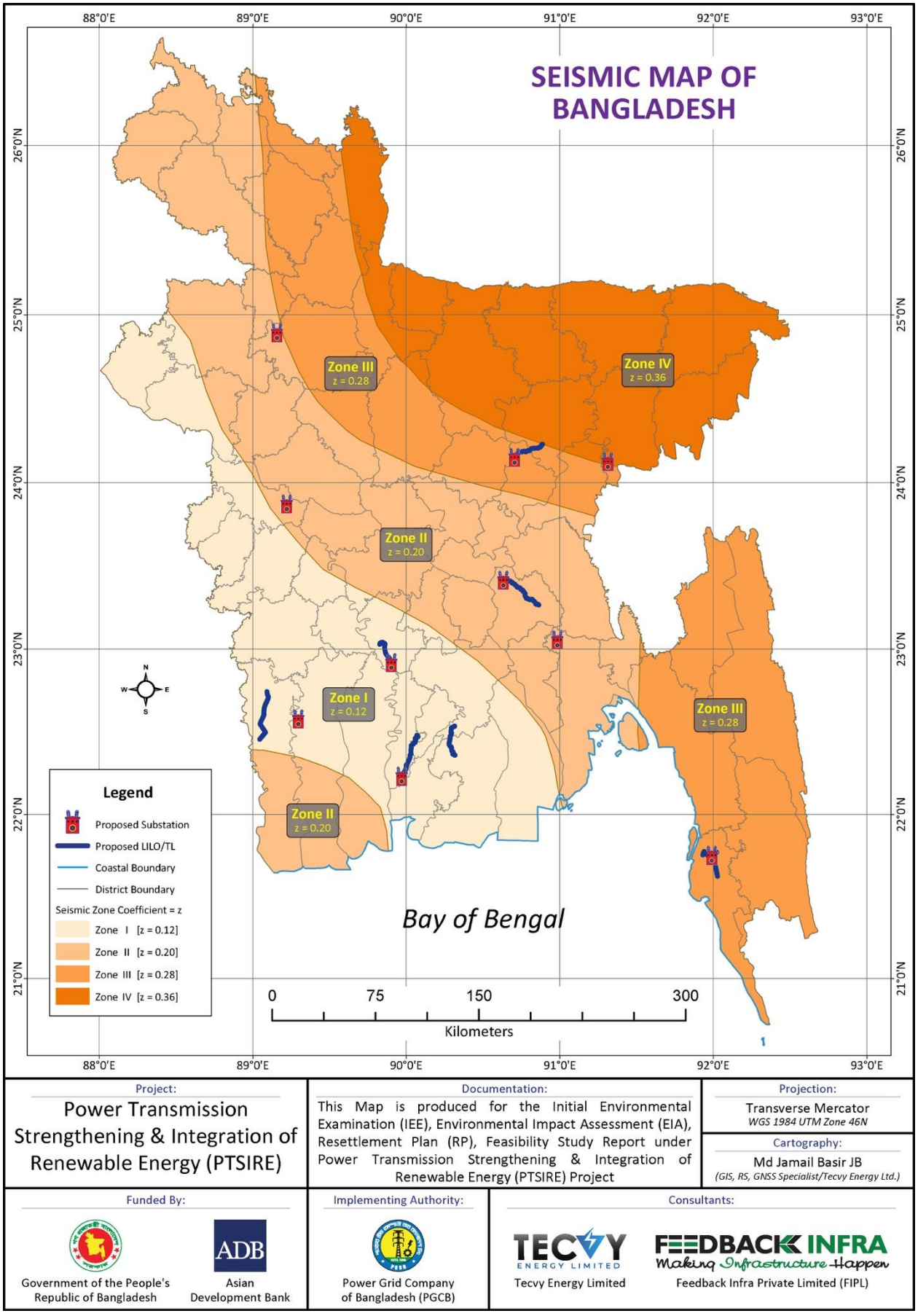


Figure 5.31: Seismic Zoning Map of Bangladesh Represents the Project Areas

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

B. Storms

221. All the project areas experience various types of storms throughout the year due to their geographical location, climate, and proximity to the Bay of Bengal. Some of the notable storms in Bangladesh include:

Tropical Cyclones:

- Bangladesh is prone to tropical cyclones, also known as hurricanes or typhoons in other parts of the world. These intense tropical storms form over warm ocean waters and can bring strong winds, heavy rainfall, storm surges, and flooding.
- The cyclone season in the Bay of Bengal typically spans from April to December, with the peak season occurring from May to November. Cyclones originating in the Bay of Bengal often make landfall in coastal areas of Bangladesh, causing significant damage to infrastructure, agriculture, and livelihoods.
- Examples of devastating cyclones in the project areas according to Bangladesh's history include Cyclone Bhola in 1970, Cyclone Sidr in 2007, and Cyclone Amphan in 2020.

Nor'westers (Kalbaishakhi):

- Nor'westers, locally known as Kalbaishakhi, are thunderstorms that occur during the pre-monsoon and monsoon seasons in the project areas, typically from March to June. These storms are characterized by strong winds, thunder, lightning, and heavy rainfall.
- Nor'westers often provide relief from the scorching heat of the pre-monsoon period but can also cause damage to crops, infrastructure, and property due to lightning strikes, gusty winds, and torrential rains.

Tornadoes:

- Although relatively rare compared to cyclones and nor'westers, tornadoes occasionally occur in the project areas, particularly during the pre-monsoon and monsoon seasons. Tornadoes are characterized by rotating columns of air extending from thunderclouds to the ground.
- Tornadoes can cause localized destruction, including damage to buildings, trees, and crops, as well as injuries and fatalities. They often occur in association with severe thunderstorms and convective weather systems.

Hailstorms:

- Hailstorms, although less common than other types of storms, can occur in Bangladesh, especially during severe thunderstorms associated with nor'westers or other convective weather systems. Hailstorms can damage crops, vehicles, and infrastructure, particularly in the project areas.

C. Flooding

- While not storms in the traditional sense, widespread flooding is a recurrent natural hazard in the project areas, particularly during the monsoon season from June to September. Heavy monsoon rains, combined with snowmelt from the Himalayas and upstream river flows, can lead to riverine and flash floods across the country.
- Floods in Bangladesh cause displacement, loss of lives, damage to property, disruption of transportation and communication networks, and adverse impacts on agriculture and livelihoods.
- Floods are a recurring natural hazard in Kushtia, Khulna, Gopalganj, Habiganj and other project areas, primarily caused by heavy rainfall during the monsoon season and overflow of major rivers such as the Brahmaputra, Padma, and the Meghna. The low-lying topography makes it highly

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

susceptible to inundation, leading to loss of lives, displacement of populations, damage to crops, and infrastructure.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

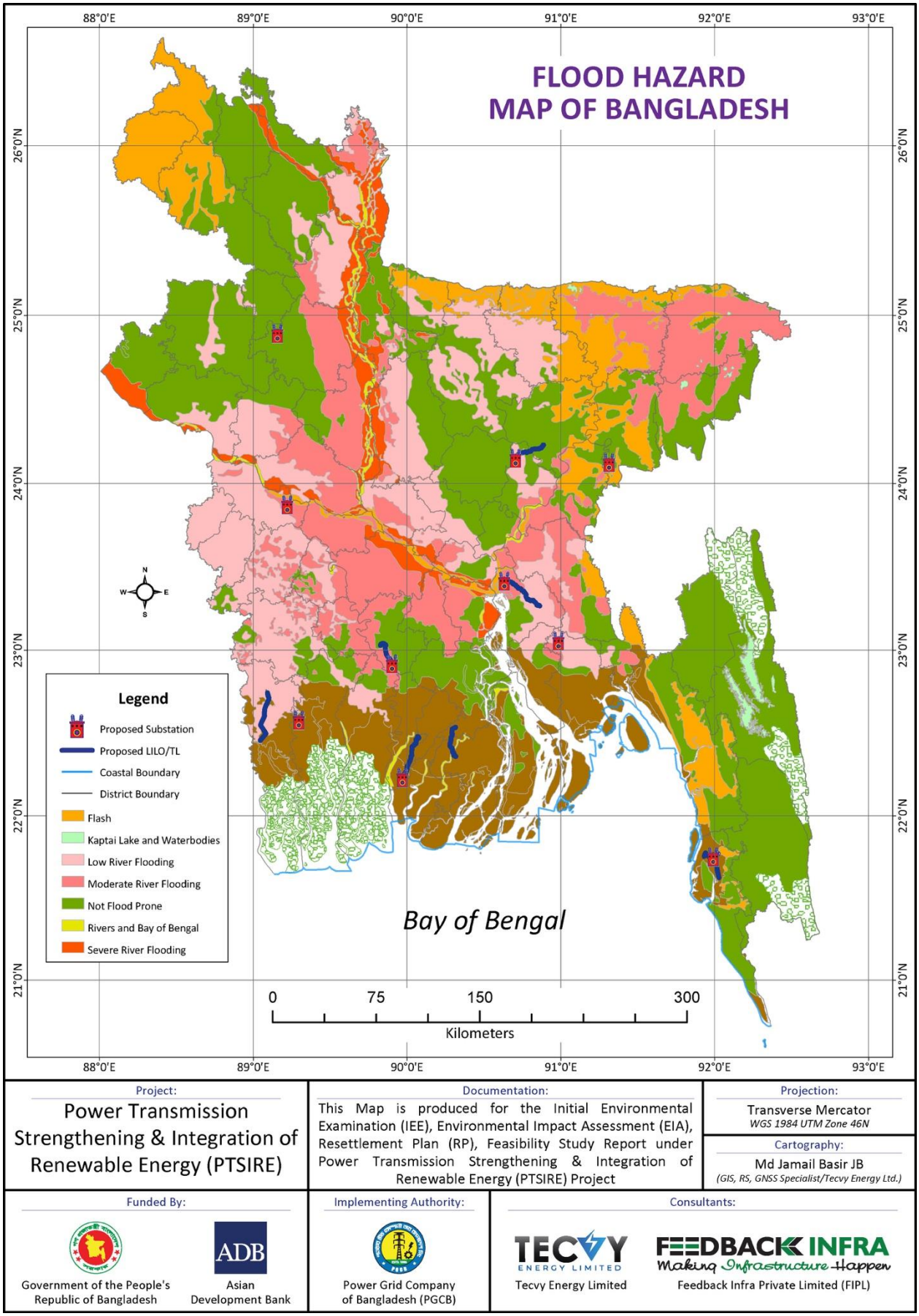


Figure 5.32: Flood Hazard Map of Bangladesh Represents the Project Areas

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

D. Drought

222. Droughts are common in the northwestern districts of Bangladesh (i.e. Barind Tract) in recent decades. Rainfall is comparatively less in Barind Tract than in the other parts of the country. However, drought can also occur in areas that usually enjoy adequate rainfall and moisture levels. Inadequate pre-monsoon showers, a delay in the onset of the rainy season or early departure of the monsoon may create drought conditions in Bangladesh. The eastern part is prone to drought mainly because of rainfall variability in the pre-monsoon and the post-monsoon periods.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

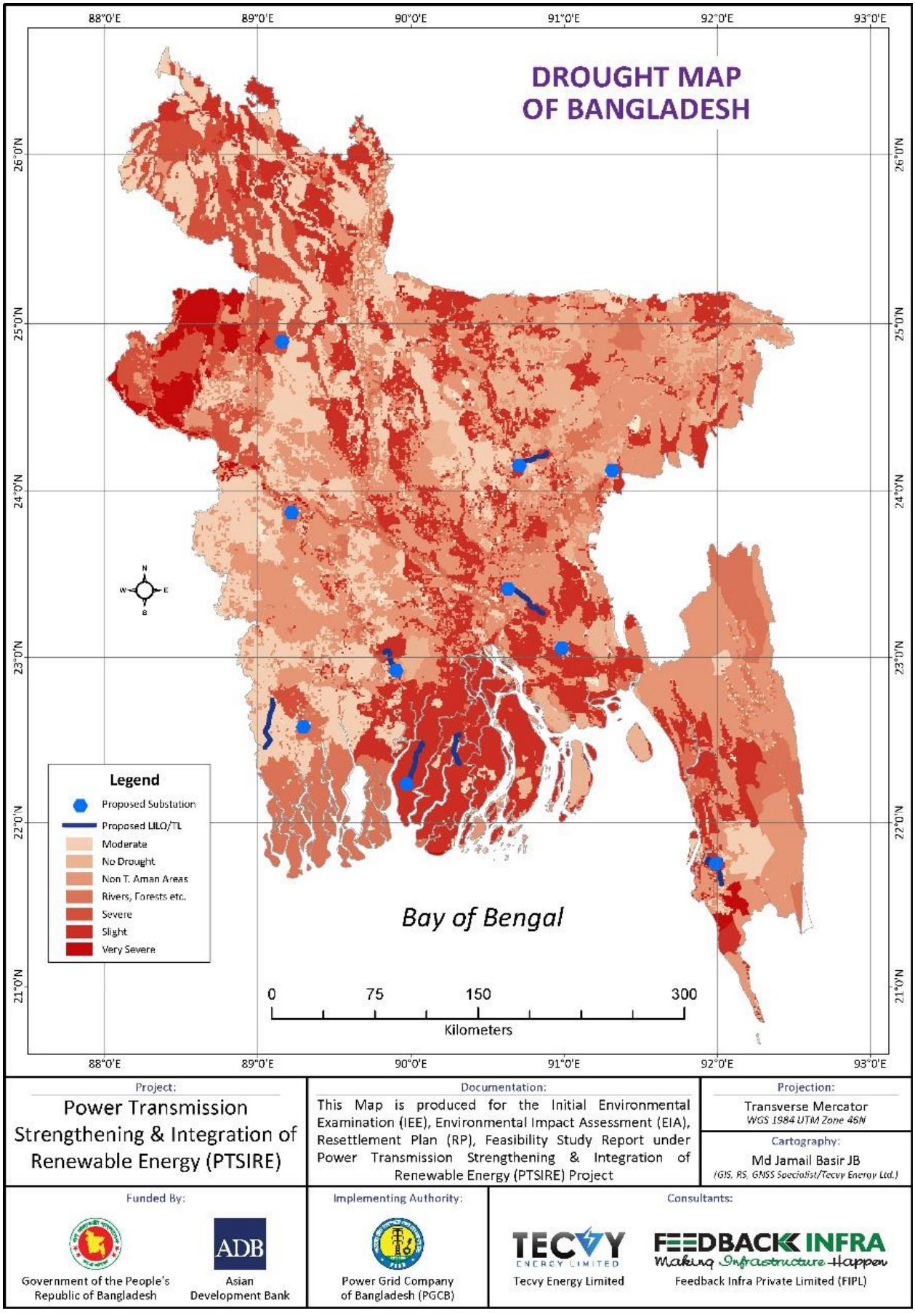


Figure 5.33: Drought Map of Bangladesh Represents the Project Areas

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

E. Thunderstorm and Lightning

223. Bangladesh is witnessing unusual casualties from lightning strikes well ahead of monsoon, that is in the pre-monsoon season comprises the months of March through May. It is due to the increased warmer weather and climate change are causing more water evaporation from the land and ocean, increasing cumulonimbus clouds, which is generating fatal lightning strikes. Considering the massive death toll due to lightning, in 2016, the Government of Bangladesh has declared it as a natural disaster[25]. Aimed to reduce the deaths and damage, the Government of Bangladesh has taken a number of initiatives including plantation of one million palm trees across the countries, development of public awareness on the thunderstorms and lightning through printed and electronic media as well as using other platforms, encourage people to plant palm and other tall tree, installing lightning rods in their houses etc. Furthermore, the warning systems have also been strengthened to make people aware of lightening preparedness. In addition to public awareness and emergency health services for the victims, the Directorate General of Health Services of Ministry of Health and Family Welfare collects information on deaths and injuries due to thunderstorms and lightning across the country regularly.

224. It is evident that lightning is a public health, social and economic issue. According to the Health Emergency Operation Center and Control Room, Directorate General of Health Services of Ministry of Health and Family Welfare, in 2018, total deaths and injuries were 120 and 77 respectively due to thunderstorm and lightning. It occurred only during the months of March to June, with the highest 68 deaths and 41 injuries in May. In 2019, only till March 2019, the total deaths were 4, and it was in March.[26]

F. Landslide

225. In Bangladesh, landslides are mostly triggered by heavy rainfall, usually during June. However, the underlying causes of landslide include deforestation, hill cutting, and unregulated development work.

226. Landslides are a regular geologic hazard in southeastern Bangladesh, notably in Chittagong Division (Bandarban, Chittagong, Cox's Bazar, Khagrachhari, and Rangamati Districts), the part of the country with the highest average slope gradients. These areas have a long history of instability. Although written records of landslide incidents are very rare, they have been a hazard to people ever since they have been living there. In fact, every year especially in the rainy season landslides take place in both natural and man-induced slopes.

227. None of the project components is located within the hilly region. Though, the Pekua Substation and the LILO are within the Cox's Bazar districts but those are far away from hilly areas.

5.3.6 Water Resources

228. Bangladesh and the western portion of the Indian State of Bengal are located within the 'Bengal Basin'. This basin includes the world's largest river delta, which occupies some 140,000sq km (the Ganges-Padma, Jumna-Brahmaputra-Tista and Meghna rivers and numerous tributary complexes), as well as the world's largest submarine fan complex (the Bengal Fan). These river systems have a combined annual sediment load of 1.5 to 2.4 billion metric tons per year.

229. The headwaters of both the Ganges-Padma and Brahmaputra-Jamuna-Tista River systems are situated in the main Himalayas ranges. Water for the Meghna River, originating from the Shillong Plateau, drains one of the heaviest rainfall areas of the world. Flooding is an annual occurrence in Bangladesh, and occurs mainly during the rainy season from May to October.

[25] Voa News. Bangladesh Declares Lightning Strikes a Disaster as Deaths Surge. 22 June, 2016. https://www.voanews.com/ east-asia/bangladesh-declares-lightning-strikes-disaster-deaths-surge

[26] Directorate General of Health Services. Ministry of Health and Family Welfare. Dhaka. 2019

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

230. In Bangladesh, rainfall and trans-boundary river flows are the main sources of surface water. Bangladesh has an average annual surface flow of approximately 1,073 million acre feet (MAF), of which about 870 MAF (93%) is received from India as inflow, and the remaining 203 MAF (7%) as rainfall. This magnitude of water is sufficient to cover the whole of Bangladesh to a depth of 9.14m. Approximately 132 MAF (65% of rainfall and 12% of total) is lost in evaporation (114.30 cm) and the remainder, approximately 5million cubic feet (MCF) flows out to the Bay of Bengal which includes a sediment load of 1.5-2.4 MCF.

A. Gopalganj

231. Rivers in Gopalganj, including the Madhumati and Ariel Khan rivers, exhibit meandering channels characteristic of lowland river systems. Meandering rivers often have sinuous, winding courses with gentle bends and curves, influenced by factors such as sediment deposition, erosion, and hydraulic processes. Meandering rivers may form oxbow lakes over time through the natural process of meander cutoffs. Oxbow lakes are crescent-shaped bodies of water that were once part of the main river channel but became isolated as the river changed course. Gopalganj may have oxbow lakes associated with its river systems, providing habitat for aquatic flora and fauna. Rivers in Gopalganj typically have broad floodplains and relatively low-lying banks, which are susceptible to inundation during monsoon floods. Floodplain areas are important for agriculture, as they receive nutrient-rich sediments deposited during floods, supporting crop cultivation. Groundwater is crucial for irrigation, especially in the agricultural sector, which is a major part of the local economy. Tube wells and hand pumps are commonly used for extraction. The primary aquifers in Gopalganj are alluvial in nature, comprising sand, silt, and clay layers. These aquifers can be recharged by rainfall and river flows.

B. Kushtia

232. Rivers in Kushtia, particularly the Ganges and its distributaries, may exhibit braided channel patterns characterized by multiple interconnected channels separated by sandbars and islands. Braided rivers are common in areas with high sediment loads and dynamic flow regimes, such as the Ganges-Brahmaputra-Meghna delta. In addition to braided channels, rivers in Kushtia may also display meandering patterns with sinuous, winding courses. Meandering rivers often have gentle curves and loops, influenced by factors such as sediment deposition, erosion, and lateral migration. Riverbanks and floodplains in Kushtia are important features of the river morphology, providing fertile land for agriculture and supporting diverse ecosystems. Floodplain areas receive nutrient-rich sediments deposited during floods, enhancing soil fertility and supporting crop cultivation. Groundwater in Kushtia, plays a crucial role in supporting agriculture, drinking water supplies, and domestic use. The region is characterized by a multi-layered aquifer system, with both shallow and deep aquifers. The shallow aquifers are often tapped for domestic use, while deeper ones are used for irrigation. Groundwater levels in this area can fluctuate with seasonal rainfall patterns, affecting availability during dry periods.

C. Khulna

233. Rivers in Khulna exhibit a significant tidal influence due to their proximity to the Bay of Bengal. Tidal fluctuations cause dynamic changes in water levels, sediment transport, and channel morphology, shaping the landscape and ecology of the region. Khulna's river systems form an estuarine environment characterized by the mixing of freshwater and saline water. Estuaries support diverse ecosystems, including mangrove forests, mudflats, and tidal creeks, which are influenced by tidal dynamics and sedimentation processes. The Sundarbans, the world's largest mangrove forest, is located in Khulna division. The Sundarbans deltaic complex is an integral part of the river morphology, providing habitat for unique flora and fauna adapted to brackish water conditions. Khulna has multiple aquifers, with both shallow and deep layers. The shallow aquifers are often used for domestic water supply, while deeper aquifers are tapped for agricultural irrigation. Groundwater quality in Khulna faces challenges, particularly with arsenic contamination. Many areas have reported high levels of arsenic, making it unsafe for drinking without treatment.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

D. Chandpur

234. Rivers in Chandpur exhibit significant tidal influence due to their proximity to the Bay of Bengal. Tidal fluctuations cause dynamic changes in water levels, sediment transport, and channel morphology, shaping the landscape and ecology of the region. Chandpur's river systems form an estuarine environment characterized by the mixing of freshwater and saline water. Estuaries support diverse ecosystems, including mangrove forests, mudflats, and tidal creeks, which are influenced by tidal dynamics and sedimentation processes. Chandpur experiences both riverbank erosion and deposition due to the dynamic nature of its river systems. Erosion can lead to the loss of agricultural land, infrastructure, and settlements, while deposition contributes to the formation of new land and habitats. The groundwater in Chandpur primarily comes from alluvial aquifers formed by sediment deposition from rivers. Chandpur has a layered aquifer system, with both shallow and deep aquifers. Shallow aquifers are typically accessed for household use, while deeper aquifers are utilized for irrigation.

E. Pirojpur

235. Rivers in Pirojpur experience significant tidal influence due to their proximity to the Bay of Bengal. Tidal fluctuations cause dynamic changes in water levels, sediment transport, and channel morphology, shaping the landscape and ecology of the region. Pirojpur's river systems form an estuarine environment characterized by the mixing of freshwater and saline water. Estuaries support diverse ecosystems, including mangrove forests, mudflats, and tidal creeks, which are influenced by tidal dynamics and sedimentation processes. Pirojpur experiences both riverbank erosion and deposition due to the dynamic nature of its river systems. Erosion can lead to the loss of agricultural land, infrastructure, and settlements, while deposition contributes to the formation of new land and habitats. Pirojpur has a complex groundwater system influenced by its geography and climate. Groundwater quality can vary, with concerns about salinity in coastal areas and contamination from agricultural runoff and industrial activities. The availability of groundwater is crucial for agriculture, drinking water, and domestic use. However, over-extraction can lead to issues like lowering water tables and reduced sustainability.

F. Narshingdi

236. In Narshingdi, the district's river morphology is characterized by its drainage patterns, which include dendritic patterns in some areas where smaller streams and tributaries merge into larger rivers or canals. Narshingdi may have wetlands and floodplains associated with its rivers and water bodies. These areas provide important habitat for wildlife, contribute to groundwater recharge, and play a role in flood mitigation during monsoon seasons. Human activities such as embankment construction, canal dredging, and land reclamation may influence the river morphology of Narshingdi. These interventions can impact natural river processes and alter the landscape over time. The region primarily relies on alluvial aquifers formed by sediment deposits from the Meghna River. These aquifers are generally good sources of groundwater. The groundwater recharge mainly occurs through rainfall and surface water infiltration. Groundwater is extensively used for irrigation, especially during the dry season when surface water availability decreases. This reliance can lead to over-extraction, which may affect the sustainability of the resource.

G. Habiganj

237. Rivers in Habiganj experience some degree of tidal influence, particularly in areas closer to the Meghna estuary. Tidal fluctuations influence water levels, sediment transport, and channel morphology, contributing to the dynamic nature of the river systems. Habiganj's river systems form an estuarine environment characterized by the mixing of freshwater and saline water. Estuaries support diverse ecosystems, including mangrove forests, mudflats, and tidal creeks, which are influenced by tidal dynamics and sedimentation processes. Like other deltaic regions, Habiganj experiences both riverbank erosion and deposition due to the dynamic nature of its river systems. Erosion can lead to the loss of agricultural land, infrastructure, and settlements, while deposition contributes to the formation of new land and habitats. Groundwater quality in Habiganj can vary. Groundwater is heavily relied upon for

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

agricultural activities, drinking water, and domestic uses. The district is characterized by alluvial and deltaic aquifers, which are generally well-suited for groundwater extraction. These aquifers are replenished by rainfall and river systems in the area. Rainfall is the primary source of groundwater recharge, particularly during the monsoon season. River systems in the area also contribute to recharge.

H. Bogura

238. In Bogura, the district's river morphology is characterized by its drainage patterns, including dendritic patterns where smaller streams and tributaries merge into larger rivers or canals. These drainage patterns influence the landscape and hydrology of Bogura. Bogura may have wetlands, marshes, and floodplains associated with its rivers and water bodies. These areas provide important habitat for wildlife, contribute to groundwater recharge, and play a role in flood mitigation during monsoon seasons. Human activities such as embankment construction, canal dredging, and land reclamation may influence the river morphology of Bogura. These interventions can impact natural river processes and alter the landscape over time. Groundwater is extensively used for irrigation, especially for rice and other crops. This is particularly important during the dry season when surface water is less available. The groundwater in Bogura is primarily found in alluvial aquifers, consisting of layers of sand, silt, and clay. These layers facilitate both water storage and movement, impacting the availability of groundwater. The recharge of groundwater mainly occurs through rainfall and infiltration from nearby rivers.

I. Noakhali

239. Rivers in Noakhali experience significant tidal influence due to their proximity to the Bay of Bengal. Tidal fluctuations influence water levels, sediment transport, and channel morphology, contributing to the dynamic nature of the river systems. Noakhali's river systems form an estuarine environment characterized by the mixing of freshwater and saline water. Estuaries support diverse ecosystems, including mangrove forests, mudflats, and tidal creeks, which are influenced by tidal dynamics and sedimentation processes. Noakhali experiences both riverbank erosion and deposition due to the dynamic nature of its river systems. Erosion can lead to the loss of agricultural land, infrastructure, and settlements, while deposition contributes to the formation of new land and habitats. Noakhali has a diverse groundwater system that plays a critical role in the local economy and community well-being. Groundwater quality can vary significantly across the region. The groundwater is characterized by layers of sand, silt, and clay. These layers help store and transmit groundwater, influencing its accessibility. While some areas have acceptable levels of minerals for drinking, others face challenges with salinity, iron, and, in certain places, arsenic contamination. Regular water quality assessments are important for ensuring safe drinking water.

J. Kishoreganj

240. Kishoreganj is traversed by several rivers, including the Meghna and its tributaries. These rivers are vital for irrigation, transportation, and fishing. Numerous canals and ponds are spread throughout the district, providing additional resources for agriculture and local livelihoods. Water from rivers and canals is extensively used for irrigation, supporting the cultivation of rice, jute, and other crops, which are integral to the local economy. Farmers often rely on traditional irrigation methods, using seasonal flooding to their advantage. The abundant water bodies support a thriving fishery sector. Local communities engage in both capture and aquaculture, contributing to food security and income. Kishoreganj relies heavily on groundwater for various purposes, including drinking, agriculture, and industrial use. The region has multiple aquifer layers. Groundwater quality can be affected by factors like arsenic contamination, salinity, and pollutants from agricultural runoff and industrial waste.

K. Satkhira

241. Satkhira, located in southwestern Bangladesh, is rich in water resources that are integral to its environment and economy. The district is crisscrossed by several significant rivers, including the Bhairab, Khati, and Kalindi. These rivers are essential for irrigation, transportation, and supporting local fisheries.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Numerous canals and ponds are prevalent, providing additional sources of water for agriculture and aquaculture. Satkhira is known for its shrimp farming and other aquaculture practices, contributing significantly to the local economy and exports. The brackish water of the region is particularly suitable for shrimp cultivation. The water from rivers and canals is crucial for irrigating crops, particularly rice, jute, and various fruits and vegetables, which are important for the local economy. Farmers often depend on monsoon rains and river flooding for natural irrigation, which can vary from year to year. The region typically has shallow alluvial aquifers, with varying depths and characteristics. The main aquifers are often composed of sandy and clayey layers, which can affect water quality and availability. Groundwater quality in Satkhira can be impacted by salinity, especially in coastal areas. Saline intrusion due to rising sea levels and excessive extraction can lead to increased salinity, affecting agricultural productivity and drinking water sources.

L. Brahmanbaria

242. Brahmanbaria, located in eastern Bangladesh, features a dynamic river morphology characterized by the interplay of its numerous rivers and tributaries, including the Meghna and its distributaries. Groundwater is a significant resource in Brahmanbaria, providing water for drinking, irrigation, and domestic use. Tubewells and hand pumps are commonly used to access groundwater, though over-extraction in some areas can lead to depletion. The region relies heavily on both surface water and groundwater for agricultural irrigation. Canals and water management systems have been developed to optimize water use, especially during dry seasons. Brahmanbaria has several wetlands that play a crucial role in maintaining biodiversity, supporting fisheries, and providing natural flood control. These wetlands are also important for local livelihoods. Brahmanbaria features both shallow and deep aquifers. Shallow aquifers are generally more vulnerable to pollution and over-extraction, while deeper aquifers may offer more stable supplies. Aquifers composed of sand, silt, and clay deposits. Groundwater recharge mainly occurs through rainfall infiltration and the natural flow of surface water bodies. The water table can fluctuate based on seasonal rains, agricultural irrigation demands, and other extraction activities.

M. Cox's Bazar

243. Cox's Bazar's rivers form an estuarine environment near their mouths where freshwater mixes with saltwater from the Bay of Bengal. Estuaries support diverse ecosystems, including mangrove forests, mudflats, and tidal creeks, which are influenced by tidal dynamics and sedimentation processes. The district's coastline is characterized by beaches and sandbars formed by the deposition of sediments carried by rivers and ocean currents. These features contribute to the unique river morphology of Cox's Bazar, attracting tourists from around the world. Coastal erosion and deposition processes play a significant role in shaping the river morphology of Cox's Bazar. Erosion can lead to changes in coastline configuration, while deposition contributes to the formation of beaches, sandbars, and coastal landforms. The groundwater in Cox's Bazar comes from alluvial aquifers and coastal aquifers. These aquifers can vary in depth and yield, depending on their proximity to the coast and geological formations. Groundwater is extensively used for domestic purposes, irrigation, and supporting the tourism industry. The district is vulnerable to the impacts of climate change, such as rising sea levels and altered rainfall patterns, which can exacerbate salinity and affect groundwater availability.

5.3.7 Environmental Quality

244. The existing environmental quality in the project influence area serves as the basis for identification, prediction and evaluation of potential environmental impacts of the project interventions. The baseline environmental quality has been assessed through field studies during April 2024 within the impact zone and analysis the information for various components of the environment, Air, Noise, Vibration, Soil, EMF, and Water.

A. Air Quality Monitoring

245. Ambient air quality has been monitored on 30 March to 04 April, 2024 at 24 points including 10

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

SS and 14 TL sites in the project areas. The portable OCEANUS AQM-09 Air Quality Monitoring Station and Single Head was used to collect, measure and document critical pollutants including Pb, SPM, PM_{10}, $PM^{27}_{2.5}$, NOx, SO_2, O_3 and CO. The monitoring period was 24 hours at each location. After the monitoring, the data were analyzed by MS Excel as per statistical analysis method and measurements were taken at 1-hour intervals over the period in consonance with the national Bangladesh standards as well as per World Health Organization (WHO) Air Quality Guidelines Global Update, 2021 for air quality.

[27] PM 24 hour is the 99th percentile

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Table 5.3: Result of Ambient Air Quality Analysis

Sample Point	Date	Package Name	GPS Location	SPM	PM_{10}	$PM_{2.5}$	Pb	SO_2	NO_x	O_3	CO
				µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	mg/m³
AAQM-1	02.04.2024	230/132/33 kV AIS: Madhabpur, Habiganj	24° 7'23.97"N, 91°18'57.68"E	88.7	41.8	17.2	BDL	8.3	12.4	9.4	0.35
AAQM-2	30.03.2024	132/33 kV AIS: Paikgacha, Khulna	22°34'43.93"N, 89°17'50.96"E	96.3	49.1	22.4	BDL	11.6	14.8	7.5	0.73
AAQM-3	30.03.2024	132/33 kV AIS: Tungipara, Gopalganj	22°55'7.11"N 89°54'12.42"E	92.4	56.5	23.1	BDL	9.2	13.1	6.9	0.64
AAQM-4	01.04.2024	132/33 kV AIS: Chatkhil/, Noakhali	23° 3'16.58"N 90°59'12.41"E	103.1	67.6	34.9	BDL	16.8	19.3	8.1	0.30
AAQM-5	01.04.2024	132/33 kV AIS: Matlab (N), Chandpur	23°24'48.50"N 90°38'2.21"E	112.6	61.9	32.2	BDL	17.5	21.9	5.7	0.51
AAQM-6	04.04.2024	132/33 kV AIS: Kumarkhali, Kushtia	23°52'14.62"N 89°13'18.28"E	89.2	44.8	17.4	BDL	7.0	8.6	10.1	0.97
AAQM-7	03.04.2024	132/33 kV AIS: Mathbaria, Pirojpur	22°13'56.28"N 89°58'16.58"E	101.1	52.6	24.5	BDL	11.4	14.9	7.3	0.58
AAQM-8	04.04.2024	132/33 kV AIS: Dupchanchia, Bogura	24°53'31.15"N 89° 9'35.45"E	96.2	48.8	19.1	BDL	8.4	11.7	5.2	0.67
AAQM-9	02.04.2024	230/132/33 kV AIS: Monohardi, Narshingdi	24° 7'55.73"N 90°42'31.21"E	119.5	71.3	39.4	BDL	21.8	23.2	9.6	0.75
AAQM-10	31.03.2024	400/230/132 kV AIS: Pekua/ Chakaria, Cox's Bazar	21°45'6.01"N 91°59'31.77"E	95.9	56.4	20.3	BDL	9.8	13.7	7.1	0.22
AAQM-11	02.04.2024	Monohardi-Bajitput 132 kV double circuit line: 21.00 km (Proposed Conductor: Twin ACSR Grosbeak)	24°10'45.51"N 90°44'31.29"E	91.1	50.8	19.2	BDL	7.3	11.7	5.4	0.46
AAQM-12	02.04.2024	Monohardi-Bajitput 132 kV double circuit line: 21.00 km (Proposed Conductor: Twin ACSR Grosbeak)	24°12'18.37"N 90°49'27.30"E	108.6	67.8	34.1	BDL	12.3	17.9	8.2	0.31
AAQM-13	04.04.2024	Monohardi-Bajitput 132 kV double circuit line: 21.00 km (Proposed Conductor: Twin ACSR Grosbeak)	24°13'39.28"N 90°52'53.98"E	110.3	71.7	35.3	BDL	11.9	18.0	7.2	0.66
AAQM-14	31.03.2024	LILO of Existing Matarbari PP – Banskhali PP 400 kV line at Pekua: 6.75 km (Conductor: Quad ACSR Finch)	21°45'24.08"N 91°57'27.41"E	104.4	69.9	32.1	BDL	15.7	19.3	6.2	0.76
AAQM-15	01.04.2024	Kachua – Matlab (N) 132 kV double circuit line: 33.00 km (Proposed Conductor: ACSR Grosbeak)	23°22'39.07"N 90°43'8.45"E	127.1	79.3	28.2	BDL	9.6	10.7	5.4	0.28
AAQM-16	01.04.2024	Kachua – Matlab (N) 132 kV double circuit line: 33.00 km (Proposed Conductor: ACSR Grosbeak)	23°18'1.06"N 90°48'27.77"E	87.5	42.1	19.6	BDL	6.7	5.9	7.2	0.46
AAQM-17	01.04.2024	Kachua – Matlab (N) 132 kV double circuit line: 33.00 km (Proposed Conductor: ACSR Grosbeak)	23°16'4.47"N 90°51'41.53"E	94.7	52.5	24.6	BDL	11.9	16.4	6.8	0.33

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Sample Point	Date	Package Name	GPS Location	SPM	PM_{10}	$PM_{2.5}$	Pb	SO_2	NO_x	O_3	CO
				µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	µg/m³	mg/m³
AAQM-18	03.04.2024	Patuakhali-Bakerganj 132 kV double circuit line: 25 km (Proposed Conductor, ACSR Grosbeak)	22°20'28.77"N 90°1'20.19"E	111.3	73.2	36.8	BDL	18.1	21.7	5.1	0.73
AAQM-19	03.04.2024	Patuakhali-Bakerganj 132 kV double circuit line: 25 Km (Proposed Conductor, ACSR Grosbeak)	22°27'37.05"N 90°3'36.52"E	103.4	51.9	26.8	BDL	11.7	12.4	7.6	0.19
AAQM-20	03.04.2024	Bhandaria-Mathbaria 132 kV double circuit transmission line: 32.00 km (Proposed Conductor: ACSR Grosbeak)	22°44'34.28"N 89°5'37.68"E	97.3	45.7	20.9	BDL	7.6	11.5	9.1	0.50
AAQM-21	03.04.2024	Bhandaria-Mathbaria 132 kV double circuit transmission line: 32.00 km (Proposed Conductor: ACSR Grosbeak)	22°31'20.69"N 89°2'19.14"E	107.8	61.1	31.3	BDL	5.2	7.9	5.6	0.41
AAQM-22	30.03.2024	Satkhira-Paikgacha 132 kV double circuit line: 30.00 km (Proposed Conductor: ACSR Grosbeak)	23° 2'28.57"N 89°50'37.43"E	92.2	49.7	21.8	BDL	9.3	8.2	10.6	0.31
AAQM-23	30.03.2024	Satkhira-Paikgacha 132 kV double circuit line: 30.00 km (Proposed Conductor: ACSR Grosbeak)	23°2'11.00"N 89°49'56.63"E	102	57	23	BDL	9.1	6.3	11.6	0.74
AAQM-24	30.03.2024	Gopalganj – Tungipara 132 kV double circuit line: 19.00 km (Proposed Conductor: ACSR Grosbeak)	24°11'9.59"N 91°20'40.56"E	94	47	18	BDL	7.3	5.9	9.1	0.34
AAQM 25	31.03.2024	Gopalganj – Tungipara 132 kV double circuit line: 19.00 km (Proposed Conductor: ACSR Grosbeak)	23° 2'10.12"N 89°49'57.31"E	106	64	29	BDL	11.8	16.6	7.3	0.71
AAQM26	02.04.2024	Reconductoring of Shahjibazar-Brahmanbaria-Ashuganj 132 kV line: (58+17) = 75.00 km) (Proposed Conductor: CFCC type HTLS equivalent to ACSR Grosbeak)	24°11'8.82"N 91°20'39.59"E	101	59	27	BDL	7.6	11.2	5.3	0.48
		Duration (Hour)		**8**	**24**	**24**	**24**	**24**	**24**	**8**	**8**
		Method		Light Scattering Nephotometer			AAS	High Sensitivity Electrochemical			
		*Bangladesh Standard (µg/m³) mg/m³ for CO		200	150	65	0.5	80	80	100	5
		WHO AQGs 2021		NYS	45	15	NYS	40	25	100	4

*__Standard__: Air Pollution Control Rules on **26th July 2022**; vide S.R.O No. 255-Law/2022 and Environment Conservation Rules (ECR) 1997 through its subsequent amendment on 19th July, 2005; vide S.R.O. No.220-Law/2005, WHO AQGs, 2021 (Global update),

Primary Data Source: EnviroCare International Limited; Reporting Month: **April**, **2024**.

Figure in Red means the parameter is above WHO guidelines

* The Patuakhali-Bakerganj 132kV double circuit line has been removed from the Project's scope after the tests had been done.

** PM_{10}, $PM_{2.5}$ values of the sampling locations are above the ADB and WGB/IFC, 2021 standards, but below the Bangladesh Standard.

** Environmental Quality Monitoring will be conducted again by the EPC Contractor at the final selected site along with detailed design.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

246. Total eight parameters (SPM, PM_{10}, $PM_{2.5}$, NO_x, SO_2, CO, Pb, and O_3) of ambient air quality have been analyzed for each location. The summary results of Air Quality monitoring are given in Table 5.3. Overall, the results show that the level of air pollutants in all of the monitoring locations were found within the permissible limit as per Bangladesh standards; however, PM10 and PM2.5 are observed to be almost universally high when compared to WHO AQGs 2021 guidelines at most locations studied mostly due to the proximity of sites near roads. The concentration of fine particulate matter (PM2.5) varies from 17.2 μg/m^3 to 39.4 μg/m^3 in the project areas. Similarly, the concentration of PM10 also varies from 42.1 μg/m^3 to 73.2 μg/m^3 in the project areas. The concentration of particulate matter in ambient air depends on several factors, such as surrounding activities (traffic movement, construction activities, and road surface dust), weather conditions (wind speed and direction, relative humidity), etc. The air quality reports of various locations and site photos of monitoring are given in Appendix II of the report (Air Quality Analysis report prepared by Envirocare Internation Ltd for PGCB IEE prepared by Tecvy & Feedback Infra).

Follow-up Action proposed:

247. Careful attention will need to be paid to dust management in vicinity of receptors for construction phase. To develop an additional project baseline, the EPC contractor shall collect full set of data during pre-construction phase as per monitoring requirements specified in Table 12.5: Environment Monitoring Plan (EMoP) using accredited laboratory under the direction of SIC. WHO AQGs 2021 guidelines will be followed for the monitoring but with reference to the baseline levels where already exceeded.

B. Noise Level Measurement

248. Noise level was measured from 24 points including 10 SS and 14 TL sites in the monitoring period on 30 March to 04 April 2024. The Lutron SL-4033DS noise level meter was used for noise level monitoring. The EIL survey team conducted the noise measurements from different areas and stations same as the locations for Air Quality Monitoring. The parameters were L-max, L-min, Leq-day, Leq-night. Noise level monitoring carried out at day time (6.00 AM to 9.00 PM) and at night time (9.00 PM to 6.00 AM) and the monitoring period was 24 hours. After the monitoring, the data were analyzed by MS Excel as per statistical analysis method following Bangladesh regulations and as per Guidelines for Community Noise, World Health Organization (WHO), 1999. Measurements were taken at 5-min intervals over the period. The device was recorded data throughout the monitoring period. After getting the raw data from the device, appropriate formula was applied to calculate L_{eq} for the monitoring location. Results of noise level monitoring is shown in Table 5.4 with the L_{eq} calculated for day and night time and Table 5.4 shows the 1hr L_{eq} separately for both the day and night time.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Table 5.4: Result of Noise Level Measurement

Sampling ID	Date	Package Name	GPS Location	Concentration Present (dBA)						Landuse
				Day			Night			
				L_{eq}	L_{max}	L_{min}	L_{eq}	L_{max}	L_{min}	
ANLM-1	02.04.2024	230/132/33 kV AIS: Madhabpur, Habiganj	24° 7'22.48"N 91°18'56.01"E	51.32	71.6	38.9	40.12	50.6	31.7	Mixed
ANLM-2:	30.03.2024	132/33 kV AIS: Paikgacha, Khulna	22°34'44.04"N 89°17'49.79"E	54.83	79.5	43.3	39.65	60.4	35.2	Silent
ANLM-3	30.03.2024	132/33 kV AIS: Tungipara, Gopalganj	22°55'6.54"N 89°54'12.45"E	52.54	69.3	34.9	38.87	53.1	32.8	Mixed
ANLM-4:	01.04.2024	132/33 kV AIS: Chatkhil/, Noakhali	23° 3'16.55"N 90°59'11.37"E	53.79	71.4	40.1	42.60	56.5	38.2	Residential
ANLM-5	01.04.2024	132/33 kV AIS: Matlab (N), Chandpur	23°24'49.60"N 90°38'0.91"E	57.92	78.4	37.7	41.92	58.3	39.1	Mixed
ANLM-6	04.04.2024	132/33 kV AIS: Kumarkhali, Kushtia	23°52'14.44"N 89°13'19.07"E	58.43	70.4	40.3	37.89	57.1	32.5	Mixed
ANLM-7:	03.04.2024	132/33 kV AIS: Mathbaria, Pirojpur	22°13'55.45"N 89°58'16.41"E	50.81	68.5	36.9	33.12	54.7	32.3	Mixed
ANLM-8	04.04.2024	132/33 kV AIS: Dupchanchia, Bogura	24°53'33.17"N 89° 9'33.57"E	53.56	70.1	36.5	37.98	60.2	40.6	Residential
ANLM-9	02.04.2024	230/132/33 kV AIS: Monohardi, Narshingdi	24° 7'52.91"N 90°42'40.94"E	56.39	73.4	40.3	41.45	58.8	34.2	Mixed
ANLM-10	31.03.2024	400/230/132 kV AIS: Pekua/ Chakaria, Cox's Bazar	21°45'6.25"N 91°59'24.24"E	50.73	67.2	38.6	38.32	54.1	33.5	Residential
ANLM-11	02.04.2024	Monohardi-Bajitput 132 kV double circuit line: 25 20.5 km (Proposed Conductor: Twin ACSR Grosbeak)	24°10'45.61"N 90°44'29.90"E	59.47	81.4	47.2	43.83	61.9	39.7	Mixed
ANLM-12	02.04.2024	Monohardi-Bajitput 132 kV double circuit line: 25 20.5 km (Proposed Conductor: Twin ACSR Grosbeak)	24°12'17.82"N 90°49'28.35"E	56.42	77.3	46.9	41.76	58.7	39.6	Mixed
ANLM-13	04.04.2024	Monohardi-Bajitput 132 kV double circuit line: 25 20.5 km (Proposed Conductor: Twin ACSR Grosbeak)	24°13'38.79"N 90°52'54.98"E	52.48	69.6	43.5	40.12	56.5	37.3	Silent
ANLM-14	31.03.2024	LILO of Existing Matarbari PP – Banskhali PP 400 kV line at MatarbariPekua: 6.75 km (Conductor: Quad ACSR Finch)	21°45'27.18"N 91°57'30.74"E	59.40	80.3	47.9	44.12	58.6	39.6	Mixed
ANLM-15	01.04.2024	Kachua – Matlab (N) 132 kV double circuit line: 33.00 km (Proposed Conductor: ACSR Grosbeak)	23°22'38.23"N 90°43'5.82"E	57.89	73.3	42.6	38.23	60.1	33.9	Mixed
ANLM-16	01.04.2024	Kachua – Matlab (N) 132 kV double circuit line: 33.00 km (Proposed	23°18'0.84"N	56.27	75.6	41.1	37.50	62.2	36.3	Mixed

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Sampling ID	Date	Package Name	GPS Location	Concentration Present (dBA)						Landuse
				Day			Night			
				L_{eq}	L_{max}	L_{min}	L_{eq}	L_{max}	L_{min}	
		Conductor: ACSR Grosbeak)	90°48'28.99"E							
ANLM-17	01.04.2024	Kachua – Matlab (N) 132 kV double circuit line: 33.00 km (Proposed Conductor: ACSR Grosbeak)	23°16'4.21"N 90°51'42.11"E	60.91	84.7	38.4	46.56	57.3	31.5	Residential
ANLM-18	03.04.2024	Patuakhali-Bakerganj 132 kV double circuit line: 25 Km (Proposed Conductor, ACSR Grosbeak)	22°20'29.96"N 90° 1'20.62"E	53.60	67.6	44.3	37.97	51.1	32.7	Mixed
ANLM-19	03.04.2024	Patuakhali-Bakerganj 132 kV double circuit line: 25 Km (Proposed Conductor, ACSR Grosbeak)	22°27'35.50"N 90° 3'36.22"E	58.23	76.5	47.8	41.87	62.4	34.8	Silent
ANLM-20	03.04.2024	Bhandaria-Mathbaria 132 kV double circuit transmission line: 32.00km (Proposed Conductor: ACSR Grosbeak)	22°44'34.94"N 89° 5'36.98"E	49.03	68.4	43.7	36.79	49.6	31.8	Mixed
ANLM-21	03.04.2024	Bhandaria-Mathbaria 132 kV double circuit transmission line: 32.00 km (Proposed Conductor: ACSR Grosbeak)	22°31'21.66"N 89° 2'21.46"E	53.67	70.1	42.3	40.16	64.3	37.8	Mixed
ANLM-22	30.03.2024	Satkhira-Paikgacha 132 kV double circuit line: 30.00 km (Proposed Conductor: ACSR Grosbeak)	23° 2'28.99"N 89°50'39.09"E	51.98	68.6	40.1	37.62	60.3	34.8	Residential
ANLM-23	30.03.2024	Satkhira-Paikgacha 132 kV double circuit line: 30.00 km (Proposed Conductor: ACSR Grosbeak)	23° 2'10.68"N 89°49'57.12"E	57.91	73.4	46.6	42.13	67.2	34.8	Mixed
ANLM-24	30.03.2024	Gopalganj – Tungipara 132 kV double circuit line: 19.00 km (Proposed Conductor: ACSR Grosbeak)	24°11'8.87"N 91°20'42.67"E	53.46	74.9	38.3	39.51	61.4	32.8	Silent
ANLM 25	31.03.2024	Gopalganj – Tungipara 132 kV double circuit line: 19.00 km (Proposed Conductor: ACSR Grosbeak)	23° 2'10.12"N 89°49'57.31"E	56.17	76.5	41.1	40.01	62.8	32.2	**Mixed**
ANLM 26	02.04.2024	Reconductoring of Shahjibazar-Brahmanbaria-Ashuganj 132 kV line: (58+17) = 75.00 km) (Proposed Conductor: CFCC type HTLS equivalent to ACSR Grosbeak)	24°11'8.82"N 91°20'39.59"E	52.45	68.1	42.4	34.12	60.1	33.6	**Mixed**

Bangladesh Standard	Day Time	Night Time
Industrial area	75	70
Commercial	70	60
Mixed area	60	50
Residential area	55	45
Silent Area	50	40
World Bank/IFC (WHO Guideline)		
Industrial area	70	70

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Sampling ID	Date	Package Name	GPS Location	Concentration Present (dBA)						Landuse	
				Day			Night				
				L_{eq}	L_{max}	L_{min}	L_{eq}	L_{max}	L_{min}		
			Residential; Intuitional; Educational							55	45

Standard: The Environment Conservation Rules (ECR), 1997 and Subsequent amendment in 2006, Primary Data Source: EnviroCare International Limited; Reporting Month: April 2024.

Figure in Red means the parameter is above WBG/IFC (WHO) guidelines

* The Patuakhali-Bakerganj 132kV double circuit line has been removed from the Project's scope after the tests had been done.
** Environmental Quality Monitoring will be conducted again by the EPC Contractor at the final selected site along with detailed design.

Table 5.5: Results of 1-hour L_{eq} for both Day and Night Time

Sampling ID	Landuse	1hr Leq																						
		Day (6 AM to 9 PM)															Night (9 PM to 6 AM)								
		6-7	7-8	8-9	9-10	10-11	11-12	12-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	1--11	11-12	12-1	1-2	2-3	3-4	4-5	5-6
ANLM-1	Mixed	47.1	47.1	47.4	47.6	47.8	44.4	44.6	45.8	43.8	44.1	44.4	44.8	44.0	44.4	44.9	40.9	41.3	40.9	41.7	37.1	35.9	37.9	37.5	34.8
ANLM-2	Silent	49.9	49.3	49.6	52.1	48.0	46.0	46.2	47.4	44.5	44.1	44.2	44.6	45.5	46.0	47.7	43.3	43.7	43.3	44.1	39.1	37.1	39.1	38.5	35.4
ANLM-3	Mixed	51.6	51.0	51.3	51.5	52.2	49.5	49.7	50.9	46.2	46.4	46.8	47.2	46.4	46.8	47.3	36.0	35.2	36.1	35.6	36.8	35.9	37.9	37.3	36.2
ANLM-4	Residential	49.6	49.0	49.3	49.5	50.5	47.5	47.7	48.9	46.9	47.4	47.7	48.1	47.3	48.6	53.2	42.0	42.4	42.1	42.8	40.6	38.8	40.1	40.0	40.4
ANLM-5	Mixed	53.4	51.7	51.2	51.4	56.4	53.6	53.8	55.0	48.8	48.3	48.6	49.0	48.2	48.6	53.3	40.7	41.3	41.1	41.7	40.4	40.8	39.5	39.7	39.4
ANLM-6	Mixed	52.2	51.6	51.9	52.1	52.3	49.5	49.7	50.9	55.0	58.8	59.1	59.5	58.7	59.1	57.2	37.1	37.5	37.1	37.9	36.5	34.8	36.8	36.4	34.6
ANLM-7	Mixed	49.8	49.2	49.5	49.7	49.1	46.0	46.2	47.4	44.4	44.6	46.4	45.3	45	45.7	46.2	40.9	41.3	41.7	37.4	35.9	37.9	37.5	34.9	40.9
ANLM-8	Residential	49.5	48.9	49.2	49.4	49.4	46.3	46.5	47.7	49.4	52.2	52.4	52.5	51.7	52.1	52.6	41.2	40.9	41.5	40.9	42.5	40.9	41.2	41.2	40.9
ANLM-9	Mixed	51.2	50.6	50.9	52.9	50.0	48.3	48.5	49.7	48.4	55.8	56.1	56.5	55.6	55.1	54.8	40.9	41.3	40.9	43.0	37.4	36.1	37.9	37.2	35.6
ANLM-10	Residential	49.2	48.6	48.9	51.0	48.9	46.8	47.0	48.2	45.7	46.3	46.6	47.0	46.2	46.5	45.5	40.9	41.3	41.9	41.7	36.5	35.9	37.9	37.5	35.1
ANLM-11	Mixed	49.0	49.0	49.3	49.7	49.9	51.8	48.0	47.3	47.3	47.4	50.3	50.0	49.6	49.6	50.9	42.9	41.3	41.4	41.6	40.8	39.3	39.1	39.7	40.0
ANLM-12	Mixed	50.9	53.6	51.6	51.8	51.9	50.0	50.3	50.7	48.5	48.2	48.2	48.5	48.2	48.2	50.1	40.9	41.3	40.9	41.7	41.4	40.3	42.3	41.9	38.4
ANLM-13	Silent	49.6	49.0	49.3	49.5	49.4	46.3	46.5	47.7	48.6	49.8	50.1	50.5	49.7	50.1	50.7	37.9	38.1	38.2	38.2	39.5	37.5	37.5	37.5	37.9

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Sampling ID	Landuse	1hr Leq																						
		Day (6 AM to 9 PM)															Night (9 PM to 6 AM)								
		6-7	7-8	8-9	9-10	10-11	11-12	12-1	1-2	2-3	3-4	4-5	5-6	6-7	7-8	8-9	9-10	1--11	11-12	12-1	1-2	2-3	3-4	4-5	5-6
ANLM-14	Mixed	51.6	51.6	50.0	50.0	55.5	53.6	53.6	53.6	55.2	56.7	56.7	54.8	54.8	55.5	56.9	41.7	42.2	42.6	43.1	44.8	43.7	43.2	41.7	42.4
ANLM-15	Mixed	59.2	58.6	58.9	59.1	52.2	47.0	47.2	48.4	52.9	55.5	55.6	55.1	57.4	56.5	57.6	34.0	34.0	34.0	34.0	36.3	34.0	34.0	34.0	34.0
ANLM-16	Mixed	49.1	48.5	51.1	56.0	54.8	52.8	53.0	54.2	52.4	48.6	49.2	49.5	47.7	46.8	47.3	40.9	41.3	40.9	43.5	38.0	36.7	37.8	37.9	37.0
ANLM-17	Residential	38.5	38.5	38.5	38.5	43.5	39.6	41.9	46.3	39.2	38.5	38.5	38.5	38.5	38.5	38.5	46.9	47.3	46.9	47.7	43.2	42.0	44.0	43.9	43.7
ANLM-18	Mixed	49.8	49.3	49.5	49.7	49.3	49.7	48.1	48.8	48.0	49.6	52.6	55.4	54.7	54.6	54.2	41.2	41.6	41.2	42.0	37.4	37.2	38.2	37.8	35.3
ANLM-19	Silent	55.7	55.2	55.3	55.2	55.5	54.8	55.8	52.0	51.5	55.6	56.7	57.0	56.7	56.7	58.6	40.9	41.3	42.6	41.7	40.2	37.8	38.2	38.6	38.9
ANLM-20	Mixed	47.1	46.6	48.3	47.7	46.8	45.2	45.4	46.1	45.2	45.1	45.2	45.6	45.0	45.1	45.6	40.2	41.4	40.8	41.6	36.7	36.1	38.1	37.7	35.3
ANLM-21	Mixed	52.1	53.2	51.8	52.0	50.9	48.8	49.1	50.2	48.7	48.7	49.0	49.4	48.6	49.0	53.5	41.0	41.3	42.7	41.7	39.4	37.8	38.5	38.6	38.3
ANLM-22	Residential	48.8	48.2	51.0	49.7	48.4	46.5	46.7	47.9	46.3	46.2	46.5	48.9	50.3	50.7	51.3	40.9	41.3	42.5	41.7	37.1	36.2	37.9	37.5	35.9
ANLM-23	Mixed	57.0	57.6	52.3	52.4	53.5	51.7	51.7	52.3	55.8	58.5	58.5	58.9	58.5	56.3	55.6	40.9	41.3	40.9	44.0	37.0	36.2	37.9	37.5	36.3
ANLM-24	Silent	47.2	46.6	49.5	47.6	46.5	44.4	44.6	45.8	43.8	44.1	42.5	43.3	42.0	43.0	42.5	40.9	41.3	42.4	41.7	36.7	35.9	37.9	37.5	35.5
ANLM 25	Mixed	53.8	53.2	53.5	53.7	50.4	46.4	46.6	47.8	47.5	48.6	48.8	48.7	47.9	48.3	48.6	32.3	32.3	32.3	32.3	35.6	32.3	33.0	33.4	32.3
ANLM 26	Mixed	51.2	50.6	50.9	51.1	51.2	48.5	48.7	49.9	48.2	48.8	49.1	49.5	48.7	49.0	49.1	35.0	36.0	35.2	36.4	37.5	35.2	35.6	35.2	34.4

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

249. All the project areas are categorized as silent, residential, and mixed respectively although it should be noted the WHO guidelines apply on a receptor not area basis. The summary results of Noise Quality monitoring are given in Table 5.3. After analyzing the data, it has been observed that noise level has not generally crossed the Bangladesh standard or WBG/IFC (WHO) guidelines except some variations both in day and night time. The overall the results show that the level of noise pollutants in most of the monitoring locations were found within the permissible limit as per Bangladesh standards or WBG/IFC (WHO) guidelines; however, Leq (daytime) are observed for some locations to be high when compared to residential and silent Bangladesh standards and WBG/IFC (WHO) guidelines; the significant reasons behind posing noise in the project area might be high wind speed, vehicle's movement, public gathering and so on. The noise level analysis data and site photos of monitoring are given in Appendix II of the report (Noise Level Analysis report prepared by Envirocare International Ltd for PGCB IEE prepared by Tecvy & Feedback Infra).

Follow-up Action proposed:

250. Careful attention will need to be paid to noise pollution to local community living in the vicinity of receptors for construction phase. To develop additional project baseline, the EPC contractor shall collect full set of data during pre-construction phase as per monitoring requirements specified in Table 12.5: Environment Monitoring Plan (EMoP) using accredited laboratory under the direction of SIC. The more stringent of Bangladesh area standard or IFC/World Bank's EHS guidelines on receptor basis will be followed for the monitoring.

C. Vibration Level Measurement

251. Vibration level monitoring was measured at 26 locations of the project areas on 30 March to 04 April 2024. Vibration level monitoring was carried out for 15-minute duration at day time only in the monitoring period. Within this duration, velocity data for 10 minutes, Acceleration data for another 10 minutes and displacement data for last 10 minutes were taken. The HTC VB- 8205 meter was used for vibration level monitoring. The device was recorded data throughout the monitoring period. After getting the raw data from the device, appropriate formula was applied to calculate vibration level for monitor location. Vibration level monitoring photos can be found in Figure 5.30.

Table 5.6: Results of Vibration Level Analysis

SN	Location	Date	Monitoring Locations	Vibration Level (mm/s)	BD Standard, ECR 2023	International Standard (BS 5228-2:2009)
1	VLM 01	02.04.2024	230/132/33 kV AIS: Madhabpur, Habiganj	0.1	NYS	**0.3 mm/sec** Vibration might be just perceptible in residential environments.
2	VLM 02	30.03.2024	132/33 kV AIS: Paikgacha, Khulna	0.1		
3	VLM 03	30.03.2024	132/33 kV AIS: Tungipara, Gopalganj	0.2		
4	VLM 04	01.04.2024	132/33 kV AIS: Chatkhil/, Noakhali	0.1		
5	VLM 05	01.04.2024	132/33 kV AIS: Matlab (N), Chandpur	0.15		
6	VLM 06	04.04.2024	132/33 kV AIS: Kumarkhali, Kushtia	0.2		
7	VLM 07	03.04.2024	132/33 kV AIS: Mathbaria, Pirojpur	0.25		
8	VLM 08	04.04.2024	132/33 kV AIS: Dupchanchia, Bogura	0.1		
8	VLM 09	02.04.2024	230/132/33 kV AIS: Monohardi, Narshingdi	0.1		
10	VLM 10	31.03.2024	400/230/132 kV AIS: Pekua/ Chakaria, Cox's Bazar	0.1		
11	VLM 11	02.04.2024	Monohardi-Bajitput 132 kV double circuit line: 21.00 km (Proposed Conductor: Twin ACSR Grosbeak)	0.15		
12	VLM 12	02.04.2024	Monohardi-Bajitput 132 kV double circuit line: 21.00 km (Proposed Conductor: Twin ACSR Grosbeak)	0.2		
13	VLM 13	04.04.2024	Monohardi-Bajitput 132 kV double circuit line: 21.00 km (Proposed Conductor: Twin ACSR Grosbeak)	0.2		
14	VLM 14	31.03.2024	LILO of Existing Matarbari PP – Banskhali PP	0.1		

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

SN	Location	Date	Monitoring Locations	Vibration Level (mm/s)	BD Standard, ECR 2023	International Standard (BS 5228-2:2009)
			400 kV line at Pekua: 6.75 km (Conductor: Quad ACSR Finch)			
15	VLM 15	01.04.2024	Kachua – Matlab (N) 132 kV double circuit line: 33.00 km (Proposed Conductor: ACSR Grosbeak)	0.1		
16	VLM 16	01.04.2024	Kachua – Matlab (N) 132 kV double circuit line: 33.00 km (Proposed Conductor: ACSR Grosbeak)	0.1		
17	VLM 17	01.04.2024	Kachua – Matlab (N) 132 kV double circuit line: 33.00 km (Proposed Conductor: ACSR Grosbeak)	0.2		
18	VLM 20	03.04.2024	Bhandaria-Mathbaria 132 kV double circuit transmission line: 32.00 km (Proposed Conductor: ACSR Grosbeak)	0.2		
19	VLM 21	03.04.2024	Bhandaria-Mathbaria 132 kV double circuit transmission line: 32.00 km (Proposed Conductor: ACSR Grosbeak)	0.1		
20	VLM 22	30.03.2024	Satkhira-Paikgacha 132 kV double circuit line: 30.00 km (Proposed Conductor: ACSR Grosbeak)	0.25		
21	VLM 23	30.03.2024	Satkhira-Paikgacha 132 kV double circuit line: 30.00 km (Proposed Conductor: ACSR Grosbeak)	0.1		
22	VLM 24	30.03.2024	Gopalganj - Tungipara 132 kV double circuit line: 19.00 Km (Proposed Conductor: ACSR Grosbeak)	0.1		
23	VLM 25	31.03.2024	Gopalganj-Tungipara 132 kV double circuit line: 19.00 Km (Proposed Conductor: ACSR Grosbeak	0.2		
24	VLM 26	02.04.2024	Reconductoring of Shahjibazar-Brahmanbaria-Ashuganj 132 kV line: (58+17) = 75.00 km) (Proposed Conductor: CFCC type HTLS equivalent to ACSR Grosbeak)	0.25		

Vibration Level	Effect
0.14 mm/sec	Vibration might be just perceptible in the most sensitive situations for most vibration frequencies associated with construction. At lower frequencies, people are less sensitive to vibration.
0.3 mm/sec	Vibration might be just perceptible in residential environments.
1.0 mm/sec	It is likely that vibration of this level in residential environments will cause complaint but can be tolerated if prior warning and explanation has been given to residents.
10 mm/sec	Vibration is likely to be intolerable for any more than a very brief exposure to this level in most building environments.

** Environmental Quality Monitoring will be conducted again by the EPC Contractor at the final selected site along with detailed design.

252. There is no vibration standard in Bangladesh according to ECR, 2023 and other relevant rules/guidelines but the standard is set out internationally by BS 5228-2:2009.

253. The summary findings of vibration level analysis are given in Table 5.6. From the measured data it has been found that, the vibration level of the maximum monitoring locations is insignificant, negligible and not perceptible in residential environments and within the British standard level. The results table shows that the highest velocity level was observed 0.25 mm/s as well as the lowest velocity level was observed 0.1 mm/s respectively. As a result, the residents of the surrounding environment

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

residing near the project site do not feel the frequency level in an intolerable and annoying way which do not break their concentration and integrity towards their work subsequently. The vibration level analysis data as site photos of monitoring are given in Appendix II of the report (Vibration Level Analysis report prepared by Envirocare Internation Ltd for PGCB IEE prepared by Tecvy & Feedback Infra).

D. Groundwater (Drinking Water) Quality

254. The groundwater samples were collected by maintaining standard procedures from 26 locations of the project areas on 30 March to 04 April 2024. After collected, the samples were placed into appropriate and labeled black bottle and kept in an ice cooler. Then the samples were submitted to the referred laboratory for analysis of parameters. Groundwater results has been compared with national standard [ECR, 2023-Schedule 2 (B)]. The analysis methods of different parameters of groundwater and Results are shown in Table 5.8.

255. The analysis process has been conducted by BEETLSL Laboratory. According to The Environment Conservation Rules (ECR) 2023, Schedule 2-B Standard for Drinking Water", Arsenic, Chloride, Coliform (Fecal), Coliform (Total), Iron, Manganese, pH, Salinity and the rest of the parameters are considered as priority contaminants.

256. It has been observed that most of the parameter's value lies within the standard except iron (there is no set WHO standard for this) in some locations as per GOB guideline. Manganese is high in some locations whereas the turbidity is uniformly high at all locations when compared to WHO standards. The fecal coliform level is zero. The samples exceeding the national/DoE standard by the value of iron and turbidity has been outlined below in Table 6.7. All the polluted drinking water sources may negative impact on the health of the local people, staff etc. in the project areas through consuming the water if it is not adequately treated.

257. Due to their geographical formation, some areas naturally contain a comparatively higher amount of iron, and people are habituated to this situation. Groundwater may have high iron concentrations due to the redox (reduction-oxidation) conditions present. In anaerobic (low-oxygen) environments, iron is often found in its reduced form (ferrous iron, Fe^{2+}), which is more soluble in water compared to its oxidized form (ferric iron, Fe^{3+}). When groundwater is low in oxygen, ferrous iron can be present in higher concentrations. Iron is commonly found in soil and rock formations. When groundwater interacts with iron-rich minerals such as iron sulfides (e.g., pyrite), iron may dissolve into the water. Construction, mining, or excavation activities may adisturb the soil and introduce sediments into the groundwater. This may be exacerbated if the activities are near wells or other sources of groundwater. Certain types of contamination, such as runoff from agricultural areas that carries pesticides or fertilizers, can also impact turbidity levels in groundwater.

Table 5.7; Samples with high Fe and turbidity values

Sampling Points with high Fe	Sampling Points with high turbidity values
GW-02, GW-05, GW-10, GW-14, GW-15, GW-16, GW-17, GW-18, GW-19, GW-22, GW-23	GW-03, GW-04, GW-07, GW-08, GW-09, GW-11, GW-12, GW-13, GW-14, GW-17, GW-20, GW-22, GW-24

258. The Groundwater analysis data and site photos of monitoring are given in Appendix II of the report (Groundwater Analysis report prepared by Bangladesh Environmental Engineering Training and Lab Services Ltd. for PGCB IEE prepared by Tecvy & Feedback Infra).

Follow-up Action proposed:

259. EMP suggests that EPC contractors and PGCB staff should be provided with RO based water filter or bottle drinking water so the worker/staff do not drink for unsafe or untreated ground water sources. However, to develop additional project baseline, the EPC contractor shall collect full set of data during

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

pre-construction phase as per monitoring requirements specified in Table 12.5: Environment Monitoring Plan (EMoP) using accredited laboratory under the direction of SIC. GOB and WHO drinking water guidelines will be followed for the monitoring.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Table 5.8: Results of Groundwater Quality Monitoring

SN	Sampling ID	GPS Location	Concentration presents in parameters											
			Arsenic	Chloride	Coliform (Faecal)	Coliform (Total)	EC	Iron (Fe)	Manganese (Mn)	Odor	PCBs	pH	Salinity	Turbidity
1	GW-01	24° 7'55.71"N 91°17'41.06"E	0.002	18	0	0	139	0.4	0.03	Odorless	<0.5	7.7	0.15	5
2	GW-02	22°34'43.07"N 89°17'49.52"E	0.003	10	0	0	131	1.4	0.07	Odorless	<0.5	7.4	0.21	3
3	GW-03	22°55'0.73"N 89°54'9.30"E	0.004	29	0	0	150	0.6	0.05	Odorless	<0.5	7.6	0.22	9
4	GW-04	23° 3'15.56"N 90°59'15.74"E	0.002	31	0	0	152	0.8	0.03	Odorless	<0.5	7.3	0.16	6
5	GW-05	23°24'49.90"N 90°37'59.83"E	0.001	16	0	0	137	1.2	0.02	Odorless	<0.5	7.2	0.13	3
6	GW-06	23°52'13.23"N 89°13'16.60"E	0.003	45	0	0	166	0.3	0.03	Odorless	<0.5	7.8	0.21	4
7	GW-07	22°13'51.68"N 89°58'9.92"E	0.001	40	0	0	161	0.6	0.05	Odorless	<0.5	7.7	0.15	7
8	GW-08	24°53'35.04"N 89° 9'36.58"E	0.002	20	0	0	141	0.7	0.01	Odorless	<0.5	7.7	0.13	11
9	GW-09	24° 7'53.81"N 90°42'41.94"E	0.004	17	0	0	138	0.5	0.07	Odorless	<0.5	7.3	0.14	8
10	GW-10	21°44'54.62"N 91°59'34.97"E	0.002	14	0	0	135	1.1	0.05	Odorless	<0.5	7.1	0.29	4
11	GW-11	24°10'48.68"N 90°44'32.63"E	0.001	27	0	0	148	0.6	0.04	Odorless	<0.5	7.6	0.27	9
12	GW-12	24°12'20.12"N 90°49'35.97"E	0.003	33	0	0	154	0.1	0.02	Odorless	<0.5	7.7	0.19	6
13	GW-13	24°13'38.68"N 90°53'0.34"E	0.002	23	0	0	144	0.9	0.03	Odorless	<0.5	7.5	0.16	10
14	GW-14	21°45'13.74"N 91°57'31.87"E	0.004	13	0	0	134	1.4	0.02	Odorless	<0.5	7.4	0.18	6
15	GW-15	23°22'36.81"N 90°43'0.04"E	0.002	17	0	0	138	1.5	0.04	Odorless	<0.5	7.2	0.27	4

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

SN	Sampling ID	GPS Location	Concentration presents in parameters											
			Arsenic	Chloride	Coliform (Faecal)	Coliform (Total)	EC	Iron (Fe)	Manganese (Mn)	Odor	PCBs	pH	Salinity	Turbidity
16	GW-16	23°17'50.31"N 90°48'25.96"E	0.001	15	0	0	136	1.3	0.06	Odorless	<0.5	7.2	0.24	2
17	GW-17	23°16'3.37"N 90°51'35.34"E	0.003	21	0	0	142	1.2	0.09	Odorless	<0.5	7.5	0.31	8
18	GW-18	22°22'2.08"N 90°18'44.43"E	0.002	13	0	0	134	1.4	0.11	Odorless	<0.5	7.1	0.16	3
19	GW-19	22°31'6.21"N 90°18'36.04"E	0.001	12	0	0	133	1.1	0.08	Odorless	<0.5	7.2	0.20	4
20	GW-20	22°20'31.08"N 90° 1'24.06"E	0.004	22	0	0	143	1.0	0.04	Odorless	<0.5	7.5	0.13	9
21	GW-21	22°27'29.75"N 90° 3'29.95"E	0.002	29	0	0	150	0.8	0.03	Odorless	<0.5	7.7	0.25	3
22	GW-22	22°44'39.43"N 89° 5'47.92"E	0.003	22	0	0	143	1.2	0.10	Odorless	<0.5	7.1	0.15	9
23	GW-23	22°31'28.01"N 89° 2'19.95"E	0.001	17	0	0	138	1.4	0.09	Odorless	<0.5	7.3	0.21	4
24	GW-24	23° 2'29.50"N 89°50'37.54"E	0.003	44	0	0	165	0.8	0.03	Odorless	<0.5	7.6	0.24	6
25	GW-25	23° 2'9.81"N 89°49'56.17"E	0.001	40	0	0	161	0.6	0.05	Odorless	<0.5	7.5	0.15	2
26	GW-26	24°11'6.31"N 91°20'49.21"E	0.002	29	0	0	150	0.5	0.07	Odorless	<0.5	7.4	0.12	4
Unit			mg/L	mg/L	CFU/100 mL	CFU/100 mL	µS/cm	mg/L	mg/L	-	µg/L	--	ppt	NTU
Analysis Method			AAS	Titrimetric	MFM	MFM	EC Meter	AAS	AAS	Threshold Method	Chromatographic	pH Meter	Multimeter	Turbidity Meter
Bangladesh Standard, ECR 2023			0.05	250*	0	0	NYS	0.3-1.0	0.4	NYS	NYS	6.5-8.5	NYS	5
WHO Standard, 2024			0.01	NYS	0	0	NYS	NYS	0.08	NYS	NYS	6.5-8.5	NYS	<1

*The Environment Conservation Rules (ECR) 2023, Schedule-2B Standard for Safe Drinking Water, WHO-Guidelines for drinking water quality, 15 February, 2024

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

* Bangladesh Environmental Engineering Training & Lab Services Ltd. (BEETLSL)
* NYS = Not Yet Set

Figure in Red means the parameter is above WHO guidelines. Figure in Blue means that parameter is above Bangladesh Standards and there is no corresponding level set for that parameter by WHO.

** Environmental Quality Monitoring will be conducted again by the EPC Contractor at the final selected site along with detailed design.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

E. Surface Water Quality

260. A total of 26 water samples were taken from representative locations of canals, rivers, and ponds of the project areas on 30 March to 04 April 2024. Samples were collected from the center of the water body approximately 0.5 m below the water surface, following standard procedures for container preparation, and sample collection, storage and preservation.

261. During surface water collection USEPA surface water sampling guideline (https://www.epa.gov/quality/surface-water-sampling) was followed. Water samples were collected as grab samples in a pre-washed 5-litre plastic can and a 1-litre sterilized clean PET bottle for complete Physico-chemical tests respectively. Samples were labeled properly. After that, the samples were submitted to the referred laboratories for analysis of parameters. After analysis, surface water results have been compared with the national standards [ECR-2023, schedule-2A]. The name of the water quality parameters and their determination methods and results are shown in Table 5.9.

262. Total Twenty-six (26) samples were collected from the project areas in summer season and the tests were analyzed in BEETLSL laboratory. Ammonia, BOD, COD, Coliform (Total), DO, pH, TDS, TSS, Turbidity, Oil and Grease and some other parameters have been tested as these parameters are considered as the priority contaminants according to the ECR 2023 standard and are indicators of pollution.

263. There are six categorical standards set out by DoE for inland surface water sources which all are applicable to compare with the observed parameter's value. The comparison with ECR 2023 (category d-water use for fisheries) is portrayed in this report only to simplify the understanding of the water condition in the project area as Bangladesh is a riverine country and these surface water sources are highly applicable to fish farming according to the opinion of local people. According to the comparison, the value of all parameters is within the standard value or limit for fisheries use. Some fluctuations of parameter's value have been observed at SW-01, SW-02, SW-05, SW-10, SW-14, SW-15, SW-16, SW-17, SW-18, SW-19, SW-22, and SW-23 compared to other locations because of the geological variations and some locations fall also in the coastal parts of Bangladesh[28]. In conclusion, it has been figured out that, all the waterbodies (ponds, rivers, and canal) are in a pollution free state with no severe negative impact on the surrounding area and biodiversity. The surface water analysis data and site photos of monitoring are given in Appendix II of the report (Surface Water Analysis report prepared by Bangladesh Environmental Engineering Training and Lab Services Ltd. for PGCB IEE prepared by Tecvy & Feedback Infra).

Follow-up Action proposed:

264. There are no IFC/World Bank's EHS guidelines corresponding for surface water so national standards will be followed. To develop additional project baseline, the EPC contractor shall collect full set of data during pre-construction phase (nearest waterbody in 500m) as per the monitoring requirements specified in Table 12.5: Environment Monitoring Plan (EMoP) using accredited laboratory under the direction of SIC.

[28] For coastal areas, the standards for coastal water are outlined in Schedule A-2 of ECR, 2023.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Table 5.9: Results of Surface Water Quality Monitoring

SN	ID	GPS Location	Concentration Presents in Parameters												
			Ammonia	BOD	COD	Chloride	Coliform (Total)	DO	pH	PO_4	(PCBs)	TDS	TSS	Turbidity	Odor	Oil and Grease
1	SW-01	24° 7'21.82"N 91°18'51.34"E	0.31	3	5	134	9	7.48	8.0	0.22	<0.5	33	5	4.24	Odorless	1.2
2	SW-02**	22°34'41.53"N 89°17'49.09"E	0.39	5	7	181	11	6.56	7.8	0.36	<0.5	88	7	6.88	Odorless	1.6
3	SW-03**	22°54'59.21"N 89°54'7.18"E	0.41	4	6	72	9	7.12	7.0	0.33	<0.5	91	6	7.36	Odorless	1.4
4	SW-04**	23° 3'17.59"N 90°59'11.81"E	0.39	3	4	47	10	6.48	7.1	0.41	<0.5	67	7	6.98	Odorless	1.6
5	SW-05**	23°24'50.33"N 90°38'0.74"E	0.44	5	11	135	10	8.36	7.9	0.49	<0.5	47	4	4.54	Odorless	1.2
6	SW-06	23°52'10.73"N 89°13'14.39"E	0.33	4	7	111	10	8.36	7.1	0.44	<0.5	29	5	5.66	Odorless	1.5
7	SW-07**	22°13'57.96"N 89°58'15.05"E	0.30	3	5	211	18	7.18	6.9	0.37	<0.5	88	7	6.18	Odorless	1.3
8	SW-08	24°53'38.24"N 89° 9'29.03"E	0.32	2	4	134	9	7.48	7.1	0.46	<0.5	91	5	6.23	Odorless	1.6
9	SW-09	24° 8'5.71"N 90°42'14.43"E	0.41	3	6	121	8	6.75	7.2	0.33	<0.5	34	4	6.11	Odorless	1.4
10	SW-10**	21°45'4.79"N 91°58'49.80"E	0.31	3	5	156	9	7.48	8.0	0.46	<0.5	33	5	4.24	Odorless	1.2
11	SW-11	24°10'46.37"N 90°44'30.08"E	0.33	3	5	88	10	6.14	7.1	0.15	<0.5	90	6	6.18	Odorless	1.6
12	SW-12	24°12'16.95"N 90°49'27.77"E	0.41	4	9	144	19	5.73	7.2	0.23	<0.5	66	5	7.12	Odorless	1.2
13	SW-13	24°13'35.45"N 90°53'0.09"E	0.47	3	7	134	9	5.39	7.1	0.28	<0.5	52	7	5.98	Odorless	1.5
14	SW-14**	21°45'25.45"N 91°57'36.37"E	0.32	3	6	177	17	6.98	8.1	0.17	<0.5	30	7	4.63	Odorless	1.4
15	SW-15**	23°22'39.37"N 90°43'0.70"E	0.40	4	6	134	9	6.45	7.7	0.11	<0.5	31	4	4.89	Odorless	1.6
16	SW-16**	23°18'1.06"N 90°48'20.67"E	0.33	5	7	94	12	6.27	7.9	0.17	<0.5	37	6	5.09	Odorless	1.3

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

SN	ID	GPS Location	Concentration Presents in Parameters													
			Ammonia	BOD	COD	Chloride	Coliform (Total)	DO	pH	PO_4	(PCBs)	TDS	TSS	Turbidity	Odor	Oil and Grease
17	SW-17**	23°16'4.53"N 90°51'35.99"E	0.38	3	9	133	8	6.83	7.8	0.35	<0.5	34	6	4.65	Odorless	1.5
18	SW-18**	22°21'48.01"N 90°18'42.26"E	0.34	5	8	83	11	6.54	7.7	0.35	<0.5	32	4	4.96	Odorless	1.3
19	SW-19**	22°31'25.12"N 90°17'44.37"E	0.34	5	7	75	11	6.94	7.7	0.44	<0.5	32	6	4.95	Odorless	1.3
20	SW-20**	22°20'30.54"N 90° 1'18.45"E	0.30	3	6	167	13	6.36	7.1	0.39	<0.5	90	7	6.93	Odorless	0.9
21	SW-21**	22°27'33.84"N 90° 3'37.73"E	0.36	5	8	185	10	6.48	7.6	0.44	<0.5	41	4	5.14	Odorless	1.2
22	SW-22**	22°44'36.51"N 89° 5'39.03"E	0.36	5	8	192	10	6.48	7.6	0.37	<0.5	41	4	5.14	Odorless	1.2
23	SW-23**	22°31'22.26"N 89° 2'20.28"E	0.31	3	6	202	17	7.54	7.7	0.28	<0.5	37	4	5.13	Odorless	1.3
24	SW-24	23° 2'29.79"N 89°50'38.66"E	0.38	4	6	79	24	6.87	7.1	0.21	<0.5	78	7	6.13	Odorless	1.3
25	SW-25	23° 2'12.65"N 89°49'56.51"E	0.40	3	7	140	15	7.11	7.3	0.42	<0.5	101	3	4.89	Odorless	1.6
26	SW-26	24°11'8.10"N 91°20'43.74"E	0.29	5	9	63	10	6.93	7.4	0.16	<0.5	64	6	5.78	Odorless	0.8
Unit			mg/L	mg/L	mg/L	mg/L	CFU/100ml	mg/L	mg/L	mg/L	µg/L	mg/L	mg/L	NTU	-	mg/L
Analysis method			UVS	5 days Incubation	CRM	Titrimetric	MFM	Multimeter	pH Meter	UVS	Chromatographic	Multimeter	Gravimetric	Turbidity Meter	Threshold Method	APHA 23RD EDN. 2017 (5520- B)
Bangladesh Standard, ECR 2023, Category d			NYS	≤6	50	NYS	≤5000	≥5	6-9	0.5	NYS	1000	NYS	NYS	NYS	NYS
Bangladesh Standard, ECR 2023, Standards for Coastal Water, Schedule			NYS	NYS	5	NYS	1000	≥5	6.5-8.5	0.08	NYS	50	NYS	NYS	NYS	0.14

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

SN	ID	GPS Location	Concentration Presents in Parameters												
			Ammonia	BOD	COD	Chloride	Coliform (Total)	DO	pH	PO_4	(PCBs)	TDS	TSS	Turbidity	Odor	Oil and Grease
2-A																

*The Environment Conservation Rules (ECR) 2023, Schedule 2-A (1) Standard for Inland Surface Water (a-f)
**Samples of Coastal Area
d. Water usable for fisheries
No WBG/IFC parameter standards
Primary data Source: *BEETLSL*, April 2024

** Environmental Quality Monitoring will be conducted again by the EPC Contractor at the final selected site along with detailed design.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

F. Soil Quality

265. Soil samples were collected from 26 locations of the project areas on 30 March to 04 April, 2024. The samples were collected in a composite sampling method by auger boring below the surface level. The samples were first placed in zipped lock plastic bags and then transferred to appropriate plastic labeled jars. The collected soil samples were tested from the referred laboratory (BEETLSL). The analysis methods of different parameters of soil are given in the following Table 5.10. The soil analysis data and site photos of monitoring are given in Appendix II of the report (Soil Analysis Report prepared by Bangladesh Environmental Engineering Training and Lab Services Ltd. for PGCB IEE prepared by Tecvy & Feedback Infra).

Table 5.10: Soil Quality Analysis Result

SN	Sampling ID	GPS Location	Concentration Presents in Parameters						
			pH	Copper (Cu)	Lead (Pb)	Cadmium (Cd)	Chromium (Cr)	Organic Content (OC)	Polychlorinated Biphenyls (PCBs)
1	SQ-01	24° 7'23.42"N 91°18'56.89"E	6.5	1.13	1.74	0.21	23.54	10.54	<1
2	SQ-02	22°34'43.98"N 89°17'51.31"E	7.3	2.43	3.67	0.38	34.57	9.54	<1
3	SQ-03	89°54'9.30"E 89°54'12.21"E	6.9	2.16	2.54	0.26	17.63	8.43	<1
4	SQ-04	23° 3'16.39"N 90°59'12.09"E	6.8	1.92	3.90	0.17	34.30	7.89	<1
5	SQ-05	23°24'48.57"N 90°38'1.33"E	7.1	2.11	4.73	0.39	36.38	10.65	<1
6	SQ-06	23°52'13.11"N 89°13'19.29"E	6.6	3.24	3.65	0.32	29.54	8.23	<1
7	SQ-07	22°13'54.69"N 89°58'16.36"E	6.5	1.90	5.34	0.41	34.31	7.83	<1
8	SQ-08	24°53'32.87"N 89° 9'34.38"E	6.7	2.63	2.56	0.22	39.76	12.63	<1
9	SQ-09	24° 7'57.61"N 90°42'29.62"E	6.5	1.91	4.92	0.43	38.07	11.77	<1
10	SQ-10	21°45'5.50"N 91°59'27.67"E	7.4	1.87	4.28	0.42	37.07	11.77	<1
11	SQ-11	24°10'45.85"N 90°44'30.59"E	6.9	2.69	3.43	0.22	44.76	10.31	<1
12	SQ-12	24°12'18.91"N 90°49'27.75"E	6.5	1.64	3.86	0.49	31.57	9.56	<1
13	SQ-13	24°13'36.80"N 90°53'2.44"E	6.7	2.45	3.13	0.23	30.38	8.32	<1
14	SQ-14	21°45'24.71"N 91°57'27.16"E	7.5	1.99	4.47	0.47	37.56	9.36	<1
15	SQ-15	23°22'38.29"N 90°43'10.33"E	7.2	2.56	3.65	0.47	41.12	8.45	<1
16	SQ-16	23°18'1.39"N 90°48'25.53"E	7.4	1.45	4.37	0.21	40.35	12.45	<1
17	SQ-17	23°16'5.45"N 90°51'42.12"E	7.5	1.67	4.56	0.49	28.59	7.56	<1
18	SQ-18	22°21'46.66"N 90°18'42.90"E	7.3	2.35	4.12	0.38	36.43	10.45	<1
19	SQ-19	22°31'24.87"N 90°17'43.41"E	7.5	2.45	4.68	0.42	42.45	13.85	<1
20	SQ-20	22°20'29.51"N 90° 1'21.61"E	6.8	2.61	3.10	0.22	40.23	9.45	<1
21	SQ-21	22°27'38.08"N 90° 3'34.19"E	6.5	1.88	4.23	0.40	28.33	12.34	<1
22	SQ-22	22°44'36.27"N	7.2	3.56	2.56	0.33	36.38	8.34	<1

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

SN	Sampling ID	GPS Location	Concentration Presents in Parameters						
			pH	Copper (Cu)	Lead (Pb)	Cadmium (Cd)	Chromium (Cr)	Organic Content (OC)	Polychlorinated Biphenyls (PCBs)
		89° 5'39.27"E							
23	SQ-23	22°31'22.12"N 89° 2'20.91"E	7.4	1.87	4.28	0.37	35.91	10.43	<1
24	SQ-24	23° 2'28.93"N 89°50'39.50"E	6.3	1.82	5.11	0.28	34.53	9.77	<1
25	SQ-25	23° 2'10.81"N 89°49'56.37"E	6.4	1.93	4.18	0.40	21.45	10.77	<1
26	SQ -26	24°11'8.27"N 91°20'42.75"E	6.6	1.90	3.93	0.21	30.53	7.83	<1
Unit			-	ppm	ppm	ppm	ppm	%	PPM
Dutch Standard			NYS	36	85	0.8	100	NYS	NYS

*Standard: Dutch Target and Intervention Values, 2000; PPM-Parts per Million, Primary Data Source: BEETLSL Laboratory, April, 2024 * NYS = Not Yet Set *PPM = Parts per Million
No corresponding WBG/IFC standards
** Environmental Quality Monitoring will be conducted again by the EPC Contractor at the final selected site along with detailed design.

266. Total Twenty-Six (26) samples were collected from the project areas in summer season and the tests were analyzed in BEETLSL laboratory. However, it is important to figure out that there is no standard set out for soil quality analysis by ECR 2023 in Bangladesh. Therefore, Dutch standard has been used to analyze the soil quality which are environmental pollutant reference values (i.e., concentrations in environmental media) used in environmental remediation, investigation and cleanup. In conclusion, this standard is used worldwide to analysis the soil quality to preserve the soil from the damage and repair past damage caused by human activity.

267. However, among all the parameters, standards are only set for Cu, Pb, Cr, and Cd by Dutch standards. All the value has been found below the standard level which mean the soil is in pollution free state; and does not hamper food security, which is essential for human survival. Some fluctuations have been observed at SQ-02, SQ-05, SQ-10, SQ-14. SQ-15, SQ-16, SQ-17, SQ-18, SQ-19, SQ-22, and SQ-23 compared to other locations because of the geological variations and some locations fall also in the coastal parts of Bangladesh. Overall, the values will not pose any risks to people's human health residing in the project areas and they are habituated with this type of soil quality.

G. EMF Monitoring

268. EMF levels were measured at 26 locations from the project areas on 30 March to 04 April 2024. All samples were up taken from the SS and TLs of the proposed project. EMF Sampling was done by automatic sampler EMF HTC 522 meter.

Table 5.11: EMF Monitoring Result

SN	Monitoring ID	Date	Monitoring Location	GPS Coordinates	Obtained Value of EMF in (µT)
1	EMF 01	02.04.2024	230/132/33 kV AIS: Madhabpur, Habiganj	21°45'6.50"N, 91°59'23.63"E	0.14
2	EMF 02	30.03.2024	132/33 kV AIS: Paikgacha, Khulna	24° 7'23.68"N, 91°18'57.08"E	0.11
3	EMF 03	30.03.2024	132/33 kV AIS: Tungipara, Gopalganj	24°7'56.99"N, 90°42'30.18"E	0.12
4	EMF 04	01.04.2024	132/33 kV AIS: Chatkhil/, Noakhali	22°55'7.37"N, 89°54'12.65"E	0.08
5	EMF 05	01.04.2024	132/33 kV AIS: Matlab (N), Chandpur	24°53'33.72"N,	0.07

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

SN	Monitoring ID	Date	Monitoring Location	GPS Coordinates	Obtained Value of EMF in (µT)
				89° 9'33.30"E	
6	EMF 06	04.04.2024	132/33 kV AIS: Kumarkhali, Kushtia	23°24'49.88"N, 90°38'0.83"E	0.08
7	EMF 07	03.04.2024	132/33 kV AIS: Mathbaria, Pirojpur	23°52'14.25"N, 89°13'20.33"E	0.06
8	EMF 08	04.04.2024	132/33 kV AIS: Dupchanchia, Bogura	23° 3'16.80"N, 90°59'12.27"E	0.08
9	EMF 09	02.04.2024	230/132/33 kV AIS: Monohardi, Narshingdi	22°34'41.66"N, 89°17'49.49"E	0.07
10	EMF 10	31.03.2024	400/230/132 kV AIS: Pekua/ Chakaria, Cox's Bazar	22°13'56.78"N, 89°58'16.52"E	0.06
11	EMF 11	02.04.2024	Monohardi-Bajitput 132 kV double circuit line: 21.00 km (Proposed Conductor: Twin ACSR Grosbeak)	24°10'46.15"N, 90°44'30.98"E	0.08
12	EMF 12	02.04.2024	Monohardi-Bajitput 132 kV double circuit line: 21.00 km (Proposed Conductor: Twin ACSR Grosbeak)	24°12'17.82"N, 90°49'27.78"E	0.09
13	EMF 13	04.04.2024	Monohardi-Bajitput 132 kV double circuit line: 21.00 km (Proposed Conductor: Twin ACSR Grosbeak)	24°13'38.22"N, 90°52'56.25"E	0.08
14	EMF 14	31.03.2024	LILO of Existing Matarbari PP – Banskhali PP 400 kV line at Pekua: 6.75 km (Conductor: Quad ACSR Finch)	21°45'24.63"N, 91°57'26.98"E	0.07
15	EMF 15	01.04.2024	Kachua – Matlab (N) 132 kV double circuit line: 33.00 km (Proposed Conductor: ACSR Grosbeak)	23°22'39.23"N, 90°43'11.92"E	0.08
16	EMF 16	01.04.2024	Kachua – Matlab (N) 132 kV double circuit line: 33.00 km (Proposed Conductor: ACSR Grosbeak)	23°18'3.35"N, 90°48'25.44"E	0.06
17	EMF 17	01.04.2024	Kachua – Matlab (N) 132 kV double circuit line: 33.00 km (Proposed Conductor: ACSR Grosbeak)	23°16'4.18"N, 90°51'41.91"E	0.07
18	EMF 18	03.04.2024	Patuakhali-Bakerganj 132 kV double circuit line: 25 Km (Proposed Conductor, ACSR Grosbeak)*	22°21'45.97"N, 90°18'42.62"E	0.10
19	EMF 19	03.04.2024	Patuakhali-Bakerganj 132 kV double circuit line: 25 Km (Proposed Conductor, ACSR Grosbeak)*	22°31'24.71"N, 90°17'42.50"E	0.11
20	EMF 20	03.04.2024	Patuakhali-Bakerganj 132 kV double circuit line: 25 Km (Proposed Conductor, ACSR Grosbeak)	22°20'26.86"N, 90° 1'21.11"E	0.06
21	EMF 21		Bhandaria-Mathbaria 132 kV double circuit transmission line: 32.00 km (Proposed Conductor: ACSR Grosbeak)	22°27'36.05"N, 90° 3'31.47"E	0.12
22	EMF 22	30.03.2024	Satkhira-Paikgacha 132 kV double circuit line: 30.00 km (Proposed Conductor: ACSR Grosbeak)	22°44'35.69"N, 89° 5'38.34"E	0.08
23	EMF 23	30.03.2024	Satkhira-Paikgacha 132 kV double circuit line: 30.00 km (Proposed Conductor: ACSR Grosbeak)	22°31'23.22"N, 89° 2'20.92"E	0.07
24	EMF 24	30.03.2024	Gopalganj – Tungipara 132 kV double circuit line: 19.00 km (Proposed Conductor: ACSR Grosbeak)	23° 2'28.75"N, 89°50'38.24"E	0.12
25	EMF 25	31.03.2024	Gopalganj – Tungipara 132 kV double circuit line: 19.00 km (Proposed Conductor: ACSR Grosbeak)	23° 2'10.12"N 89°49'57.31"E	0.10
26	EMF 26	02.04.2024	Reconductoring of Shahjibazar-Brahmanbaria-Ashuganj 132 kV line: (58+17) = 75.00 km)	24°11'8.82"N 91°20'39.59"E	0.09

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

SN	Monitoring ID	Date	Monitoring Location	GPS Coordinates	Obtained Value of EMF in (μT)
			(Proposed Conductor: CFCC type HTLS equivalent to ACSR Grosbeak)		
EMF Standard					
Non-Ionizing Radiation Protection (ICNIRP)					
Limits for general public exposure					83-100

* The Patuakhali-Bakerganj 132kV double circuit line has been removed from the Project's scope after the tests had been done.

** Environmental Quality Monitoring will be conducted again by the EPC Contractor at the final selected site along with detailed design.

269. EMF has been monitored from 26 locations in the project corridor. The summary findings of EMF analysis are given in Table 5.11. From the measured data it has been found that, all onsite recorded values have been observed below the typical maximum public exposure as per Non-Ionizing Radiation Protection (ICNIRP). The EMF data and site photos of monitoring are given in Appendix II of the report (prepared by Bangladesh Environmental Engineering Training and Lab Services Ltd. for PGCB IEE prepared by Tecvy & Feedback Infra).

5.3.8 Agriculture Resources

A. Agro-ecological Zone (AEZ)

270. Agriculture is the backbone and single largest producing sector of Bangladesh. It is the major source of livelihood in the rural areas, where some 80 percent of the population lives. It contributes about 20.24% to the total Gross Domestic Product (GDP) of the country (BBS, 2012). Rice is the staple food of Bangladeshi people. Approximately two-thirds of the labour force is employed in agriculture. With irrigation covering only around 42 percent of the potentially irrigated area, agriculture is still weather dependent and has grown slower than was earlier expected, particularly because of the predominantly small farmer holdings in Bangladesh. Agricultural environment consists of agricultural land, seeds and crops, chemical inputs, irrigation water, pests, sun light etc. For more production from a unit land area, protection and conservation of agricultural environment is very important.

271. According to the most recent assessment was completed by the Soil Resource Development Institute (SRDI, 1998) which classified Bangladesh into 30 AEZs. The project area contains the following AEZs;

1. Dupchachia Substation: this substation is located in **Level Barind Tract** (8 sq km) region which is developed over madhupur clay. The landscape is almost level. The predominant soils have a grey, silty, puddled topsoil with ploughpan. Shallow grey terrace soil and deep grey terrace soils are the major components of general soil types of the area. The soils are low in available moisture holding capacity and slightly acidic to acidic in reaction. Organic matter status is very low and most of the available nutrients are limiting.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

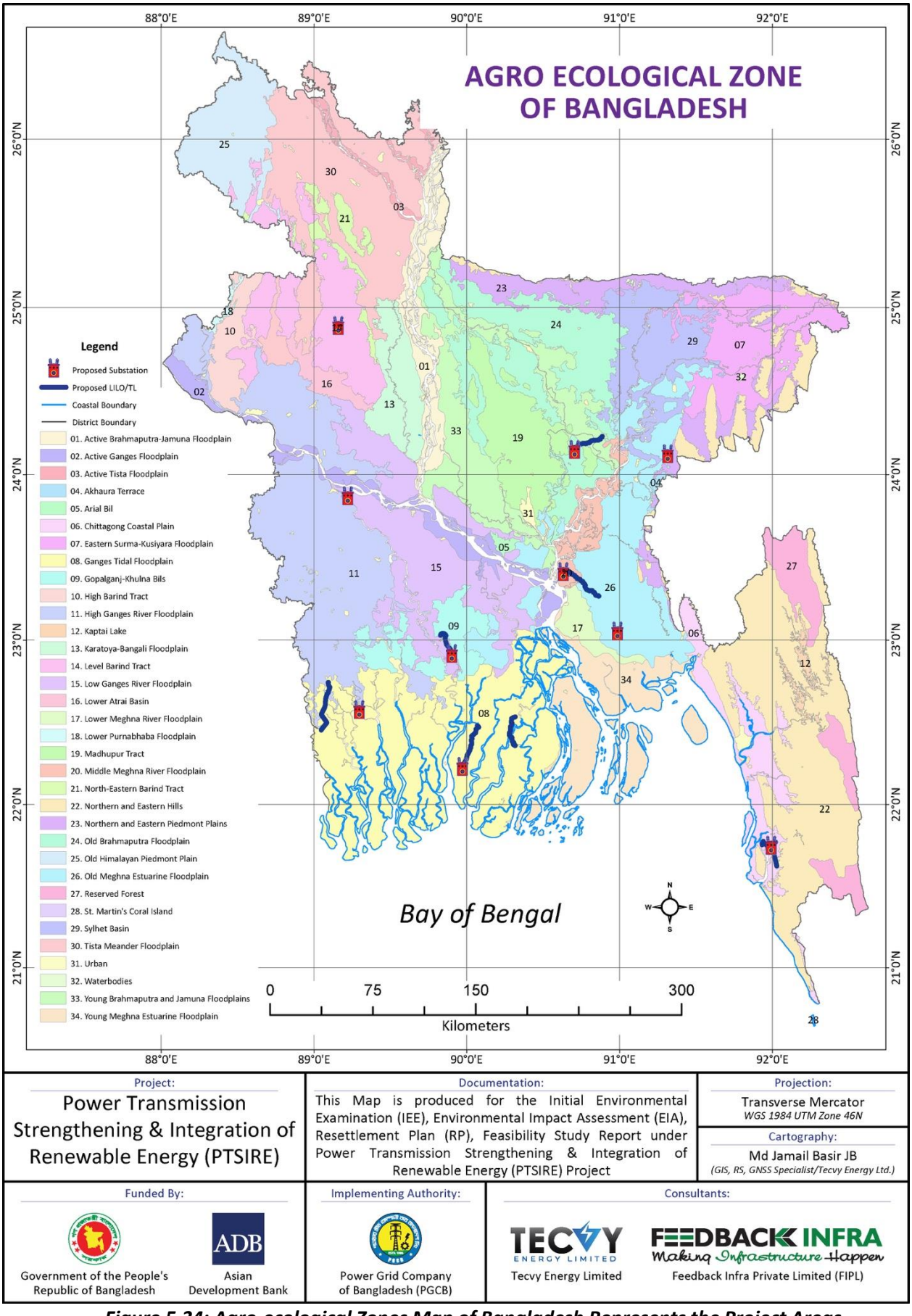


Figure 5.34: Agro-ecological Zones Map of Bangladesh Represents the Project Areas

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

2. Kumarkhali Substation: this substation is located in **High Ganges River Floodplain** (13,205 sq km). This region includes the western part of the Ganges River floodplain which is predominantly highland and medium highland. Most areas have a complex relief of broad and narrow ridges and inter-ridge depressions. The upper parts of high ridges stand above normal flood level. Lower parts of ridges and basin margins are seasonally shallowly flooded. General soil types predominantly include calcareous dark grey floodplain soils and calcareous brown floodplain soils. Organic matter content in the brown ridge soils is low but higher in the dark grey soils. Soils are slightly alkaline in reaction. General fertility level is low.
3. Monohardi Substation: this substation is located in **Old Brahmaputra Floodplain** (7,230 sq km). This region occupies a large area of Brahmaputra sediments before the river shifted to its present Jamuna channel about 200 years ago. The region has broad ridges and basins. Relief is irregular, especially near the old and present river channels. Soils of the area are predominantly silt loams to silty clay loams on the ridges and clay in the basins. Organic matter content is low on the ridges and moderate in the basins, topsoils moderately acidic but subsoils neutral in reaction. General fertility level is low.
4. Madhabpur Substation: this substation is located in **Northern and Eastern Piedmont Plains** (4,038 sq km). This is a discontinuous region occurring as a narrow strip of land at the foot of the northern and eastern hills. The region comprises merging alluvial fans which slope gently outward from the foot of the northern and eastern hills into smooth, low-lying basins. Grey piedmont soils and non-calcareous grey floodplain soils are the major general soil types of the area. Soils of the area are loams to clays, slightly acidic to strongly acidic in reaction. General fertility level is low to medium.
5. Matlab (N) Substation: this substation is located in **Middle Meghna River Floodplain** (1,555 sq km) this region occupies an abandoned channel of the Brahmaputra River on the border between the greater Dhaka and Comilla districts. The region includes areas of old Brahmaputra chars within the Meghna River as well as adjoining parts of the mainland. Soils of the area are grey loam on the ridges and grey to dark grey clays in the basins. The dominant general soil type is non-calcareous grey floodplain soil. Topsoils are strongly acidic and subsoils slightly acidic to slightly alkaline. General fertility level is medium with low N and organic matter.
6. Chatkhil/ Substation: this substation is located in **Old Meghna Estuarine Floodplain** (7,740 sq km). This region occupies a large area, mainly low-lying land between the south of the Surma-Kushiyara floodplain and the northern edge of the young Meghna estuarine floodplain. Silt loam soils predominate on highlands and silty clay to clay on lowlands. Organic matter content of the soils is moderate. Topsoils are moderately acidic, but subsoils neutral in reaction. General fertility level is medium.
7. Tungipara Substation: this substation is located in **Lower Ganges River Floodplain** (7,968 sq km). The region comprises the eastern half of the Ganges River floodplain which is low-lying. The area has a typical meander floodplain landscape of broad ridges and basins. Soils of this region are silt loams and silty clay loams on the ridges and silty clay loam to heavy clays on lower sites. General soil types predominantly include calcareous dark grey and calcareous brown floodplain soils. Organic matter content is low in ridges and moderate in the basins. General fertility level is medium.
8. Paikgacha Substation: this substation is located in **Ganges Tidal Floodplain** (17,066 sq km). This region occupies an extensive area of tidal floodplain land in the southwest of the country. The greater part of this region has smooth relief having large areas of salinity. Riverbanks generally stand about a metre or less above the level of adjoining basins. Non-calcareous grey floodplain soil is the major component of general soil types. acid sulphate soil also occupies a significant part of the area, where it is extremely acidic during the dry season. Most of the topsoils are acidic and subsoils are neutral to mildly alkaline. Soils of the Sundarbans area is alkaline. General fertility level is high, with medium to high organic matter content.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

9. Mathbaria Substation: this substation is located in **Ganges Tidal Floodplain** (17,066 sq km). This region occupies an extensive area of tidal floodplain land in the southwest of the country. The greater part of this region has smooth relief having large areas of salinity. Riverbanks generally stand about a metre or less above the level of adjoining basins. Non-calcareous grey floodplain soil is the major component of general soil types. acid sulphate soil also occupies a significant part of the area, where it is extremely acidic during the dry season. Most of the topsoils are acidic and subsoils are neutral to mildly alkaline. Soils of the Sundarbans area is alkaline. General fertility level is high, with medium to high organic matter content.
10. Pekua Substation: this substation is located in **Chittagong Coastal Plain** (3,720 sq km). This region occupies the plain land in greater Chittagong district and the eastern part of Feni district. It is a compound unit of piedmont, river, tidal and estuarine floodplain landscapes. The major problem in these soils is high salinity during the dry season (October to May). Grey silt loams and silty clay loam soils are predominant. Acid sulphate soils occur in mangrove tidal floodplains. General fertility level of the soils is medium, but N and K are limiting. Organic matter content is low to moderate.

B. Farming Practices

272. Farming practices in the study area are largely controlled by physical, biological, climatological and socio-economic factors. Agricultural crops are grown by cropping seasons. There are two cropping seasons in a year. They are Kharif and Rabi seasons. The Kharif season starts from March and ends in October while the Rabi season starts from November and ends in February. Based on crop suitability and farming practice, the Kharif season has been further sub-divided into the Kharif-I (March-June) and the Kharif-II (July-October) season.

273. The climatic condition in the kharif-I season is characterized by high temperature, low humidity, high evaporation, high solar radiation. The season is also characterized by uncertain rainfall, which means low alternating dry and wet spells. In this season land remains fully fallow due to high salinity of soil. The salinity level goes beyond the tolerance level of crop, that is usually grown in this season e.g. vegetables and fruits. The Kharif-II (monsoon) cropping season is characterized by high rainfall, lower solar radiation, lower temperature and high humidity. The Kharif-II season starts from July and ends in October. HYV Aman rice is the predominant crop grown during this season due to the submergence of soil in the study area. The Rabi (winter) cropping season starts in November and ends in February. During this period, crops are favored with high solar radiation, low humidity and temperature. But due to inadequate soil moisture, the crop yield is low in this study area. Major crops grown in this season are vegetable, HYV Boro rice, fruits etc.

C. Cropping Pattern and Intensity in the Study Area

274. Cropping patterns and intensity in Bangladesh are influenced by various factors including climate, soil fertility, land availability, market demand, and socio-economic conditions.

275. In Gopalganj and Kushtia, districts in Bangladesh, cropping patterns and intensity are influenced by various factors including climate, soil fertility, land availability, market demand, and socio-economic conditions.

Cropping Patterns:

- **Rice:** Rice cultivation is the predominant agricultural activity in Gopalganj and Kushtia. Both Aman (monsoon) and Boro (dry season) rice are grown. Aman rice is usually transplanted in the wet season (June-July), while Boro rice is cultivated in the dry season (December-March) using irrigation.
- **Jute:** Jute cultivation is significant in both districts, especially in areas with suitable soil and climatic conditions. Jute cultivation typically occurs during the monsoon season, and both districts are known for producing high-quality jute fibers.
- **Vegetables:** Various vegetables such as cauliflower, cabbage, brinjal (eggplant), tomato, and potato are grown in Gopalganj and Kushtia throughout the year. Vegetable cultivation is often intensive and may involve multiple cropping cycles.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

- **Fruits:** Fruit cultivation, including mangoes, bananas, papayas, and guavas, is common in both districts. Fruit orchards are established in suitable locations, and fruit production contributes to both local consumption and commercial markets.
- **Pulses and Oilseeds:** Pulses such as lentils and oilseeds like mustard are cultivated as rotational crops or intercropped with other main crops to improve soil fertility and diversify agricultural production.

Cropping Intensity:

- Cropping intensity in Gopalganj and Kushtia is relatively high due to favorable agro-climatic conditions and irrigation facilities.
- Multiple cropping systems are practiced, especially in areas with reliable access to water for irrigation. Farmers often cultivate two or three crops successively within a single agricultural season.
- Intensive cropping systems, such as the cultivation of vegetables and short-duration crops, are common, particularly in peri-urban and densely populated areas.
- Some farmers also practice relay cropping or intercropping to maximize land productivity and optimize resource use efficiency.
- However, cropping intensity may vary across different agro-ecological zones within Gopalganj and Kushtia, influenced by factors such as soil type, water availability, and market demand.

276. In Chandpur and Habiganj, districts in Bangladesh, cropping patterns and intensity are influenced by various factors including climate, soil fertility, land availability, market demand, and socio-economic conditions.

- **Rice:** Rice cultivation is the primary agricultural activity in Chandpur and Habiganj. Both Aman (monsoon) and Boro (dry season) rice are grown. Aman rice is usually transplanted in the wet season (June-July), while Boro rice is cultivated in the dry season (December-March) using irrigation.
- **Jute:** Jute cultivation is significant in both districts, especially in areas with suitable soil and climatic conditions. Jute cultivation typically occurs during the monsoon season, and both districts are known for producing high-quality jute fibers.
- **Vegetables:** Various vegetables such as cauliflower, cabbage, brinjal (eggplant), tomato, and potato are grown in Chandpur and Habiganj throughout the year. Vegetable cultivation is often intensive and may involve multiple cropping cycles.
- **Fruits:** Fruit cultivation, including mangoes, bananas, papayas, and guavas, is common in both districts. Fruit orchards are established in suitable locations, and fruit production contributes to both local consumption and commercial markets.
- **Pulses and Oilseeds:** Pulses such as lentils and oilseeds like mustard are cultivated as rotational crops or intercropped with other main crops to improve soil fertility and diversify agricultural production.

Cropping Intensity:

- Cropping intensity in Chandpur and Habiganj is relatively high due to favorable agro-climatic conditions and irrigation facilities.
- Multiple cropping systems are practiced, especially in areas with reliable access to water for irrigation. Farmers often cultivate two or three crops successively within a single agricultural season.
- Intensive cropping systems, such as the cultivation of vegetables and short-duration crops, are common, particularly in peri-urban and densely populated areas.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

- Some farmers also practice relay cropping or intercropping to maximize land productivity and optimize resource use efficiency.
- However, cropping intensity may vary across different agro-ecological zones within Chandpur and Habiganj, influenced by factors such as soil type, water availability, and market demand.

277. In Noakhali, a district in Bangladesh, cropping patterns and intensity are influenced by various factors including climate, soil fertility, land availability, market demand, and socio-economic conditions.

Cropping Patterns:

- **Rice:** Rice cultivation is the predominant agricultural activity in Noakhali. Both Aman (monsoon) and Boro (dry season) rice are grown. Aman rice is usually transplanted in the wet season (June-July), while Boro rice is cultivated in the dry season (December-March) using irrigation.
- **Jute:** Jute is another important crop in Noakhali, especially in areas with suitable soil and climatic conditions. Jute cultivation typically occurs during the monsoon season, and Noakhali is known for producing high-quality jute fibers.
- **Vegetables:** Various vegetables such as cauliflower, cabbage, brinjal (eggplant), tomato, and potato are grown in Noakhali throughout the year. Vegetable cultivation is often intensive and may involve multiple cropping cycles.
- **Fruits:** Fruit cultivation, including mangoes, bananas, papayas, and guavas, is common in Noakhali. Fruit orchards are established in suitable locations, and fruit production contributes to both local consumption and commercial markets.
- **Pulses and Oilseeds:** Pulses such as lentils and oilseeds like mustard are cultivated as rotational crops or intercropped with other main crops to improve soil fertility and diversify agricultural production.

Cropping Intensity:

- Cropping intensity in Noakhali is relatively high due to favorable agro-climatic conditions and irrigation facilities.
- Multiple cropping systems are practiced, especially in areas with reliable access to water for irrigation. Farmers often cultivate two or three crops successively within a single agricultural season.
- Intensive cropping systems, such as the cultivation of vegetables and short-duration crops, are common, particularly in peri-urban and densely populated areas.
- Some farmers also practice relay cropping or intercropping to maximize land productivity and optimize resource use efficiency.
- However, cropping intensity may vary across different agro-ecological zones within Noakhali, influenced by factors such as soil type, water availability, and market demand.

278. In Bogura, a district in Bangladesh, cropping patterns and intensity are influenced by various factors including climate, soil fertility, land availability, market demand, and socio-economic conditions.

Cropping Patterns:

- **Rice:** Rice cultivation is the predominant agricultural activity in Bogura. Both Aman (monsoon) and Boro (dry season) rice are grown. Aman rice is usually transplanted in the wet season (June-July), while Boro rice is cultivated in the dry season (December-March) using irrigation.
- **Wheat:** Wheat is an important Rabi (winter) crop in Bogura. It is usually sown in November-December and harvested in April-May.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

- **Potatoes:** Potato cultivation is significant in Bogura, especially during the Rabi season. Potatoes are grown in rotation with other crops or as an intercrop with wheat.
- **Vegetables:** Various vegetables such as cauliflower, cabbage, brinjal (eggplant), tomato, and pumpkin are grown in Bogura throughout the year. Vegetable cultivation is often intensive and may involve multiple cropping cycles.
- **Pulses and Oilseeds:** Pulses such as lentils and oilseeds like mustard are cultivated as rotational crops or intercropped with other main crops to improve soil fertility and diversify agricultural production.

Cropping Intensity:

- Cropping intensity in Bogura is relatively high due to favorable agro-climatic conditions and irrigation facilities.
- Multiple cropping systems are practiced, especially in areas with reliable access to water for irrigation. Farmers often cultivate two or three crops successively within a single agricultural season.
- Intensive cropping systems, such as the cultivation of vegetables and short-duration crops, are common, particularly in peri-urban and densely populated areas.
- Some farmers also practice relay cropping or intercropping to maximize land productivity and optimize resource use efficiency.
- However, cropping intensity may vary across different agro-ecological zones within Bogura, influenced by factors such as soil type, water availability, and market demand.

279. In Narshingdi, a district in Bangladesh, cropping patterns and intensity are influenced by various factors including climate, soil fertility, land availability, market demand, and socio-economic conditions.

Cropping Patterns:

- **Rice:** Rice cultivation is predominant in Narshingdi, with both Aman (monsoon) and Boro (dry season) rice being grown. Aman rice is usually transplanted in the wet season (June-July), while Boro rice is cultivated in the dry season (December-March) using irrigation.
- **Jute:** Jute is another important crop in Narshingdi, especially in areas with suitable soil and climatic conditions. Jute cultivation typically occurs during the monsoon season, and Narshingdi is known for producing high-quality jute fibers.
- **Vegetables:** Various vegetables such as cauliflower, cabbage, brinjal (eggplant), tomato, and potato are grown in Narshingdi throughout the year. Vegetable cultivation is often intensive and may involve multiple cropping cycles.
- **Fruits:** Fruit cultivation, including mangoes, bananas, papayas, and guavas, is common in Narshingdi. Fruit orchards are established in suitable locations, and fruit production contributes to both local consumption and commercial markets.
- **Pulses and Oilseeds:** Pulses such as lentils and oilseeds like mustard are cultivated as rotational crops or intercropped with other main crops to improve soil fertility and diversify agricultural production.

Cropping Intensity:

- Cropping intensity in Narshingdi is relatively high due to favorable agro-climatic conditions and irrigation facilities.
- Multiple cropping systems are practiced, especially in areas with reliable access to water for irrigation. Farmers often cultivate two or three crops successively within a single agricultural season.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

- Intensive cropping systems, such as the cultivation of vegetables and short-duration crops, are common, particularly in peri-urban and densely populated areas.
- Some farmers also practice relay cropping or intercropping to maximize land productivity and optimize resource use efficiency.
- However, cropping intensity may vary across different agro-ecological zones within Narshingdi, influenced by factors such as soil type, water availability, and market demand.

280. Cox's Bazar, located in southeastern Bangladesh, is known for its long sandy beach and diverse ecosystems. The region's agricultural practices are influenced by its coastal environment, including salinity and water availability.

Cropping Pattern:

- **Rice:** Aman Rice: The major crop, sown during the monsoon season (June to November). It is essential for local food security. Boro Rice: Grown in the dry season (December to May) with the aid of irrigation, particularly in areas where salinity is managed.
- **Vegetables:** A variety of vegetables, such as potatoes, carrots, tomatoes, and leafy greens, are cultivated year-round. These crops are important for local markets and diets.
- **Fruits**: Tropical fruits like mangoes, bananas, and papayas are commonly grown, benefiting from the favorable coastal climate.
- **Jute:** Grown in certain areas, although its prominence has declined compared to other crops.
- **Shrimp Farming:** A significant contributor to the local economy, shrimp farming is prevalent in coastal areas, integrating aquaculture with traditional agriculture.
- **Pulses and Oilseeds:** Pulses such as lentils and various oilseeds are grown in the Rabi season, although less prominent compared to other regions.

Cropping Intensity:

- Moderate Intensity: The cropping intensity in Cox's Bazar can vary, but it often allows for multiple cropping cycles, especially for rice and vegetables. Key factors include:
- The use of improved varieties and irrigation techniques.
- Seasonal variations and the ability to manage saline conditions for better yields.

281. In Khulna, Bangladesh, the cropping pattern and intensity are influenced by various factors, including climate, soil type, water availability, and socio-economic conditions.

Cropping Pattern

- **Rice:** The staple crop, primarily grown in both the Aman (monsoon) and Boro (dry season) seasons.
- **Jute**: Another significant crop due to its economic value, often grown in the monsoon.
- **Vegetables**: Various vegetables are cultivated, particularly during the Rabi season (winter).
- **Pulses**: Commonly grown alongside rice.

Crop Rotation: Farmers often practice crop rotation to maintain soil fertility and manage pest populations, alternating between rice and legumes or other crops.

Intercropping: Some farmers adopt intercropping techniques, planting two or more crops simultaneously to maximize land use and improve yields.

Cropping Intensity:

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

- High Intensity: Khulna has a relatively high cropping intensity, often exceeding 200%, due to the multiple cropping systems practiced, especially in areas with access to irrigation.
- Seasonal Variations: The intensity varies with seasons; for instance, during the Aman and Boro seasons, the land is utilized more intensively compared to the fallow period.

282. Kishoreganj, located in Bangladesh, has a diverse cropping pattern influenced by its climate, soil type, and water availability. The region primarily engages in agriculture, with rice being the dominant crop, especially in the wet season.

Cropping Pattern:

- **Rice**: Aman Rice: Grown in the monsoon season (June to November). Boro Rice: Cultivated in the dry season (December to May) with irrigation support.
- **Wheat**: Grown in the Rabi season (November to March).
- **Maize**: Increasingly popular due to its high yield and market demand.
- **Pulses and Oilseeds:** Commonly grown during the Rabi season, including lentils and mustard.
- **Vegetables and Fruits:** Diverse vegetables (e.g., potatoes, brinjals) and fruits (e.g., mangoes, guavas) are cultivated year-round.
- **Jute and sugarcane** are also significant, especially in certain areas, contributing to the local economy.

Cropping Intensity:

- High Intensity: Kishoreganj has a high cropping intensity, often achieving multiple cropping cycles within a year. This is largely due to:
    - The favorable climate for rice and other crops.
    - Advancements in irrigation techniques.
    - Adoption of high-yielding varieties.

283. The cropping pattern in Satkhira is characterized by a diverse array of agricultural practices shaped by its geographical and climatic conditions. The region's proximity to the Bay of Bengal and the Sundarbans mangrove forest significantly influences its agricultural outputs.

Cropping Pattern:

- **Rice:** Aman Rice: Dominates the kharif season (June to November), benefiting from monsoonal rainfall. Boro Rice: Cultivated during the dry season (December to May) with reliance on irrigation systems, particularly in areas with access to groundwater.
- **Wheat:** Primarily grown during the Rabi season (November to March), wheat serves as a staple food and is cultivated in rotation with other crops to enhance soil fertility.
- **Maize**: Increasingly adopted due to its adaptability and market demand, maize is cultivated in both Rabi and Kharif seasons.
- **Pulses and Oilseeds:** Various pulses such as lentils and mung beans, alongside oilseeds like mustard, are incorporated into the cropping system during the Rabi season, contributing to nitrogen fixation and soil health.
- **Vegetables**: A wide range of vegetables, including potatoes, onions, and gourds, are cultivated year-round. Their cultivation is strategically timed to optimize market conditions and local dietary needs.
- **Fruits**: The region supports the growth of tropical fruits, notably mangoes, guavas, and bananas, which are integral to local consumption and economic activity.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

- **Aquaculture**: Due to its coastal geography, shrimp farming represents a significant component of the agricultural landscape, providing both livelihoods and export opportunities.

Cropping Intensity:

- The cropping intensity in Satkhira varies from moderate to high, largely contingent upon the availability of irrigation, soil health, and the adoption of modern agricultural practices.
- The integration of multiple cropping systems allows for efficient land use, although this is often challenged by environmental factors such as salinity and flooding.

284. Brahmanbaria, located in the eastern part of Bangladesh, has a rich agricultural landscape shaped by its fertile plains and river systems.

Cropping Pattern:

- **Rice**: Aman Rice: The most significant crop, grown during the monsoon season (June to November). It is a staple food for the local population. Boro Rice: Cultivated in the dry season (December to May) with the help of irrigation, particularly in areas with access to water.
- **Wheat**: Grown primarily in the Rabi season (November to March), wheat is an important alternative to rice and contributes to food diversification.
- **Pulses**: Various pulses, such as lentils, mung beans, and chickpeas, are planted during the Rabi season, enhancing soil fertility and nutrition.
- **Vegetables**: A wide range of vegetables, including potatoes, onions, brinjals, and leafy greens, are cultivated year-round, providing both food security and income for farmers.
- **Fruits**: Tropical fruits like mangoes, jackfruits, and guavas are common, contributing to the local economy and dietary variety.
- **Cash Crops:** Jute and sugarcane are also grown, with jute being particularly significant for both local use and export.

Cropping Intensity:

- Moderate to High Intensity: Brahmanbaria typically experiences high cropping intensity due to:
    - The practice of multiple cropping cycles, especially with short-duration crops following the main rice harvest.
    - The use of improved agricultural practices, including high-yielding varieties and irrigation facilities.

285. Pirojpur, located in the southwestern part of Bangladesh, has a diverse agricultural landscape shaped by its fertile soils and proximity to rivers.

Cropping Pattern

- **Rice**: Aman Rice: The primary crop, planted during the monsoon season (June to November). It is crucial for local food security. Boro Rice: Grown in the dry season (December to May) with irrigation, contributing significantly to the region's rice production.
- **Wheat**: Cultivated mainly during the Rabi season (November to March). Wheat serves as an important alternative crop.
- **Pulses**: Various pulses, such as lentils, mung beans, and peas, are grown during the Rabi season, enhancing soil fertility and providing nutritional benefits.
- **Vegetables**: A wide variety of vegetables, including potatoes, onions, tomatoes, and leafy greens, are cultivated year-round, supporting local diets and markets.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

- **Fruits**: Commonly grown fruits include mangoes, jackfruits, and guavas, which are important for both local consumption and market sales.
- **Jute and sugarcane** are also significant, with jute being a traditional cash crop in the region.

Cropping Intensity:

- High Intensity: The cropping intensity in Chandpur is typically high, often exceeding 200%, due to multiple cropping systems, particularly in irrigated areas.
- Seasonal Variations: The intensity of cropping can fluctuate based on seasonal conditions and water availability, with more crops planted during favorable periods.

5.4 Biological Environment

5.4.1 Bio-ecological Zone

286. The ecosystems of Bangladesh are categorized into two major groups, i.e. (i) land based and (ii) aquatic. The land-based ecosystems include agro-ecosystems and homestead ecosystems; while seasonal and perennial wetlands, rivers, lakes and coastal ecosystems fall into the aquatic category. Each of the ecosystems has many sub-units with distinct characteristics as well. IUCN Bangladesh in 2002 classified the country into twenty-five bio-ecological zones.

287. For the context of bio ecological zone of the project areas, Khulna, and Pirojpur falls in Ganges tidal floodplain. The boundary between this unit and the Ganges floodplain is traditional. The tidal landscape has a low ridge and a basin relief crossed by innumerable tidal rivers and creeks. Local differences in elevation generally are less than 1m compared with 2-3m on the Ganges floodplain. The sediments are mainly non-calcareous clays, but they are silty and slightly calcareous on riverbanks.

288. Gopalganj and Kushtia falls in Low Ganges River Floodplain. Ganges alluvium is calcareous when deposited, but most basin clays and some older ridge soils have been decalcified and acidified in their upper layers; lime is found only in the subsoil or substratum of such soils. Clay soils predominate in basins and on the middle parts of most ridges, with loamy soils (and occasionally sands) occurring mainly on ridge crests.

289. Satkhira falls within the Ganges Delta bio-ecological zone of Bangladesh. This zone is characterized by its low-lying topography, tidal influences, and rich alluvial soils, which support a variety of ecosystems, including wetlands and mangrove forests. The Ganges Delta is crucial for agriculture, particularly rice and shrimp farming, and is also home to diverse wildlife. Additionally, the area is vulnerable to flooding and salinity issues due to its proximity to the Bay of Bengal.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

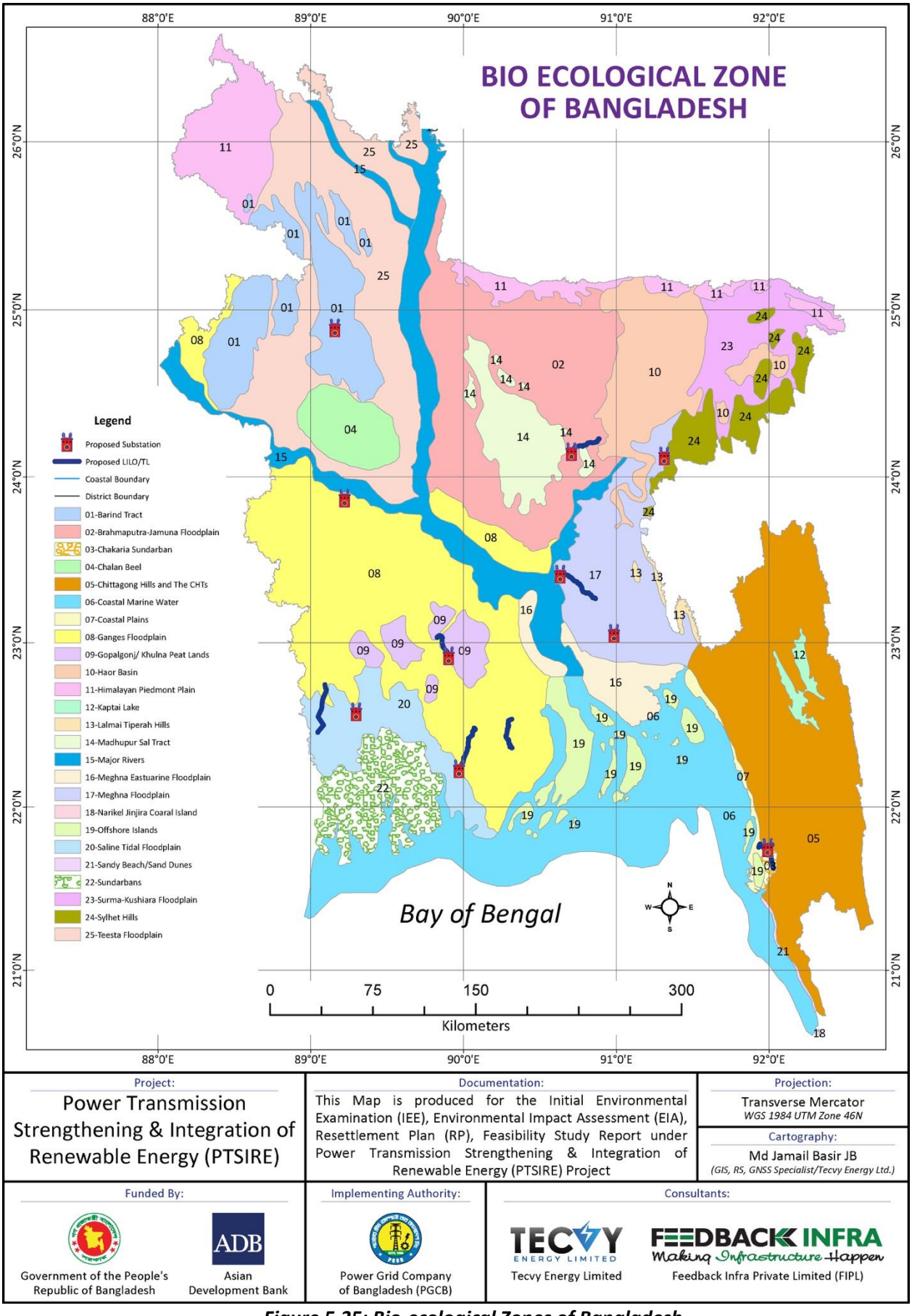


Figure 5.35: Bio-ecological Zones of Bangladesh

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

290. Chandpur and Habiganj falls in Middle Meghna River Floodplain. The main channel of the Meghna upstream from its junction with the Dhaleshwari and Ganges as far as Bhairab Bazar is known as the middle Meghna. The sediments are mainly silty and clays and sandy Brahmaputra sediments occur at the surface on some ridges in the north. Seasonal flooding from the Meghna is mainly deep. Basin sites are submerged early and drain late.

291. Noakhali falls in Old Meghna Estuarine Floodplain. The landscape in this extensive unit is quite different from that on river and tidal floodplains. The relief is almost level, with little difference in elevation between ridges and basins. Natural rivers and streams are far apart in the southern part and drainage is provided by a network of man-made canals (khal).

292. Bogura falls in Barind Tract, between the Ganges and Brahmaputra. In the south, the Barind Tract is an older Pleistocene terrace forming a small plateau with a flat or - in some sectors - a slightly undulating surface. The Barind unit is comparatively at higher elevation than the adjoining floodplains. The contours of the tract suggest that there are two terrace levels - one at 40m and the other between 19.8 and 22.9m.

293. Kishoreganj falls in the Haor Basin of Bangladesh. The Haor Basin is a low-lying area that experiences seasonal flooding, especially during the monsoon. This region is characterized by its wetland ecosystems, which support a rich variety of flora and fauna. The flooding in the Haor Basin is beneficial for agriculture, as it replenishes the soil and creates fertile conditions for growing rice and other crops. However, it also poses challenges, such as displacement of communities and damage to infrastructure during severe flooding.

294. Brahmanbaria is part of the Meghna Floodplain bio-ecological zone. This region is characterized by its fertile alluvial plains formed by the Meghna River and its tributaries. The area experiences seasonal flooding, which enriches the soil and supports diverse agricultural practices. The Meghna Floodplain is important for rice cultivation and is home to various aquatic and terrestrial ecosystems.

295. Narshingdi falls in Old Meghna Estuarine Floodplain. The relief is almost level, with little difference in elevation between ridges and basins. The sediments are predominantly deep and silty, but a shallow clay layer in some basin centers overlies them. Seasonal flooding is mainly deep, but it is shallow in the southeast. Some basin centers stay wet throughout the dry season.

296. Cox's Bazar falls in Chittagong Coastal Plain. Flooding is mainly shallow and fluctuates in depth with the tide (except where this is prevented by river or coastal embankments). The average daily rise in the tide is about two meters. Some soils on tidal and estuarine floodplains become saline in the dry season.

5.4.2 Forests and Land Cover

297. The Bangladesh Forest Inventory (BFI)[29] is a multi-source and multi-purpose NFMS that assesses, evaluates, interprets and reports the status of trees and forest resources nationally. The first BFI cycle was initiated in 2015 by Forest Department[30] under the Ministry of Environment, Forest and Climate Change (MoEFCC). It provides updated estimates of tree and forest resources in future cycles. To give context to how trees, forests and people interact, five BFI zones capture the major differences that occur geographically across the country. In the case of the biophysical inventory, the zones are Sal, Sundarbans, Village, Hill, and Coastal (BFD, 2016). In Bangladesh there are mainly three types of forests, namely, mangrove forest, inland sal forest, hill forests and village forest.

298. The Hill zone represents hilly geographical areas in the eastern part of the country. The average elevation is 125 m, and water and terrestrial land area occupy 3% and 97% of the land, respectively (GoB 2019). The mean annual precipitation is 2720 mm (2061 - 4370 mm) (Hijmans, Cameron et al. 2005). The soils of Hill zone have been classified as acid sulphate, brown hill, and noncalcareous grey flood plain

[29] Tree and Forest Resources of Bangladesh, Report on Bangladesh Forest Inventory, Forest Department, Ministry of Environment, Forest and Climate Change, 2020.

[30] Initial implementation by the FD under the USAID-funded project "Strengthening National Forest Inventory and Satellite Land Monitoring System in Support of REDD+ in Bangladesh" (GCP/BGD/058/USA).

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

(nonsaline) (FAO-UNDP 1988). Evergreen and semi-evergreen forest types dominate, which extend from northeast to southeast of the country and the most common tree species are garjan (Dipterocarpus spp.), civit (Swintonia floribunda), kadam (Anthocephalus chinensis), pitali (Trewia nudiflora), bandarhola (Duabanga grandiflora), Syzygium spp., Gmelina arborea, Ficus carica, Grewia spp., Albizia spp., Acacia auriculiformis, Artocarpus heterophyllus, Swietenia mahogany, Tectona grandis, Acacia auriculiformis, and homestead tree species such as Mangifera indica. The hill forests consist of moist tropical evergreen and semievergreen forests. Besides, bamboo is found in abundance throughout several of the Forest Reserves.

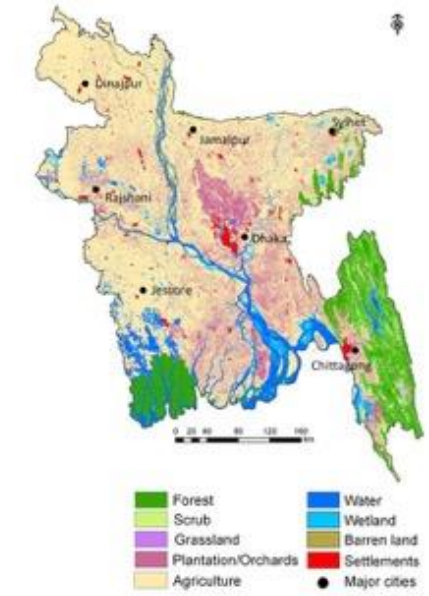
299. The Sal zone represents the geographical areas in Madhupur and Barind tract with small hillocks and plain land. The average elevation is 17 m, and water and terrestrial land area occupy 3% and 97%, respectively. The mean annual precipitation is 2040 mm (1804 - 2462mm). The soils of sal zone have been classified as acid basin clays, brown hill, brown mottled terrace, deep red-brown terrace, shallow grey and shallow red-brown terrace. Inland sal (Shorea robusta) forests originally covered most of the lowlands and floodplains in the central and western parts of the country. This forest has been dramatically reduced in area and now exists only in a number of widely scattered and degraded patches. This zone consists of deciduous Sal Forest, and the most common tree species are Shorea robusta, Albizia spp., Artocarpus heterophyllus, Swietenia mahogany, Acacia auriculiformis etc. and homestead tree species such as Mangifera indica. Mixed subtype is dominated by sal in the canopy, and includes many other associated species such as Terminalia bellerica, Albizzia procera, Lagerstroemia flos-resinae.

300. The Coastal zone represents geographical areas with accreted land in the southern part of the country. The average elevation of coastal zone is 3 m, and water and terrestrial land area occupy 55% and 45%, respectively. The mean annual precipitation is 2870 mm (2267 - 3698 mm). The soils of coastal zone have been classified as brown hill, acid sulphate, calcareous alluvium (non-saline), calcareous grey floodplain, non-calcareous alluvium and noncalcareous grey floodplain. The most common tree species are Sonneratia apetala, Avicennia officinalis, Excoecaria agallocha, Areca catechu and homestead tree species such as Artocarpus heterophyllus, Samanea saman, Azadirachta indica and Mangifera indica.

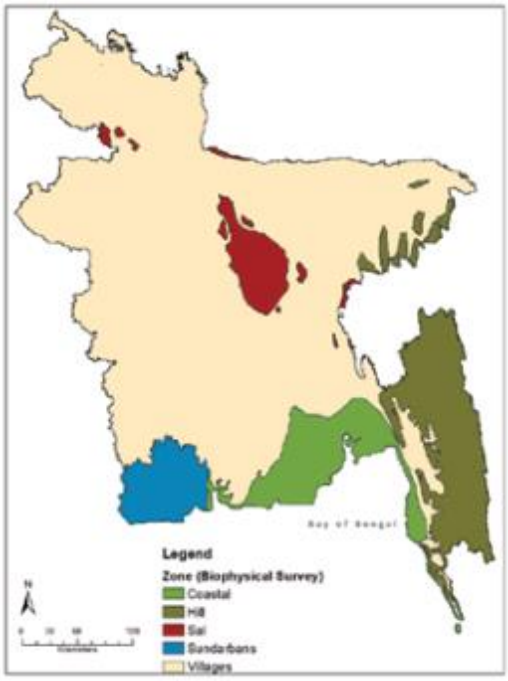
301. The Sundarban zone represents the mangroves of the Sundarbans reserve forest found in the south-western part of the country. The elevation ranges from 2 to 9m with an average of 6 m. Water and terrestrial land area occupy 37% and 63%, respectively. The mean annual precipitation is 2004 mm (1783 - 2343 mm). The soils have been classified as acid sulphate and non-calcareous grey floodplain (non-saline). This zone consists of natural mangrove forest and the most common tree species are Heritiera fomes, Excoecaria algallocha, and Ceriops decandra. The mangrove forest originally covered a vast area of coastal Bangladesh. They account for at least half of the remaining area of natural forest of Bangladesh. Sundri (*Heritiera fomes*) is the characteristic species of the mangrove forest; among others gewa (*Excoecaria agallocha*), goran (*Ceriops decandra*) golpatta (*Nypa fruticans*), baen (*Avicennia officinalis*), passur (*Xylocarpus mekongensis*), kakra (*Bruguiera gymnorhiza*) and keora (*Sonneratia apetala*) are important mangrove species.

302. The Village zone covers the rest of the area not occupied by the Hill, Sundarban, Sal or Coastal zones. The average elevation is 16m, and water and terrestrial land area occupy 8% and 92%, respectively. The mean annual precipitation is 1600 mm. The soils of village zone have been classified as acid basin clays, brown hill, calcareous alluvium (non-saline), calcareous brown floodplain, calcareous dark grey floodplain, deep grey terrace, grey piedmont, non-calcareous alluvium, non-calcareous brown floodplain, non-calcareous dark grey floodplain, non-calcareous grey floodplain (non-saline), and shallow Grey Terrace. The most common tree species are *Swietenia mahogany, Areca catechu, Mangifera indica, Acacia auriculiformis, Samanea saman,* and *Eucalyptus camaldulensis*. The Village forests consist of mixed fruits, fuelwood, shade and other multipurpose trees and bamboos in homesteads and villages throughout Bangladesh.

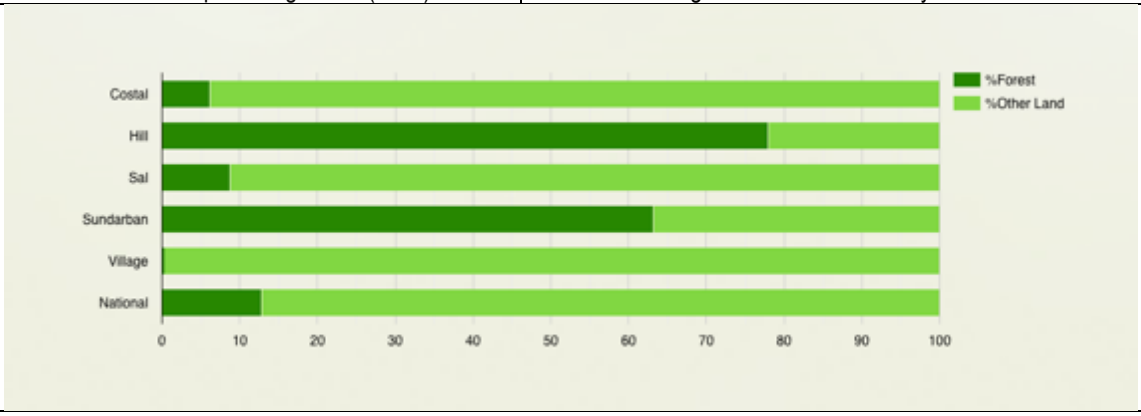
INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.



Land use / Land cover map of Bangladesh (2014)



Zones of the Bangladesh Forest Inventory.



Source: Bangladesh Forestry Inventory

Figure 5.36: Bangladesh Forestry Inventory

303. Key inferences from Bangladesh Forestry Inventory:

- Forest cover 12.8% of the total country area.
- When only land area is considered, forest cover is 14.1%
- This amounts to 0.03 acres forest per person
- Orchards (tree or shrub) and plantations were only 1.7% and 1.1% of the total area, respectively.
- Trees in agricultural land primarily used for cultivation (Multiple and Single Crop) have low sapling and tree densities (49 to 56 stem/ha) and low basal[31] area (0.80 to 0.91 m^2 /ha).

[31] The basal area of a tree is defined as the cross-sectional area (usually in square feet) of a single tree at breast height, or 4. feet above ground. The diameter of a tree at 4. feet above the ground is called diameter at breast height, or 4 feet above ground. The diameter of a tree at 4. feet above the ground is called diameter at breast height (DBH). The cross-sectional area of all stems of a species or all stems in a stand measured at breast height and expressed as per unit of land area.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Table 5.12: Zonal Tree Density

Zone	Number of species[1]	Tree stem density (stem/ha)	Total number of stem (million)	Basal area (m^2/ha)	Total basal area (million m^2)
Coastal	103	229	969	8.82	4.50
Hill	284	146	630	6.23	10.34
Sal	113	169	268	5.89	3.08
Sundarban[2]	28	661	6,861	22.29	8.99
Village	232	98	184	3.28	33.93
National	392	129	472	4.52	60.8

[1] Excludes unknown tree species

[2] Sundarbans zone has only two land cover classes - Mangrove Forest and Riverbank. Tree and sapling density for the whole Sundarbans was 6861 where for Mangrove Forest class the density was 6843 stem/ha and for Riverbank 23418 stem/ha. Riverbank tree and sapling density was 470 stem/ha for all zones.

5.4.3 Biodiversity in the Project Areas

304. The status of terrestrial and aquatic floras and faunas at all the project site were assessed from visual observations, review of literature, and information documented by other agencies. The project area consists of several ecological subsystems e.g. open agricultural land, homesteads, and roadside vegetation. The open agriculture land ecosystem dominates the project areas providing widespread habitat types for various species of flora and fauna under flooded and non-flooded conditions. The vegetation covers of agricultural lands are different crop species, weeds and other herbaceous plants species. The faunal species in the agriculture land and roadside bush ecosystems include birds, amphibians, fish, snakes, rodents and a few other mammals. The homestead ecosystem provides the main tree covered areas within rural Bangladesh including the project sites. The homesteads are covered by fruit, timber, fuelwood, medicinal plants and various multipurpose tree species. The wildlife species in homestead ecosystem include the birds, amphibians, reptiles, mammals like rodents, mongoose, jackal, cats etc.

305. Many of the species including mammals are vulnerable or/and endangered in Bangladesh due to habitat loss, over exploitation, natural calamities and lacking of management. The project areas are not the specific habitat for any particular species of flora and fauna. However, vulnerable and endangered species of flora and fauna have been recorded, as per the following sections, that may be affected due to project implementation. The species identification and IUCN status classification has been questioned by ADB since some species flagged as VU or EN marked with a ^ are LC (or DD or not listed) or a ^^ are NT (or CD conservation dependent to maintain their non-threatened status) per the IUCN global list and do not appear on the Bangladesh list – some are common fruit trees like papaya and mango trees. *Pterocarpus santalinus,* a species endemic to India, and the eastern Ghats, that are distant from Bangladesh is recorded (**) as present at Paigkacha and Mathbaria substation sites. The ADB queried if this species is a misidentification since it would be a new record for Bangladesh if present and a trigger for critical habitat. *Heritiera fomes* (+) is EN and per the IUCN (but not the Bangladesh red list although its presence in the country is recognized, and it is the dominant mangrove species in the Sundabarns) potentially CR endangered in Bangladesh due to rapid decline, is a potential critical habitat trigger for Paigkacha, Mathbaria and Pekua substations if present – since no trees are present at these three substations the species must have been recorded in the surrounding area and will not be directly impacted by the substation itself. *Dipterocarpus turbinatus* is a VU species at Pekua substation, it is a common species and the dominant tree species in semi evergreen troptical rainforest, but can also be found in both disturbed and undisturbed sites, it is not on the Bangladesh red list as being nationally vulnerable and it is thus unlikely to trigger critical habitat – since no trees are present at Pekua substation the species must have been recorded in the surrounding area and will not be directly impacted by the substation. Following query by ADB the EIA/IEE team has checked the baseline data reported in this EIA/IEE study and confirmed the species list as being accurate; but ADB has requested ecological survey be reconducted by the contractor's qualified ecologist and recommendations developed to inform detailed design and final EIA/IEE report. Further, there is the potential for migratory

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

birds to be supported at Pekua and Paigkacha substations requiring the overwintering bird surveys to be conducted here, and then the critical habitat assessment to be reviewed, to inform the baseline of the final EIA/IEE report.

306. If threatened, endemic, migratory or congregatory species are confirmed at the sites, following critical habitat assessment for an appropriate area of analysis by an expert ecologist, recommendations for the detailed design will need to ensure ADB's Safeguard Policy Statement (2009) critical habitat requirements and no net loss of biodiversity are complied – if necessary, entranceways to the substation sites which may encroach on trees and transmission line routings will be reconsidered to avoid impacts on critical habitat.

5.4.4 Diversity of Terrestrial and Aquatic Flora

A. Terrestrial Flora

307. The project influence area (PIA) is highland with mixed vegetation. Crops, vegetables are cultivated in the surroundings mainly include rice, wheat, tobacco, corn, nut, Rabi crops and variety of homestead vegetables. A sizeable number of fruit trees with economic value have been observed in the PIA. The fruit trees include jackfruit, mangoes, litchi, banana, coconut, blackberry etc. and timber trees include mahogany, neem, epil-epil, koroi etc. Considerable number of trees and bushes in the PIA site provide habitat for birds and other animals. The composition of plant community includes low growing grasses, trees, herbs and shrubs. The data collected from the field survey suggests that the predominant species are those of cultivated vegetables and trees. Some VU and EN species have been recorded and will need to be protected if confirmed by ecological survey as present on the project sites. A detailed list of terrestrial floral species found in the project areas during the baseline survey as well as literature review is shown in Table 5.13 to Table 5.25.

Table 5.13: List of Flora Identified in Tungipara (Gopalganj)

Common Name	Scientific Name	Family	English Name	IUCN Status
Am	*Mangifera indica*	Anacardiaceae	Mango	LC
Amra	*Spondias pinnata*	Anacardiaceae	Wild mango	LC
Bamboo	*Bambosa spp.*	Poaceae		LC
Banana	*Musa sapientum*	Musaceae	Banana	LC
Bel	*Aegle marmelos*	Rutaceae	Wood apple	LC
Pomegranate	*Punica granatum)*	Lythraceae.	Pomegranate	LC
Bokna Neem	*Melia azadirach*	Mahogany		LC
Boroi	*Zizyphusm auritiana*	Rhamnacea		LC
Bot	*Ficus benghala nsis*	Mulberry	Banyan tree	LC
Chatim	*Alstonia scholaris*	Dogbanes	Chatian	LC
Chalta	*Dellenia indica*	Dilleniaceae		LC
Debdaru	*Polyalthia longifolia*	Custard apples	-	LC
Jarul	*Lagerstroemia speciosa*	Lythraceae	Giant crepe-myrtle	LC
Jolpai	*Elaeocarpus robustus*	Elaeocarpaceae	Olive	LC
Karamcha	*Carissa carandas*	Apocynaceae	Karuanda	LC
Kathal	*Artocarpus heterophyllus*	Mulberry	Jackfruit	LC
Kodbel	*Feronia limonia*	Rutaceae	Wood Apple	NT
Lebu	*Citrus aurantifolia*	Rutaceae	Lemon	LC
Nayantara	*Vinca rosea*	Dogbanes	Pri winkle	LC
Papaya	*Carica papaya*	Caricaceae	Papaw tree	LC
Racta Jaba	*Hibiscus rosa-sinensis*	Mallows	Rose of china	LC
Sofeda	*Manilkara zapota*	Sapotaceae	Sapota	LC
Tentul	*Tamarindus indica*	Legumes	Tamarind	LC
Venna	*Ricinus communes*	Spurges		VU^
Zamrul	*Syzygium samarangense*	Myrtle		LC

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Table 5.14: List of Flora Identified in Paikgacha (Khulna)

Common Name	Scientific Name	Family	English Name	IUCN Status
Akanda	*Calotropis procera*	Apocynaceae	Swallow wort	LC
Bain	*Avicennia officinalis*	Acanthaceae	Indian Mangrove	LC
Hargoza	*Acanthus ilicifolius*	Acanthaceae	Sea Holly	LC
Ashok	*Saraca indica*	Fabaceae	Ashoka	LC
Sundari	*Heritiera fomes*	Malvaceae	Sundri	EN+
Passur	*Xylocarpus mekongensis*	Meliaceae	Cedar Mangrove	VU^
Aurjun	*Terminalia arjuna*	Combretaceae	Aurjun	LC
Amra	*Spondias pinnata*	Anacardiaceae	Wild mango	LC
Am	*Mangifera indica*	Anacardiaceae	Mango	LC
Bashak	*Adhatoda vasica*	Acanthaceae	Malabar Nut Tree	LC
Bamboo	*Bambosa spp.*	Poaceae		LC
Banana	*Musa sapientum*	Musaceae	Banana	LC
Bel	*Aegle marmelos*	Rutaceae	Wood apple	LC
Banar Lathi	*Cassia fistula*	Fabaceae	Indian laburnum	LC
Bokna Neem	*Melia azadirach*	Mahogany		LC
Bot	*Ficus benghala nsis*	Mulberry	Banyan tree	LC
Chalta	*Dellenia indica*	Dilleniaceae		LC
Coconut	*Cocos nucifera*	Palms		LC
Debdaru	*Polyalthia longifolia*	Custard apples	-	LC
Dhundul	*Luffa eregrinel*	Luffa	Sponge gourd	LC
Dalim	*Panica granatum*	Lythraceae	Pomegranate	LC
EpilEpil	*Leucaenaleucocephala*	Legumes		LC
Jarul	*Lagerstroemia speciosa*	Lythraceae	Giant crepe-myrtle	LC
Jolpai	*Elaeocarpus robustus*	Elaeocarpaceae	Olive	LC
Kamranga	*Averrhoa carambola*	Oxalidaceae	Carambola apple	LC
Kathal	*Artocarpus heterophyllus*	Mulberry	Jackfruit	LC
Koroi	*Albizzia procera*	Mimosaceae	Porrot tree	LC
Kodbel	*Feronia limonia*	Rutaceae	Wood Apple	LC
Lebu	*Citrus aurantifolia*	Rutaceae	Lemon	LC
Litchi	*Litchi chinenss*	Soapberry		LC
Mehogoni	*Swietenia mahagoni*	Mahogany		LC
Papaya	*Carica papaya*	Caricaceae	Papaw tree	LC
Racta Jaba	*Hibiscus rosa-sinensis*	Mallows	Rose of china	LC
Radhachura	*Peltophorum pterocarpum*	Legumes	Copperpod	LC
Racta Chandal	*Pterocarpus santalinus*	Legumes	Red sanders	EN**
Sal	*Shorea robusta*	Dipterocarpaceae		LC
Shishu	*Dalbergia sisoo*	Legumes		LC
Sofeda	*Manilkara zapota*	Sapotaceae	Sapota	LC
Tentul	*Tamarindus indica*	Legumes	Tamarind	LC

Table 5.15: List of Flora Identified in Kumarkhali (Kushtia)

Common Name	Scientific Name	Family	English Name	IUCN Status
Akashmoni	*Acacia aurculiformios*	Fabaceae (Leguminosae)	Northern black wattle	LC
Akanda	*Calotropis procera*	Apocynaceae	Swallow wort	LC
Ashok	*Saraca indica*	Fabaceae	Ashoka	VU^
Aurjun	*Terminalia arjuna*	Combretaceae	Aurjun	LC
Amra	*Spondias pinnata*	Anacardiaceae	Wild mango	LC
Am	*Mangifera indica*	Anacardiaceae	Mango	LC
Bashak	*Adhatoda vasica*	Acanthaceae	Malabar Nut Tree	LC
Banana	*Musa sapientum*	Musaceae	Banana	LC

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Common Name	Scientific Name	Family	English Name	IUCN Status
Bel	*Aegle marmelos*	Rutaceae	Wood apple	LC
Banar Lathi	*Cassia fistula*	Fabaceae	Indian laburnum	VU^
Boroi	*Zizyphusm auritiana*	Rhamnacea		LC
Bot	*Ficus benghala nsis*	Mulberry	Banyan tree	LC
Coconut	*Cocos nucifera*	Palms		LC
Dalim	*Panica granatum*	Lythraceae	Pomegranate	LC
Jolpai	*Elaeocarpus robustus*	Elaeocarpaceae	Olive	LC
Kamranga	*Averrhoa carambola*	Oxalidaceae	Carambola apple	LC
Kathal	*Artocarpus heterophyllus*	Mulberry	Jackfruit	LC
Lebu	*Citrus aurantifolia*	Rutaceae	Lemon	LC
Litchi	*Litchi chinenss*	Soapberry		LC
Mehogoni	*Swietenia mahagoni*	Mahogany		LC
Papaya	*Carica papaya*	Caricaceae	Papaw tree	LC
Segun	*Tectona grandis*	Lamiaceae	Teak	LC
Sofeda	*Manilkara zapota*	Sapotaceae	Sapota	LC
Jam	*Syzygium cumini*	Myrtaceae	Jamun	LC

Table 5.16: List of Flora Identified in Mathbaria (Pirojpur)

Common Name	Scientific Name	Family	English Name	IUCN Status
Am	*Mangifera indica*	Anacardiaceae	Mango	LC
Sundi	*Heritiera fomes*	Malvaceae	Sundri	EN+
Cedar Mangrove	*Xylocarpus mekongensis*	Meliaceae	Cedar Mangrove	LC
Aurjun	*Terminalia arjuna*	Combretaceae	Aurjun	LC
Nipa Palm	*Nypa fruticans*	Arecaceae	Nipa Palm	LC
Amra	*Spondias pinnata*	Anacardiaceae	Wild mango	LC
Passur	*Xylocarpus mekongensis*	Meliaceae	Cedar Mangrove	LC
Babla	*Acacia nilotica*	Legumes		EN^
Bashak	*Adhatoda vasica*	Acanthaceae	Malabar Nut Tree	LC
Bogi	*Avicennia officinalis*	Acanthaceae	Indian Avicennia	LC
Pitali	*Trewia nudiflora*	Euphorbiaceae	False White Teak	LC
Banana	*Musa sapientum*	Musaceae	Banana	LC
Bel	*Aegle marmelos*	Rutaceae	Wood apple	EN^^
Boroi	*Zizyphusm auritiana*	Rhamnacea		LC
Bot	*Ficus benghala nsis*	Mulberry	Banyan tree	LC
Chatim	*Alstonia scholaris*	Dogbanes	Chatian	LC
Coconut	*Cocos nucifera*	Palms		LC
Dhundul	*Luffa eregrinel*	Luffa	Sponge gourd	LC
EpilEpil	*Leucaena leucocephala*	Legumes		VU^^
Eucalyptus	*Eucalyptus citriodora*	Myrtle		LC
Jarul	*Lagerstroemia speciosa*	Lythraceae	Giant crepe-myrtle	LC
Kalpanath/Kalo megh	*Andrographis paniculata*	Acanthaceae	Creat	LC
Kathal	*Artocarpus heterophyllus*	Mulberry	Jackfruit	LC
Mehedi/Mendi	*Lawsonia inermis*	Lythraceae	-	LC
Mehogoni	*Swietenia mahagoni*	Mahogany		LC
Nishinda	*Vitex negundo*	Lamiaceae	Five leaved caste tree	LC
Papaya	*Carica papaya*	Caricaceae	Papaw tree	VU^
Peyara	*Psidium guajava*	Myrtaceae	Guava	LC
Radhachura	*Peltophorum pterocarpum*	Legumes	Copperpod	LC
Racta Chandal	*Pterocarpus santalinus*	Legumes	Red sanders	EN**
Segun	*Tectona grandis*	Lamiaceae	Teak	LC

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Table 5.17: List of Flora Identified in Chatkhil (Noakhali)

Common Name	Scientific Name	Family	English Name	IUCN Status
Akashmoni	*Acacia aurculiformios*	Fabaceae (Leguminosae)	Northern black wattle	LC
Akanda	*Calotropis procera*	Apocynaceae	Swallow wort	LC
Aurjun	*Terminalia arjuna*	Combretaceae	Aurjun	LC
Am	*Mangifera indica*	Anacardiaceae	Mango	LC
Bashak	*Adhatoda vasica*	Acanthaceae	Malabar Nut Tree	LC
Bamboo	*Bambosa spp.*	Poaceae		LC
Banana	*Musa sapientum*	Musaceae		LC
Bel	*Aegle marmelos*	Rutaceae	Wood apple	LC
Banar Lathi	*Cassia fistula*	Fabaceae	Indian laburnum	LC
Bokna Neem	*Melia azadirach*	Mahogany		VU^
Bot	*Ficus benghala nsis*	Mulberry	Banyan tree	LC
Coconut	*Cocos nucifera*	Palms		LC
Dhundul	*Luffa 170eregrine170l*	Luffa	Sponge gourd	LC
Dalim	*Panica granatum*	Lythraceae	Pomegranate	LC
EpilEpil	*Leucaenaleucocephala*	Legumes		NT
Jarul	*Lagerstroemia speciosa*	Lythraceae	Giant crepe-myrtle	LC
Kalpanath/Kalo megh	*Andrographis paniculata*	Acanthaceae	Creat	LC
Kathal	*Artocarpus heterophyllus*	Mulberry	Jackfruit	LC
Koroi	*Albizzia procera*	Mimosaceae	Porrot tree	NT
Lebu	*Citrus aurantifolia*	Rutaceae	Lemon	LC
Mehogoni	*Swietenia mahagoni*	Mahogany		LC
Papaya	*Carica papaya*	Caricaceae	Papaw tree	LC
Racta Jaba	*Hibiscus rosa-sinensis*	Mallows	Rose of China	LC
Racta Chandal	*Pterocarpus santalinus*	Legumes	Red sanders	LC
Sal	*Shorea robusta*	Dipterocarpaceae		LC
Segun	*Tectona grandis*	Lamiaceae	Teak	LC
Shimul	*Bombax ceiba*	Malvaceae		LC
Shishu	*Dalbergia sisoo*	Legumes		VU^
Sofeda	*Manilkara zapota*	Sapotaceae	Sapota	LC
Tentul	*Tamarindus indica*	Legumes	Tamarind	LC
Ziga	*Lannea coromandelica*	Anacardiaceae		LC

Table 5.18: List of Flora Identified in Kishoreganj

Common Name	Scientific Name	Family	English Name	IUCN Status
Akashmoni	*Acacia aurculiformios*	Fabaceae (Leguminosae)	Northern black wattle	LC
Am	*Mangifera indica*	Anacardiaceae	Mango	VU^
Banana	*Musa sapientum*	Musaceae	Banana	NE
Bel	*Aegle marmelos*	Rutaceae	Wood apple	NT
Bamboo	*Bambosa spp.*	Poaceae		LC
Amra	*Spondias pinnata*	Anacardiaceae	Wild mango	NT
Coconut	*Cocos nucifera*	Palms		LC
Sal	*Shorea robusta*	Dipterocarpaceae		LC
Mehogoni	*Swietenia mahagoni*	Mahogany		LC
Boroi	*Zizyphusm auritiana*	Rhamnacea		LC
Kathal	*Artocarpus heterophyllus*	Mulberry	Jackfruit	LC
Bot	*Ficus benghala nsis*	Mulberry	Banyan tree	LC
Bashak	*Adhatoda vasica*	Acanthaceae	Malabar Nut Tree	LC
Jam	*Syzygium cumini*	Myrtaceae	Jamun	NE
Lebu	*Citrus aurantifolia*	Rutaceae	Lemon	NE

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Common Name	Scientific Name	Family	English Name	IUCN Status
Akashmoni	*Acacia aurculiformios*	Fabaceae (Leguminosae)	Northern black wattle	LC
Am	*Mangifera indica*	Anacardiaceae	Mango	VU^
Banana	*Musa sapientum*	Musaceae	Banana	NE
Bel	*Aegle marmelos*	Rutaceae	Wood apple	NT
Bamboo	*Bambosa spp.*	Poaceae		LC
Amra	*Spondias pinnata*	Anacardiaceae	Wild mango	NT
Coconut	*Cocos nucifera*	Palms		LC
Mehedi/Mendi	*Lawsonia inermis*	Lythraceae	-	LC
Papaya	*Carica papaya*	Caricaceae	Papaw tree	NT
Racta Jaba	*Hibiscus rosa-sinensis*	Mallows	Rose of China	NT
Bokna Neem	*Melia azadirach*	Mahogany		LC
Tentul	*Tamarindus indica*	Legumes	Tamarind	LC
Jolpai	*Elaeocarpus robustus*	Elaeocarpaceae	Olive	VU^^

Table 5.19: List of Flora Identified in Satkhira

Common Name	Scientific Name	Family	English Name	IUCN Status
Am	*Mangifera indica*	Anacardiaceae	Mango	LC
Keora	*Sonneratia apetala*	Lythraceae		EN^
Ashok	*Saraca indica*	Fabaceae	Ashoka	LC
Amra	*Spondias pinnata*	Anacardiaceae	Wild mango	NT
Jolpai	*Elaeocarpus robustus*	Elaeocarpaceae	Olive	LC
Kamranga	*Averrhoa carambola*	Oxalidaceae	Carambola apple	LC
Kathal	*Artocarpus heterophyllus*	Mulberry	Jackfruit	LC
Koroi	*Albizzia procera*	Mimosaceae	Porrot tree	LC
Kodbel	*Feronia limonia*	Rutaceae	Wood Apple	LC
Lebu	*Citrus aurantifolia*	Rutaceae	Lemon	LC
Litchi	*Litchi chinenss*	Soapberry		LC
Mehogoni	Swietenia mahagoni	Mahogany		LC
Papaya	*Carica papaya*	Caricaceae	Papaw tree	VU^
Racta Jaba	*Hibiscus rosa-sinensis*	Mallows	Rose of china	LC
Racta Chandal	*Pterocarpus santalinus*	Legumes	Red sanders	LC
Shishu	*Dalbergia sisoo*	Legumes		EN^
Sofeda	*Manilkara zapota*	Sapotaceae	Sapota	LC
Bamboo	*Bambosa spp.*	Poaceae		LC
Banana	*Musa sapientum*	Musaceae	Banana	LC
Bel	*Aegle marmelos*	Rutaceae	Wood apple	LC
Banar Lathi	*Cassia fistula*	Fabaceae	Indian laburnum	LC
Bot	*Ficus benghala nsis*	Mulberry	Banyan tree	LC
Coconut	*Cocos nucifera*	Palms		LC
Debdaru	*Polyalthia longifolia*	Custard apples	-	LC
Dalim	*Panica granatum*	Lythraceae	Pomegranate	LC
Jarul	*Lagerstroemia speciosa*	Lythraceae	Giant crepe-myrtle	LC

Table 5.20: List of Flora Identified in Brahmanbaria

Common Name	Scientific Name	Family	English Name	IUCN Status
Amra	*Spondias pinnata*	Anacardiaceae	Wild mango	LC
Am	*Mangifera indica*	Anacardiaceae	Mango	LC
Banana	*Musa sapientum*	Musaceae	Banana	LC
Bel	*Aegle marmelos*	Rutaceae	Wood apple	NT
Bamboo	*Bambosa spp.*	Poaceae		LC

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Common Name	Scientific Name	Family	English Name	IUCN Status
Bashak	*Adhatoda vasica*	Acanthaceae	Malabar Nut Tree	LC
Kodbel	*Feronia limonia*	Rutaceae	Wood Apple	NT
Lebu	*Citrus aurantifolia*	Rutaceae	Lemon	LC
Litchi	*Litchi chinenss*	Soapberry		LC
Babla	*Acacia nilotica*	Legumes		LC
Coconut	*Cocos nucifera*	Palms		LC
Jarul	*Lagerstroemia speciosa*	Lythraceae	Giant crepe-myrtle	LC
Karamcha	*Carissa carandas*	Apocynaceae	Karuanda	LC
Kathal	*Artocarpus heterophyllus*	Mulberry	Jackfruit	LC
Papaya	*Carica papaya*	Caricaceae	Papaw tree	LC
Racta Jaba	*Hibiscus rosa-sinensis*	Mallows	Rose of China	LC
Shimul	*Bombax ceiba*	Malvaceae		LC
Zamrul	*Syzygium samarangense*	Myrtle		LC
Koroi	*Albizzia procera*	Mimosaceae	Porrot tree	LC
Mehedi/Mendi	*Lawsonia inermis*	Lythraceae	-	LC

Table 5.21: List of Flora Identified in Dupchanchia (Bogura)

Common Name	Scientific Name	Family	English Name	IUCN Status
Amra	*Spondias pinnata*	Anacardiaceae	Wild mango	LC
Am	*Mangifera indica*	Anacardiaceae	Mango	LC
Bashak	*Adhatoda vasica*	Acanthaceae	Malabar Nut Tree	VU^
Banana	*Musa sapientum*	Musaceae		LC
Bel	*Aegle marmelos*	Rutaceae	Wood apple	LC
Bokna Neem	*Melia azadirach*	Mahogany		LC
Bot	*Ficus benghala nsis*	Mulberry	Banyan tree	LC
Chatim	*Alstonia scholaris*	Dogbanes	Chatian	VU^
Chalta	*Dellenia indica*	Dilleniaceae		LC
Coconut	*Cocos nucifera*	Palms		LC
Dhundul	*Luffa eregrinel*	Luffa	Sponge gourd	LC
Dalim	*Panica granatum*	Lythraceae	Pomegranate	LC
Gab	*Diospytos eregrine*	Ebenaceae	River ebony	LC
Jarul	*Lagerstroemia speciosa*	Lythraceae	Giant crepe-myrtle	LC
Karamcha	*Carissa carandas*	Apocynaceae	Karuanda	LC
Kathal	*Artocarpus heterophyllus*	Mulberry	Jackfruit	LC
Lebu	*Citrus aurantifolia*	Rutaceae	Lemon	LC
Litchi	*Litchi chinenss*	Soapberry		LC
Mehedi/Mendi	*Lawsonia inermis*	Lythraceae	-	LC
Papaya	*Carica papaya*	Caricaceae	Papaw tree	LC
Racta Jaba	*Hibiscus rosa-sinensis*	Mallows	Rose of China	LC
Sal	*Shorea robusta*	Dipterocarpaceae		LC
Shishu	*Dalbergia sisoo*	Legumes		LC
Tentul	*Tamarindus indica*	Legumes	Tamarind	LC
Venna	*Ricinus communes*	Spurges		NT

Table 5.22: List of Flora Identified in Matlab (N) (Chandpur)

Common Name	Scientific Name	Family	English Name	IUCN Status
Akashmoni	*Acacia aurculiformios*	Fabaceae (Leguminosae)	Northern black wattle	LC
Ashok	*Saraca indica*	Fabaceae	Ashoka	NT
Aurjun	*Terminalia arjuna*	Combretaceae	Aurjun	VU^

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Common Name	Scientific Name	Family	English Name	IUCN Status
Amra	*Spondias pinnata*	Anacardiaceae	Wild mango	LC
Am	*Mangifera indica*	Anacardiaceae	Mango	LC
Babla	*Acacia nilotica*	Legumes		VU^
Banana	*Musa sapientum*	Musaceae		LC
Bel	*Aegle marmelos*	Rutaceae	Wood apple	LC
Boroi	*Zizyphusm auritiana*	Rhamnacea		LC
Coconut	*Cocos nucifera*	Palms		LC
Dalim	*Panica granatum*	Lythraceae	Pomegranate	LC
EpilEpil	*Leucaena leucocephala*	Legumes		EN^^
Jolpai	*Elaeocarpus robustus*	Elaeocarpaceae	Olive	LC
Kamranga	*Averrhoa carambola*	Oxalidaceae	Carambola apple	LC
Kathal	*Artocarpus heterophyllus*	Mulberry	Jackfruit	LC
Koroi	*Albizzia procera*	Mimosaceae	Porrot tree	LC
Kodbel	*Feronia limonia*	Rutaceae	Wood Apple	LC
Mehedi/Mendi	*Lawsonia inermis*	Lythraceae	-	LC
Mehogoni	*Swietenia mahagoni*	Mahogany		LC
Nayantara	*Vinca rosea*	Dogbanes	Pri winkle	LC
Nishinda	*Vitex negundo*	Lamiaceae	Five leaved caste tree	LC
Racta Jaba	*Hibiscus rosa-sinensis*	Mallows	Rose of China	LC
Segun	*Tectona grandis*	Lamiaceae	Teak	LC
Tentul	*Tamarindus indica*	Legumes	Tamarind	LC
Venna	*Ricinus communes*	Spurges		LC

Table 5.23: List of Flora Identified in Monohardi (Narshingdi)

Common Name	Scientific Name	Family	English Name	IUCN Status
Aurjun	*Terminalia arjuna*	Combretaceae	Aurjun	LC
Amra	*Spondias pinnata*	Anacardiaceae	Wild mango	LC
Am	*Mangifera indica*	Anacardiaceae	Mango	LC
Babla	*Acacia nilotica*	Legumes		VU^
Bot	*Ficus benghala nsis*	Mulberry	Banyan tree	LC
Chalta	*Dellenia indica*	Dilleniaceae		LC
Coconut	*Cocos nucifera*	Palms		LC
Debdaru	*Polyalthia longifolia*	Custard apples	-	NT
Dhundul	*Luffa 173eregrine173l*	Luffa	Sponge gourd	LC
Dalim	*Panica granatum*	Lythraceae	Pomegranate	LC
Jarul	*Lagerstroemia speciosa*	Lythraceae	Giant crepe-myrtle	LC
Jolpai	*Elaeocarpus robustus*	Elaeocarpaceae	Olive	LC
Karamcha	*Carissa carandas*	Apocynaceae	Karuanda	VU^
Kathal	*Artocarpus heterophyllus*	Mulberry	Jackfruit	LC
Koroi	*Albizzia procera*	Mimosaceae	Porrot tree	LC
Lebu	*Citrus aurantifolia*	Rutaceae	Lemon	LC
Mehogoni	*Swietenia mahagoni*	Mahogany		LC
Papaya	*Carica papaya*	Caricaceae	Papaw tree	LC
Racta Jaba	*Hibiscus rosa-sinensis*	Mallows	Rose of China	LC
Segun	*Tectona grandis*	Lamiaceae	Teak	LC
Shimul	*Bombax ceiba*	Malvaceae		LC
Tentul	*Tamarindus indica*	Legumes	Tamarind	LC
Venna	*Ricinus communes*	Spurges		VU^^
Zamrul	*Syzygium samarangense*	Myrtle		NT

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Table 5.24: List of Flora Identified in Madhabpur (Habiganj)

Common Name	Scientific Name	Family	English Name	IUCN Status
Amra	*Spondias pinnata*	Anacardiaceae	Wild mango	LC
Am	*Mangifera indica*	Anacardiaceae	Mango	LC
Babla	*Acacia nilotica*	Legumes		NE
Bashak	*Adhatoda vasica*	Acanthaceae	Malabar Nut Tree	LC
Coconut	*Cocos nucifera*	Palms		LC
Debdaru	*Polyalthia longifolia*	Custard apples	-	VU^
Jarul	*Lagerstroemia speciosa*	Lythraceae	Giant crepe-myrtle	LC
Kalpanath/Kalo megh	*Andrographis paniculata*	Acanthaceae	Creat	LC
Karamcha	*Carissa carandas*	Apocynaceae	Karuanda	VU^
Kathal	*Artocarpus heterophyllus*	Mulberry	Jackfruit	LC
Koroi	*Albizzia procera*	Mimosaceae	Porrot tree	LC
Lebu	*Citrus aurantifolia*	Rutaceae	Lemon	LC
Mehedi/Mendi	*Lawsonia inermis*	Lythraceae	-	LC
Papaya	*Carica papaya*	Caricaceae	Papaw tree	LC
Racta Jaba	*Hibiscus rosa-sinensis*	Mallows	Rose of China	LC
Radhachura	*Peltophorum pterocarpum*	Legumes	Copperpod	LC
Raktadrun	*Leucas sibiricus*	Lamiacea		NT
Shimul	*Bombax ceiba*	Malvaceae		LC
Zamrul	*Syzygium samarangense*	Myrtle		LC

Table 5.25: List of Flora Identified in Pekua/ Chakaria (Cox's Bazar)

Common Name	Scientific Name	Family	English Name	IUCN Status
Sundari	Heritiera fomes	Malvaceae	Sundari Tree	EN+
Keora	Sonneratia apetala	Lythraceae	Mangrove Apple	LC
Garjan	Dipterocarpus turbinatus	Dipterocarpaceae	Gurjan Tree	VU+
Golpata	Nypa fruticans	Arecaceae	Nipa Palm	LC
Goran	Ceriops decandra	Rhizophoraceae	Spurred Mangrove	LC
Baen	Avicennia alba	Acanthaceae	White Mangrove	NT
Gewa	Excoecaria agallocha	Euphorbiaceae	Blind Your Eye Mangrove	LC
Kankra	Bruguiera gymnorhiza	Rhizophoraceae	Black Mangrove	NT
Dhundal	Xylocarpus granatum	Meliaceae	Cannonball Mangrove	LC
Kewra	Pandanus fascicularis	Pandanaceae	Screw Pine	EN^
Hijol	Barringtonia acutangula	Lecythidaceae	Freshwater Mangrove	LC
Ashok	Saraca indica	Fabaceae	Ashoka	LC
Aurjun	Terminalia arjuna	Combretaceae	Aurjun	LC
Amra	Spondias pinnata	Anacardiaceae	Wild mango	LC
Am	Mangifera indica	Anacardiaceae	Mango	LC
Babla	Acacia nilotica	Legumes		LC
Bashak	Adhatoda vasica	Acanthaceae	Malabar Nut Tree	LC
Bamboo	Bambosa spp.	Poaceae		LC
Banana	Musa sapientum	Musaceae		NE
Bel	Aegle marmelos	Rutaceae	Wood apple	LC
Banar Lathi	Cassia fistula	Fabaceae	Indian laburnum	VU^
Coconut	Cocos nucifera	Palms		LC
Debdaru	Polyalthia longifolia	Custard apples	-	LC
EpilEpil	Leucaena leucocephala	Legumes		VU^^
Eucalyptus	Eucalyptus citriodora	Myrtle		NE
Kathal	Artocarpus heterophyllus	Mulberry	Jackfruit	LC
Koroi	Albizzia procera	Mimosaceae	Porrot tree	LC

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Common Name	Scientific Name	Family	English Name	IUCN Status
Lebu	Citrus aurantifolia	Rutaceae	Lemon	LC
Nishinda	Vitex negundo	Lamiaceae	Five leaved caste tree	LC
Racta Chandal	Pterocarpus santalinus	Legumes	Red sanders	LC
Sal	Shorea robusta	Dipterocarpaceae		LC
Segun	Tectona grandis	Lamiaceae	Teak	LC
Shishu	Dalbergia sisoo	Legumes		LC
Sofeda	Manilkara zapota	Sapotaceae	Sapota	LC

Source: Environmental Survey in the project areas, April 2024 & Literature review

*Note: IUCN Status Codes: LC = Least Concern, NT = Near Threatened, VU = Vulnerable, EN = Endangered, CR= Critically Endangered, NE=Not Evaluated

308. Subject to confirmation of species and IUCN classification, at least one species recorded is a potential critical habitat trigger. Sundari (EN) has a restricted distribution in South Asia and is found in the landward margin, which is a mangrove area most threatened by coastal development. It is found in the Sundarbans in India and Bangladesh, through Myanmar, Thailand, and northern Malaysia which is its southernmost limit. It can be locally common and abundant in some parts of its range such as the Sundarbans and in Bangladesh. But it has limited overall distribution. This species is listed as endangered by IUCN. However, populations in India and Bangladesh are rapidly declining and may qualify for Critically Endangered at a regional level. That said, it is the dominant mangrove species found in the Sundabarns and although referred to in the document it is not listed on the Bangladesh red list. It is a marine intertidal species that prefers freshwater and is thus fast-growing in low-saline environments. It occurs in stands and grows up to 25 m. The main threat is habitat destruction and removal of mangrove areas. Reasons for removal include cleared for agriculture, rice production and salt pans, and for the development of urban and industrial areas, road construction, etc. Other threats include pollution from sewage effluents, solid wastes, siltation, oil, and agricultural and urban runoff. Climate change is also thought to be a threat, particularly at the edges of a species range. Natural threats include cyclones, hurricane and tsunamis. Since no trees are found at the substation site, even if the area of analysis for Pekua substation supports the critical habitat, then it will not be directly impacted, but there is potential for indirect disturbance of the species and the transmission lines may encounter it.

Common Name	Scientific Name	Family	English Name	Project Component/District	Affected Number of Trees
Sundari	Heritiera fomes	Malvaceae	Sundari Tree	Paikgacha, Mathbaria, Cox's Bazar	0



Citrus aurantifolia



Artocarpus heterophyllus

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.



Carica papaya



Aeglemarmelos

Source: Environmental Survey in the project area, April 2024

Figure 5.37: Terrestrial Flora Around the Project Area

B. Aquatic Flora

309. Different types of aquatic flora species were recorded in all the project areas. The most abundant hydrophytes in the project area are Kochuripana (*Eichhornia crassipes*), Topapana (*Pistia stratiotes*), Khudipana (*Lemna minor*) Pata Jhajii (*Vallisneria spiralis*), Shapla (*Nymphaea* sp.), Kolmi (*Ipomoea aquatica*), Helenchaa (*Enhydra fluctuant*), and Duckweed (*Spiredella* sp.). Numerous algae (e.g. *Spirogyra* and *Scytonema*) and amphibian plant, Dholkolmi (*Ipomoea fistulosa*) are also found in the road side water bodies.



Eichhornia crassipes



Ipomoea aquatic

Source: Environmental Survey in the project area, May 2024

Figure 5.38: Aquatic Flora Around the Project Areas

C. Terrestrial Fauna

310. The diversified habitats and ecosystems in the project areas support various types of animals as given in the following Tables 5.26 to 5.38. Primary and secondary mode was adopted for identification of fauna. Most of the birds are identified through direct observation rather than from people. Most of the Amphibians, Reptiles and Mammals were identified by using books and description of the local people during the survey.

Table 5.26: List of Fauna Identified in Tungipara (Gopalganj)

Scientific Name	Family	English Name	Local Name	IUCN Status
Class: Amphibia				
Hoplobatrachus tigerinus	Dicroglossidae	Red-eared Bullfrog	Red-eared Bullfrog	LC
Polypedates bengalensis	Rhacophoridae	Bengal Tree Frog	Bengal Tree Frog	LC
Class: Reptilia				

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Scientific Name	Family	English Name	Local Name	IUCN Status
Naja naja	Elapidae	Indian Cobra	Cobra	LC
Python molurus	Pythonidae	Indian Python	Indian Python	LC
Mabuya carinata	Skink	Common skink	Anjon	LC
Varanus bengalensis	Monitor lizards	Bengal monitor	Gui shap	NT
Ahaetulla nasutus	Colubridae	Common vine snake	Laodoga shap	LC
Class: Aves				
Phalacrocorax niger	Cormorants	Little cormorant	Paan-kowri	LC
Casmerodius albus	Herons	Great egret	Sada bok	LC
Anastomus oscitans	Stork	Asian Openbill	Shamuk-khol	LC
Haliastur indus	Accipitridae	Brahminy kite	Shankho chil	LC
Milvus migrans	Accipitridae	Black kite	Bhubon chil	LC
Actitis hypoleucos	Accipitridae	Common sandpiper	Kada Khocha	LC
Tringa stagnatilis	Sandpiper	Marsh Sandpiper	Bil Batan	LC
Streptopelia decaocto	Columbidae	Eurasian collared dove	Konthighughu	LC
Amaurornis phoenicurus	Rail	White-breasted waterhen	Dahuk	LC
Eudynamys scolopacea	Cuckoos	Asian cuckoo	Kokil	LC
Centropus sinensis	Cuckoos	Greater coucal	Kanakua	LC
Cuculus micropterus	Cuckoos	Indian cuckoo	Bou-kotha-kao Pakhi	LC
Alcedo atthis	Kingfisher	Common kingfisher	Choto Maachranga	LC
Halcyon smyrnensis	Kingfisher	White-throated kingfisher	Maachranga	LC
Psilopogon lineatus	Megalaimidae	Lineated barbet	Gurkhod	LC
Class: Mammalia				
Axis axis	Cervidae	Spotted Deer	Badur	LC
Pipistrellus coromandra	Vespertilionidae	Indian Pipistrelle	Chamchika	LC
Herpestes auropunctatus	Mongoose	Small Indian Mongoose	Benji	LC
Vulpes bengalensis	Canidae	Bengal Fox	Khek shial	LC

Table 5.27: List of Fauna Identified in Kishoreganj

Scientific Name	Family	English Name	Local Name	IUCN Status
Class: Amphibia				
Bufo melanostictus	True toad	Common Toad	Kuno bang	LC
Class: Reptilia				
Hemidactylus flaviviridis	Geckos	Common House Lizard	Tiktiki	LC
Varanus bengalensis	Monitor lizards	Bengal monitor	Gui shap	LC
Class: Aves				
Phalacrocorax niger	Cormorants	Little cormorant	Paan-kowri	LC
Anastomus oscitans	Stork	Asian Openbill	Shamuk-khol	LC
Actitis hypoleucos	Accipitridae	Common sandpiper	Kada Khocha	LC
Tringa stagnatilis	Sandpiper	Marsh Sandpiper	Bil Batan	LC
Spilopelia chinensis	Columbidae	Spotted dove	Tila Ghughu	LC
Eudynamys scolopacea	Cuckoos	Asian cuckoo	Kokil	LC
Centropus sinensis	Cuckoos	Greater coucal	Kanakua	LC
Cuculus micropterus	Cuckoos	Indian cuckoo	Bou-kotha-kao Pakhi	LC
Halcyon smyrnensis	Kingfisher	White-throated kingfisher	Maachranga	LC
Merops orientalis	Bee-eater	Little Green bee-eater	Suichora	LC
Megalaima haemacephala	Megalaimidae	Coppersmith barbet	Choto Basanta Bauri	LC
Dinopium benghalense	Picidae	Black-rumped flameback	Kaththokra	LC
Corvus levaillantii	Crow	Jungle crow	Dar Kak	LC
Dicrurus macrocercus	Drongos	Black drongo	Fingey	LC
Copsychus saularis	Old world flycatchers	Oriental magpie robin	Doel	LC
Acridotheres fuscus	Starling	Jungle myna	Jhuti Shalik	LC

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Scientific Name	Family	English Name	Local Name	IUCN Status
Pycnonotus cafer	Bulbul	Red-vented bulbul	Bulbuli	LC
Orthotomus sutorius	Cisticolidae	Common tailorbird	Tuntuni	LC
Passer domesticus	Old World sparrows	House sparrow	Charui	LC
Ploceus philippinus	Weavers	Baya weaver	Babui	LC
Class: Mammalia				
Pteropus giganteus	Old World fruit bats	Flying Fox	Badur	LC
Herpestes auropunctatus	Mongoose	Small Indian Mongoose	Benji	LC
Vulpes bengalensis	Canidae	Bengal Fox	Khek shial	LC
Rattus rattus	Murids	Common House Rat	Indur	LC
Suncus murinus	Shrews	House Shrew	Chicka	LC

Table 5.28: List of Fauna Identified in Satkhira

Scientific Name	Family	English Name	Local Name	IUCN Status
Class: Amphibia				
Bufo melanostictus	Bufonidae	Common Toad	Kuno bang	LC
Hylarana erythraea	Ranidae	Green Paddy Frog	Ghas Foring	LC
Class: Reptilia				
Gavialis gangeticus	Gavialidae	Gharial	Gharial	LC
Naja naja	Elapidae	Common Cobra	Common Cobra	LC
Xenochrophis piscator	Colubrid Snakes	Checkered keelback	Dhora shap	LC
Class: Aves				
Phalacrocorax niger	Cormorants	Little cormorant	Paan-kowri	LC
Aegithina tiphia	Iora	Common iora	Towfik	LC
Actitis hypoleucos	Accipitridae	Common sandpiper	Kada Khocha	LC
Amaurornis phoenicurus	Rail	White-breasted waterhen	Dahuk	LC
Athene brama	True owl	Spotted owlet	Khuruley Pencha	LC
Alcedo atthis	Kingfisher	Common kingfisher	Choto Maachranga	LC
Haliastur indus	Accipitridae	Brahminy kite	Shankho chil	LC
Milvus migrans	Accipitridae	Black kite	Bhubon chil	LC
Corvus splendens	Crow	House crow	Pati Kak	LC
Corvus levaillantii	Crow	Jungle crow	Dar Kak	LC
Dendrocitta vagabunda	Crow	Rufous treepie	Hanrichacha	LC
Dicrurus macrocercus	Drongos	Black drongo	Fingey	LC
Dicrurus aeneus	Drongos	Bronze Drongo	Chota, Fingey	LC
Tringa stagnatilis	Sandpiper	Marsh Sandpiper	Bil Batan	LC
Glareola lactea	Glareolidae.	Small Pratincole	Chhoto Babui Batan	LC
Spilopelia chinensis	Columbidae	Spotted dove	Tila Ghughu	LC
Streptopelia decaocto	Columbidae	Eurasian collared dove	Konthighughu	LC
Streptopelia tranquebarica	Columbidae	Red-collared Dove	Lal Ghughu	LC
Eudynamys scolopacea	Cuckoos	Asian cuckoo	Kokil	LC
Cuculus micropterus	Cuckoos	Indian cuckoo	Bou-kotha-kao Pakhi	LC
Tyto alba	Barn-owls	Barn owl	Laxmi Pencha	LC
Cypsiurus balasiensis	Apodidae	Asian palm swift	Nakkati	LC
Halcyon smyrnensis	Kingfisher	White-throated kingfisher	Maachranga	LC
Merops orientalis	Bee-eater	Little Green bee-eater	Suichora	LC
Megalaima haemacephala	Megalaimidae	Coppersmith barbet	Choto Basanta Bauri	LC
Psilopogon asiaticus	Megalaimidae	Blue-throated barbet	Neelgola Boshonto	LC
Psilopogon lineatus	Megalaimidae	Lineated barbet	Gurkhod	LC
Artamus fuscus	Artamidae	Ashy woodswallow	Latora	LC
Pericrocotus cinnamomeus	Cuckooshrike	Small minivet	Sat saili	LC
Copsychus saularis	Old world flycatchers	Oriental magpie robin	Doel	LC
Bradypterus thoracicus	Locustellidae	Brown Bush Warbler	Palasi Froringfutki	LC
Ploceus philippinus	Weavers	Baya weaver	Babui	LC

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Scientific Name	Family	English Name	Local Name	IUCN Status
Class: Mammalia				
Axis axis	Cervidae	Spotted Deer	Spotted Deer	LC
Bandicota indica	Murids	Bandicoot Rat	Bara indur	LC
Herpestes auropunctatus	Mongoose	Small Indian Mongoose	Benji	LC
Megaderma lyra	Megadermatidae	Greater False Vampire	Badur	LC
Rattus rattus	Murids	Common House Rat	Indur	LC
Suncus murinus	Shrews	House Shrew	Chicka	LC
Vulpes bengalensis	Canidae	Bengal Fox	Khek shial	LC

Table 5.29: List of Fauna Identified in Brahmanbaria

Scientific Name	Family	English Name	Local Name	IUCN Status
Class: Amphibia				
Polypedates bengalensis	Rhacophoridae	Bengal Tree Frog	Bengal Tree Frog	LC
Hoplobatrachus tigerinus	Dicroglossidae	Bull Frog	Kola bang	LC
Class: Reptilia				
Calotes versicolor	Agamid lizards	Common Garden Lizard	Rokto-chosha	LC
Varanus bengalensis	Monitor lizards	Bengal monitor	Gui shap	NT
Mabuya carinata	Skink	Common skink	Anjon	LC
Class: Aves				
Phalacrocorax niger	Cormorants	Little cormorant	Paan-kowri	LC
Amaurornis phoenicurus	Rail	White-breasted waterhen	Dahuk	LC
Eudynamys scolopacea	Cuckoos	Asian cuckoo	Kokil	LC
Cuculus micropterus	Cuckoos	Indian cuckoo	Bou-kotha-kao Pakhi	LC
Dendrocygna javanica	Ducks	Lesser Whistling-duck	Shorali	LC
Tringa stagnatilis	Sandpiper	Marsh Sandpiper	Bil Batan	LC
Glareola lactea	Glareolidae.	Small Pratincole	Chhoto Babui Batan	LC
Metopidius indicus	Jacanidae	Bronze-winged Jacana	Jolpipi	LC
Columba livia	Columbidae	Rock pigeon	Jalali Kobutar	LC
Spilopelia chinensis	Columbidae	Spotted dove	Tila Ghughu	LC
Treron phoenicopterus	Columbidae	Yellow-footed Green Pigeon	Holdeypa Harial	LC
Oriolus xanthornus	Old World orioles	Black-headed oriole	Holdey Pakhi	LC
Dicrurus macrocercus	Drongos	Black drongo	Fingey	LC
Copsychus saularis	Old world flycatchers	Oriental magpie robin	Doel	LC
Hierococcyx varius	Cuculidae	Common hawk cuckoo	Chokhgelo Pakhi	LC
Cacomantis merulinus	Cuculidae	Plaintive Cuckoo	Koroon Papia	LC
Halcyon smyrnensis	Kingfisher	White-throated kingfisher	Maachranga	LC
Sturnus malabaricus		Chestnut-tailed starling	Kath Shalik	LC
Pycnonotus cafer	Bulbul	Red-vented bulbul	Bulbuli	LC
Orthotomus sutorius	Cisticolidae	Common tailorbird	Tuntuni	LC
Passer domesticus	Old World sparrows	House sparrow	Charui	LC
Ploceus philippinus	Weavers	Baya weaver	Babui	LC
Class: Mammalia				
Pteropus giganteus	Old World fruit bats	Flying Fox	Badur	LC
Pipistrellus coromandra	Vespertilionidae	Indian Pipistrelle	Chamchika	LC
Vulpes bengalensis	Canidae	Bengal Fox	Khek shial	LC
Rattus rattus	Murids	Common House Rat	Indur	LC
Mus musculus	Murids	House Mouse	Nengri indur	LC

Table 5.30: List of Fauna Identified in Paikgacha (Khulna)

Scientific Name	Family	English Name	Local Name	IUCN Status

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Scientific Name	Family	English Name	Local Name	IUCN Status
Bufo melanostictus	Bufonidae	Common Toad	Kuno bang	LC
Hylarana erythraea	Ranidae	Green Paddy Frog	Ghas Foring	LC
Class: Reptilia				
Gavialis gangeticus	Gavialidae	Gharial	Gharial	LC
Naja naja	Elapidae	Common Cobra	Common Cobra	LC
Xenochrophis piscator	Colubrid Snakes	Checkered keelback	Dhora shap	LC
Class: Aves				
Phalacrocorax niger	Cormorants	Little cormorant	Paan-kowri	LC
Haliastur indus	Accipitridae	Brahminy kite	Shankho chil	LC
Milvus migrans	Accipitridae	Black kite	Bhubon chil	LC
Actitis hypoleucos	Accipitridae	Common sandpiper	Kada Khocha	LC
Tringa stagnatilis	Sandpiper	Marsh Sandpiper	Bil Batan	LC
Glareola lactea	Glareolidae.	Small Pratincole	Chhoto Babui Batan	LC
Spilopelia chinensis	Columbidae	Spotted dove	Tila Ghughu	LC
Streptopelia decaocto	Columbidae	Eurasian collared dove	Konthighughu	LC
Streptopelia tranquebarica	Columbidae	Red-collared Dove	Lal Ghughu	LC
Amaurornis phoenicurus	Rail	White-breasted waterhen	Dahuk	LC
Eudynamys scolopacea	Cuckoos	Asian cuckoo	Kokil	LC
Cuculus micropterus	Cuckoos	Indian cuckoo	Bou-kotha-kao Pakhi	LC
Athene brama	True owl	Spotted owlet	Khuruley Pencha	LC
Tyto alba	Barn-owls	Barn owl	Laxmi Pencha	LC
Cypsiurus balasiensis	Apodidae	Asian palm swift	Nakkati	LC
Alcedo atthis	Kingfisher	Common kingfisher	Choto Maachranga	LC
Halcyon smyrnensis	Kingfisher	White-throated kingfisher	Maachranga	LC
Merops orientalis	Bee-eater	Little Green bee-eater	Suichora	LC
Megalaima haemacephala	Megalaimidae	Coppersmith barbet	Choto Basanta Bauri	LC
Psilopogon asiaticus	Megalaimidae	Blue-throated barbet	Neelgola Boshonto	LC
Psilopogon lineatus	Megalaimidae	Lineated barbet	Gurkhod	LC
Corvus splendens	Crow	House crow	Pati Kak	LC
Corvus levaillantii	Crow	Jungle crow	Dar Kak	LC
Dendrocitta vagabunda	Crow	Rufous treepie	Hanrichacha	LC
Dicrurus macrocercus	Drongos	Black drongo	Fingey	LC
Dicrurus aeneus	Drongos	Bronze Drongo	Chota, Fingey	LC
Artamus fuscus	Artamidae	Ashy woodswallow	Latora	LC
Pericrocotus cinnamomeus	Cuckooshrike	Small minivet	Sat saili	LC
Copsychus saularis	Old world flycatchers	Oriental magpie robin	Doel	LC
Aegithina tiphia	Iora	Common iora	Towfik	LC
Bradypterus thoracicus	Locustellidae	Brown Bush Warbler	Palasi Froringfutki	LC
Ploceus philippinus	Weavers	Baya weaver	Babui	LC
Anthus rufulus	pipit and wagtail	Paddyfield pipit	Dhani Tulika	LC
Class: Mammalia				
Axis axis	Cervidae	Spotted Deer	Spotted Deer	LC
Megaderma lyra	Megadermatidae	Greater False Vampire	Badur	LC
Herpestes auropunctatus	Mongoose	Small Indian Mongoose	Benji	LC
Vulpes bengalensis	Canidae	Bengal Fox	Khek shial	LC
Rattus rattus	Murids	Common House Rat	Indur	LC
Bandicota indica	Murids	Bandicoot Rat	Bara indur	LC
Suncus murinus	Shrews	House Shrew	Chicka	LC

Table 5.31: List of Fauna Identified in Kumarkhali (Kushtia)

Scientific Name	Family	English Name	Local Name	IUCN Status
Class: Amphibia				

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Scientific Name	Family	English Name	Local Name	IUCN Status
Bufo melanostictus	True toad	Common Toad	Kuno bang	LC
Hoplobatrachus tigerinus	Dicroglossidae	Bull Frog	Kola bang	LC
Class: Reptilia				
Hemidactylus flaviviridis	Geckos	Common House Lizard	Tiktiki	LC
Mabuya carinata	Skink	Common skink	Anjon	LC
Varanus bengalensis	Monitor lizards	Bengal monitor	Gui shap	NT
Atretium schistosum	Colubridae	Olive keelback	Maitta shap	LC
Class: Aves				
Phalacrocorax niger	Cormorants	Little cormorant	Paan-kowri	LC
Dendrocygna javanica	Ducks	Lesser Whistling-duck	Shorali	LC
Casmerodius albus	Herons	Great egret	Sada bok	LC
Nycticorax nycticorax	Herons	Black-crowned night heron	Nishi bok	LC
Anastomus oscitans	Stork	Asian Openbill	Shamuk-khol	LC
Haliastur indus	Accipitridae	Brahminy kite	Shankho chil	LC
Elanus caeruleus	Accipitridae	Black-shouldered kite	Katua Chil	LC
Tringa stagnatilis	Sandpiper	Marsh Sandpiper	Bil Batan	LC
Glareola lactea	Glareolidae.	Small Pratincole	Chhoto Babui Batan	LC
Metopidius indicus	Jacanidae	Bronze-winged Jacana	Jolpipi	LC
Eudynamys scolopacea	Cuckoos	Asian cuckoo	Kokil	LC
Halcyon smyrnensis	Kingfisher	White-throated kingfisher	Maachranga	LC
Merops orientalis	Bee-eater	Little Green bee-eater	Suichora	LC
Psilopogon lineatus	Megalaimidae	Lineated barbet	Gurkhod	LC
Dinopium benghalense	Picidae	Black-rumped flameback	Kaththokra	LC
Artamus fuscus	Artamidae	Ashy woodswallow	Latora	LC
Pericrocotus cinnamomeus	Cuckooshrike	Small minivet	Sat saili	LC
Copsychus saularis	Old world flycatchers	Oriental magpie robin	Doel	LC
Aegithina tiphia	Iora	Common iora	Towfik	LC
Acridotheres tristis	Sturnidae	Common myna	Bath Shalik	LC
Pycnonotus cafer	Bulbul	Red-vented bulbul	Bulbuli	LC
Orthotomus sutorius	Cisticolidae	Common tailorbird	Tuntuni	LC
Class: Mammalia				
Pteropus giganteus	Old World fruit bats	Flying Fox	Badur	LC
Pipistrellus coromandra	Vespertilionidae	Indian Pipistrelle	Chamchika	LC
Herpestes auropunctatus	Mongoose	Small Indian Mongoose	Benji	LC
Rattus rattus	Murids	Common House Rat	Indur	LC
Suncus murinus	Shrews	House Shrew	Chicka	LC

Table 5.32: List of Fauna Identified in Mathbaria (Pirojpur)

Scientific Name	Family	English Name	Local Name	IUCN Status
Class: Amphibia				
Hoplobatrachus tigerinus	Dicroglossidae	Indian Bullfrog	Chal Bang	LC
Duttaphrynus melanostictus	Bufonidae	Common Toad	Kuno bang	LC
Hoplobatrachus tigerinus	Dicroglossidae	Bull Frog	Kola bang	LC
Class: Reptilia				
Python molurus	Pythonidae	Indian Python	Indian Python	LC
Calotes versicolor	Agamid lizards	Common Garden Lizard	Rokto-chosha	LC
Mabuya carinata	Skink	Common skink	Anjon	LC
Varanus bengalensis	Monitor lizards	Bengal monitor	Gui shap	NT
WLSWLS WLSXenochrophis piscator	Colubrid Snakes	Checkered keelback	Dhora shap	LC
Ahaetulla nasutus	Colubridae	Common vine snake	Laodoga shap	LC
Class: Aves				

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Scientific Name	Family	English Name	Local Name	IUCN Status
Phalacrocorax niger	Cormorants	Little cormorant	Paan-kowri	LC
Ardeola grayii	Herons	Indian pond heron	Kani bok	LC
Casmerodius albus	Herons	Great egret	Sada bok	LC
Egretta intermedia	Herons	Intermediate egret	Mazla bok	LC
Egretta garzetta	Herons	Little egret	Choto bok	LC
Nycticorax nycticorax	Herons	Black-crowned night heron	Nishi bok	LC
Anastomus oscitans	Stork	Asian Openbill	Shamuk-khol	LC
Haliastur indus	Accipitridae	Brahminy kite	Shankho chil	LC
Actitis hypoleucos	Accipitridae	Common sandpiper	Kada Khocha	LC
Tringa stagnatilis	Sandpiper	Marsh Sandpiper	Bil Batan	LC
Metopidius indicus	Jacanidae	Bronze-winged Jacana	Jolpipi	LC
Columba livia	Columbidae	Rock pigeon	Jalali Kobutar	LC
Spilopelia chinensis	Columbidae	Spotted dove	Tila Ghughu	LC
Streptopelia decaocto	Columbidae	Eurasian collared dove	Konthighughu	LC
Amaurornis phoenicurus	Rail	White-breasted waterhen	Dahuk	LC
Centropus sinensis	Cuckoos	Greater coucal	Kanakua	LC
Cuculus micropterus	Cuckoos	Indian cuckoo	Bou-kotha-kao Pakhi	LC
Hierococcyx varius	Cuculidae	Common hawk cuckoo	Chokhgelo Pakhi	LC
Athene brama	True owl	Spotted owlet	Khuruley Pencha	LC
Tyto alba	Barn-owls	Barn owl	Laxmi Pencha	LC
Apus nipalensis	Swifts	House swift	Ghor Batashi	LC
Cypsiurus balasiensis	Apodidae	Asian palm swift	Nakkati	LC
Alcedo atthis	Kingfisher	Common kingfisher	Choto Maachranga	LC
Halcyon smyrnensis	Kingfisher	White-throated kingfisher	Maachranga	LC
Merops orientalis	Bee-eater	Little Green bee-eater	Suichora	LC
Megalaima haemacephala	Megalaimidae	Coppersmith barbet	Choto Basanta Bauri	LC
Psilopogon asiaticus	Megalaimidae	Blue-throated barbet	Neelgola Boshonto	LC
Psilopogon lineatus	Megalaimidae	Lineated barbet	Gurkhod	LC
Dendrocopos macei	Woodpeckers	Fulvous-breasted woodpecker	Pakra Kaththokra	LC
Dinopium benghalense	Picidae	Black-rumped flameback	Kaththokra	LC
Lanius cristatus	Shrike	Brown shrike	Khoira Latora	LC
Lanius schach	Shrike	Long-tailed shrike	Bagha tiki	LC
Oriolus xanthornus	Old World orioles	Black-headed oriole	Holdey Pakhi	LC
Corvus splendens	Crow	House crow	Pati Kak	LC
Corvus levaillantii	Crow	Jungle crow	Dar Kak	LC
Dendrocitta vagabunda	Crow	Rufous treepie	Hanrichacha	LC
Dicrurus macrocercus	Drongos	Black drongo	Fingey	LC
Artamus fuscus	Artamidae	Ashy woodswallow	Latora	LC
Pericrocotus cinnamomeus	Cuckooshrike	Small minivet	Sat saili	LC
Copsychus saularis	Old world flycatchers	Oriental magpie robin	Doel	LC
Sturnus malabaricus		Chestnut-tailed starling	Kath Shalik	LC
Pycnonotus cafer	Bulbul	Red-vented bulbul	Bulbuli	LC
Pycnonotus jocosus	Bulbul	Red-whiskered Bulbul	Shepahi Bulbul	LC
Orthotomus sutorius	Cisticolidae	Common tailorbird	Tuntuni	LC
Bradypterus thoracicus	Locustellidae	Brown Bush Warbler	Palasi Froringfutki	LC
Nectarinia asiatica	Nectariniidae	Purple sunbird	Beguni Moutushi	LC
Ploceus philippinus	Weavers	Baya weaver	Babui	LC
Anthus rufulus	pipit and wagtail	Paddyfield pipit	Dhani Tulika	LC
Motacilla alba	pipit and wagtail	White wagtail	Dhola Khonjon	LC
Parus major	Parus major	Great tit	Boro Tit	LC
Class: Mammalia				
Macaca mulatta	Cercopithecidae	Rhesus Macaque	Rhesus Macaque	LC
Vulpes bengalensis	Canidae	Bengal Fox	Khek shial	LC
Rattus rattus	Murids	Common House Rat	Indur	LC
Bandicota indica	Murids	Bandicoot Rat	Bara indur	LC
Mus musculus	Murids	House Mouse	Nengri indur	LC

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Table 5.33: List of Fauna Identified in Chatkhil (Noakhali)

Scientific Name	Family	English Name	Local Name	IUCN Status
Class: Amphibia				
Bufo melanostictus	True toad	Common Toad	Kuno bang	LC
Duttaphrynus melanostictus	Bufonidae	Common Toad	Kuno bang	LC
Hoplobatrachus tigerinus	Dicroglossidae	Bull Frog	Kola bang	LC
Class: Reptilia				
Hemidactylus flaviviridis	Geckos	Common House Lizard	Tiktiki	LC
Calotes versicolor	Agamid lizards	Common Garden Lizard	Rokto-chosha	LC
Mabuya carinata	Skink	Common skink	Anjon	LC
Varanus bengalensis	Monitor lizards	Bengal monitor	Gui shap	NT
Xenochrophis piscator	Colubrid Snakes	Checkered keelback	Dhora shap	LC
Atretium schistosum	Colubridae	Olive keelback	Maitta shap	LC
Class: Aves				
Phalacrocorax niger	Cormorants	Little cormorant	Paan-kowri	LC
Casmerodius albus	Herons	Great egret	Sada bok	LC
Egretta garzetta	Herons	Little egret	Choto bok	LC
Haliastur indus	Accipitridae	Brahminy kite	Shankho chil	LC
Actitis hypoleucos	Accipitridae	Common sandpiper	Kada Khocha	LC
Glareola lactea	Glareolidae.	Small Pratincole	Chhoto Babui Batan	LC
Halcyon smyrnensis	Kingfisher	White-throated kingfisher	Maachranga	LC
Merops orientalis	Bee-eater	Little Green bee-eater	Suichora	LC
Megalaima haemacephala	Megalaimidae	Coppersmith barbet	Choto Basanta Bauri	LC
Psilopogon lineatus	Megalaimidae	Lineated barbet	Gurkhod	LC
Dinopium benghalense	Picidae	Black-rumped flameback	Kaththokra	LC
Corvus levaillantii	Crow	Jungle crow	Dar Kak	LC
Acridotheres tristis	Sturnidae	Common myna	Bath Shalik	LC
Pycnonotus cafer	Bulbul	Red-vented bulbul	Bulbuli	LC
Orthotomus sutorius	Cisticolidae	Common tailorbird	Tuntuni	LC
Nectarinia zeylonica	Nectariniidae	Purple-rumped sunbird	Moutusi	LC
Passer domesticus	Old World sparrows	House sparrow	Charui	LC
Ploceus philippinus	Weavers	Baya weaver	Babui	LC
Motacilla alba	pipit and wagtail	White wagtail	Dhola Khonjon	LC
Parus major	Parus major	Great tit	Boro Tit	LC
Class: Mammalia				
Pteropus giganteus	Old World fruit bats	Flying Fox	Badur	LC
Pipistrellus coromandra	Vespertilionidae	Indian Pipistrelle	Chamchika	LC
Herpestes auropunctatus	Mongoose	Small Indian Mongoose	Benji	LC
Vulpes bengalensis	Canidae	Bengal Fox	Khek shial	LC
Rattus rattus	Murids	Common House Rat	Indur	LC
Mus musculus	Murids	House Mouse	Nengri indur	LC

Table 5.34: List of Fauna Identified in Dupchanchia (Bogura)

Scientific Name	Family	English Name	Local Name	IUCN Status
Class: Amphibia				
Bufo melanostictus	True toad	Common Toad	Kuno bang	LC
Class: Reptilia				
Hemidactylus flaviviridis	Geckos	Common House Lizard	Tiktiki	LC
Varanus bengalensis	Monitor lizards	Bengal monitor	Gui shap	NT
Xenochrophis piscator	Colubrid Snakes	Checkered keelback	Dhora shap	LC
Class: Aves				

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Scientific Name	Family	English Name	Local Name	IUCN Status
Phalacrocorax niger	Cormorants	Little cormorant	Paan-kowri	LC
Anastomus oscitans	Stork	Asian Openbill	Shamuk-khol	LC
Actitis hypoleucos	Accipitridae	Common sandpiper	Kada Khocha	LC
Tringa stagnatilis	Sandpiper	Marsh Sandpiper	Bil Batan	LC
Spilopelia chinensis	Columbidae	Spotted dove	Tila Ghughu	LC
Treron phoenicopterus	Columbidae	Yellow-footed Green Pigeon	Holdeypa Harial	LC
Eudynamys scolopacea	Cuckoos	Asian cuckoo	Kokil	LC
Centropus sinensis	Cuckoos	Greater coucal	Kanakua	LC
Cuculus micropterus	Cuckoos	Indian cuckoo	Bou-kotha-kao Pakhi	LC
Cacomantis merulinus	Cuculidae	Plaintive Cuckoo	Koroon Papia	LC
Apus nipalensis	Swifts	House swift	Ghor Batashi	LC
Cypsiurus balasiensis	Apodidae	Asian palm swift	Nakkati	LC
Halcyon smyrnensis	Kingfisher	White-throated kingfisher	Maachranga	LC
Merops orientalis	Bee-eater	Little Green bee-eater	Suichora	LC
Megalaima haemacephala	Megalaimidae	Coppersmith barbet	Choto Basanta Bauri	LC
Psilopogon asiaticus	Megalaimidae	Blue-throated barbet	Neelgola Boshonto	LC
Psilopogon lineatus	Megalaimidae	Lineated barbet	Gurkhod	LC
Dinopium benghalense	Picidae	Black-rumped flameback	Kaththokra	LC
Corvus levaillantii	Crow	Jungle crow	Dar Kak	LC
Dicrurus macrocercus	Drongos	Black drongo	Fingey	LC
Copsychus saularis	Old world flycatchers	Oriental magpie robin	Doel	LC
Acridotheres fuscus	Starling	Jungle myna	Jhuti Shalik	LC
Pycnonotus cafer	Bulbul	Red-vented bulbul	Bulbuli	LC
Orthotomus sutorius	Cisticolidae	Common tailorbird	Tuntuni	LC
Passer domesticus	Old World sparrows	House sparrow	Charui	LC
Ploceus philippinus	Weavers	Baya weaver	Babui	LC
Class: Mammalia				
Pteropus giganteus	Old World fruit bats	Flying Fox	Badur	LC
Herpestes auropunctatus	Mongoose	Small Indian Mongoose	Benji	LC
Vulpes bengalensis	Canidae	Bengal Fox	Khek shial	LC
Rattus rattus	Murids	Common House Rat	Indur	LC
Suncus murinus	Shrews	House Shrew	Chicka	LC

Table 5.35: List of Fauna Identified in Matlab (N) (Chandpur)

Scientific Name	Family	English Name	Local Name	IUCN Status
Class: Amphibia				
Bufo melanostictus	True toad	Common Toad	Kuno bang	LC
Hoplobatrachus tigerinus	Dicroglossidae	Bull Frog	Kola bang	LC
Class: Reptilia				
Hemidactylus flaviviridis	Geckos	Common House Lizard	Tiktiki	LC
Calotes versicolor	Agamid lizards	Common Garden Lizard	Rokto-chosha	LC
Mabuya carinata	Skink	Common skink	Anjon	LC
Varanus bengalensis	Monitor lizards	Bengal monitor	Gui shap	NT
Xenochrophis piscator	Colubrid Snakes	Checkered keelback	Dhora shap	LC
Ahaetulla nasutus	Colubridae	Common vine snake	Laodoga shap	LC
Class: Aves				
Phalacrocorax niger	Cormorants	Little cormorant	Paan-kowri	LC
Ardeola grayii	Herons	Indian pond heron	Kani bok	LC
Casmerodius albus	Herons	Great egret	Sada bok	LC
Tringa stagnatilis	Sandpiper	Marsh Sandpiper	Bil Batan	LC
Glareola lactea	Glareolidae.	Small Pratincole	Chhoto Babui Batan	LC

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Scientific Name	Family	English Name	Local Name	IUCN Status
Spilopelia chinensis	Columbidae	Spotted dove	Tila Ghughu	LC
Amaurornis phoenicurus	Rail	White-breasted waterhen	Dahuk	LC
Eudynamys scolopacea	Cuckoos	Asian cuckoo	Kokil	LC
Tyto alba	Barn-owls	Barn owl	Laxmi Pencha	LC
Halcyon smyrnensis	Kingfisher	White-throated kingfisher	Maachranga	LC
Merops orientalis	Bee-eater	Little Green bee-eater	Suichora	LC
Psilopogon asiaticus	Megalaimidae	Blue-throated barbet	Neelgola Boshonto	LC
Dinopium benghalense	Picidae	Black-rumped flameback	Kaththokra	LC
Oriolus xanthornus	Old World orioles	Black-headed oriole	Holdey Pakhi	LC
Corvus levaillantii	Crow	Jungle crow	Dar Kak	LC
Dendrocitta vagabunda	Crow	Rufous treepie	Hanrichacha	LC
Dicrurus macrocercus	Drongos	Black drongo	Fingey	LC
Copsychus saularis	Old world flycatchers	Oriental magpie robin	Doel	LC
Aegithina tiphia	Iora	Common iora	Towfik	LC
Acridotheres fuscus	Starling	Jungle myna	Jhuti Shalik	LC
Pycnonotus cafer	Bulbul	Red-vented bulbul	Bulbuli	LC
Orthotomus sutorius	Cisticolidae	Common tailorbird	Tuntuni	LC
Bradypterus thoracicus	Locustellidae	Brown Bush Warbler	Palasi Froringfutki	LC
Nectarinia zeylonica	Nectariniidae	Purple-rumped sunbird	Moutusi	LC
Passer domesticus	Old World sparrows	House sparrow	Charui	LC
Ploceus philippinus	Weavers	Baya weaver	Babui	LC
Class: Mammalia				
Pipistrellus coromandra	Vespertilionidae	Indian Pipistrelle	Chamchika	LC
Megaderma lyra	Megadermatidae	Greater False Vampire	Badur	LC
Herpestes auropunctatus	Mongoose	Small Indian Mongoose	Benji	LC
Vulpes bengalensis	Canidae	Bengal Fox	Khek shial	LC
Mus musculus	Murids	House Mouse	Nengri indur	LC
Suncus murinus	Shrews	House Shrew	Chicka	LC

Table 5.36: List of Fauna Identified in Monohardi (Narshingdi)

Scientific Name	Family	English Name	Local Name	IUCN Status
Class: Amphibia				
Hoplobatrachus tigerinus	Dicroglossidae	Bull Frog	Kola bang	LC
Class: Reptilia				
Hemidactylus flaviviridis	Geckos	Common House Lizard	Tiktiki	LC
Calotes versicolor	Agamid lizards	Common Garden Lizard	Rokto-chosha	LC
Ahaetulla nasutus	Colubridae	Common vine snake	Laodoga shap	LC
Atretium schistosum	Colubridae	Olive keelback	Maitta shap	LC
Class: Aves				
Phalacrocorax niger	Cormorants	Little cormorant	Paan-kowri	LC
Dendrocygna javanica	Ducks	Lesser Whistling-duck	Shorali	LC
Ardeola grayii	Herons	Indian pond heron	Kani bok	LC
Casmerodius albus	Herons	Great egret	Sada bok	LC
Anastomus oscitans	Stork	Asian Openbill	Shamuk-khol	LC
Actitis hypoleucos	Accipitridae	Common sandpiper	Kada Khocha	LC
Tringa stagnatilis	Sandpiper	Marsh Sandpiper	Bil Batan	LC
Metopidius indicus	Jacanidae	Bronze-winged Jacana	Jolpipi	LC
Columba livia	Columbidae	Rock pigeon	Jalali Kobutar	LC
Streptopelia tranquebarica	Columbidae	Red-collared Dove	Lal Ghughu	LC
Amaurornis phoenicurus	Rail	White-breasted waterhen	Dahuk	LC
Eudynamys scolopacea	Cuckoos	Asian cuckoo	Kokil	LC
Centropus sinensis	Cuckoos	Greater coucal	Kanakua	LC
Cuculus micropterus	Cuckoos	Indian cuckoo	Bou-kotha-kao	LC

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Scientific Name	Family	English Name	Local Name	IUCN Status
			Pakhi	
Hierococcyx varius	Cuculidae	Common hawk cuckoo	Chokhgelo Pakhi	LC
Athene brama	True owl	Spotted owlet	Khuruley Pencha	LC
Apus nipalensis	Swifts	House swift	Ghor Batashi	LC
Cypsiurus balasiensis	Apodidae	Asian palm swift	Nakkati	LC
Alcedo atthis	Kingfisher	Common kingfisher	Choto Maachranga	LC
Dinopium benghalense	Picidae	Black-rumped flameback	Kaththokra	LC
Lanius cristatus	Shrike	Brown shrike	Khoira Latora	LC
Lanius schach	Shrike	Long-tailed shrike	Bagha tiki	LC
Corvus levaillantii	Crow	Jungle crow	Dar Kak	LC
Dendrocitta vagabunda	Crow	Rufous treepie	Hanrichacha	LC
Dicrurus macrocercus	Drongos	Black drongo	Fingey	LC
Artamus fuscus	Artamidae	Ashy woodswallow	Latora	LC
Pericrocotus cinnamomeus	Cuckooshrike	Small minivet	Sat saili	LC
Copsychus saularis	Old world flycatchers	Oriental magpie robin	Doel	LC
Aegithina tiphia	Iora	Common iora	Towfik	LC
Acridotheres fuscus	Starling	Jungle myna	Jhuti Shalik	LC
Pycnonotus cafer	Bulbul	Red-vented bulbul	Bulbuli	LC
Pycnonotus jocosus	Bulbul	Red-whiskered Bulbul	Shepahi Bulbul	LC
Orthotomus sutorius	Cisticolidae	Common tailorbird	Tuntuni	LC
Passer domesticus	Old World sparrows	House sparrow	Charui	LC
Ploceus philippinus	Weavers	Baya weaver	Babui	LC
Parus major	Parus major	Great tit	Boro Tit	LC
Class: Mammalia				
Pteropus giganteus	Old World fruit bats	Flying Fox	Badur	LC
Pipistrellus coromandra	Vespertilionidae	Indian Pipistrelle	Chamchika	LC
Megaderma lyra	Megadermatidae	Greater False Vampire	Badur	LC
Vulpes bengalensis	Canidae	Bengal Fox	Khek shial	LC
Rattus rattus	Murids	Common House Rat	Indur	LC
Suncus murinus	Shrews	House Shrew	Chicka	LC

Table 5.37: List of Fauna Identified in Madhabpur (Habiganj)

Scientific Name	Family	English Name	Local Name	IUCN Status
Class: Amphibia				
Polypedates bengalensis	Rhacophoridae	Bengal Tree Frog	Bengal Tree Frog	LC
Hoplobatrachus tigerinus	Dicroglossidae	Bull Frog	Kola bang	LC
Class: Reptilia				
Varanus salvator	Varanidae	Common Water Monitor	Common Water Monitor	LC
Calotes versicolor	Agamid lizards	Common Garden Lizard	Rokto-chosha	LC
Mabuya carinata	Skink	Common skink	Anjon	LC
Varanus bengalensis	Monitor lizards	Bengal monitor	Gui shap	NT
Class: Aves				
Phalacrocorax niger	Cormorants	Little cormorant	Paan-kowri	LC
Dendrocygna javanica	Ducks	Lesser Whistling-duck	Shorali	LC
Tringa stagnatilis	Sandpiper	Marsh Sandpiper	Bil Batan	LC
Glareola lactea	Glareolidae.	Small Pratincole	Chhoto Babui Batan	LC
Metopidius indicus	Jacanidae	Bronze-winged Jacana	Jolpipi	LC
Columba livia	Columbidae	Rock pigeon	Jalali Kobutar	LC
Spilopelia chinensis	Columbidae	Spotted dove	Tila Ghughu	LC
Treron phoenicopterus	Columbidae	Yellow-footed Green Pigeon	Holdeypa Harial	LC
Amaurornis phoenicurus	Rail	White-breasted waterhen	Dahuk	LC
Eudynamys scolopacea	Cuckoos	Asian cuckoo	Kokil	LC
Cuculus micropterus	Cuckoos	Indian cuckoo	Bou-kotha-kao Pakhi	LC

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Scientific Name	Family	English Name	Local Name	IUCN Status
Hierococcyx varius	Cuculidae	Common hawk cuckoo	Chokhgelo Pakhi	LC
Cacomantis merulinus	Cuculidae	Plaintive Cuckoo	Koroon Papia	LC
Halcyon smyrnensis	Kingfisher	White-throated kingfisher	Maachranga	LC
Merops leschenaulti	Bee-eater	Chestnut-headed Bee-eater	Shuichora	LC
Oriolus xanthornus	Old World orioles	Black-headed oriole	Holdey Pakhi	LC
Dicrurus macrocercus	Drongos	Black drongo	Fingey	LC
Copsychus saularis	Old world flycatchers	Oriental magpie robin	Doel	LC
Sturnus malabaricus		Chestnut-tailed starling	Kath Shalik	LC
Pycnonotus cafer	Bulbul	Red-vented bulbul	Bulbuli	LC
Orthotomus sutorius	Cisticolidae	Common tailorbird	Tuntuni	LC
Passer domesticus	Old World sparrows	House sparrow	Charui	LC
Ploceus philippinus	Weavers	Baya weaver	Babui	LC
Class: Mammalia				
Pteropus giganteus	Old World fruit bats	Flying Fox	Badur	LC
Pipistrellus coromandra	Vespertilionidae	Indian Pipistrelle	Chamchika	LC
Megaderma lyra	Megadermatidae	Greater False Vampire	Badur	LC
Vulpes bengalensis	Canidae	Bengal Fox	Khek shial	LC
Rattus rattus	Murids	Common House Rat	Indur	LC
Mus musculus	Murids	House Mouse	Nengri indur	LC

Table 5.38: List of Fauna Identified in Pekua/ Chakaria (Cox's Bazar)

Scientific Name	Family	English Name	Local Name	IUCN Status
Class: Amphibia				
Microhyla ornata	Microhylidae	Ornate Narrow-mouthed Frog	Shobuj Bang	LC
Bufo melanostictus	True toad	Common Toad	Kuno bang	LC
Duttaphrynus melanostictus	Bufonidae	Common Toad	Kuno bang	LC
Hoplobatrachus tigerinus	Dicroglossidae	Bull Frog	Kola bang	LC
Class: Reptilia				
Hemidactylus flaviviridis	Geckos	Common House Lizard	Tiktiki	LC
Calotes versicolor	Agamid lizards	Common Garden Lizard	Rokto-chosha	LC
Mabuya carinata	Skink	Common skink	Anjon	LC
Varanus bengalensis	Monitor lizards	Bengal monitor	Gui shap	NT
Xenochrophis piscator	Colubrid Snakes	Checkered keelback	Dhora shap	LC
Ahaetulla nasutus	Colubridae	Common vine snake	Laodoga shap	LC
Atretium schistosum	Colubridae	Olive keelback	Maitta shap	LC
Class: Aves				
Milvus migrans	Accipitridae	Black kite	Bhubon chil	LC
Elanus caeruleus	Accipitridae	Black-shouldered kite	Katua Chil	LC
Tringa stagnatilis	Sandpiper	Marsh Sandpiper	Bil Batan	LC
Treron phoenicopterus	Columbidae	Yellow-footed Green Pigeon	Holdeypa Harial	LC
Amaurornis phoenicurus	Rail	White-breasted waterhen	Dahuk	LC
Centropus sinensis	Cuckoos	Greater coucal	Kanakua	LC
Cuculus micropterus	Cuckoos	Indian cuckoo	Bou-kotha-kao Pakhi	LC
Hierococcyx varius	Cuculidae	Common hawk cuckoo	Chokhgelo Pakhi	LC
Athene brama	True owl	Spotted owlet	Khuruley Pencha	LC
Tyto alba	Barn-owls	Barn owl	Laxmi Pencha	LC
Alcedo atthis	Kingfisher	Common kingfisher	Choto Maachranga	LC
Halcyon smyrnensis	Kingfisher	White-throated kingfisher	Maachranga	LC
Psilopogon lineatus	Megalaimidae	Lineated barbet	Gurkhod	LC
Lanius cristatus	Shrike	Brown shrike	Khoira Latora	LC
Lanius schach	Shrike	Long-tailed shrike	Bagha tiki	LC
Corvus splendens	Crow	House crow	Pati Kak	LC
Corvus levaillantii	Crow	Jungle crow	Dar Kak	LC

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Scientific Name	Family	English Name	Local Name	IUCN Status
Dendrocitta vagabunda	Crow	Rufous treepie	Hanrichacha	LC
Dicrurus macrocercus	Drongos	Black drongo	Fingey	LC
Dicrurus aeneus	Drongos	Bronze Drongo	Chota, Fingey	LC
Artamus fuscus	Artamidae	Ashy woodswallow	Latora	LC
Pericrocotus cinnamomeus	Cuckooshrike	Small minivet	Sat saili	LC
Aegithina tiphia	Iora	Common iora	Towfik	LC
Bradypterus thoracicus	Locustellidae	Brown Bush Warbler	Palasi Froringfutki	LC
Nectarinia asiatica	Nectariniidae	Purple sunbird	Beguni Moutushi	LC
Nectarinia zeylonica	Nectariniidae	Purple-rumped sunbird	Moutusi	LC
Anthus rufulus	pipit and wagtail	Paddyfield pipit	Dhani Tulika	LC
Motacilla alba	pipit and wagtail	White wagtail	Dhola Khonjon	LC
Parus major	Parus major	Great tit	Boro Tit	LC
Class: Mammalia				
Pipistrellus coromandra	Vespertilionidae	Indian Pipistrelle	Chamchika	LC
Megaderma lyra	Megadermatidae	Greater False Vampire	Badur	LC
Herpestes edwardsii	Mongoose	Common Mongoose	Bara benji	LC
Herpestes auropunctatus	Mongoose	Small Indian Mongoose	Benji	LC
Bandicota indica	Murids	Bandicoot Rat	Bara indur	LC
Mus musculus	Murids	House Mouse	Nengri indur	LC
Suncus murinus	Shrews	House Shrew	Chicka	LC

Source: Environmental Survey in the project area, April 2024

*Note: LC-Least Concern, NT-Near Threatened, EN= Endangered, CR= Critically Endangered



Scientific Name: Eudynamys scolopacea



Scientific Name: Casmerodius albus



Scientific Name: Phalacrocorax niger



Scientific Name: Copsychus saularis

Figure 5.39: Terrestrial Fauna (Aves) Around the Project Area

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

D. Aquatic Fauna

311. Fish is the most important aquatic fauna of all the project areas, along with other groups. The aquatic fauna includes prawns (*Macrobrachium* spp.), crabs, snails (*Pila, Vivipara, Lymna* etc.), freshwater mussels (*Lamellidens* sp.) etc. invertebrates and several species of fish. The major freshwater fish species are the rui, katla, mrigal, kalbashu; shoal, gajar, taki, boal, tengra, aier, bacha, ritha, shing, magur and shrimp, baillya, chela, batashi, kahalisha, puthi, sharputhi, kai, falli, chital, baim, chanda, kharali, etc. The aquatic birds are Pancowri (*Phalacrocoraxcarto*), Kanibok (*Ardeolagrayii*), Sadabok (*Egrettagarzetta*), Borobok (*Egrettaalba*), Machranga (*Halcyon pileata*), Dahuk (*Gallicrexcinerea*), and winter migratory birds Balihash (*Dendrocygnajavanica*) and Chakha (*Tadornaferruginea*). In addition to fish cultivation, people in the project areas mostly catch the fishes in the river. Most of the fishes are identified in the river. Most of the Shrimp and Prawns, Crabs, Turtles and Shellfish were identified by using books and description of the local people during the field survey.

Table 5.39: List of Aquatic Fauna Identified in and around Tungipara (Gopalganj)

Scientific Name	Family	English Name	Local Name	IUCN Status
Class: Actinopterygii				
Labeo rohita	Cyprinidae	Rohu	Rohu	LC
Catla catla	Cyprinidae	Catla	Katla	LC
Cirrhinus mrigala	Cyprinidae	Mrigal	Mrigal	LC
Tilapia spp.	Cichlidae	Tilapia	Tilapia	LC
Platanista gangetica	Platanistidae	dolphin	Ganges River dolphin	LC
Class: Macrobrachium spp.				
Macrobrachium genus	Macrobrachium	Rohu	Rupchanda	NT
Class: Potamonautes spp.				
Potamonautidae spp.	Potamonautidae	River crabs	crabs	LC
Class: Malacostraca				
Macrobrachium	Atyidae	Freshwater shrimp	chingri	LC
Class: Pila spp				
Pila spp.	Ampullariidae	Apple Snails	Apple Snails	LC
Class: Gastropoda				
Anodonta	Unionidae	Freshwater Mussels	shellfish	LC

Table 5.40: List of Aquatic Fauna Identified in and around Kishoreganj

Scientific Name	Family	English Name	Local Name	IUCN Status
Class: Actinopterygii				
Labeo rohita	Cyprinidae	Rohu	Rohu	LC
Cirrhinus mrigala	Cyprinidae	Mrigal	Mrigal	LC
Tilapia spp.	Cichlidae	Tilapia	Tilapia	LC
Catla catla	Cyprinidae	Catla	Katla	LC
Class: Pila spp				
Pila spp.	Ampullariidae	Apple Snails	Apple Snails	LC
Class: Amphibia				
Hoplobatrachus tigerinus	Dicroglossidae	Indian bullfrog	(Manpukura)	LC

Table 5.41: List of Aquatic Fauna Identified in and around Satkhira

Scientific Name	Family	English Name	Local Name	IUCN Status
Class: Actinopterygii				

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Scientific Name	Family	English Name	Local Name	IUCN Status
Anabas testudineus	Anabantidae	Climbing perch	Koi	LC
Labeo rohita	Cyprinidae	Rohu	Rohu	LC
Catla catla	Cyprinidae	Catla	Katla	LC
Wallago attu	Siluridae	Wallago	Boal	LC
Tilapia spp.	Cichlidae	Tilapia	Tilapia	LC
Clarias batrachus	Clariidae	Walking catfish	Magur	LC
Class: Macrobrachium spp.				
Macrobrachium genus	Macrobrachium	Rohu	Rupchanda	NT
Class: Potamonautes spp.				
Potamonautidae spp.	Potamonautidae	River crabs	crabs	LC
Class: Malacostraca				
Macrobrachium	Atyidae	Freshwater shrimp	chingri	LC
Class: Pila spp				
Pila spp.	Ampullariidae	Apple Snails	Apple Snails	LC
Class: Gastropoda				
Anodonta	Unionidae	Freshwater Mussels	shellfish	LC
Class: Amphibia				
Hoplobatrachus tigerinus	Dicroglossidae	Indian bullfrog	(Manpukura)	LC

Table 5.42: List of Aquatic Fauna Identified in and around Brahmanbaria

Scientific Name	Family	English Name	Local Name	IUCN Status
Class: Actinopterygii				
Catla catla	Cyprinidae	Catla	Katla	LC
Tilapia spp.	Cichlidae	Tilapia	Tilapia	LC
Clarias batrachus	Clariidae	Walking catfish	Magur	LC
Cirrhinus mrigala	Cyprinidae	Mrigal	Mrigal	LC
Class: Potamonautes spp.				
Potamonautidae spp.	Potamonautidae	River crabs	crabs	LC
Class: Malacostraca				
Macrobrachium	Atyidae	Freshwater shrimp	chingri	VC
Class: Amphibia				
Hoplobatrachus tigerinus	Dicroglossidae	Indian bullfrog	Manpukura	LC

Table 5.43: List of Aquatic Fauna Identified in and around Paikgacha (Khulna)

Scientific Name	Family	English Name	Local Name	IUCN Status
Class: Actinopterygii				
Tenualosa ilisha	Clupeidae	Hilsa	Ilish	LC
Wallago attu	Siluridae	Wallago	Boal	LC
Labeo rohita	Cyprinidae	Rohu	Rohu	LC
Catla catla	Cyprinidae	Catla	Katla	LC
Tilapia spp.	Cichlidae	Tilapia	Tilapia	LC
Anabas testudineus	Anabantidae	Climbing perch	Koi	LC
Clarias batrachus	Clariidae	Walking catfish	Magur	LC
Class: Macrobrachium spp.				
Macrobrachium genus	Macrobrachium	Rohu	Rupchanda	NT
Class: Potamonautes spp.				
Potamonautidae spp.	Potamonautidae	River crabs	crabs	LC
Class: Malacostraca				
Macrobrachium	Atyidae	Freshwater shrimp	chingri	LC
Class: Pila spp				

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Scientific Name	Family	English Name	Local Name	IUCN Status
Pila spp.	Ampullariidae	Apple Snails	Apple Snails	LC
Class: Gastropoda				
Anodonta	Unionidae	Freshwater Mussels	shellfish	LC
Class: Amphibia				
Hoplobatrachus tigerinus	Dicroglossidae	Indian bullfrog	(Manpukura)	LC

Table 5.44: List of Aquatic Fauna Identified in and around Kumarkhali (Kushtia)

Scientific Name	Family	English Name	Local Name	IUCN Status
Class: Actinopterygii				
Mystus tengara	Bagridae	Tengra Fish	**Tengra**	LC
Labeo rohita	Cyprinidae	Rohu	Rohu	LC
Catla catla	Cyprinidae	Catla	Katla	LC
Anabas testudineus	Anabantidae	Climbing perch	Koi	LC
Channa striata	Channidae	Striped snakehead	Shol	LC
Ompok pabda	Siluridae	Butter Catfish	Pabda	LC
Class: Potamonautes spp.				
Potamonautidae spp.	Potamonautidae	River crabs	crabs	LC
Class: Malacostraca				
Macrobrachium	Atyidae	Freshwater shrimp	chingri	LC
Class: Pila spp				
Pila spp.	Ampullariidae	Apple Snails	Apple Snails	LC
Class: Gastropoda				
Anodonta	Unionidae	Freshwater Mussels	shellfish	LC
Class: Amphibia				
Hoplobatrachus tigerinus	Dicroglossidae	Indian bullfrog	Manpukura	LC

Table 5.45: List of Aquatic Fauna Identified in and around Mathbaria (Pirojpur)

Scientific Name	Family	English Name	Local Name	IUCN Status
Class: Actinopterygii				
Tenualosa ilisha	Clupeidae	**Hilsa**	**Ilish**	LC
Class: Actinopterygii				
Labeo rohita	Cyprinidae	Rohu	Rohu	LC
Catla catla	Cyprinidae	Catla	Katla	LC
Tilapia spp.	Cichlidae	Tilapia	Tilapia	LC
Clarias batrachus	Clariidae	Walking catfish	Magur	LC
Platanista gangetica	Platanistidae	dolphin	Ganges River dolphin	LC
Class: Macrobrachium spp.				
Macrobrachium genus	Macrobrachium	Rohu	Rupchanda	NT
Class: Potamonautes spp.				
Potamonautidae spp.	Potamonautidae	River crabs	crabs	LC
Class: Malacostraca				
Macrobrachium	Atyidae	Freshwater shrimp	chingri	LC
Class: Pila spp				
Pila spp.	Ampullariidae	Apple Snails	Apple Snails	LC
Class: Gastropoda				
Anodonta	Unionidae	Freshwater Mussels	shellfish	LC
Class: Amphibia				
Hoplobatrachus tigerinus	Dicroglossidae	Indian bullfrog	Manpukura	LC

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Table 5.46: List of Aquatic Fauna Identified in and around Chatkhil (Noakhali)

Scientific Name	Family	English Name	Local Name	IUCN Status
Class: Actinopterygii				
Tenualosa ilisha	Clupeidae	Hilsa	Ilish	LC
Class: Actinopterygii				
Labeo rohita	Cyprinidae	Rohu	Rohu	LC
Catla catla	Cyprinidae	Catla	Katla	LC
Cirrhinus mrigala	Cyprinidae	Mrigal	Mrigal	LC
Tilapia spp.	Cichlidae	Tilapia	Tilapia	LC
Platanista gangetica	Platanistidae	dolphin	Ganges River dolphin	LC
Class: Macrobrachium spp.				
Macrobrachium genus	Macrobrachium	Rohu	Rupchanda	NT
Class: Potamonautes spp.				
Potamonautidae spp.	Potamonautidae	River crabs	crabs	LC
Class: Malacostraca				
Macrobrachium	Atyidae	Freshwater shrimp	chingri	LC
Class: Pila spp				
Pila spp.	Ampullariidae	Apple Snails	Apple Snails	LC
Class: Gastropoda				
Anodonta	Unionidae	Freshwater Mussels	shellfish	LC
Class: Amphibia				
Hoplobatrachus tigerinus	Dicroglossidae	Indian bullfrog	Manpukura	LC

Table 5.47: List of Aquatic Fauna Identified in and around Dupchanchia (Bogura)

Scientific Name	Family	English Name	Local Name	IUCN Status
Class: Actinopterygii				
Labeo rohita	Cyprinidae	Rohu	Rohu	LC
Catla catla	Cyprinidae	Catla	Katla	LC
Cirrhinus mrigala	Cyprinidae	Mrigal	Mrigal	LC
Tilapia spp.	Cichlidae	Tilapia	Tilapia	LC
Platanista gangetica	Platanistidae	dolphin	Ganges River dolphin	LC
Class: Macrobrachium spp.				
Macrobrachium genus	Macrobrachium	Rohu	Rupchanda	NT
Class: Potamonautes spp.				
Potamonautidae spp.	Potamonautidae	River crabs	crabs	LC
Class: Pila spp				
Pila spp.	Ampullariidae	Apple Snails	Apple Snails	LC
Class: Gastropoda				
Anodonta	Unionidae	Freshwater Mussels	shellfish	LC
Class: Amphibia				
Hoplobatrachus tigerinus	Dicroglossidae	Indian bullfrog	(Manpukura)	LC

Table 5.48: List of Aquatic Fauna Identified in and around Matlab (N) (Chandpur)

Scientific Name	Family	English Name	Local Name	IUCN Status
Class: Actinopterygii				
Tenualosa ilisha	Clupeidae	Hilsa	Ilish	LC
Class: Actinopterygii				
Labeo rohita	Cyprinidae	Rohu	Rohu	LC
Catla catla	Cyprinidae	Catla	Katla	LC
Cirrhinus mrigala	Cyprinidae	Mrigal	Mrigal	LC

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Scientific Name	Family	English Name	Local Name	IUCN Status
Tilapia spp.	Cichlidae	Tilapia	Tilapia	LC
Platanista gangetica	Platanistidae	dolphin	Ganges River dolphin	LC
Class: Macrobrachium spp.				
Macrobrachium genus	Macrobrachium	Rohu	Rupchanda	NT
Class: Potamonautes spp.				
Potamonautidae spp.	Potamonautidae	River crabs	crabs	LC
Class: Malacostraca				
Macrobrachium	Atyidae	Freshwater shrimp	chingri	LC
Class: Pila spp				
Pila spp.	Ampullariidae	Apple Snails	Apple Snails	LC
Class: Gastropoda				
Anodonta	Unionidae	Freshwater Mussels	shellfish	LC
Class: Amphibia				
Hoplobatrachus tigerinus	Dicroglossidae	Indian bullfrog	Manpukura	LC

Table 5.49: List of Aquatic Fauna Identified in and around Monohardi (Narshingdi)

Scientific Name	Family	English Name	Local Name	IUCN Status
Class: Actinopterygii				
Labeo rohita	Cyprinidae	Rohu	Rohu	LC
Catla catla	Cyprinidae	Catla	Katla	LC
Cirrhinus mrigala	Cyprinidae	Mrigal	Mrigal	LC
Tilapia spp.	Cichlidae	Tilapia	Tilapia	LC
Anabas testudineus	Anabantidae	Climbing perch	Koi	LC
Class: Actinopterygii				
Hypophthalmichthys molitrix	Cyprinidae	Silver Carp	Silver Carp	LC
Class: Potamonautes spp.				
Potamonautidae spp.	Potamonautidae	River crabs	crabs	LC
Class: Malacostraca				
Macrobrachium	Atyidae	Freshwater shrimp	chingri	LC
Class: Pila spp				
Pila spp.	Ampullariidae	Apple Snails	Apple Snails	LC
Class: Amphibia				
Hoplobatrachus tigerinus	Dicroglossidae	Indian bullfrog	Manpukura	LC

Table 5.50: List of Aquatic Fauna Identified in and around Madhabpur (Habiganj)

Scientific Name	Family	English Name	Local Name	IUCN Status
Class: Actinopterygii				
Labeo rohita	Cyprinidae	Rohu	Rohu	LC
Catla catla	Cyprinidae	Catla	Katla	LC
Cirrhinus mrigala	Cyprinidae	Mrigal	Mrigal	LC
Tilapia spp.	Cichlidae	Tilapia	Tilapia	LC
Clarias batrachus	Clariidae	Walking catfish	Magur	LC
Platanista gangetica	Platanistidae	dolphin	Ganges River dolphin	LC
Class: Macrobrachium spp.				
Macrobrachium genus	Macrobrachium	Rohu	Rupchanda	NT
Class: Potamonautes spp.				
Potamonautidae spp.	Potamonautidae	River crabs	crabs	LC
Class: Malacostraca				
Macrobrachium	Atyidae	Freshwater shrimp	chingri	LC
Class: Pila spp				

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Scientific Name	Family	English Name	Local Name	IUCN Status
Pila spp.	Ampullariidae	Apple Snails	Apple Snails	LC
Class: Gastropoda				
Anodonta	Unionidae	Freshwater Mussels	shellfish	LC
Class: Amphibia				
Hoplobatrachus tigerinus	Dicroglossidae	Indian bullfrog	Manpukura	LC

Table 5.51: List of Aquatic Fauna Identified in and around Pekua/ Chakaria (Cox's Bazar)

Scientific Name	Family	English Name	Local Name	IUCN Status
Latescalcarifer	Latidae	GiantSeaperch	Vetki/Koral	LC
Cynoglossus lingua	Cynoglossidae	LongTungSole	Kukkurjib	LC
Arius sp	Ariidae	CatFish	Kata Mach	LC
Mystus gulio	Bagridae	BagridCatfish	NunaTengra/Guilla	LC
Ephippus orbis	Ephippidae	SpadeFish	Hatir Kaan	LC
Drepane longimanna	Drepaneidae	Sicklefish	Pann Machh	EN^
Lactarius lactarius	Lactariidae	FalseTrevally	Sadha Machh	LC
Lutjanus johni	Lutjanidae	RedSnapper	Ranga Choukya	EN^
Mene maculata	Menidae	MoonFish	Chan Chanda	LC
Upeneus sulphureus	Mullidae	GoatFish	Sonali Bata	LC
Liza tade	Mugilidae	TadeGreyMullet	GoolBata	LC
Liza subviridis	Mugilidae	GreenBackGreyMullet	Khurul Bata/Bhangna Bata	LC
Class: Malacostraca				
Penaeus monodon	Penaeidae	Bagda Chingri	Giant black tiger Shrimp	LC
Penaeus semisulcatus	Penaeidae	Bagatara Chingri	Green Tiger Shrimp	LC
Penaeus japonicus	Penaeidae	Dorakata Chingri	Tiger shrimp	LC
Penaeus indicus	Penaeidae	Chaga Chingri	Indian white Shrimp	LC
Penaeus merguiensis	Penaeidae	Baga Chama Chingri	Banana Shrimp	LC
Metapenaeus brevicornis	Penaeidae	Loilla/Honney Chingri	Brown/Yellow Shrimp	LC
Metapenaeus spinulatus	Penaeidae	--	Brown shrimp	LC
Parapenaeopsis sculptilis	Penaeidae	Ruda Chingri	Pink/Rainbow Shrimp	LC
Parapenaeopsis stylifera	Penaeidae	Rida Chingri	Pink/Kiddi Shrimp	LC
Scylla serrata	Portunidae	Mud crab	Sila kakra	LC
Portunus pelagicus	Portunidae	swimming crab	Samudra kakra	LC
Portunus sanguinolentus	Portunidae	Swimming crab	Kakra	LC

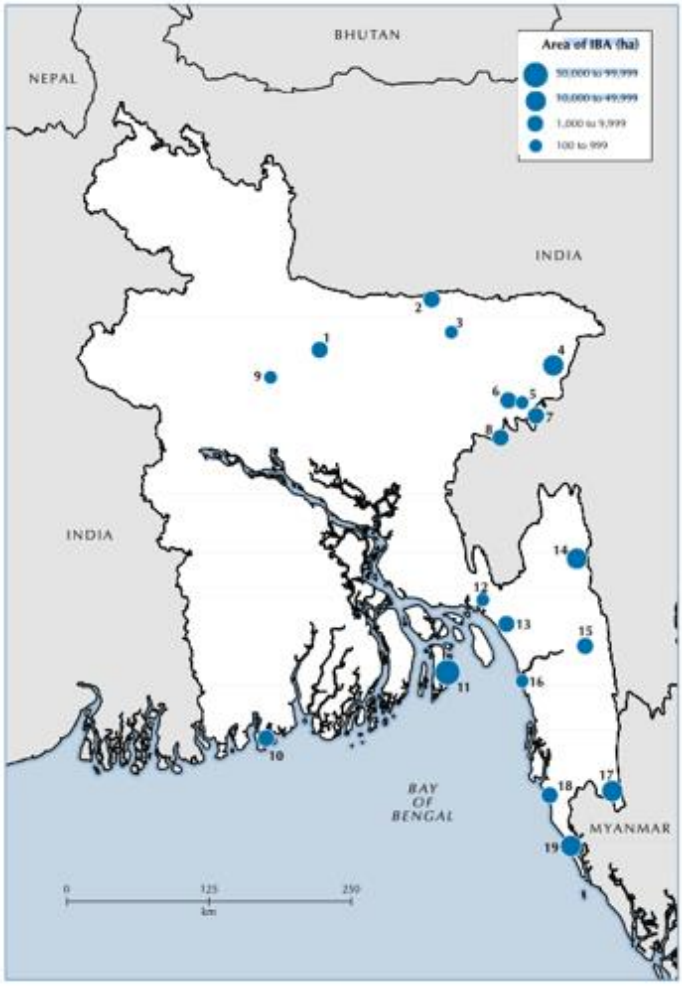
5.4.5 Biodiversity/Environmentally Sensitive Areas

312. In 2001, the Government of Bangladesh had declared 14 protected areas under the Bangladesh Wildlife Preservation Act, including five national parks, eight wildlife sanctuaries and one game reserve. These have a total area of 2,278 km^2 or just over 1.5% of the country's land area and are managed by the Wildlife Division under the Forest Department of the MoEF. Protected areas for biodiversity conservation in Bangladesh are based on three legislations: (i) Bangladesh Wildlife Preservation (amended) Act in 1973 (ii) Bangladesh Environment Conservation Act, 1995 (amended in 2002 and 2010) and (iii) Fish Act 1850 (amended in 1985).

313. Many wildlife species are in stress in Bangladesh, many more are threatened, and a large number already faced extinction. The status of faunal species in Bangladesh has been published by IUCN (2000). According to the IUCN findings, the country has lost 10% of its mammalian fauna, 3% avifauna and 4% reptiles over the last 100 years. More than 50 species are presently critically endangered in Bangladesh of which 23 species are already declared as endangered in the Red Data Book of IUCN. In addition, 83 species are commercially threatened and are included in the appendices of Convention on International Trade in Endangered Species (CITES). Among the most endangered species are elephant, tiger, wild cat, leopard or

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

wild goat, serao, dolphin; birds: white-winged duck, comb duck, stork, carne, pheasant, partridge, and herpetofauna: crocodile, python, monitor, lizard, tiger, terrapin, roofed turtle, soft turtle, and marine turtles. Any construction must consider impacts on the rate of deforestation, loss of habitat, habitat fragmentation, and interruption of wildlife migration patterns. However, no protected areas or ecologically critical areas (ECAs) are located within the project impact areas.



Location and size of IBAs (Source IBA Bangladesh)

IBA's relevant to project locations

10 Sundarbans (East, South, West Wildlife Sanctuaries) - Protected [R, WH] ■ A1 ■ A4iii
Coordinates 21°50'N 89°40'E **Altitude** 0–3 m **Area** 139,699 ha **Habitats** Forest; Wetlands
■ **Threatened species** *Pelecanus philippensis*, *Leptoptilos javanicus*, *Leptoptilos dubius*, *Haliaeetus leucoryphus*, *Heliopais personata*, *Eurynorhynchus pygmeus*, *Rynchops albicollis*

11 Ganges-Brahmaputra-Meghna delta - Unprotected ■ A1 ■ A4i, iii
Coordinates 22°18'N 91°10'E **Altitude** Sea-level **Area** 75,000 ha **Habitats** Forest; Wetlands
■ **Threatened species** *Eurynorhynchus pygmeus*, *Tringa guttifer*, *Rynchops albicollis* ■ **Congregatory waterbirds** *Anser indicus*, *Tadorna tadorna*, *Numenius arquata*, *Eurynorhynchus pygmeus*, *Tringa guttifer*, *Rynchops albicollis*

12 Muhuri Dam - Unprotected ■ A4i
Coordinates 22°51'N 91°28'E **Altitude** Unknown **Area** 500 ha **Habitats** Grassland; Wetlands
■ **Congregatory waterbirds** *Anas strepera*, *Anas penelope*, *Anas acuta*, *Anas querquedula*, *Anas crecca*, *Aythya nyroca*, *Aythya fuligula*

13 Hazarikhil Wildlife Sanctuary - Partially protected ■ A3
Coordinates 22°40'N 91°40'E **Altitude** Unknown **Area** 2,903 ha **Habitats** Forest ■ **Biomes** AS09: Indochinese tropical moist forest

16 Patenga Beach - Unprotected ■ A1 ■ A4i
Coordinates 22°14'N 91°48'E **Altitude** Sea-level **Area** 500 ha **Habitats** Forest; Wetlands
■ **Threatened species** *Tringa guttifer*, *Eurynorhynchus pygmeus* ■ **Congregatory waterbirds** *Charadrius mongolus*

18 Himchari National Park – Protected ■ A3
Coordinates 21°22'0''N 92°1'59''E **Altitude** 0–0 m **Area** 1,729 ha **Habitats** Forest

19 Teknaf Game Reserve – Protected ■ A1 ■ A3
Coordinates 21°0'0''N 92°13'59''E **Altitude** 5–700 m **Area** 11,615 ha **Habitats** Forest
■ **Threatened species** *Leptoptilos dubius*, *Leptoptilos javanicus, Rynchops albicollis, Aquila heliacal*

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

References from IBA publication and data from MINISTRY OF ENVIRONMENT AND FORESTS (2001) State of environment Bangladesh 2001. Bangladesh: Ministry of Environment and Forests. (downloaded on 30 June 2004 from: http://www.moef.gov.bd/)

Figure 5.40: Location and size of IBAs

314. Of the 20 original IBAs in Bangladesh, 12 support globally threatened species, 10 have biome-restricted species and 10 qualify as IBAs because they hold large congregations of waterbirds. Bangladesh's IBAs cover less than 4% of the total land area of the country, reflecting the great reduction and fragmentation of natural habitats in the country. However, additional sites are likely to be added to this preliminary list of IBAs in the future.

315. Ten original IBAs (53%) contain examples of terrestrial forest ecosystems, which together cover all significant areas of forest known to remain in Bangladesh. They include the Indo-Malayan tropical dry forests in Madhupur National Park (IBA 1) to the north of Dhaka, three IBAs in north-eastern Bangladesh where Indochinese tropical moist forest is the dominant biome, and six IBAs in the Chittagong hill tracts in the south-east of the country, where Indochinese tropical moist forest and Sino-Himalayan subtropical forest are the main habitats.

316. Five original IBAs contain freshwater ecosystems and some also have remnants of natural grassland. Tanguar Haor (IBA 2) and Hakaluki Haor (IBA 4) in north-east Bangladesh are outstanding because of their breeding population of Pallas's Fish-eagle, and for their large wintering concentrations of waterbirds, including Baer's Pochard.

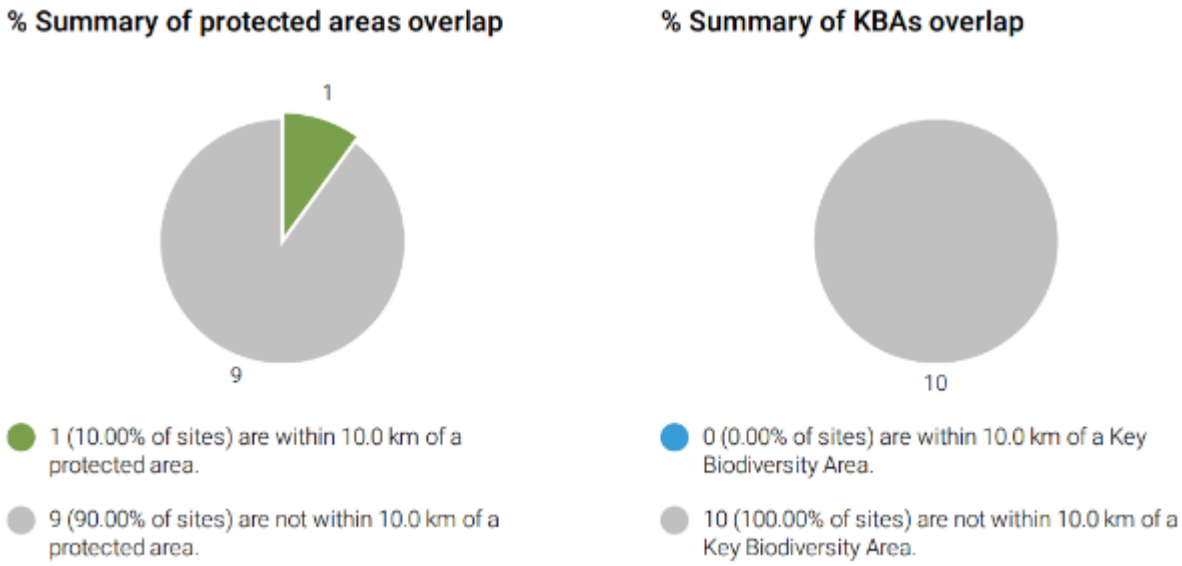
317. Coastal ecosystems are represented at seven original IBAs. The intertidal mud and sand flats of the Ganges-Brahmaputra-Meghna delta (IBA 11) IBA support the largest known concentrations of Spotted Greenshank, Spoon-billed Sandpiper and Indian Skimmer in the world. The Sundarbans (IBA 10) is globally recognized as habitat.

318. Table 5.75: Distances of Project Components from in Section 5.6.11 provides distances to these biodiversity areas.

319. In addition to the original IBAs, a 2013 addition to the IBA list is Sonadia Island. BirdLife International designated this due to its significant populations of wintering migratory waders, including great knots (EN), spoon-billed sandpipers (CR), and spotted greenshanks (EN). It is recognized as a sanctuary for the globally critically endangered spoon-billed sandpiper. 10% of the known population of the Critically Endangered Spoon-billed Sandpiper *Eurynorhynchus pygmeus* spends the winter making this IBA a definite critical habitat.

320. The Integrated Biodiversity Assessment Tool (IBAT) primarily serves as a platform for accessing and visualizing biodiversity-related information from various databases. Appendix IV contains Proximity IBAT analysis reports for Pekua, Paigacha, Mathbaria as well as one multisite report. The detailed IBAT analysis is given in Appendix IV. Only Fasiakhali Wildlife Sanctuary overlaps with a 10km area around the Pekua substation.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.



*Protected Area: Fasiakhali Wildlife Sanctuary

Figure: Number of protected areas and KBAs overlapped by a 10.0 km buffer for each substation site

Figure 5.41: Summary Multi-Site Report for Proposed Substations Location (Within 50 Km)

Table 5.52: IUCN Red List of Threatened Species including Critically Endangered (CR), Endangered (EN) or Vulnerable (VU) found within 50 km of each site as per area of occurrence from IBAT

Site	No. of Threatened Species including Critically Endangered (CR), Endangered (EN) or Vulnerable (VU) found within 50 km of each site
Dupchanchia 132/33kV AIS Substation	44
Kumarkhali 132-33kV AIS Substation	82
Madhabpur 230-132-33kV AIS Substation	64
Mathbaria 132-33kV AIS Substation	135
Matlab North 132-33kV AIS Substation	98
Monohardi 230-132-33kV AIS Substation	93
Paikgacha 132-33kV AIS Substation	52
Pekua 400-230-132kV AIS Substation	156
Chatkhil 132-33kV AIS Substation	151
Tungipara 132-33kV AIS Substation	88

321. **Sundarbans Reserve Forest** is located in the adjacent districts of Khulna near Paikgacha, and Satkhira, the Sundarbans Reserve Forest is the largest mangrove forest in the world and a UNESCO World Heritage Site. It serves as a critical habitat for numerous species, including the Bengal tiger, estuarine crocodile, and various bird species. Sundarbans as a designated protected area, including its boundaries, management status, and conservation significance. The Sundarbans is also designated as a Ramsar Site, recognized for its importance as a wetland of international significance. IBAT allows users to access information on Ramsar sites, including ecological characteristics, threats, and management measures. This data can support wetland conservation and management efforts within the Sundarbans.

322. **Tanguar Haor** is the other Ramsar site in Bangladesh. The site lies in the northeastern part of the country in the floodplain of the Surma River, one of the main tributaries of the Brahmaputra at the base of the Meghalaya Hills in adjacent India.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

5.4.6 Ecologically Critical Area

323. The government has declared thirteen Ecologically Critical Areas (ECA) under the Environmental Conservation Act, 1995 (amendment, 2010) with a total area of 2,097 km^2 or just under 1.5% of the land area of Bangladesh. An Ecologically Critical Area (ECA) is an environmental protection zone in Bangladesh. In 1995, specific areas in Bangladesh could be deemed Ecologically Critical Areas as a result of the Environmental Conservation Act 1995.

324. ECA also falls within the category of natural and cultural heritage. The Government of Bangladesh has declared seven areas as ECAs in 1999, e.g. Cox's Bazar and Teknaf Peninsula, St. Martin's Island, Sonadia Island, Hakaluki Haor, Tanguar Haor and Marjat Baor and Sundarbans. 5 more areas were added to the list of ECAs: Gulshan-Baridhara Lake (2001), Buriganga River (2009), Turag River (2009), Balu River (2009), Shitalakhya River (2009) and Jaflong and Dauki River (2015).

5.4.7 ADB Defined Natural and Critical Habitat

325. None of the project sites fall within natural habitat, all are modified habitat. As above, some species of flora or migratory birds may trigger critical habitat taking a wider area of analysis but this will be confirmed for the final IEE, with impacts on such species being avoided through sensitive siting and routing of the project components.

SS and TLs	Habitat Passed
400/230/132kV New AIS Substation at Pekua/Chakaria, Cox's Bazar	Modified habitat
230/132/33 kV New AIS Substation at Madhabpur, Habiganj	Modified habitat
230/132/33 kV New AIS Substation at Monohardi, Narsingdi	Modified habitat
132/33 kV New AIS Substation at Tungipara, Gopalganj	Modified habitat
132/33 kV New AIS Substation at Dupchanchia, Bagura	Modified habitat
132/33 kV New AIS Substation at Matlab Uttar, Chandpur	Modified habitat
132/33 kV New AIS Substation at Kumarkhali, Kushtia	Modified habitat
132/33 kV New AIS Substation at Chatkhil, Noakhali	Modified habitat
132/33 kV New AIS Substation at Paikgacha, Khulna	Modified habitat
132/33 kV New AIS Substation at Mathbaria, Pirojpur	Modified habitat
LILO of Existing Matarbari PP – Banskhali PP 400 kV line at Pekua: 6.75 km (Conductor: Quad ACSR Finch)	Modified habitat
LILO of Anwara – Cox's Bazar 230 kV line at Matarbari: 0.50 km (Conductor: Twin ACSR Mallard)	Modified habitat
LILO of Existing Matarbari (132/33) – Chakaria 132 kV line at Matarbari: 1.30 km (Conductor: ACSR Grosbeak)	Modified habitat
LILO of Cumilla (N) – Shahjibazar PP 230 kV double circuit line at Madhabpur: 1.20 km (Conductor: Twin ACSR Mallard)	Modified habitat
LILO of Shahjibazar-Brahmanbaria 132kV double circuit line at Madavpur: 1.20 km (Conductor: CFCC type HTLS equivalent to ACSR Grosbeak)	Modified habitat
Reconductoring of Shahjibazar-Brahmanbaria-Ashuganj 132 kV line: (58+17) = 75.00 km) (Proposed Conductor: CFCC type HTLS equivalent to ACSR Grosbeak)	Modified habitat
LILO of Sripur - Ashuganj 230 kV double circuit line at Monohardi: 5.50 km (Conductor: Twin ACSR Mallard)	Modified habitat
Monohardi-Bajitput 132kV double circuit line: 21.00 km (Proposed Conductor: Twin ACSR Grosbeak)	Modified habitat
Gopalganj – Tungipara 132 kV double circuit line: 19.00 km (Proposed Conductor: ACSR Grosbeak)	Modified habitat
LILO of Bogura (S) – Naogaon 132 kV line at Dupchanchia: 2.50 km (Existing Conductor: ACCC Grosbeak)	Modified habitat
Kachua – Matlab (N) 132kV double circuit line: 33.00 km (Proposed Conductor:	Modified habitat

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

SS and TLs	Habitat Passed
ACSR Grosbeak)	
LILO of Bheramara – Rajbari 132 kV line at Kusthia (E): 0.60 km (Existing Conductor: ACCC Hawk)	Modified habitat
LILO of Chowmuhani – Ramganj 132 kV double circuit line at Chatkhil: 2.00 km (Existing Conductor: ACSR Grosbeak)	Modified habitat
Satkhira-Paikgacha 13 2kV double circuit line: 30.00 km (Proposed Conductor: ACSR Grosbeak)	Modified habitat
Bhandaria-Mathbaria 132kV double circuit transmission line: 32.00 km (Proposed Conductor: ACSR Grosbeak)	Modified habitat

5.5 Social Baseline

5.5.1 Administrative Bounding of the Study Area

326. To figure out the administrative boundary, the whole project falls in in a combination of cultivated agricultural land and salt pans in the rural areas in Tungipara (Gopalganj), Paikgacha (Khulna), Kumarkhali (Kushtia), Mathbaria (Pirojpur), Chatkhil (Noakhali), Dupchanchia (Bogura), Matlab (N) (Chandpur), Monohardi (Narshingdi), Madhabpur (Habiganj), and Pekua/ Chakaria (Cox's Bazar) respectively. The administrative bounding of the proposed project is shown in the following Figure 5.42.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

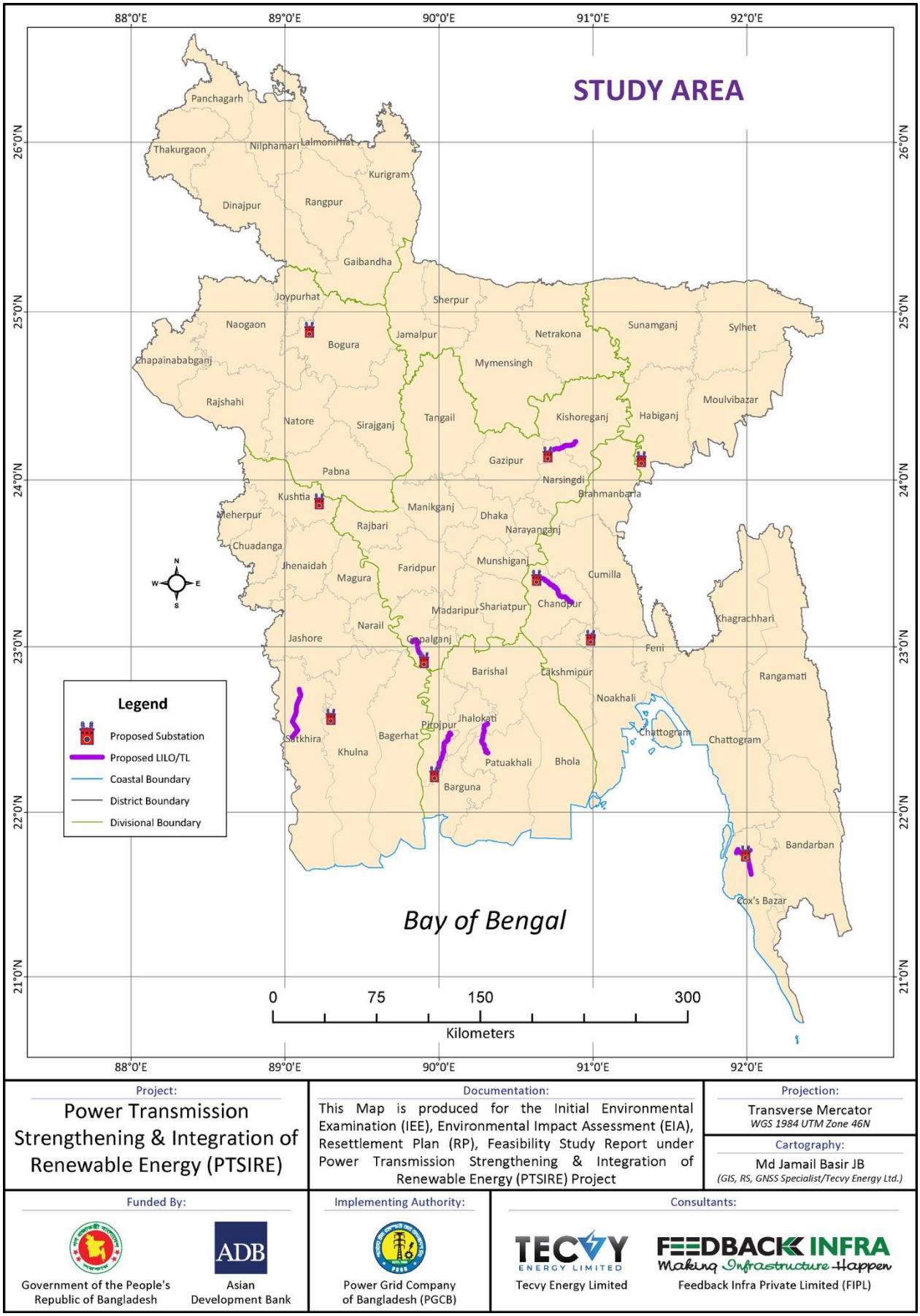


Figure 5.42: Administrative Bounding of Study Area

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

5.5.2 Households and Population

327. The project will cover 14 upazilas of Gopalganj, Khulna, Kushtia, Pirojpur, Noakhali, Bogura, Chandpur, Narshingdi, Habiganj, Brahmanbaria, Kishoreganj, Satkhira and Cox's Bazar districts under six divisions. According to Population and Housing Census 2022, the benefited households of the project area are 934,589 and the estimated the population of the project area is 3,816,749 of which 1,840,498 are males (48.22%) and 1,976,251 are females (51.78%). The average household size in project upazilas is 4.05. The average literacy rate of the project area was found 76.95 of which male 78.46 and female 75.53.

Table 5.53: Demographics and Population

SN	Division	District	Upazila	Household	Population Total	Male	Female	HH Size	Literacy Rate Total	Male	Female
1.	Chattogram	Cox's Bazar	Pekua	45957	214349	106000	108349	4.62	70.62	71.07	70.19
2.	Sylhet	Habiganj	Madabhpur	84348	384212	187135	197077	4.51	68.93	70.39	67.56
3.	Dhaka	Narsingdi	Monohardi	75940	298603	139850	158753	3.88	75.30	76.4	74.30
4.	Dhaka	Gopalganj	Tungipara	26334	114480	56794	57686	4.23	81.41	81.7	81.06
5.	Rajshahi	Bogura	Dupchachia	54922	195051	94080	100971	3.49	73.53	76.6	70.70
6.	Chattogram	Chandpur	Matlab Dakkhin	55851	226718	103014	123704	4.01	75.82	76.28	75.46
7.	Chattogram	Chandpur	Matlab Uttar	74514	295814	136473	159341	3.95	76.97	78.56	75.64
8.	Khulna	Kushtia	Kumarkhali	95089	373734	184451	189283	3.92	68.18	69.1	67.25
9.	Chattogram	Noakhali	Chatkhil	59019	258786	118264	140522	4.32	85.27	85.6	84.98
10.	Khulna	Khulna	Paikgachha	74000	286192	143352	142840	3.85	75.17	80.00	70.34
11.	Barishal	Pirojpur	Bhandaria	41382	163648	79880	83768	3.91	84.51	85.01	84.04
12.	Barishal	Barishal	Bakerganj	88035	356012	173054	182958	3.96	79.93	82.06	77.95
13.	Barishal	Borguna	Borguna Sadar	73674	294350	144587	149763	3.95	82.28	83.85	80.77
	Total/Average			**934589**	**3816749**	**1840498**	**1976251**	**4.05**	**76.95**	**78.46**	**75.53**

Source: BBS Population and Housing Census 2022

328. A total of 961 affected households was found as affected household by the project[32]. During socioeconomic survey April to May 2024, the 544 (56.61%) households were found as responsive of survey questionnaire and other were non-responsive who were not present at the project areas. The details socio-economic status of the affected household of proposed project area is described below.

5.5.3 Household Size

329. As per survey, total households were 961 and total population estimated around 3748, it has been found that most of the households comprises of four or more members in each household. Findings reveal that, on an average, the household size in the study area was found 3.90 where the national average household size is 3.98 as of BBS Population and Housing Census 2022.

5.5.4 Age Composition

330. The Table 5.54 represents age-sex distribution of the affected HHs. The table indicates that population density increases respectively from the age group of 5-14. According to the age band, the most prominent group is 15-59. The number of affected persons steadily decreases with increasing age limit above 60.

Table 5.54: Age-Sex Distribution of the Affected HHs

Age Group (Yrs)	Male		Female		Overall	
	No.	%	No.	%	No.	%

[32] Paikgacha land has been in possession of PGCB since 2021, land for substation extensions is also already owned by PGCB. There is no household that exists on the substation. All other relevant information can be found in the RAP if so required

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Age Group (Yrs)	Male		Female		Overall	
01 to 04	27	1.27	26	1.22	53	2.50
05 to 14	165	7.77	161	7.58	326	15.35
15-29	339	15.96	319	15.02	658	30.98
30-59	522	24.58	450	21.19	972	45.76
60-65	57	2.68	19	0.89	76	3.58
Above 65	20	0.94	19	0.89	39	1.84
Total	1130	53.20	994	46.80	2124	100

Source: SES survey, June 2024

5.5.5 Dependency Ratio

331. Dependency ratio is defined as the ratio of sum of population aged 0-14 years and 65+ years to the population aged 15-64 years expressed as percentage. Age structure shows that larger portion (18.62%) of population belongs to the age group of 1-14 year which is regarded as the youth dependency population. On the contrary, the age group 65+ is 4.98%. The dependence ratio of project area is estimated as 23.6% where national the Dependence ratio of Bangladesh is 52.63% (BBS Population and Housing Census 2022).

5.5.6 Sex Profile of Affected HHs

332. Sex profile of the affected HHs has been illustrated in the below table. It represents that the percentage of male populations are greater than female in the project areas. In the project areas total of 2124 population will be affected where 53.20% are male and 46.80 %are female. The overall male-female ratio of the project areas is 100:104, which represents that there are slightly more male than female percentage of population in the project areas.

Table 5.55: Sex Profile of Affected HHs and Tenants

Gender	Total	%
Male	1130	53.20
Female	994	46.80
Total	2124	100.00

Source: SES survey, June 2024

5.5.7 Population by Religion

333. The religion distribution of the affected households (HHs) is presented in a bar diagram. The figure represents that majority of the population follow Muslim religion, with some followers of Hindu religion. There were no other religious people found during the survey period in the project areas.

Table 5.56: Percentage of affected population by religion

Household Type	Total	%
Muslim	494	90.81
Hindu	50	9.19
Total	544	100.00

Source: SES survey, June 2024

5.5.8 Education Level of Affected Population (7 Years and above)

334. The education level of the affected population is presented in Table 5.57. The table demonstrates that primary and secondary level education entrance is high in the area. But the dropout rate is very high as the number of people sharply decreases from secondary certificate achievers. It also indicates that education rate is higher among male population than female. Also, illiteracy is higher among female

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

population.

Table 5.57: Level of Education of Affected Population

Education Level	Male		Female		Total	
	No.	%	No.	%	No.	%
Up to class five/ Ebtedaye Madrasha	367	17.28	169	7.96	536	25.24
Class six to ten	168	7.91	212	9.98	380	17.89
SSC or equivalent	120	5.65	118	5.56	238	11.21
HSC or equivalent	169	7.96	84	3.95	253	11.91
BA or equivalent	70	3.30	365	17.18	435	20.48
MA or equivalent	13	0.61	1	0.05	14	0.66
Child below 5 years	174	8.19	35	1.65	209	9.84
Hafez	23	1.08	1	0.05	24	1.13
Can Sign Only	26	1.22	9	0.42	35	1.65
Total	1130	53.20	994	46.80	2124	100

Source: SES survey, June 2024

5.5.9 Primary Occupation of Affected Population

335. According to the census findings, the most affected primary occupation in the project areas has been identified to be service. In addition to service, the other significant occupations are involvement with agriculture, business, retired and expatriate. Apart from these, a large number of populations has been identified as unemployed in the form of housewives, student and aged persons.

Table 5.58: Primary Occupation of Affected Population (15 years and above)

SL.	Occupation	Male	Male	Female	Female	Total	Total
		N	%	N	%	N	%
1	Agriculture	182	10.90	96	5.75	278	16.65
2	Service	362	21.68	281	16.83	643	38.50
3	House Wife	0	0.00	240	14.37	240	14.37
4	Fisher Man	9	0.54	1	0.06	10	0.60
5	Business	84	5.03	13	0.78	97	5.81
6	Day Labour	11	0.66	0	0.00	11	0.66
7	Driver	26	1.56	60	3.59	86	5.15
8	Student	185	11.08	40	2.40	225	13.47
9	Mechanic	7	0.42	9	0.54	16	0.96
10	Unemployment	27	1.62	13	0.78	40	2.40
11	Aged Person	11	0.66	13	0.78	24	1.44
Total		**904**	**54.13**	**766**	**45.87**	**1670**	**100**

Source: SES survey, June 2024

5.5.10 Income Level of Affected Populations

336. The total affected population has been divided into 7 sections based on per capita income. The level starts from BDT 126,000, which is classified as vulnerable group[33] in terms of income level for the project areas. Only 19 HH has been located to be in the vulnerable group. It also represents that living condition for majority of the project affected households are better off compared to national average.

[33] HHs income level below 120,000/year are counted as vulnerable for this proposed project

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Table 5.59: Income Level of Affected Population

Level of Income (BDT)	Total	
	No.	%
Up to 126,000	19	3.49
126001 to 180000	107	19.67
180001 to 240000	230	42.28
240001 to 360000	117	21.51
360001 to 480000	29	5.33
480001 to 600000	19	3.49
Above 600000	23	4.23
Total	544	100

Source: SES survey, June 2024

5.5.11 Marital Status of Affected Population

337. The illustration indicates that most of the affected population are married. 35.44% of the total population are unmarried. But only 14.56% female population are unmarried against 20.88% of the male population. The number of widowed females is 1.76%, whereas the number of widowed, abandoned and divorced male population is negligible. During the census, it was found that most of the female get married at the age of 18 or above that means there is no childhood marriage is occurring in the proposed project areas.

Table 5.60: Marital Status of Affected Population

Marital Status	Gender	10-15	16-17	18-30	31-40	41-50	51-60	Above 60	Total
		%	%	%	%	%	%	%	%
Married	Male	0.00	0.00	4.15	10.21	9.43	5.34	2.33	31.45
	Female	0.00	0.00	10.36	10.36	7.46	1.81	0.36	30.36
Unmarried	Male	6.06	2.64	11.71	0.47	0.00	0.00	0.00	20.88
	Female	7.41	2.59	4.56	0.00	0.00	0.00	0.00	14.56
Widower/Widow	Male	0.00	0.00	0.00	0.00	0.00	0.10	0.26	0.36
	Female	0.00	0.00	0.05	0.21	0.21	0.31	0.98	1.76
Abandoned	Female	0.00	0.00	0.00	0.05	0.10	0.05	0.05	0.26
Divorced	Female	0.00	0.00	0.05	0.16	0.05	0.05	0.05	0.36
Total		13.47	5.23	30.88	21.45	17.25	7.67	4.04	100

Source: SES survey, June 2024

5.5.12 Housing Infrastructure

338. The Housing condition in the study area is characterized by 42.84% Semi pucca, 13.73% Pucca and Tin Shed 26.09%. And Katcha households was found 11% in the study areas.

Table 5.61: Housing Condition of Project Areas

House type	Number	Percentage %
Pucca house	91	13.73
Semi-pucca house	284	42.84
Tin shed	173	26.09
Katcha house	79	11.92
Thatched	9	1.36

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

House type	Number	Percentage %
Wood made house	27	4.07
Total	663	100

Source: SES survey, June 2024

5.5.13 Household Amenities

339. **Water Facilities:** In the project area, 99.26% of general households get their water from tube-wells. Only 0.74% of households use river water for domestic purposes. The table below shows the representation of water sources in the project areas.

Table 5.62: Source of Water

Type of Source	Source of Drinking Water		Source of Domestic purpose	
	N	%	N	%
Private well/tube well	510	93.75	509	93.57
Public well/tube well	32	5.88	31	5.70
Government water scheme	1	0.18		0.00
River/stream/pond	1	0.18	4	0.74
Total	544	100	544	100

Source: SES survey, June 2024

340. **Sanitation Facilities:** In the study areas, 63.24% of households use sanitary latrines (with water seals), followed by 26.65% who use public toilets. Non-sanitary latrines are used by 3.13% of households, while 1.47% of households share a toilet with a neighbor, and another 1.47% have no toilet facilities. The table below shows the types of sanitation facilities in the study areas.

Table 5.63: Sanitation Types of The Study Areas

Toilet type	Number	Percentage (%)
Own flush toilet with commode	22	4.04
Own water-seal toilet	344	63.24
Own pit toilet	17	3.13
Toilet shared with a neighbor	8	1.47
Public toilet	145	26.65
No toilet	8	1.47
Total	544	100

Source: SES survey, June 2024

5.5.14 Household Assets

341. The table below shows the availability of household assets in the study areas. It was found that 25.56% of households have an electric fan, followed by 24.25% with a television, and 20.21% with a fridge. Other household assets include electric irons, air conditioners, computers, water pumps, and rice cookers. The table below shows the household assets status in the project areas.

Table 5.64: Household Assets Status of HH

SL	Name of Assets	Total	%
1	Television	499	24.25
2	Radio	14	0.68
3	Refrigerator	416	20.21
4	Electric fans	526	25.56

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

SL	Name of Assets	Total	%
5	Air conditioner	19	0.92
6	Washing machine	4	0.19
7	Electric iron	214	10.40
8	Rice cooker	198	9.62
9	Other kitchen utensils	34	1.65
10	Computer	24	1.17
11	Electricity operated water pump	110	5.34
Total		2058	100

Source: SES survey, June 2024

5.5.15 Land Ownership

The table below presents the types of land ownership among households in the study areas. It was found that a significant majority, 79.41%, of households own ancestral land. This is followed by 11.58% of households that have purchased their land. A smaller portion, 5.88%, of households own a combination of their own land and government-leased land. Only 1.10% of households occupy government or khas land, and 2.02% of households use land owned by another person. The Table 5.65 below details the distribution of land ownership types in the project areas.

Table 5.65: Land Ownership Type

Ownership type	Number	Percentage (%)
Ancestral	432	79.41
Purchased land	63	11.58
Government land/ khas land	6	1.10
Own and Government/Leased	32	5.88
In others person's	11	2.02
Total	544	100

Source: SES survey, June 2024

5.5.16 Government Assistance

342. There are various types of government assistance available in Bangladesh through government initiatives such as VGF, Freedom Fighter allowance, Disability allowance, old age allowance, Widow's allowance, humanitarian relief, and food for work. During the survey, most households (93.5%) reported that they did not receive any government assistance during the last 12 months. On the other hand, 6.5% of households said they received government assistance, including VGF (2.6%), Widow's allowance (0.4%), Old age allowance (1.3%), Freedom Fighter allowance (1.3%), and agriculture subsidies received by only 0.9% of households in the project area.

Table 5.66: Status of Government Assistance

Government Assistance	Valid percentage
VGF	2.6
Widow allowance	0.4
Old age allowance	1.3
Freedom Fighter allowance	1.3
Agriculture subsides	0.9
No Assistance	93.5

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Government Assistance	Valid percentage
Total	100

Source: SES survey, June 2024

5.5.17 Foreign Remittance

343. During field survey it was found that only 2.6% of household's earning from Foreign Remittance in the project areas. Below table presents the distribution of overseas migrants who sent remittances during the last 12 months. At the national level, the average amount of remittances received per household was Tk. 257.5 thousand. In project divisions, migrants from the Chattogram Division claim the top position regarding the share of total remittances sent (44.30%) and the average amount of remittances received per household (Tk 303.23 thousand). Dhaka and Chattogram divisions combined hold the majority share (79.36%) of total remittances sent by migrant workers followed by Sylhet division (6.24%), Khulna division (5.26%), Rajshahi division (3.01%) and the Barishal Division holds the lowest position Tk. 162.03 thousand (2.13%) in terms of the average amount of remittance received per household in project divisions.

Table 5.67: Percentage of Migrated Persons Working Abroad who sent Remittance by Division

Remittance (in '000' Tk.)	Total	Division							
		Barishal	Chittagang	Dhaka	Khulna	Mymensingh	Raishahi	Rangpur	Sylhet
National	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
<25	10.1	18.34	9.91	7.6	16.12	11.05	4.24	15.99	**13.76**
25 -49	6.55	11.39	3.43	7.5	4.35	8.96	11.07	4.77	**12.34**
50-99	11.29	15.59	7.65	13.69	12.14	2.63	6.09	6.92	**19.48**
I00-149	15.62	15.37	12.99	17.02	16.93	13.65	21.95	6.94	**19.62**
150-199	14.42	6.46	11.38	19.3	8.38	16.81	17.22	13.84	**13.71**
200 -299	16.25	16.22	22.09	10.25	17.18	17.93	21.66	29.23	**9.95**
300-399	5.4	3.39	7.25	4.45	8.76	2.63	4.24	4.77	**1.92**
1400 -499	8.56	3.71	9.18	10.52	7.18	8.4	8.48	10.62	**2.02**
500 and above	257.5	162.03	303.23	262.66	232.32	229.5	210.7	219.04	**152.36**
Average per household (in'000')	100	3.38	37.62	34.37	5.82	2.77	3.68	1.80	**10.55**
% of Total remittance in (No)	100	2.13	44.30	35.06	5.26	2.47	3.01	1.53	**6.24**
% of Total remittance in amount)	**5.4**	**3.39**	**7.25**	**4.45**	**8.76**	**2.63**	**4.24**	**4.77**	**1.92**

Source: Household Income and Expenditure Survey

5.5.18 Indebtedness

344. In the household survey, only 26.1% of households were reported to have taken loan from different sources like Bank (6.5%), Finance Company (2.6%), NGO (14.3%) and Family member/ Neighbor (2.6%). Majority of households 69.6% reported they paid the loan partially and 21.7% household said they are not able to pay the loan in last 24 months (Table 5.68).

Table 5.68: Source of Loan by Household

Source of Loan	Loan Received by HH (%)
Bank	6.5
Finance company	2.6
NGO	14.3
Family member	2.6
Not borrowed	73.9

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Source of Loan	Loan Received by HH (%)
Total	**100**

Source: Census and survey by Feedback Infra-Techvy Energy JV, April 2024-May 2024

Table 5.69: Status of loan repay by household

Household response	Percentage (%)
Partially	69.6
No	21.7
Total	100.0

Source: Census and survey by Feedback Infra-Techvy Energy JV, April 2024-May 2024

5.5.19 Health and Services

345. People approach multiple institutions for medical care and treatment. Government hospitals, private hospital and community clinic are the medical/health care institutions that are frequently accessed by the households. During the survey it was reported that most of the household get the medical facilities from government hospital (99.1%) followed by only Private Hospital (38.3%) and Community Clinic (7.8%). It was found that about 37.8% of household use both Government Hospital and Private hospital on the other hand 3.5% household used all services i.e. Government Hospital, Private and Community Clinic for medical treatment purposes.

Table 5.70: Medical Service Status (Multiple Response)

Medical Service point	Number of households	Service received by HH (%)
Govt. Hospital	228	99.1
Both Govt. Hospital and Private	87	37.8
Both Govt. Hospital and Private and Community Clinic	8	3.5
Private	88	38.3
Community Clinic	18	7.8

Source: Census and survey by Feedback Infra-Techvy Energy JV, April 2024-May 2024

5.5.20 Energy Use

346. Electricity is the main source of lighting for grid-connected households, used by 96% of surveyed households, while 3.31% of households use solar energy during load shedding. For cooking purposes, the sources of energy used by households include electricity (76.65%), gas (0.74%), firewood (22.61%), and kerosene (0.74%).

Table 5.71: Source of Energy Used by the HH for Lighting Purposes

SL	Source for Lighting	Total	%
1	Only Electricity	524	96.32
2	Only Solar	2	0.37
3	Solar and Electricity	18	3.31
Total		544	100

Source: SES survey, June 2024

Table 5.72: Energy Sources Used by the HH for Other Domestic Purposes

SL	Energy Source	Total	%

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

SL	Energy Source	Total	%
1	Grid Electricity and Gas	188	34.56
2	Grid Electricity and Kerosene	229	42.10
3	Gas and Kerosene	4	0.74
4	Firewood and Cow dung/straw	123	22.61
Total		544	100

Source: SES survey, June 2024

5.5.21 Indigenous Peoples/ Ethnic minorities

347. According to field survey there is no existence of the indigenous people or the ethnic minority people along the route of transmission lines and the substations area. Therefore, no permanent or temporary and direct or indirect impacts on indigenous people's communities are anticipated.

5.6 Sensitive Features Surrounding 10 Substations (5 km Radius)

5.6.1 400/230/132 kV AIS: Pekua/ Chakaria, Cox's Bazar

348. Various features are located near this proposed substation (within 5 km radius) which are ecologically, environmentally, and socially sensitive including Salt Pan, Khals, Mosque, Madrasha, School and so on. Some mentionable socially sensitive features are Elishia Jame Mosque, Elishia Bazar Para Jame Masjid, Dorbesh Kata Madrasha, Dorbesh Kata High School, Kutub Nogor Govt. Primary School, Madhujam Konakhali Jame Mosque, 53 No. Khonakhali Government Primary School, Purbo Pukuria Para Jame Mosque, Bahadder Kata High School, Bahadder Kata Al Iman Mahila Madrasha, Demoshia Gandhi Para Mosque, Pacchim Para Baitul Ijjat Jame Mosque (West). The nearest is mosque at 400m, no residential properties are within 50m of the substation. This substation area is surrounded by Demusia Khal (at 150 m) which has important role as water source for the project site, overflow to fill the salt pan area, and for small-scale local fish and shrimp cultivation, mainly for local consumption, with no large-scale commercial fishing or export activities. In the monsoon period the site will be completely underwater. During the rest of the year only the salt pans are filled. Water is taken from the khal to fill the area for salt pan during dry season. The substation land is about 2-meter depth below the road surface.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.



Figure 5.43: Google Earth Image of Pekua SS

5.6.2 230/132/33 kV AIS: Madhabpur, Habiganj

349. Various features are located near this proposed substation (within 5 km radius) which are ecologically, environmentally, and socially sensitive including Khals, Paddy field, and proximity to river, Mosque, Madrasha, Hotel, School and so on. Hotel Highway Inn is just located near the southern part of the substation, at 50m distant. A renowned factory of Akij Group is under construction process beside the substation. Khasty river flows approximately 2.5 km away from the project area which is the major water source in the project area for agriculture. Some mentionable socially sensitive features are Jamiatu Sunnah Anwara Begum Islamia Madrasha, Baksair Government Primary School, Dr. Mir Mahmud Hossain High School, Anduira Government Primary School, Joal Bhanga Jame Mosque and so on. The nearest is mosque at 300m, nearest residential properties is 110m from the substation. The proposed land is a paddy field and is about 4m meters below the road surface.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

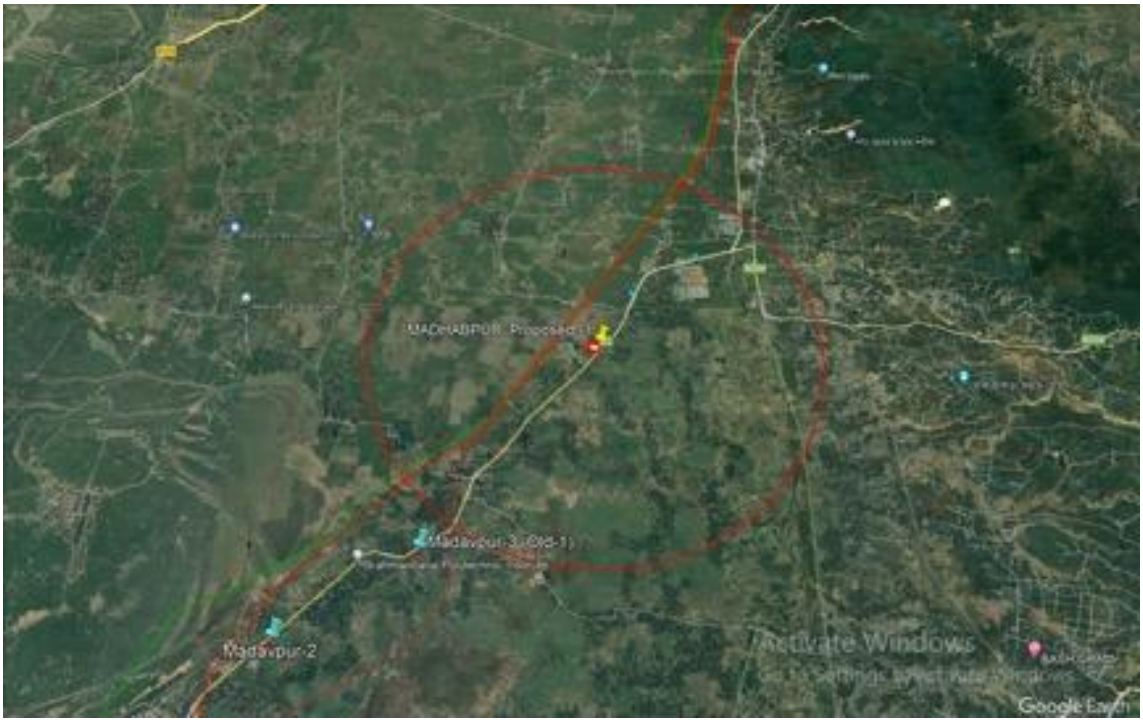


Figure 5.44: Google Earth Image of Madhabpur SS

5.6.3 230/132/33 kV AIS: Monohardi, Narshingdi

350. Various features are located near this proposed substation (within 5 km radius) which are within project impact area. Ghorshab river is the main water sources in the project area. Some significant social features are available along with a memorial academy called Sahabuddin Memorial Academy which is located at the northern part of the substation. Another memorial academy is located called Dairadi Momtaz Uddin Memorial Academy which is situated within 5 km radius of the project area. Some other mentionable socially sensitive features are Monohardi Darul Islam Dakhil Madrasha, MA Majid Science College, Monohardi Pilot High School, Monohardi Upazilla Health Complex, and so on. The nearest is mosque at 300m, no residential properties are within 50m of the substation. The proposed land is a paddy filed and is 3-4 meters below the road surface. This land located in middle of two rainwater culverts, there is a small water channel behind the SS.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.



Figure 5.45: Google Earth Image of Monohardi SS

5.6.4 132/33 kV AIS: Tungipara, Gopalganj

351. There is no waterbody such as ponds, rivers, or lakes in the immediate surroundings of this project impact area. Baghir River is at 380m (west). Shitola Mondir is located at the northern side of the substation boundary. Some others significant features are Senerchar Primary School, 72 No. Gojaliya Government Primary School and Dumuria High School which is situated at the south-western part of the project area. No sensitive or other residential properties are within 50m of the substation. The proposed land is paddy field with one small water body created for water storage. The SS land is located in front of a rainwater culvert and would need proper rainwater drainage. The land is 3-4 meters below the road level. 114 trees are supported on the site: 43 non-fruiting, 59 fruiting and 12 medicinal.



Figure 5.46: Google Earth Image of Tungipara SS

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

5.6.5 132/33 kV AIS: Dupchanchia, Bogura

352. There are numerous features located near this proposed substation (within 5 km radius) which are ecologically, environmentally, and socially sensitive including Khals, Mosque, Mondir, School and so on. Some significant ecologically sensitive features are lake and ponds within the 5 km radius of the substation, some significant socially sensitive features are Coksohaga Jame Masjid located near the northern part of the substation, Dhupchanchia Technical School and College, Gunahar Waktia Masjid, Kali Mondir, and Dorbar sharif. The nearest is a school at 400m, no residential properties are within 50m of the substation. The proposed land is a paddy field that is 2 m below the road level.

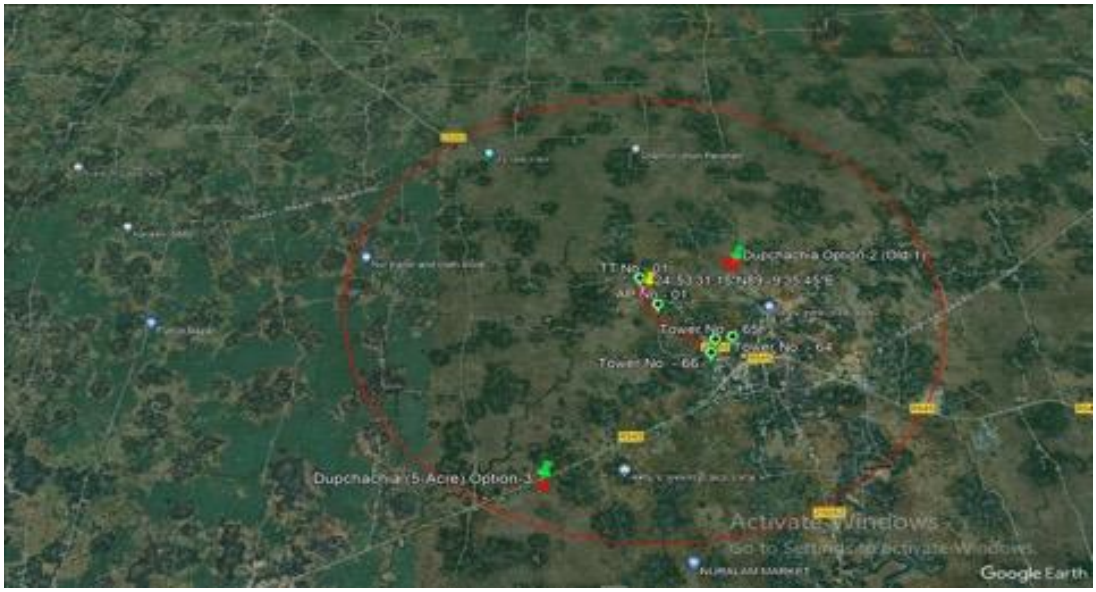


Figure 5.47: Google Earth Image of Dupchanchia SS

5.6.6 132/33 kV AIS: Matlab (N), Chandpur

353. There are numerous features located near this proposed substation (within 5 km radius). Meghna which is one of the main rivers of Bangladesh is located within the 5 km radius of the proposed substation. Apart from that, there are numerous features located near this proposed substation which are ecologically, environmentally, and socially sensitive such as ponds, lakes, Nedamdi Ideal School, Golder Bari Jame Masjid, Ekotai Sokti Cultural Organization, Siddikia Girls High School, and so on. The nearest is mosque at 300m, no residential properties are within 50m of the substation. Water channel in front of proposed land adjoining the road. The proposed land is a low-lying area 2 m below the paddy field, used for paddy and for fishing in monsoon period. There are some migratory birds reported using habitat a few kilometers away from the substation but they do not come to this location.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.



Figure 5.48: Google Earth Image of Matlab Uttar SS

5.6.7 132/33 kV AIS: Kumarkhali, Kushtia

354. Two significant water bodies pass beside this substation called Gorai and Madhumati River (within 5 km radius). An ecologically sensitive area is located just beside the project site called Gorai Eco Park. Apart from this, there are numerous features located near this proposed substation which are socially and culturally sensitive such as Kumarkhali MN Pilot High School and Aladdin Ahmed Shikkhapalli Park respectively. There are no sensitive or residential properties within 50m of the substation. The proposed land is a paddy field that is about 4 m below the road level.

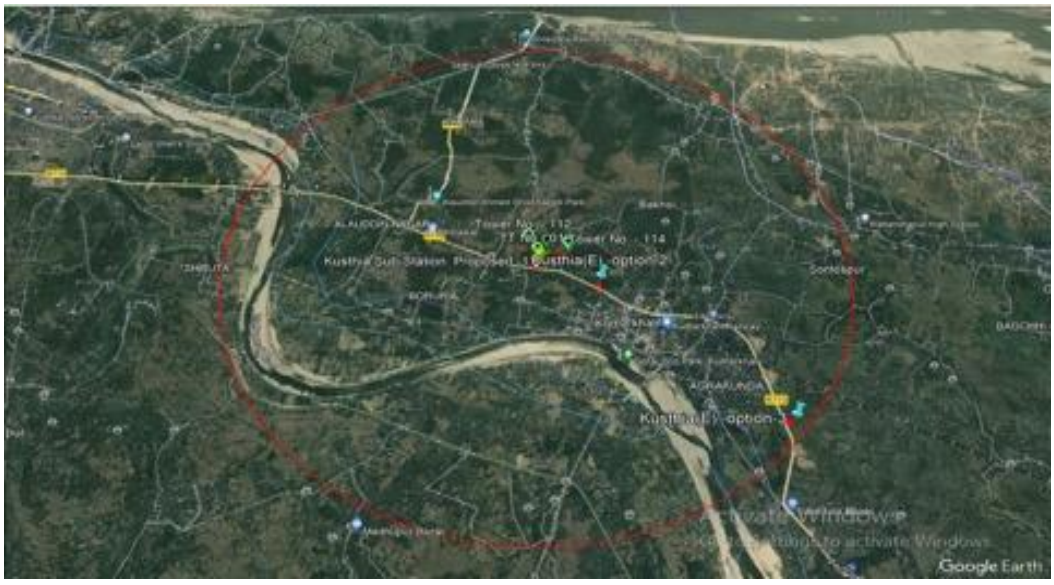


Figure 5.49: Google Earth Image of Kumarkhali SS

5.6.8 132/33 kV AIS: Chatkhil, Noakhali

355. Numerous features are located near this proposed substation which are ecologically, environmentally, and socially sensitive Rice field, Dighi, Khals, Mosque, Academy, School and so on. Some mentionable socially sensitive features are Chatkhil PG Government High School, Chatkhil Upazilla Model

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Masjid, Shingbahura Girl's Academy etc. Halima Dighi and numerous khals are the major environmentally sensitive areas in the project site. These features are all located within 5 km radius. The nearest is a mosque at 400m, no residential properties are within 50m of the substation. The proposed land is a paddy field about 3-4 m below the road level and used for rice paddy.

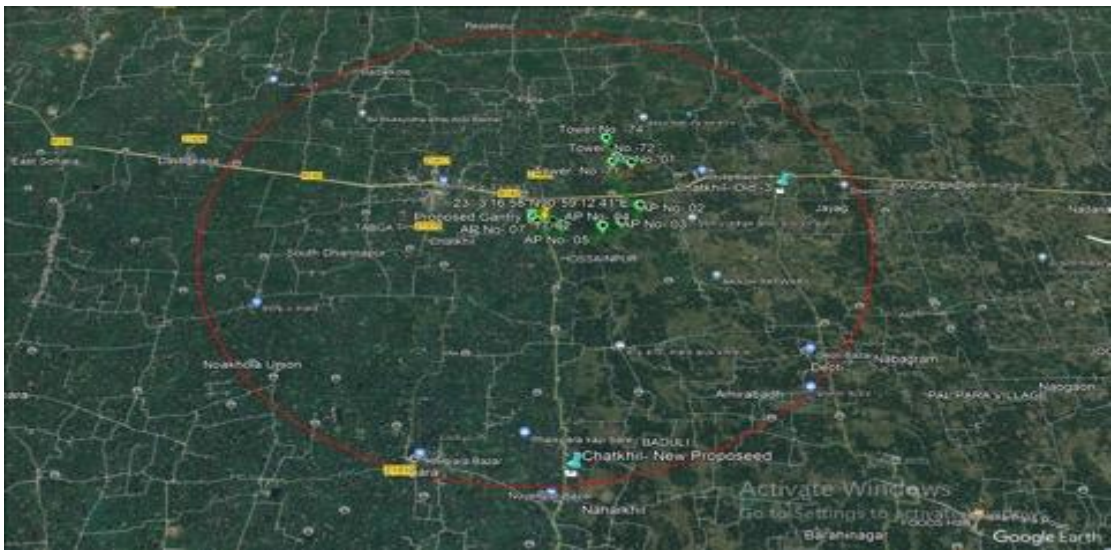


Figure 5.50: Google Earth Image of Chatkhil SS

5.6.9 132/33 kV AIS: Paikgacha, Khulna

356. A school called 111 No. Shoronkhali Government School is just situated adjacent to the substation, at only 20m distance. This school is thus highly vulnerable and sensitive. Apart from this, Kobadak river passes from west to north (380 m) and a baor is located at the eastern side of the substation within 5 km of radius. There are lots of social features including mosque, school and colleges in which Alomtola Char Jame Mosjid is a remarkable religious institution located near the site. The PGCB owned land is filled with water at about 3-meter depth from the main road. School and houses are facing the area which is deemed sensitive, attention will need to be paid to avoid noise disturbance and air pollution during substation construction e.g. through noise attenuation wall. Water channels from the river flow on the other side of road and the area is reported to support a few migratory birds in the winter season. Seven trees are supported on the site: 3 non-fruiting and 4 fruiting.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

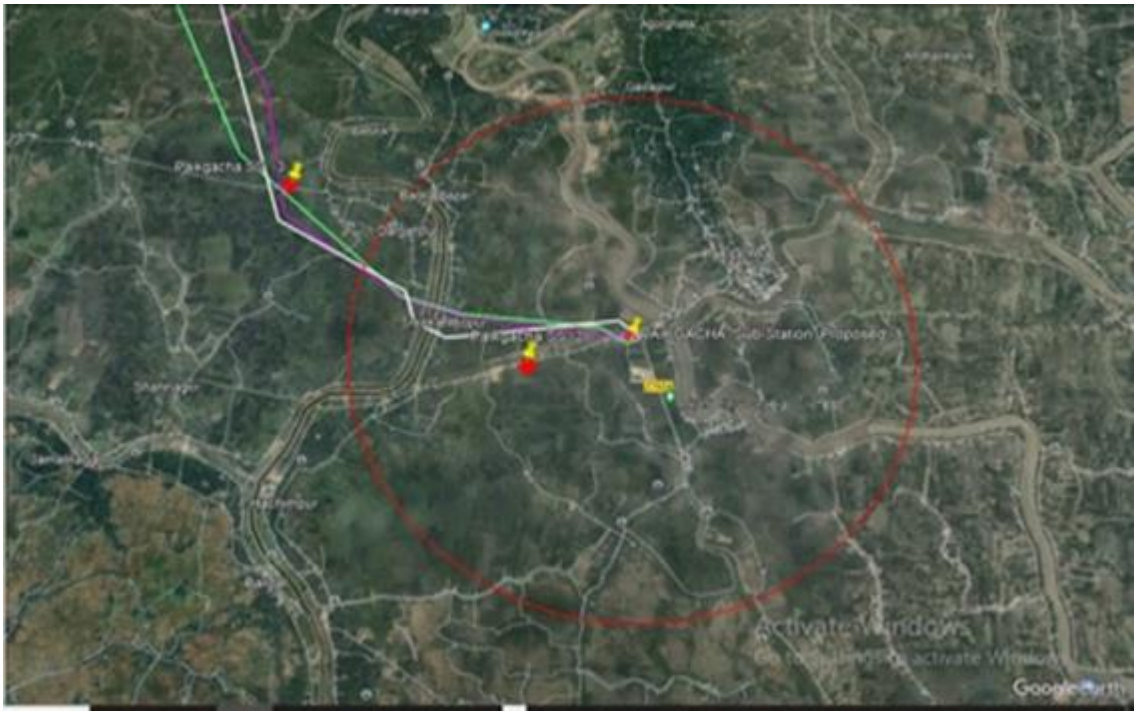


Figure 5.51: Google Earth Image of Paikgacha SS

5.6.10 132/33 kV AIS: Mathbaria, Pirojpur

357. Balaswar river is the most significant waterbody passing near this substation. Apart from that, various khals, ponds are also located here. Overall, there are lots of social features including mosque, school and colleges in which Moksed Ali Master Bari Masjid, and Jati Buniya Dakhil Madrasha are one of the remarkable religious institutions located near the substation. There are no sensitive or residential properties within 50m of the substation. The proposed substation is a paddy field that is 2 meter below road level with houses nearby. This is a dead-end station with domestic load.

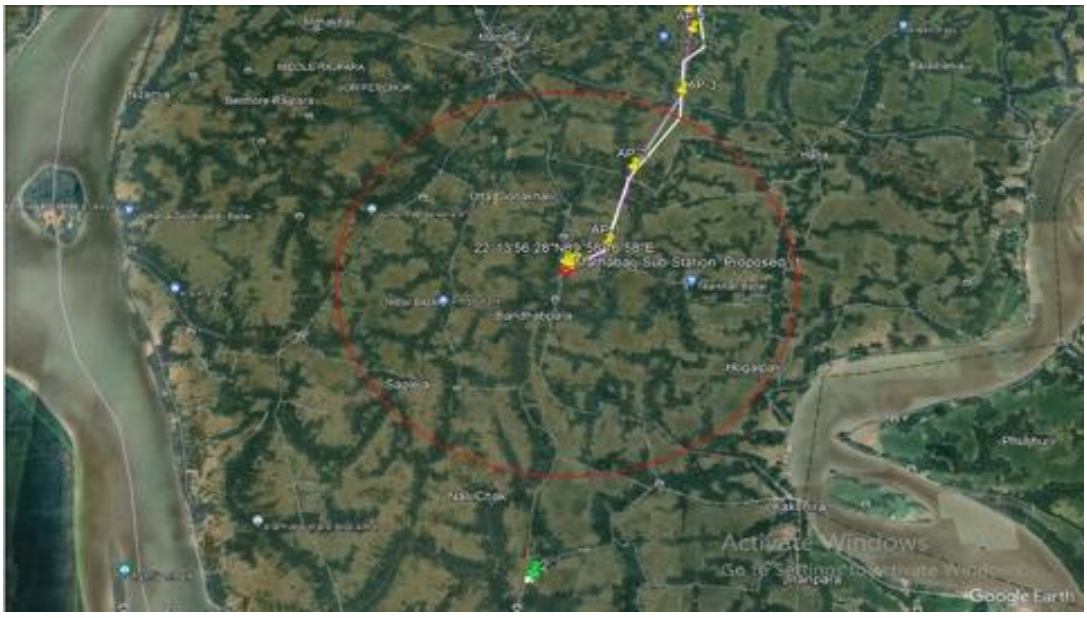


Figure 5.52: Google Earth Image of Mathbaria SS

5.6.11 Proximity of Project to Sensitive Receptors

358. **Substations**. Identified land for new substations is paddy/saltpan/low lying year round waterlogged

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

land mostly located away from major habitations. There are residential properties or other receptors within 100m of some substations. Some substations are silient zones, such as a school at 20 m from Paikgacha SS from the substation land.

359. Pertinent receptors for 5 existing substations to be upgraded are detailed in the Environment Audit (Appendix XII).

360. **Transmission Lines**. Indicative new LILO transmission line alignments and existing transmission lines pass through cultivated paddy, bamboo plantations, and cross strip plantation and waterlogged areas.

361. Details of villages (receptors) nearest to the tentative transmission line alignment are given in Table 5.73 with those within the zone of influence (500m or 50m) highlighted. Since the new route alignments are only tentative, the population data is provided for the villages of which GPS is noted. However, it should not be assumed that the transmission line will pass through the village itself but rather at a distance away based on detailed design by the EPC contractor.

362. During detailed route survey, the EPC contractor shall ensure the Right of Way of new transmission lines will be routed away from villages to minimize the impact on population and land/property assets in the vicinity. The EPC contractor must ensure that any structures are outside the safety clearances as per Bangladesh Electricity Rules or relocated in accordance with the Resettlement Plan.

363. Inventorisation of receptors for substations and transmission lines conducted by ADB TA consultants is attached in Appendix XV and Appendix XVI respectively. The sample inventorisation data sheets are attached in Appendix XI.

364. Detailed Substation inventorisation surveys and transmission line route surveys will only be undertaken during the detailed design phase by the Engineering Procurement Construction (EPC) Contractors so the substation boundaries and transmission line route alignments presented in this EIA/IEE are only indicative having been developed by PGCB specifically for the purpose of undertaking the assessment. The EIA/IEE will be updated or an addendum produced, as per SPS 2009 para 23 of Appendix 1 to reflect unanticipated environmental impacts which become apparent during project implementation, the final EIA/IEE will be available before works start.

Table 5.73: Distance to Sub-project boundary/tentative alignment

#		Distance From SS to village (km)	Name of Closest village	Primary School in km	Secondary School in km	Mosque/ Temple in km	Primary Clinic (PHC) in km	Main Hospital in km	College or any other place of religious or cultural significance in km	Population/ Inhabitants (in pockets) near sub-project components
A	**Substation**									
1	Madhabpur Substation -	0.11 km – 4km	Itakhola Haria Mir Nagar Baghsair Andiura Madhabpur Bazar Baneshwar	710m	1.13 km	300m 2.8 km	-	2 km	1.28 km	Total 319016; Male 155882, Female 163134
2	Pekua S Substation	6.58 km	Poschim Boro Bheoula	700m 5km	4.5km	400m	-	-	4.43km	Total 171538; Male 86310; Female 85228
3	Matlab (N) Substation	3.26 km	Chor Palalokodi	800m	3.89km I km college	300m 4.43km	-	-	3.16km	Total 292057; Male 140753, Female 151304
4	Dupchanchia Substation	0.54 km	Bhatahar, Islampur	400m	2.36km 2 km college	<5km	-	3 km		Total 176678; Male 87073, Female 89605
5	Kusthia (Kumarkhali) Substation	38.53km	Choraikol Durgapur	2.4 km	1.43km 3 km	-	-	2.5 km	2.18km	Total 328457; Male 163461,

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

#		Distance From SS to village (km)	Name of Closest village	Primary School in km	Secondary School in km	Mosque/ Temple in km	Primary Clinic (PHC) in km	Main Hospital in km	College or any other place of religious or cultural significance in km	Population/ Inhabitants (in pockets) near sub-project components
					college					Female 164996
6	Tungipara Substation	0.74 km	Baladanga	2.90km	>5km	2 km	-	-	-3 km - 2km	Total 100893; Male 50517, Female 50376
7	Mathbaria Sub-Station	28.87 km	Gulisakhali	600m	900 m	400m 3.62km	-	3 km	<5km	Total 262841; Male 128845, Female 133996
8	Chatkhil (Chatkhil) Substation	8.61 km	Kaluyai	-	0.65km	1.99km	-	-	2.73km	Total 327194; Male 149751, Female 177443
9	Monohardi Substation	-	Kismot Soraikandi	1.84 km	0.52 km	300m	1 km	2.14 km	4.93km 1.28km	Total 275112; Male 131316, Female 143796
10	Paikgacha Substation	-	Soronkhali, Chakbogure, Loksar	20 m	1 km college	2.5 km	-	2.5 km	-	
B	**Transmission Line**									
1	Bhandaria-Mathbaria132kV Line 32.00 km	2.54 km	Bhandaria AP1-AP24	-	1 km	4.65 km 1.8-7km	-	1-6 km	-	Total 262841; Male 128845, Female 133996
2	Gopalganj -Tungipara 132kV Line 19.00 km	0.89 km	Golabaria AP1-AP8	-	1 km	4-6 km	-	2-6 km	-500m	Total 100893; Male 50517, Female 50376
3	Kachua-Matlab (Uttor) 132kV line 33.00 km	1.7 km	Palalokdi Pouro AP-AP41	-2 km	-1 km	- 3-7 km	-	2-6 km	-2 km	Total 292057; Male 140753, Female 151304
4	Monohardi-Bajitpur 132kV Line 21.00 km	1 km	Madhabdi Chak AP1-AP29	1 km	-1 km	-1 km -4-7 km	-	-1km -2-6 km	-	Total 275112; Male 131316, Female 143796
5	Satkhira-Paikgacha 132kV Line 30.00 km	0.43 km	Dohakula AP 1 – AP 10	-1.5 km -2km -	-500m	4-7 km	-	2-6 km	-4km -2km	Total 247983; Male 123900, Female 124083
6	LILO of Anwara Coxs Bazar 230kV line at Pekua	0.86 km	Paschim Bara Bheola	None	-		-	-	-	Total 171538; Male 86310; Female 85228
7	LILO of Cumilla (N) - Shahjibazar PP 230kVline at Madhabpur	2.54 km	Bakshair (JL 69)	None	--	-	-	-	-	Total 319016; Male 155882, Female 163134
8	LILO of Existing Matarbari PP – Banskhali PP 400kV line at Pekua 6.75 km	0.82 km	Paschim Bara Bheola AP1-AP8	-1.5km -1km	-	-2km -4-7 km	-	3-6 km	-	262841; Male 128845, Female 133996
9	LILO of Existing Matarbari 132-33 Chakaria132kVline At Pekua	1.07 km	Paschim Bara Bheola	None	-	-	-	-	-	262841; Male 128845, Female 133996
10	LILO of Shahjibazar - Brahmanbaria132kVline at Madhabpur	0.94 km	Monohardi	None	-	-2 km -1km	-	-	-	Total 319016; Male 155882, Female 163134
11	LILO of Bheramara-Rajbari 132kV line at Kumarkhali 600m	4.8km	Choraikol AP 1	-	-	3-5 km	-	5-6 km	-	Total 328457; Male 163461, Female 164996
12	LILO of Bogura(S) - Naogaon 132kV line at Dupchanchia 2.5 km	-4.8km	Matihas AP1	-1km	-	5-6 km	-	4-6 km	-1km -2km	Total 176678; Male 87073, Female 89605
13	LILO of Chowmuhani – Ramganj 132kV double	-	AP1-3	-	-	4-6 km	-	2-6 km	-	-

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

#		Distance From SS to village (km)	Name of Closest village	Primary School in km	Secondary School in km	Mosque/ Temple in km	Primary Clinic (PHC) in km	Main Hospital in km	College or any other place of religious or cultural significance in km	Population/ Inhabitants (in pockets) near sub-project components
	circuit line at Chatkhil/ Chatkhil: 3.5 km									
14	Reconductoring of Shahjibazar-Brahmanbaria-Ashuganj 132kV line: (58+17) = 75 km)	-	AP 1-AP75	-	-	4-7 km	-	2-6 km	-	-

Details from Tables for Substations in Appendix XV and Table 1 of Appendix XVI for transmission lines
Source: SES survey, June 2024

Table 5.74: Details about lands for transmission lines

Si	Details about lands for transmission lines	Length in meters	Percentage	Cumulative
1	**Total length (m)**	246212		
a	Private Land	240664	97.7	100 %
b	Government Land	5548	2.3%	
	Details of land in 1 above (m)			
2	Forest area	0	0%	100 %
3	Waterlogged	19709	8%	
4	Cultivated/ Irrigated	161232	65.5%	
5	Cultivated/Non-Irrigated	35747	14.5%	
6	Residential	9937	4%	
7	Vita/High Land (land for development, raised above the flood level but not yet developed)	6312	2.5%	
8	Orchard	2321	1%	
9	Bamboo	131	0%	
10	Uncultivated/Fallow	10623	4.3%	

Source: SES survey and Tree Inventory Survey, June 2024
Derived from Table 2 in Appendix XVI.

Table 5.75: Distances of Project Components from Biodiversity/Ecologically Sensitive Areas

No	Name of Project Component	Distance	WLS/Reserve Forest Area/Protected Area/River system
A	**Mathbaria 132/33kV AIS Substation and Associated Lines** Bhandaria-Mathbaria132kV double circuit transmission Line	75 km 15 km	Char Kukri Mukri WLS Sunderbans Forest
B	**Tungipara 132/33kV AIS Substation and Associated Lines** Gopalganj -Tungipara 132kV Double Circuit Line	50 km	Ata Danga Baor Wildlife Sanctuary
C	**Monohardi 230/132/33kV AIS Substation and Associated Lines** Monohardi-Bajitpur 132kV Double Circuit Line LILO of Sripur - Ashuganj 230kV double circuit line at Monohardi	33 km	Bhawal National Park
D	**Paikgacha 132/33kV AIS Substation and Associated Lines** Satkhira-Paikgacha 132kV Double Ctrcuit Line	60 km 30 km	Khajura Boar Sunderbans Forest
E	**Chatkhil 132/33kV AIS Substation and Associated Lines** LILO of Chowmuhani- Ramganj 132kV double circuit line at Chatkhil	60 km	Hazarkhil WLS
F	**Dupchanchia 132/33kV AIS Substation and Associated Lines** LILO of Bogura(S) - Naogaon 132kV line at Dupchanchia	45 km	Padma River
G	**Madhabpur 230/132/33kV AIS Substation and Associated**	11 km	Shatchari Reserved Forest

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

No	Name of Project Component	Distance	WLS/Reserve Forest Area/Protected Area/River system
	Lines LILO of Shahjibazar - Brahmanbaria132kVdouble circuit line atMadhabpur LILO of Cumilla (N) - Shahjibazar PP 230kVdouble circuit lineat Madhabpur		
H .	**Pekua 400/230/132kV AIS Substation and Associated Lines** LILO of Anwara Coxs Bazar 230kV line at Pekua LILO of Existing Matarbari PP – Banskhali PP 400kV line at Pekua LILO of Existing Matarbari PP – Banskhali PP 400kV line at Pekua LILO of Existing Matarbari 132-33 Chakaria132kVline at Pekua	11.35 km 17 km 10 km 13 km 13 km 17.31 km	Fasiakhli WLS Chunati Wildlife Sanctuary Chakaria Sundarbans Reserved Forest Ringbhang Reserved Forest, Dulahazara Safari Park Haser Char Sea Turtle Nesting Reserve
I	**Kumarkhali 132/33kV AIS Substation and Associated Lines** LILO of Bheramara-Rajbari 132kV line at Kumarkhali	6 km	Padma River
J	**Matlab Uttar 132/33kV AIS Substation and Associated Lines** Kachua-Matlab (Uttor)132kV double circuit line	5 km	Padma River
K	**Reconductoring of Shahjibazar-Brahmanbaria-Ashuganj** 132kV line	35 km	Shatchari Reserved Forest

365. Waterlogged areas constitute only 8% of transmission line construction, whereas the cultivated/irrigated land is about 65.5% of the total length. Notably there are no forest lands in the ROW of the transmission lines (Table 5.75: Distances of Project Components from) as well as residential structures are only in 4% of the line alignment.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

6 Substation Environmental Audits

6.1 Introduction

366. This section of the report summarizes the findings of the environmental audit of 5 substations to be extended under the Project along with a summary of the audit of the substations. The full audit of the 5 substations is included in the IEE Appendix XII.

6.2 Environmental Audit Requirements

367. Under ADB's Safeguard Policy Statement (2009) for projects involving facilities that already exist or are under construction before ADB's involvement, ADB requires relevant external experts to conduct an environment audit, including on site assessment. For a project involving an upgrade or expansion of existing facilities, as is the case for 5 existing substations (SS) the requirements for environmental assessment (this EIA/IEE) and EMP apply in addition to the environmental audit.

368. The environmental audit will determine the existence of any areas where the existing substations of PGCB may cause or are causing environmental impacts and risks. The existing facilities must comply with ADB's Safeguard Policy Statement (2009) and applicable national laws and regulations on environment, health, and safety. Where existing facilities are found not to be in accordance with the environment safeguard principles and requirements that are applicable to the project, a Corrective Action Plan (CAP) is to be prepared, including implementation schedule and sufficient budget, to bring the existing facilities into compliance.

6.3 Audit Methodology for Existing Substations

369. Desktop review (available information from PGCB, team discussions, Google Earth search of study area, etc.) of the substations were conducted to identify the environmental setting before undertaking site visits and audits. The environmental audit by the environmental experts at the five existing substations took place from April to May 2024. A work plan containing the auditing details and output as well as detailed schedules and plans were communicated to/approved with regular communication to PGCB officials before the visits.

370. Methodology used for the environmental audit was as follows:

- Interviewing staff and any workers engaged at these substations.
- Reviewing all health and safety aspects, tools and plant, cleanliness, proper equipment usage and maintenance procedures followed.
- Reviewing all storage facilities for transformer oil, batteries, SF6 cylinders, trash and empty oil drums etc.
- Discussions with staff to record if any Polychlorinated Biphenyl (PCB) filled transformer and asbestos material exists in the substations.
- Comparing work procedure at these substations with the EMP to be applied for the project; review work place practices at the substation.
- Reviewing any complaints received by PGCB staff in the area at these substations and check complaint redress process and the situation of current complaints.

371. As noted above, during the site visits to these substations, a visual inspection of the surroundings, compound including switch yard and control rooms/buildings, road access condition was conducted. Photos, measuring of GPS coordinates, air temperature, noise and EMF using smartphone-based applications were taken and the critical environment, health and safety issues cross checked using an audit checklist to identify areas of strength in each substation, and areas that need corrective actions to meet the required standard. Interviews were also held with PGCB substation engineers and staff and at most locations with local

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

communities in the vicinity of the substations.

372. The attached Environment Audit Checklist in Appendix XII identifies issues as per the following criteria according to Government of Bangladesh (GOB's) environment, health and safety policies, acts, rules, notifications, and standards, and ADB's Safeguard Policy 2009:

- General environmental management
- Waste management practices
- Hazardous material management
- Ground water and soil contamination control
- Occupational and community[34] health and safety management, and
- Noise[35] and EMF[36] management
- Presence of PCB and asbestos.
- Biodiversity issues

6.4 PGCB Substation Setting

373. The five existing substations are spread all across the Bangladesh and within five districts – Kishoreganj, Gopalganj, Pirojpur, Satkhira, and Chandpur and all support modified habitat. The typical land use within the substations comprises control buildings, switch yards with electrical equipment, and open areas with exposed soil, grass, shrubs, and internal roads; the available open space within the substations varies from 5% (Bhandaria, Satkhira, and Kachua) to 30% (Baljitpur and Gopalganj). The table provides detailed description of each of the existing substations where additional bays will be constructed or accessories at uprating bays and suitable equipment will be changed due to match conductor ratings.

Table 6.1: Proposed Substations Name with Bay Extension Works

SN	Name of the Proposed Substation	Bay Extension Work		
		Bay Extension at other end SS	**Future Required Bay**	**Required Bays**
1	230/132/33kV AIS: Monohardi, Narshingdi	Bay Extension: 2× 132 kV AIS bay extension at Bajitpur Substation	230kV: 4 132kV: 4	Required Bays: 230 kV: LB=4 (Sripur:2, Ashuganj PP: 2) TB=2, BCB=1 Required Bays: 132kV: LB=2 TB=4 BCB=1 Required Bays: 22kV: TB=2
2	132/33kV AIS: Tungipara, Gopalganj	Bay Extension: 2× 132kV AIS bay extension at Gopalganj (Old) Substation	132kV: 3	Required Bays: 132kV: LB=2 (Gopalganj: 2) TB=2 BCB=1 33kV: TB=2
3	132/33kV AIS: Matlab (N), Chandpur	Bay Extension: 2× 132kV AIS bay extension at Kachua 230/132kV Substation	132kV: 3	Required Bays: 132kV: LB=2 (Kachua: 2) TB=2 BCB=1 33kV: TB=2
4	132/33kV AIS: Paikgacha, Khulna	Bay Extension: 2×132kV AIS bay extension at Satkhira Substation	132kV: 3	Required Bays: 132kV: LB=2 (Satkhira: 2) TB=2 BCB=1 33kV: TB=2

[34] Security related issues
[35] Ambient sound levels (in dB) taken from cellphone application; no scientific instrument was used therefore reading cannot be used as baseline data.
[36] EMF in uT measured from held cellphone application, no scientific instrument was used therefore reading cannot be used as baseline data.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

SN	Name of the Proposed Substation	Bay Extension Work		
		Bay Extension at other end SS	**Future Required Bay**	**Required Bays**
5	132/33kV AIS: Mathbaria, Pirojpur	Bay Extension: 2x132kV AIS bay extension at Bhandaria Substation	132kV: 3	Required Bays: 132kV: LB=2 (Bhandaria: 2) TB=2 BCB=1 33kV: TB=2

374. Two of the substations are within or just on the outskirts of urban areas (Bhandaria, and Satkhira). Another three substations are within rural and semi built-up areas. All the substations in rural areas are set in village areas where the surrounding habitats have been modified.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.



Figure 6.1: Location of Existing SS in the Bangladesh

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

6.5 Audit Report

375. The Government of Bangladesh (GOB's) environment, health and safety policies, acts, rules, notifications, and standards, and ADB's Safeguard Policy 2009 including WBG/IFC guidelines apply to all components/subprojects funded by ADB as discussed in Chapter 4 of the IEE.

376. Several environmental and social issues have been identified at the sites. The generic (common to all substations) and specific issues (applicable to individual substations) are outlined in Table 6.2.

Table 6.2: Audit Observations

Audit Item	**Audit Observations**	
	Generic	**Specific**
General	• PGCB has developed EHS policy or manuals/procedures for substation operation • SS staff are aware of EHS management systems and procedures	Applicable to all SSs
Housekeeping/Waste Management	• Staff was aware of guidelines for pollution prevention or waste management, including hazardous wastes management, but no manuals were available at site • Guidelines were available at the substations • SSs in need of housekeeping measures - Storage was mostly in the open due to lack of dedicated storage area. No designated waste storage areas were observed in any of the SS. - Empty drums are stored in the yards having no impermeable floor or bunded facility. - End of life batteries are stored at site and then replaced by the vendors. - Trash (municipal waste) stored / dumped inside some SS yards.	• Open drum storage in yard/SS compound were observed in – Baljitpur SS, Satkhira SS, and Bhandaria SS. • Large scale material, cable and transformers/equipment and municipal waste debris storage was observed all over the SS compounds including yards in all the SSs. • In Bhandaria SS, end of life equipment including redundant transformers are kept at site and in the open for long term.
Transformers and Oil Leakage	• Transformer test report available at the SS • No specific management or handling procedures were observed for hazardous wastes, oil spills, spillage, runoff from leaks of equipment in any of the SS. • Most substations have transformers and several SF6 circuit breakers that are mixed in age i.e. ranging between 1984-2020. According to the site visits, substation staff informed the team that the substation transformers were PCB free (it can be confirmed by PGCB for all transformers manufactured before 2016 as they are being tested under a DOE initiative for PCBs with other transformers screened against DOE/UNIDO guidelines and tested if they are at risk).[37]	• Applicable to all SS

[37] The Department of Environment, which operates under the Ministry of Environment, Forest and Climate Change, has initiated a project called "Environmentally Sound Development of the Power Sector with Final Disposal of Poly Chlorinated Bi-phenyls (PCB)". The aim of the project is to identify transformers of Power Division's Companies (BPDB, DESCO, DPDC, NESCO, BREB, PGCB & WZPDCL) in Bangladesh that have been contaminated by PCBs and dispose of them in safe locations. The United Nations Industrial Development Organization (UNIDO) is providing technical assistance for the

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Audit Item	Audit Observations	
	Generic	**Specific**
	• All transformers were oil insulated • There are no dedicated, labelled storage areas for drums, oil storage. Drums are kept in an unorganized manner all over the SS and are a significant health and safety risk. These drums are not labelled, and content is not provided/disclosed. • Material Safety Data Sheets were not available at any of the SS • Transformer foundations have containment bund / tanks for oil spillage management of 110% capacity for oil spillage during operations. However, some additional transformers are installed on concrete pathways without any capacity to contain any spillage into the soils. • Spill management materials like sand, cloth was not available or mostly inadequate. Spills were left as it is to be soaked in ground resulting in soil contamination. • Records of transformer oil change dates were available at SS • Maintenance records are available for most of the SS	
Escape of SF6 (sulfur hexafluoride) and other greenhouse/ hazardous gases	• SF6 gas cylinders are stored in the store but not checked for leakages. • All those visited SS had a Gas Circuit Breaker that are operational and housed in the switch yard. The SF6 labels are visible. • No leakage / breakdown was reported, although no SF6 leakage detectors are available to check the leakage. • No SF6 leakage detectors are installed in any of the SSs. Handheld SF6 leakage detection instrument must be made available at site. • Record of SF6 leakage and other information not kept/available at any of the SS	• Applicable to all SS
Earthing	• Substations have proper earthing and have protective shields to minimize radiation and magnetic field effects. • The insulation is tested regularly at each instrument and found adequate by PGCB engineers during periodic maintenance checks. • Substation have proper lightning arrestors on equipment and the station • Reports on number of lightning strikes is not available at the substation	• Applicable to all SS
Noise, EMF, Lighting and Ventilation	• Air and noise monitoring was not conducted by SS	• Applicable to all SS

project, which is being funded by the Global Environment Facilities (GEF). In summary, the project is focused on identifying and safely disposing of PCB-contaminated transformers in PGCB.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Audit Item	Audit Observations	
	Generic	**Specific**
	• Ambient noise levels were observed to be low with most SS not exposed to traffic or other noise sources. • Spot noise levels near gates, yards, transformer area and inside office using smartphone-based app were mostly in the 54 dB(A) to 64 dB (A) range and within safe limits for OHS • Transformer hum was audible in some cases from nearly 3 meters and spot levels ranged between 60 dB(A) to 67 dB(A) using a smartphone- based app • No high level of air pollution was observed in any of the SS. • There were no sources of vibrations observed • No EMF warnings were present in any SS • No EMF shields were installed in the SS. • No EMF monitoring is conducted by SS. • Spot EMF reading using smartphone-based app were mostly low at all locations, inside office and near gates, varying between 40 uT – 80 uT. • Ventilation was mostly adequate, and vents were not blocked as they are located high up near the ceiling. • Natural light was mostly adequate across all SS. However, lux requirements at sites will be assessed if any additional lighting is required.	
First Aid Equipment	• First aid kits supplied by previous EPC contractors is small plastic box which is not a standard off the shelf medical supply item for industrial use. Eye wash and shower not available. • Complete first kits should be supplied.	• Applicable to all SS
Fire Protection systems and Fire Safety Equipment	• Number of foam extinguishers/water for transformers in the yards, fire extinguishers in control rooms, and for administration blocks are available but may not be sufficient for transformer fire. • Fire safety equipment was adequate in all the SSs • Sand buckets available having adequate sand content. • All SS have CO_2 based fire extinguisher and were well within expiry date. • No automatic alarm and fire suppressions system was found in any of the SS. • Fire safety training by local fire stations is provided to PGCB stations as well.	• One case, at Brahmanbaria 132/33 kV substation the water spray system for transformer was not operational. • At other substations, there was no provision for the water spray facility or water storage facility. • No firewalls in any of the SS except the Baljitpur SS.
Community Health and Safety	• Overall, the security of the SS areas is adequate, and locals do not have access the SS area. • Most SS have adequate fencing with concrete	• Applicable to all SS

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Audit Item	Audit Observations	
	Generic	**Specific**
	boundary wall. • SS gates remain close 24 hours and the security guards always present there. • Caution / danger signage was observed at the SSs entry points or on the boundary / fence and on the electrical equipment etc. • The substations are properly fenced, whereas the signage for the general public regarding electrocution risk was not installed at all substations	
Handling Emergencies	• Emergency preparedness plan available in the SS • Emergency exit signage was not observed in any of the SSs. • Emergency response training provided to staff by external authority. • Fire drills and alarm tests need to be regularly conducted • Posters on medical revival, prevention / fire safety was observed. • Doctors/emergency health contacts list in case of emergency was observed in the SS • Trainings / workshops on fire safety, first aid or other emergency situations are conducted	• Applicable to all SS
Health and Safety of Staff	• No workplace related air, water, noise measurements are made during operations • Incomplete first aid kit boxes; need proper PPE for supervisors and workers at operational sites. First aid kits supplied by previous EPC contractors is small plastic box which is not a standard off the shelf medical supply item for industrial use • Safety and danger signages at sites were very limited at all SS. • OHS training for staffs were provided once in 2-4 years. • Staff are aware of PPE although vests and helmets were only supplied to them. • Trip hazards, cracks, holes, cracked tiles were sparingly observed across all SS; whereas they were found to be not observed inside the control room. • Air conditioning systems have been installed in the SS • No ACM survey done but asbestos containing materials not observed • Most maintenance works and civil works/maintenance are done by hired labors/contractors • No pest problems were reported in any of the SS. Pest control measures are not conducted.	• In Gopalganj SS, contract workers were observed working on top of bus bars and handling cables connections without any PPE, boots, etc. • Building structural status – most of the SS are adequately managed, and some repair work is required although they were structurally sound except Bhandaria SS which is very old and need repair.
Drainage	• Drainage and wastewater – in all the cases storm drains were present in the SS area.	• Flooding due to bad drainage in the surroundings after heavy rainfall was

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Audit Item	Audit Observations	
	Generic	**Specific**
	• The wastewater from toilets (bathing, basin, urinals) other than WC is moved through internal drains and directed into open main drains outside the compound. • Standing water was not observed in any SS.	reported at Satkhira SS. with a requirement for storm drainage observed.
Sanitation and Welfare Facilities	• Toilets are available inside the buildings of all SS • Separate toilets for women are not available in any of the SS. No women staff were recorded in any of the SSs. • Overall, the toilets were observed to be clean and hygienic. • Lights were working and doors were adequate with locks working. • Septic tanks are available for all the SS. Septic tanks are mostly below ground and were observed to be adequately maintained. • Potable water is available on site. Quality of drinking water, as reported by staff was mostly potable and agreeable. The source of water is mostly bore well water. However, filtered and/or RO water are not installed. • Testing reports are not available and no periodic potability testing was reported. • Drinking water and toilet facilities with soakpits available at the sites. However, drinking water facilities/coolers are not available at the sites, but rather water facility is supplemented by purchase of refilled water bottles. Staff need to use personal protective equipment (PPE) at all times • Water is sourced from submersible pumps at all substations and there is no alternate water supply available. • No dedicated accommodation / rest rooms are available in any of the SS. The staff, including night shift staff stay within the control rooms and have temporary mats/beds within the control room area. • Dedicated accommodations, TV/Internet connection/heating are not available. • Cooking is mostly not practiced, but in some SS a temporary cooking set up, using electric heaters was observed inside the control/office rooms, which may pose a fire hazard.	• Applicable to all SS

377. **Public Concern.** There are no public concerns regarding the substations as the substations are located a safe distance away (>50 m) from settlements. In fact, during consultations by the survey teams near the substation area, the local people said that though they are not aware of the proposed project connecting the substations, they want work/job opportunity in the project and they were ready to support the project without any objection.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

6.6 Key Findings of Audit

378. Positives identified based on the environmental audit include:

- All substations are located on PGCB land
- All the substations are adequately fenced and gated
- No asbestos containing materials (ACMs) were recorded in the audited substations based on visual inspection. PGCB officials informed that they were not aware of ACMs being used either as insulating material or in other equipment in the SS. However, there is no documentary evidence to confirm if asbestos is present or not.
- Majority of the substations have available area within the existing compound for renovation/upgradation works.
- None of the substations were affected by significant noise or air pollution.
- Records of breakdown and maintenance, transformer oil changes are available in the substations.
- Well maintained garden and green belt is present in all SS
- There are written hazardous materials or solid and hazardous waste management systems and guidelines for substation personnel along with the corporate safety manual of Environment, Health and Safety procedures or trainings to prepare staff for emergencies.

379. Areas for strengthening required

- Major oil leaks/contaminations were observed in substations from the drums; those are kept in open area.
- Most of transformers were placed on foundations with 110% designed spill bund but some were also kept on unbunded concrete surface.
- Safety requirements and training and awareness of staff required strengthening.
- The substations need to maintain yard cleanliness. Overall waste management, including handling, storage, and disposal, is the principal EHS concern in all substations audited. Pieces of solid wastes (removed parts of transformers, metal scraps etc.) had no specific and designated area for collection and storage, and there was no organized disposal mechanism. Usually, they are seen all over the compound and stored there until transported to another substation.
- workplace related air, water, noise measurements are required to strengthen during operations.
- Need to provide adequate Personal Protective Equipment (PPE) and first aid at all substations.
- SF6 cylinder storage areas need to be marked

6.7 Conclusions of Environmental Audit

380. General EHS audit findings reflect the fact that the national requirements are complying in the substations, but improvements are required in relation to the following aspects and ADB's SPS 2009 requirements. Accordingly, the major audit findings and observations for 5 substations are listed in Table 6.3.

Table 6.3: Non-compliances observed

No.	Non-Compliance Issues	Non-compliance with ADB's SPS 2009 requirements
A	**132 kV Substations**	
1	Health and Safety	Staff need to use personal protective equipment (PPE) at all times, some of which are missing from substations First aid kits supplied by previous EPC contractors is small plastic box which is not a standard off the shelf medical supply item for industrial use. Safety sign boards are missing from inside substation and substation boundaries. Slip, trip and fall hazards must not be present and buildings structurally sound

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

No.	Non-Compliance Issues	Non-compliance with ADB's SPS 2009 requirements
		Drinking water supply with evidence meeting GOB standards is required at each site. Non-WC wastewater (bathing, basin, urinals) to be connected to the sewerage system or septic tank, it should not be allowed to discharge to open drains Dedicated area needed in all control buildings for accommodation/rest room/cooking if this is permitted on site Inadequate drainage system resulting in flooding of switchyard
2	Waste management in substation	Substation facilities must designate areas for solid waste collection and collect all unwanted scraps for a safe disposal. Debris is strewn across yard. Lack of signage in the yard demarcating waste stacks in the yard.
3	Oil leaks from drums, transformers	Oil leaks from some drums contaminating the land area due to rusting of the seams. In some places, drums are not kept under cover or on concrete lined platforms[38]. Transformers are mixed in age i.e. ranging between 1984-2020 and there is a risk they may contain PCBs that are to be phased out by 31.12.2025 under the Stockholm Convention
4	Handling of hazardous materials/materials management	Storage areas for SF6 gas cylinders and lined facility for transformer oil, and non-hazardous material needs to be improved especially in storage arrangement and prevention of spillage. 110% bunded area, impermeable surface etc. required. SF6 gas cylinders are stored randomly and not checked for leakages. Handheld SF6 leakage detection instrument must be available at site. During site visits, it was noticed that asbestos was not present in SS and its absence was confirmed by PGCB/O&M contract staff[39].
5	Fire safety	Insufficient capacity of foam-based fire extinguishers in case of transformer fire. No water spray or nitrogen-based system for suppressing transformer fire at any SS

6.8 Corrective Action Plan with Time Frame

381. The above review demonstrates that corrective action is required to ensure that existing adverse impacts and risks are addressed, including in relation to contractor access to substations during construction particularly in relation to working conditions and amenities, health and safety etc. All national laws need to be adhered during implementation of the project activities. Monitoring by PGCB to make the project implementation at existing facilities compliant with the EIA/IEE/EMP is required.

382. A corrective action plan (CAP) has been prepared and shall be implemented by PGCB as part of the Project scope. The CAP has been given in EMP chapter. As part of the EMP during detailed design and pre-construction, PGCB is required to review the Existing Facilities Audit Report and undertake the corrective action plan, including specific actions, budget responsible agencies/persons and within the required deadline for each action as shown in Table 6.4. This is applicable to all 5 number existing substations. If actions will be delegated by PGCB, the CAP will need to be included in the bid document to be implemented by the respective contractors where applicable.

[38] 110% bunded area, impermeable surface etc. required.
[39] Competent asbestos surveyor of the EPC contractor must confirm during the detailed design.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Table 6.4: Corrective Action Plan

No	Issues	Corrective Action	By whom/ budget source	By when
1	**Ensuring Health and Safety of Substation Staff** Staff need to use personal protective equipment (PPE) at all times Standardized medical kits need to be supplied and be kept supplied with in-date supplies on regular basis Safety sign boards must be installed at substation boundaries Drinking water supply meeting GOB standards with purifiers where required must be supplied to the staff Non-WC wastewater (bathing, basin, urinals) to be connected to the sewerage system or septic tank, it should not be allowed to discharge to open drains Dedicated area needed in all control buildings for accommodation/rest	**Corporate Level** • Ensure existing EHS guidance is issued to all SS Managers, • Source first aid kits and PPE for distribution to SS Managers -- PPE (footwear, masks, protective clothing, and goggles in appropriate areas) to be provided to the staff in accordance with GOB requirements and with reference to EMP • Periodic checks of first aid kits and PPE at substations should be carried out by corporate office, recorded and information on the same should be monitored • Develop as part of health and safety system/procedure a checklist for SS managers on correct content of first aid kit, PPE to be provided at SS, need for renewal if out of date etc. • Develop as part of health and safety system/procedure an incentive/disciplinary system to ensure use of PPE by workers at SS, such as use of written warnings etc. • Provide training to all SS managers on use of the checklist and incentive/disciplinary system, as well as on (i) use of PPEs - the importance of safety needs to be stressed to effect behavioral/attitudinal change, (ii) general health and safety aspects, and (iii) emergency procedures in event of accident, fire or natural hazard to be given on a train-the-trainer basis (document training and attendance by SS managers) • Provide training to all SS managers on the development and implementation of emergency preparedness and response plans for (i) environmental incident, (ii) health and safety incident in accordance with the General EHS Guidelines **Substation Level** **Short term:** • Ensure existing EHS guidance, pollution prevention and hazardous waste management manuals are kept on site. • Ensure fully equipped first aid kits available at first aid stations in each working area and building to be signed and easily accessible; to include list of equipment and use by dates as well as poster of the first aid procedures and emergency contact details/local hospital. • Safety mats must be installed at all substations. • Ensure appropriate PPE is available at the substation and is actively used by staff	PGCB corporate office and substation managers, O&M budget Costs to be borne by PGCB for repairing broken slabs, providing safety sign boards, drinking water purifiers, complete PPE and standardized medical first aid kits etc. Corporate office to provide guidance, training and oversee implementation by SS managers	Immediately for short term actions with compliance to be confirmed prior to access by EPC Contractor Long term actions; for compliance before handover of bay extension for operation and maintenance is undertaken

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

No	Issues	Corrective Action	By whom/ budget source	By when
	room/cooking if this is permitted on site	by implementing the incentive/disciplinary system. • SS manager to provide training to all SS staff (including housekeeping staff) on (i) use of PPEs the importance of safety needs to be stressed to effect behavioral/attitudinal change, (ii) general health and safety aspects, and (iii) emergency procedures in event of accident (document training and attendance by SS managers) • Ensure that a trained first aider is always provided on-site; this can be a member of staff trained in emergency procedures to follow in event of accident. • Broken slabs at SS need immediate replacement to avoid any slip, trip or fall related accidents. • Safety sign boards must be installed within the substation and at substation boundaries including visual warning of electrocution • Mark emergency exist signage and ensure emergency exit routes are kept clear of debris at all times • Conduct fire drills and alarm tests on a monthly basis with records kept • Place posters on medical revival, prevention / fire safety • Drinking water purifiers where required must be supplied to the staff and supply of drinking water from borewells to be tested to confirm that it meets GOB requirements • Ensure all toilets are lockable given no separate toilets for women are provided • Lighting to standard LUX levels to be installed • Provide emergency eye wash and shower • Provide dedicated shelter for security guards on duty Long term: • Undertake repair works to and maintain all control buildings with structural repair of Bhandaria SS to ensure safety of workers • Connect the non-WC wastewater (bathing, basin, urinals) to the sewerage system or septic tank, it should not be allowed to discharge to open drains • Improve capacity of the storm drainage at Satkhira SS to prevent waterlogging of switchyard (this needs to be done in parallel with drainage design for the project) • Provide a dedicated area in all control buildings for accommodation/rest room which meets the ILO worker accommodation guidelines and if cooking is permitted ensure that a separate cooking area is set up that does not pose a fire		

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

No	Issues	Corrective Action	By whom/ budget source	By when
		hazard		
2	**Improvement of Waste Management** No proper arrangements for waste management Scrap material is currently scattered across the substation sites in open areas	**Corporate Level** • Ensure proper implementation of standardized waste management system/procedure in accordance with national laws and regulations and the EHS Guidelines on Waste Management for all substations. • System/procedure to include avoiding or minimizing the generation of waste materials, as far as practicable. Where waste generation cannot be avoided but has been minimized, the preference should be recovery and reuse. Where waste cannot be recovered or reused, reputable, legitimate, licensed contractors must be appointed to treat, destroy, and dispose of it in an environmentally sound manner. • Develop as part of system/procedure a checklist for SS managers on correct storage and disposal of transformer oils, other fuel, oil, and chemicals, old transformers, scrap metals, electronic wastes, municipal solid wastes, and wastewater etc. • Provide training to all SS managers on implementation of the waste management system/procedure and use of the checklist (document training and attendance by SS managers) • Source covered, enclosed garbage bins and drip trays for distribution to SS to enable improved solid waste management. **Substation Level** In short-term: • Removal of all currently stored/dumped waste from the substation premises including end of life equipment. • Identify and demark in the SS compound an appropriate area for waste storage yard. Ensure labelled, covered, enclosed garbage bins and drop trays are available. All liquid-related wastes should be stored on an impermeable bunded surface to 110% capacity of the volume to be stored, or on drip trays if not available in the short term. • SS manager to provide training to all SS staff (including housekeeping staff) on waste management system/procedure • Implement waste management system/procedure to include the (i) segregation of all solid and hazardous waste generated; and (ii) environmentally sound storage of	PGCB corporate office and substation managers, O&M budget Costs to be borne by PGCB for development of area for storage of waste and subsequent environmentally safe and sound disposal etc. Corporate office to provide guidance, training and oversee implementation by SS managers	Immediately for short term actions with compliance to be confirmed prior to access by EPC Contractor Long term actions; for compliance before handover of bay extension for operation and maintenance is undertaken

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

No	Issues	Corrective Action	By whom/ budget source	By when
		all solid and hazardous waste in dedicated, labelled areas within the premises of substations using covered, enclosed garbage bins and placing liquid wastes on drip trays if no impermeable bunded storage area. In long-term: • Ensure the waste storage yard is undercover with impermeable bunded surface to 110% capacity of the volume to be stored.		
3	**Preventing Oil Leakages from Transformers and Oil Drums** Seals of older transformer and drums can leak No impermeable, bunded storage areas for drums to be kept Compliance with Bangladesh commitment under the Stockholm Convention[40]	**Corporate Level** In short-term: • Develop and cascade to all SS for implementation a strengthened, standardized waste oil and oil spill plan/procedure in accordance with national laws and regulations and the EHS Guidelines on Hazardous Materials Management. • Provide training to all SS managers on implementation of the waste oil and spill plan/procedure and use of the checklist (document training and attendance by SS managers) • Source drip trays and absorbent materials (e.g. sorbents, dry sand, sandbags) to soak up spills for supply to SS. In long-term: • Transformers at existing substations are mixed in age i.e. ranging between 1980-2020. Status of PCB presence can be checked and confirmed by PGCB for all transformers manufactured before 2016 as they are being tested under a DOE initiative for PCBs with other transformers screened against DOE/UNIDO guidelines and tested if they are at risk. PGCB will work with DOE to detect and clean any transformers containing PCB before 31.12.2025 per the Stockholm Convention obligations. • PGCB has to submit to ADB proof of all substation transformers being free from PCB before the loan is completed.	PGCB corporate office and substation managers, O&M budget Costs to be borne by PGCB for management of transformer oil leakage etc. Testing for PCB is to be done by PGCB staff. Corporate office to provide guidance, training and oversee implementation by SS managers	Immediately for short term actions with compliance to be confirmed prior to access by EPC Contractor Long term actions; for compliance before handover of bay extension for operation and maintenance is undertaken, by 31.12. 2025 for proof of PCB free transformers and results of soil and groundwater investigations to be available

[40] The Department of Environment, which operates under the Ministry of Environment, Forest and Climate Change, has initiated a project called "Environmentally Sound Development of the Power Sector with Final Disposal of Poly Chlorinated Bi-phenyls (PCB)". The aim of the project is to identify transformers of Power Division's Companies (BPDB, DESCO, DPDC, NESCO, BREB, PGCB & WZPDCL) in Bangladesh that have been contaminated by PCBs and dispose of them in safe locations. The United Nations Industrial Development Organization (UNIDO) is providing technical assistance for the project, which is being funded by the Global Environment Facilities (GEF). In summary, the project is focused on identifying and safely disposing of PCB-contaminated transformers in PGCB.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

No	Issues	Corrective Action	By whom/ budget source	By when
		Substation Level In short-term: • Carry out preventive maintenance of transformers and ensure values, nuts and bolts are fully functional and tightly secured, ensure rubber seals of radiators are intact, continue to do so on a regular basis such that there is no oil leakage. • Monitor and maintain account of the oil usage and spills/leaks at SS and have a site-based plan/procedure for dealing with any oil spillage. • Provide in a signed, accessible location on-site sufficient absorbent materials (e.g. sorbents, dry sand, sandbags) for soaking up oil spills. • Soak up existing oil spills and, as required, remove soil to approximately a depth of 30cm for 1m beyond footprint of visible spillage for disposal to hazardous landfill site by reputable, legitimate, licensed contractor keeping photographic records and waste transfer notes. Extra gravel is to be placed to intercept and prevent any further oil percolation into the ground. • SS manager to provide training to all SS staff (including housekeeping staff) on waste oil and spill plan/procedure. In long-term: • All transformers to have containment bund / tanks for oil spillage management of 110% capacity for oil spillage during operations in order that any oil spill will be contained. • Soil and groundwater investigation to be undertaken by suitably qualified consultant to confirm extent of any contamination across/beneath SS from oil leaks and spills and additional remedial measures required. • Implement any additional remedial measures identified following the testing of soil and groundwater.		
4	**Ensuring Safe Storage of Hazardous Materials** Transformer oil being stored haphazardly without any bunding to prevent leakage to ground	**Corporate Level** • Develop and cascade to all SS for implementation a standardized hazardous materials management system/procedure in accordance with national laws and regulations and the EHS Guidelines on Hazardous Materials Management. • Develop as part of system/procedure a checklist for SS managers on correct storage and disposal of transformer oils, other fuel, oil, and chemicals, old transformers, SF6, scrap metals, electronic wastes, municipal solid wastes, and wastewater etc.	PGCB corporate office and substation managers, O&M budget Costs of construction of bunded area to be borne by PGCB. PGCB to purchase SF6	Immediately for short term actions with compliance to be confirmed prior to access by EPC Contractor Long term actions; for compliance before handover of bay extension

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

No	Issues	Corrective Action	By whom/ budget source	By when
	Storage areas for SF6 gas cylinders and lined facility for transformer oil, and non-hazardous material needs to be improved	• Provide training to all SS managers on implementation of the hazardous materials management system/procedure and use of the checklist (document training and attendance by SS managers) • SF6 detection handheld unit must be purchased and made available at each substation. • Drip trays must be purchased and made available at each substation without adequate capacity impermeable bunded storage area. **Substation Level** In short-term: • Identify and demark in the SS compound an appropriate area for hazardous materials storage yard and for storage of oil barrels, fuel, SF6 etc. • SS manager to provide training to all SS staff (including housekeeping staff) on hazardous materials management system/procedure • Implement housekeeping and hazardous materials management system/procedure to include the (i) segregation of all solid and hazardous waste generated; and (ii) environmentally sound storage of all solid and hazardous materials and waste in dedicated, labelled areas within the premises of substations e.g. proper stacking of SF6 cylinders. • All oil drums and waste oil or empty drums and SF6 cylinders should be moved to the dedicated, labelled storage area. If covered, impermeable 110% bunded area is not currently available on site immediately store all barrels of transformer oil, other fuel, oils, and chemicals temporarily on the drip trays; ideally to be undercover. • Post Material Safety Data Sheets at the storage area. • Ensure all SF6 cylinders have been serviced and remain within the service validity date. • Maintain record of SF6 leakage checks being undertaken, leakage volumes recorded and any SF6 maintenance works etc. In long-term: • Construct a dedicated, covered, bunded, impermeable area to 110% for storage of barrels of transformer oil, other fuel, oils, and chemicals as well as liquid-related waste such as empty oil drums to prevent leakage into the ground and causing	detection handheld unit to be made available at each substation etc. Corporate office to provide guidance, training and oversee implementation by SS managers	for operation and maintenance is undertaken

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

No	Issues	Corrective Action	By whom/ budget source	By when
		pollution.		
5	**Improvement of Fire Safety** Non-availability of and insufficient capacity of foam-based extinguishers for transformer fire Lack of automatic alarm and fire suppressions system, lack of the water spray/nitrogen-based system for transformer fire.	**Corporate Level** • Fire extinguishers and other manual firefighting equipment must be purchased for distribution to SS that are requiring them. **Substation Level** **Short term:** • In each working area and building and at any oil storage site provide fire extinguishers and other manual firefighting equipment maintained in good working order and readily accessible – number to be adequate for size of premises, equipment installed, physical and chemical properties of substances present, and maximum number of people present, to avoid any fatal incident during O&M. Ensure adequate quantity of foam-based extinguishers for the fire risk. • Erect/repair water spray mechanism for prevention of transformer fires at substations. Long term: • Install/erect/repair automatic alarm and fire suppressions system, water spray mechanism/nitrogen-based system for prevention of transformer fires at substations. • Three substations among the five were noticed without any firewall. Provisions should be made to ensure proper safety mechanisms are insta to isolate the two transformers from any fire risks. Install fire walls to transformers.	PGCB corporate office and substation managers, O&M budget Costs to be borne by PGCB for purchase of fire extinguishers, installation/repair of water spray/nitrogen-based system for transformer fires etc. Corporate office to provide guidance, training and oversee implementation by SS managers	Immediately for short term actions with compliance to be confirmed prior to access by EPC Contractor Long term actions; for compliance before handover of bay extension for operation and maintenance is undertaken

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

6.9 Budget

383. The full cost of implementation of the above CAP will be borne by PGCB out of their O&M budget.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

7 Alternative Analyses

7.1 Introduction

384. Conducting an alternatives/options analysis in a project feasibility study is essential to ensure that all potential solutions are thoroughly evaluated. This process helps maximize value, manage risks, optimize resources, align with strategic goals, satisfy stakeholders, and foster innovation. By making informed, evidence-based decisions, organizations can choose the most feasible and beneficial project path. The purpose of the analysis of alternatives as part of the Feasibility Study is to assess the best substation location and best transmission line route selection considering minimum environmental and social impacts among all possible Project options. The assessment is then combined with the economic and financial feasibility to select the most reasonable alternative. The assessments and recommendations made by the feasibility team are presented below.

385. A project alternative is necessary if the project's design significantly impacts environmental and social components. Typically, the project proponent evaluates various sites for substations and associated transmission lines based on several criteria, including location, raw material transportation accessibility, availability of manpower during construction, proximity to settlements, land use patterns, natural habitats, and vulnerability to natural and man-made disasters. However, it is crucial to conduct a comparative analysis of the proposed routes and substations.

7.1.1 No Project Scenario

386. The "without project" or "no project" alternative means that no new transmission lines would be added, and no substations would be established as planned. This would leave the current electricity network in various parts of Bangladesh unchanged. The benefits of this scenario include the absence of environmental and social impacts related to substation establishment, construction activities, and the laying of transmission lines. Additionally, the capital investment required for the project would be unnecessary, and no operations and maintenance activities would be required. However, the main drawback of the "no project" sce nario would be the development of severe capacity constraints in the area's electricity network. The network would be unable to handle additional electricity generation or meet the increasing demand in the area.

387. The proposed project to build ten new substations across different parts of Bangladesh aims to ensure power evacuation from renewable energy power plants and meet the rising demand for electricity nationwide. As the country develops and industries rapidly expand, the living standards of its people also improve. This project is designed to accommodate the increasing electricity demand associated with this growth. Without implementing this project, the electricity network would fail to support the rapidly expanding commercial, industrial, and residential sectors. Consequently, regional commercial and industrial growth would stagnate, hindering the country's economic development. Therefore, the "no project" scenario is not a viable option and is thus rejected.

7.2 Alternatives for Subproject Components

7.2.1 Transmission Lines

388. PGCB has undertaken route selection for transmission lines in close consultation with representatives from Departments of Forest and the local community. Although under the national law, PGCB has the RoW it considers alternative alignments during site selection, with minor alterations to avoid environmentally sensitive areas and settlements at the implementation stage.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

i. Alternative routes shall be studied in detail using a set of techno-economical, environmental, ecological and social impact parameters to arrive at the most optimally suitable alignment that is technically feasible, economically viable, socially just and environmentally safe.
ii. A maximum width of RoW for transmission lines and minimum clearances between conductors (depending on specific voltage) and trees to be adhered in route selection.
iii. PGCB shall attempt at reducing the number of trees affected and width of the RoW etc. through adoption of appropriate technological option like construction of narrow base towers, towers with extension, compact towers, multi-circuits, and monopole towers and/or innovating upon standard procedures. Specially designed high towers shall be used for reducing impact on trees, wildlife and crossing riverbeds.
iv. Tower sites shall be located as far as technically feasible and permitted by the safety parameters mandatory under Bangladesh Electricity Act Rules regarding clearances from ground and buildings respectively
v. All efforts to minimize the involvement of trees falling in RoW shall be made. PGCB shall minimize number of trees required to be felled even if their costs have been paid. Pruning of trees will be done wherever required instead of heavy lopping or felling.
vi. Transmission line design shall comply with the limits of electromagnetic interference from overhead power lines.
vii. Visible pathways along the transmission line alignment shall be maintained for patrolling and maintenance purposes.
viii. For aviation safety, in addition to putting visible signs along the conductors and on the towers, the route alignment would be shared with the nearest airport or nearest office of the Airports Authority.
ix. In addition, care is also taken to avoid/minimise protected parks/forests, bird sanctuaries and any other ecologically sensitive area rich in wild life.
x. Ensure all proposed transmission line routes conform to coastal regulations of GoB.

389. The following tree clearing RoW widths are considered: 12.8 meters for 400 kV, 9.2 meters for 230 kV, and 7.6 meters for 132 kV. The full RoW widths of the transmission lines are: 46 meters for 400 kV, 40 meters for 230 kV, and 28 meters for 132 kV.

7.2.2 Substations

390. For the selection of appropriate sites for substations, the following points are taken into consideration:

i) Site selection should consider seismicity and geography of the local area; the area should not be prone to landslide or be unstable.
ii) Construction activities do not adversely affect the population living near the proposed substations and does not create any threat to the survival of any community with special reference to tribal community etc.
iii) The location of substation does not affect any monument of cultural or historical importance.
iv) No resettlement of households by the substation site, no loss of livelihoods, siting of transformers away from schools, hospitals and other sensitive receptors, with due consultation with the community and local government units concerned.
v) Transformers and other equipment specifications compliant with GoB rules/regulations and International Electro-Technical Commission (IEC) standards shall be followed.
vi) Construction techniques and machinery selection shall be made with a view to minimize ground disturbance.
vii) While planning for substations, drainage lines shall also be marked and studied to avoid seepage/leakages and pollution of water sources and springs etc.
viii) Substation location/design to ensure that noise will not be a nuisance to neighbouring properties. Provision of noise barriers near substation sites, if needed, will be made.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

ix) Substation design will comply with the limits of electromagnetic interference within floor area. Security fences will be erected around substations. Warning signs shall be displayed.
x) PGCB shall adopt good practices and shall always strive for a high standard of house-keeping for its substations facilities.
xi) PGCB shall incorporate the best technical practices to deal with environmental issues in its working.
xii) Design of substations shall be made so as to include modern fire control systems/firewalls. Provision of firefighting equipment would be made to be located close to transformers, switchgears etc.

7.2.3 Alternative Technologies for Substations

391. There are generally two technology options for the substations: more conventional air insulated switchgear (AIS); or technologically more advanced gas insulated switchgear (GIS). The technical, financial, economic, environmental and social aspects of these alternatives are presented in Table 7.1.

Table 7.1: Comparative Analysis of GIS and AIS Substations

SN	Description	GIS	AIS
A.	**Technical Aspects**		
1.	Fault Occurrence/ outage	GIS are modern and more regulated, so the chances of faults occurring is extremely low; The extremely low mean time between failures (MTBF) means there is very low outage as well.	AIS are archaic and not as much as regulated in comparison to GIS, so the chances of faults occurring is significantly high. The relatively high MTBF means there will be more outages during its lifecycle; More MTBF also is translated to more man-hours spent in repair/ replacement works during the lifecycle of an AIS.
2.	Reliability	Compartmentalized enclosure of the live parts in GIS makes for a very reliable system due to reduced disruption of the insulation system;	Open air components so the reliability is compromised in AIS system;
3.	Assembling	Quick assembly due to extensive pre-assembly; compact nature of the components mean they can be shipped assembled;	Slow assembly process due to dismantled shipment of heavy and oversized components;
4.	Replacement and Repair Works	If faults/ failures occur, it requires extensive and time-consuming works; the advanced nature of the system also means highly adept technicians are required to conduct the replacement and repair works; GIS based systems are required to be dismantled and sent out to designated facilities to conduct such works; these translates to longer out of service, expensive repair works, added burden of transportation etc. GIS replacement and repair works sum sort of proprietary item its cost lot of money.	AIS based systems are more prone to faults/ failures; however, the repair/ replacement work can be carried out by any regular technician because of the simplicity of the systems; the detection of faults/ failures is much easier as the components are exposed, and visible observation is sometimes more than enough to identify the faults. The repair works usually do not take long and can be done in-house, i.e., within the substation's facility so no added burden of transportation;
5.	Regular maintenance works	Considerably low; the first and only comprehensive maintenance work may not be required before 15 to 20 years; Under normal O&M, very low maintenance requirements due to expedient design and protection against external elements;	Very high; the first comprehensive maintenance work may be required within 3 to 5 years of commissioning and then every year after that; under normal O&M, high maintenance requirements due to the exposed nature of the AIS system;
6.	Procurement	Procurement and supply of SF_6 gas can be a problem especially in rough terrain and offsite locations; thereby further increasing the costs;	No such procurement required for AIS substation;

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

SN	Description	GIS	AIS
7.	Structures	Small and compact components can be placed in a housing; not much foundation work is required;	Large and heavy components are placed under open area; a lot of foundation works is required to mount the switchyard components and the transformers;
B.	**Economic and Financial Aspects**		
1.	Initial Expense	GIS based substations of similar functions/ capacities tend to be 1.1 to 1.4 times higher in cost compared to GIS based systems. However low land requirements can offset this difference.	AIS based substations of similar functions/ capacities tend to cost between 70~90% compared to AIS based substation. However high cost of land can be quite significant particularly in urban areas.
2.	Life span	GIS based system has much longer lifespan. A GIS based substation can operate up to 30 years with extremely low maintenance requirements	AIS based system has much shorter lifespan; An AIS based substation can operate up to 25~30 years with considerably high maintenance requirements that tend to increase at the latter stage of the lifecycle.
C.	**Environmental Impact**		
1.	Occupational Health and Safety and Public Safety	The earthed metal enclosure allows a safe working environment for the attending personnel and also for nearby communities	The open/ exposed live components pose a safety risk for workers as well as general public; AIS needs to be completely disconnected and discharged before conducting scheduled cleaning activities.
2.	Fire Safety	Lower risk of fire as the system operates in the presence of non-flammable, high cooling, arc quenching SF_6 gas	AIS based system do not have the arc quenching property of SF_6, thus, it has higher chance of fire accidents
3.	Climate impact	SF_6 is a potent greenhouse gas with a high global warming potential, and its concentration in the earth atmosphere is rapidly increasing. During its working cycle, SF_6 decomposes under electrical stress, forming toxic byproducts that are a health threat for working personnel in the event of exposure. Though SF6 is a very good insulator, it is also a greenhouse gas having a global warming potential of 22,800.	
		GIS uses a superior dielectric gas, SF6, at moderate pressure for phase-to-phase and phase-to-ground insulation. The high voltage conductors, circuit breaker interrupters, switches, current transformers, and voltage transformers are in SF6 gas inside grounded metal enclosures.	The atmospheric air insulation used in a conventional, air-insulated substation (AIS) requires meters of air insulation to do what SF6 can do in centimeters. As a result, AIS is more reliable and requires less maintenance than AIS.
4.	Wildlife impacts	No risk since all the live parts are totally sealed and encapsulated.	Open to air live parts of the substation pose risks of bird electrocution and bird hits.
D.	**Social Considerations**		
1.	Land Requirements	Requires about 20% of the land compared to the conventional GIS substation	Requires large area of land that can be difficult to arrange and can be quite expensive particularly in urban settings.
2.	Construction related impacts (such as community disturbance and labor issues)	Low since construction activities are not very extensive. Most parts of GIS come in compact and modular form requiring limited extent of on-site installation/construction works	Extensive since large equipment need to be installed
3.	Locality Preference	More suitable to urban and suburban areas where land availability and cost are significant issues.	More suitable for rural and unpopulated areas where land is available easily at reasonable costs.

392. The choice between GIS and AIS substations depends on various factors including space

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

availability, environmental conditions, initial and long-term costs, maintenance capabilities, and safety requirements.

393. GIS substations are ideal for urban areas or regions where space is at a premium and where environmental conditions are harsh. They offer high reliability and low maintenance but come with higher initial costs and environmental concerns related to SF6 gas.

394. AIS Substations are suitable for rural or less space-constrained areas where initial cost savings are a priority. They require more maintenance and have a larger footprint but are simpler to install and pose fewer environmental concerns related to greenhouse gases.

395. Consultant discussed with PGCB team on PGCB's experience on existing GIS substation in the context of future extension and maintenance works. Recent experience of PGCB on GIS system is not good. Due to low quality GIS, system faults are occurring frequently on existing GIS system. The Original Equipment Manufacturer (OEM) is demanding huge price for replacement and extension of existing GIS system. PGCB has come to a conclusion of not using any more GIS system at suburban and rural areas where land is available.

396. In this project, planned substations are outside of urban area and the required land may be arranged relatively easily so PGCB consider constructing the substations in AIS configuration instead of GIS configuration is preferred.

7.2.4 Alternatives for Transmission Lines

397. Two types of transmission lines have been considered for the proposed project: overhead transmission lines using bare conductors; and underground transmission lines using insulated cable. The technical, financial, economic, environmental and social aspects of these alternatives are presented in the below Table 7.2.

Table 7.2: Comparative Analysis of OHL/UG Transmission lines

SN	Description	Overhead	Underground
A.	**Technical Aspects**		
1.	Construction activities	Extensive, requiring tower foundation construction, erection of towers, conductor stringing, and installation of insulators and other devices.	Less extensive, involving trench excavation, laying of cables, laying of sand over cables, and covering the trench,
2.	Fault Occurrence/ outage	Very high due to the exposed nature.	Very low due to the concealed nature.
3.	Fault Detection	Relatively easy as it is exposed and can be visibly identified;	Relatively difficult due to the concealed nature of the line;
4.	Replacement and Repair Works	Easy replacement and repair work; can be completed within 24 hours and less expensive;	Difficult to do replacement and repair works as it would require careful excavation, breaking of road/ pavements, sidewalks etc.; may take several weeks to complete and more expensive;
5.	Regular maintenance works	More, typically every year, maintenance is significantly high	Very low. Typically, once in every 5-10 years, low maintenance expenses, usually visual inspections, marking
6.	Terrain Preference	Flat terrain is preferred; however, can be implemented in hilly terrain as well;	Flat terrain is preferred; not recommended for hilly terrain which would add more cost in tunneling and trenching works.
7.	Water bodies	Easy to implement in case of stringing over water bodies; for wider water bodies, a few numbers of towers can be erected on the water to string transmission lines.	Extremely difficult to implement in case of passing a water body as it would require very high intervention and thus usually avoided when tower erection is possible.
8.	Insulation	It usually uses porcelain discs for insulation	The buried cables come with expensive

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

SN	Description	Overhead	Underground
		between the conductor and the towers, and air gap from conductor to conductor which are less expensive;	insulation compounds covering the conductors; the insulations are also covered by jackets/braids/ sheath/ screens to avoid damage and thus they are more expensive;
9.	Interference	Due to the exposed nature of the conductors, OHTL introduces significant interference to receivers/ antennas, disrupts mobile or internet communication networks.	Due to the buried/sheathed nature of the UGTL, it does not introduce any interference to receivers/ antennas, and thus does not disrupt mobile or internet communication networks.
B.	**Economic and Financial Aspects**		
1.	Implementation expenditure	Significantly low compared to UGTL, usually only 10-20% of the expenditure of the same capacity and length;	Very high, typically 5-10 times for same capacity and length;
C.	**Environmental considerations**		
1.	Safety (Public)	Due to the fact that OHTL are exposed, they pose higher public safety risks; OHTL are more prone to accidents for the same reason.	UGTL are buried and as a result they are inaccessible and thus do not pose safety issues; UGTL are thus less prone to accidents.
2.	Safety (Maintenance)	Most of the OHTL maintenance work such as replacement of insulators, clearing of vegetation etc. involve working in significantly alleviated height (25m+) resulting in higher safety risks for the maintenance crew.	UGTL maintenance works are carried out at ground level or in shallow depth (2-3m) and as such it poses lower safety concerns.
3.	Natural Calamity	Can be affected by thunderstorms, lightning, cyclones, floods, mudslide and earthquakes.	Can be affected by floods, mudslides and earthquakes.
4.	Vegetation	TL allows vegetation under certain height underneath the RoW.	UGTL allows vegetation of any types (irrespective of voltage ratings) above the land
5.	Threat to wildlife	Although very rare, climbing mammals can be electrocuted by bridging live conductors with the steel towers.	Shielding (sheath and screen) protects earth excavating animals such as rodents to enter live conductors.
6.	Threat to birds	Overhead transmission lines pose risks of electrocution and also bird hits.	Underground transmission lines pose no such risks.
D.	**Social Considerations**		
1.	Land Requirement	Requires land acquisition of the tower footings, which can be significant depending on the size (governed by voltage ratings, terrain type, soil quality etc.) and type of the tower (suspension, angular).	Public roadside space, under the sidewalks or pavements are usually selected for UGTL thus it normally does not require land acquisition.
2.	Structures	OHTL allows public and private structures under it up to a certain height; sometimes to allow existing structures to be under the Right of Way (RoW), tower heights are increased.	UGTL only allows limited public structures such as roads, pavements and sidewalks above it.
3.	Locality Preference	Rural areas with fallow lands have low height structures and crop fields thus OHTL is more suited for these areas.	Urban and suburban areas have more roads that are suitable for UGTL and taller structures that can be avoided if UGTL is used, thus UGTL is preferable for such localities.
4.	Visual Preference	Erected towers, danger signs posted, and strung conductors affect the visual aesthetics of the area.	Buried nature of the UGTL means that they are out of sight and hence no aesthetic issues.

398. The choice between overhead and underground transmission lines depends on a balance of factors including cost, reliability, environmental impact, safety, aesthetics, and technical requirements. Overhead lines offer cost advantages and ease of maintenance, making them suitable for many applications, particularly in less populated areas. On the other hand, underground lines provide greater

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

reliability and less environmental and visual impact, making them more appropriate for urban areas and environmentally sensitive locations. Each type of transmission line has its place in a well-designed electrical grid, and the optimal solution often involves a combination of both to meet the diverse needs of the power distribution network.

399. The proposed locations of this project are rural areas. In view of the above considerations, the overhead transmission line has been used under the proposed project as transmission line route available in project areas.

7.3 Substation Location Alternatives

400. Substation land records are mentioned in Appendix XIII. Location options for ten (10) substations considered under the proposed project are discussed below.

7.3.1 Pekua 400/230/132kV Substation

401. The newly proposed Pekua 400/230/132kV AIS substation comprises one & half breaker bus system at 400 kV of 3×520 MVA (400/230 kV) & double bus 2×225/300 MVA (230/132kV), and required AIS bay of 11 numbers for 400 kV including 4 future provision, 14 numbers for 230kV including 4 future provision, 11 numbers of 132 kV including 4 future provision, will be built AIS type with a control room and transformers being placed outdoor in an area of 32 acres of land in Cox's Bazar district.

402. **Option-1:** This is one of the three options considered for Pekua substation. Location is well connected by 10 meters of well-conditioned road with Chakaria-Matabari Road (R172) by which equipment can be transported easily using the existing road (21°45'6.90"N 91°59'32.82"E) located at Rampur mauza of Chakaria Upazila under Cox's Bazar district. Approximately 65 meters wide water channel is situated on one side of the proposed land. Around 200 acres of land are available in the adjacent area; hence right of way for future expansion would be easier. Dimension of the land is matched with the expected layout of the switchyard. To get the Right of Way for constructing new lines would be less complicated. No resettlement would be required. The site is a private land and mostly used for salt farming.



Google Map Location for Pekua Substation Option-1 (Final)

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

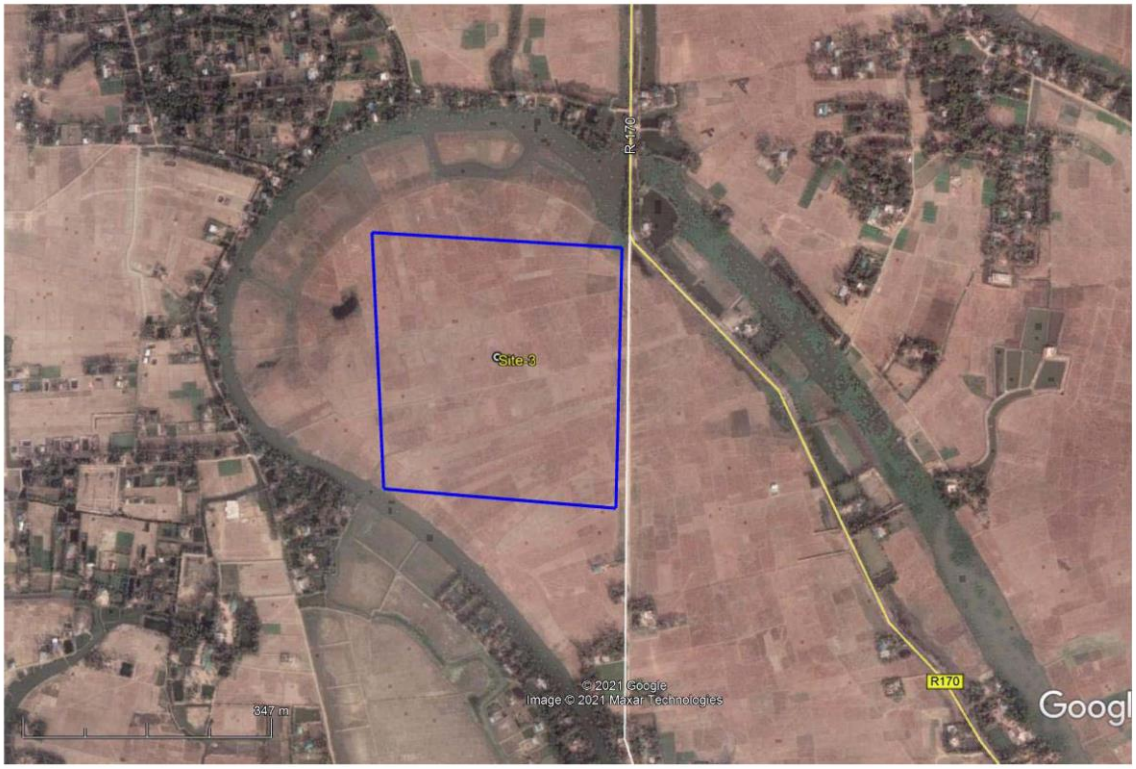
403. **Option-2:** Location is well connected by 10 meters of well-conditioned road with Chakaria-Matabari Road (R172) by which equipment can be transported easily using the existing road (21°45'11.93"N 91°59'27.95"E). The location located Rampur mouza of Chakaria Upazila under Cox's Bazar district. Approximately 65 meters wide water channel is situated on one side of the proposed land. Around 200 acres of land are available in the adjacent area; hence right of way for future expansion would be easier. Dimension of the land is matched with the expected layout of the switchyard. To get the Right of Way for constructing new lines would be less complicated. No resettlement would be required. The site is a private land and mostly paddy field.



Google Map Location for Pekua Substation Option-2

404. **Option-3:** Location is adjacent to Chakaria-Pekura hence equipment can be transported easily using existing road (21°48'33.59"N 91°58'4.00"E). The site is located at Agla and Porchim Mehernama Mouza of Pekua Upazila. Dimension of the land is matched with the expected layout of the switchyard. An approximately 30 meters of wide water channel is located on the northern side of the proposed land. A small link road (around 200 meters) may need to be constructed for the entrance of the switchyard. Around 70 acres of land is available in the adjacent area. No resettlement would be required. The site is a private land and mostly paddy field.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.



Google Map Location for Pekua Substation Option-3

405. The locations of the above-described siting options are shown in below figures while the technical, financial, economic, environmental and social aspects of these alternatives are presented in the below Table 7.3.



Google Map Locations of Three Sitting Options for Pekua Substation

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Table 7.3: Comparative Analysis of Site Selection at Pekua 400/230/132kV AIS Substation

Attributes	Option-1 (Final)	Option-2	Option-3
Technical Aspects			
Land Use	Salt Pan	Agriculture	Agriculture
Road Condition	Good	Good	Moderately Good
Transmission line shifting Required	No	No	No
Land filling work	Medium	High	High
Scope of future Expansion	Yes	Yes	Yes
Land ownership	Private	Private	Private
Complexity Level of Acquisition	Medium	High	High
Meet Present Demand	Yes	Yes	Yes
Power System Growth	Yes	Yes	Yes
Meets Future Demand	Yes	Yes	Yes
Financial and Economic Aspects			
Implementation Expense	Medium	High	High
Environmental and Social Aspects			
Construction related impacts	Medium	High	Medium
Nearby Water Body	Yes	Yes	Yes
Inundated or waterlogged land	Inundated		
Loss of vegetation	Medium	High	Medium
Noise	Medium	High	High
Involuntary resettlement	No	No	No

406. **Observation:** In view of the lower cost and less significant environmental and social issues as shown in table above, the Option-1 is the preferred for final option and therefore it has been selected. Environmental Quality Monitoring will be conducted again by the EPC Contractor at the final selected site along with detailed design.

7.3.2 Madhabpur 230/132/33 kV Substation

407. The newly proposed Madhabpur 230/132/33 kV AIS substation comprises double bus 3×225/300 MVA (230/132kV) & 2×80/120 MVA (132/33kV), and required AIS bay of 10 numbers for 230kV including 3 future provision, 13 numbers of 132 kV including 3 future provision, will be built AIS type with a control room and transformers being placed outdoor in an area of 10 acres of land in Habiganj district.

408. **Option-1:** This place is situated at Baghsair mouza of Madhabpur Upazila under Habiganj district. The land is mainly private where one crops agricultural activities are carried out (21°45'6.90"N 91°59'32.82"E). The minimum population density and avoidance of human habitation is possible. Transmission lines can be moved in and out of the substation without any damage. The existing line is near. So, it will be very easy to in and out of the line from the substation. The market value of land is relatively low.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.



Google Map Location for Madhabpur Substation Option-1 (Final)

409. **Option-2:** This place is situated at Madhabpur Upazila under Habiganj district [24° 3'56.71"N; 91°15'15.95"E]. The land is mainly private where triple crops agricultural activities are carried out. Option-2 is harder to avoid human habitation than option-1. So, it will be a problem to in and out of the line from the substation in future. In some places it will be impossible to lay transmission lines.

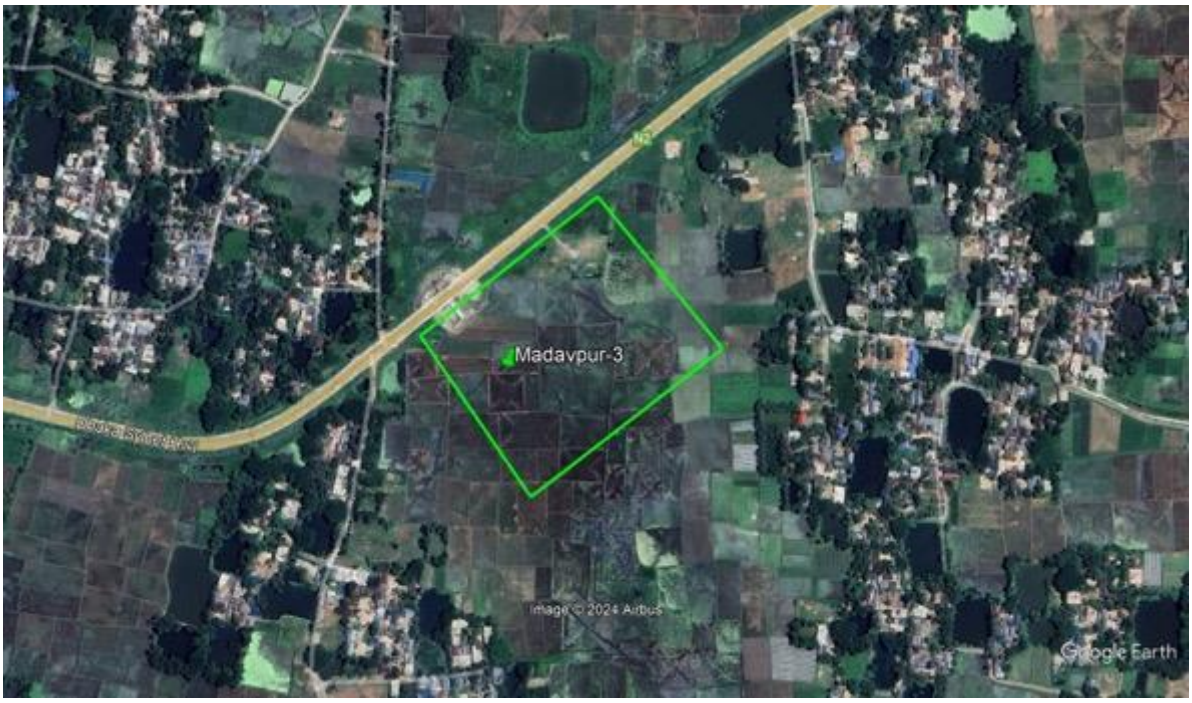


Google Map Location for Madhabpur Substation Option-2

410. **Option-3:** This place is situated at Madhabpur Upazila under Habiganj district [24° 4'54.11"N; 91°16'49.16"E]. The land is mainly private where triple crops agricultural activities are carried out. Densely populated area. Avoidance of human habitation is not possible. The market value of land is relatively high. As the existing line is very close it will be a problem to in and out of the line from the

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

substation in future.



Google Map Location for Madhabpur Substation Option-3

411. The locations of the above-described siting options are shown in below figures while the technical, financial, economic, environmental and social aspects of these alternatives are presented in the below Table 7.4.



Google Map Locations of Three Sitting Options for Madhabpur Substation

Table 7.4: Comparative Analysis of Site Selection at Madhabpur 230/132/33kV AIS Substation

Attributes	Option-1 (Final)	Option-2	Option-3
Technical Aspects			
Land Use	Agriculture	Agriculture	Agriculture
Road Condition	Good	Moderately Good	Moderately Good

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Attributes	Option-1 (Final)	Option-2	Option-3
Transmission line shifting Required	No	No	No
Land filling work	Medium	High	High
Scope of future Expansion	Yes	Yes	Yes
Land ownership	Private	Private	Private
Complexity Level of Acquisition	Medium	High	High
Meet Present Demand	Yes	Yes	Yes
Power System Growth	Yes	Yes	Yes
Meets Future Demand	Yes	Yes	Yes
Financial and Economic Aspects			
Implementation Expense	Medium	High	High
Environmental and Social Aspects			
Construction related impacts	Medium	High	Medium
Nearby Water Body	No	No	No
Inundated or waterlogged land			
Loss of vegetation	Medium	High	Medium
Noise	Medium	High	High
Involuntary resettlement	No	No	No

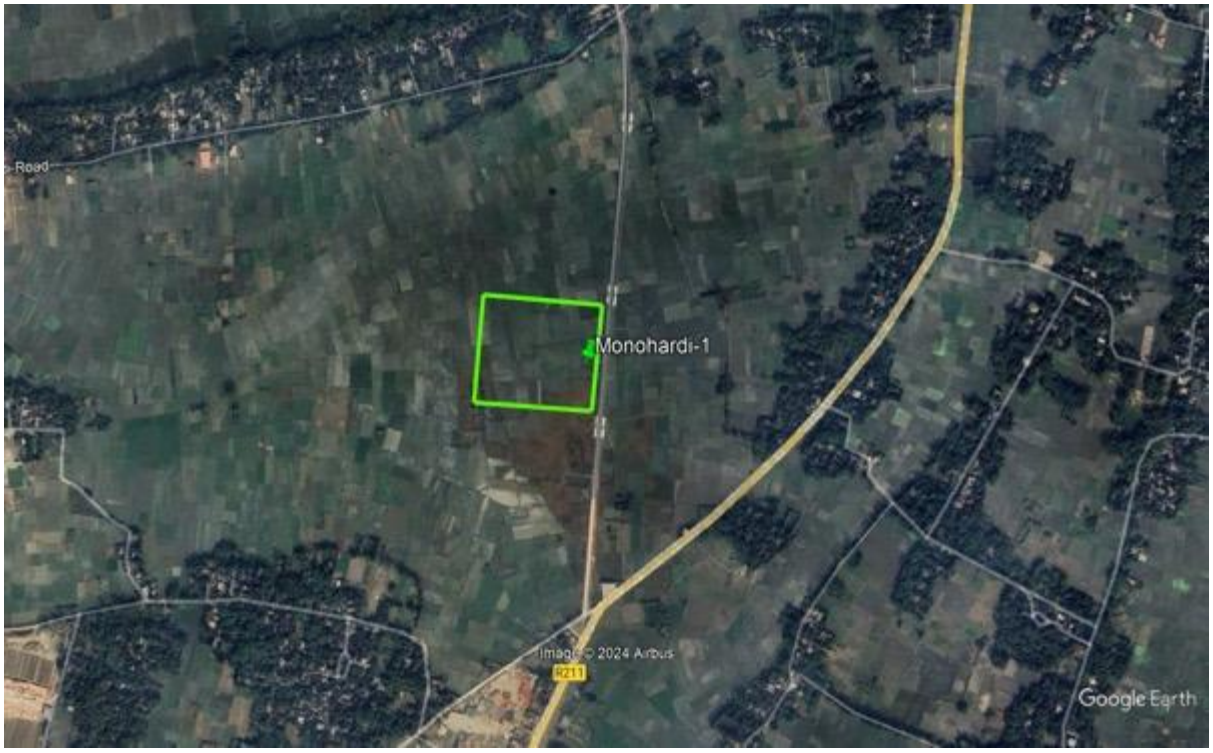
412. **Observation:** In view of the lower cost and less significant environmental and social issues as shown in table above, the Option-1 is the preferred for final option and therefore it has been selected. Environmental Quality Monitoring will be conducted again by the EPC Contractor at the final selected site along with detailed design.

7.3.3 Monohardi 230/132/33 kV Substation

413. The newly proposed Monohardi 230/132/33 kV AIS substation comprises double bus 2×225/300 MVA (230/132kV) & 2×80/120 MVA (132/33kV), and required AIS bay of 9 numbers for 230kV including 3 future provision, 11 numbers of 132 kV including 3 future provision, will be built AIS type with a control room and transformers being placed outdoor in an area of 10 acres of land in Narsingdi district.

414. **Option-1:** This place is situated at Kismot Sarikandi mouza of Manohardi Upazila under Dhaka district [24°10'4.23"N; 90°43'6.72"E]. The land is mainly private where one crops agricultural activities are carried out. The minimum population density and avoidance of human habitation is possible. Transmission lines can be moved in and out of the substation without any damage. The existing line is within 500 meters. So, it will be very easy to in and out of the line from the substation. The market value of land is relatively low.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.



Google Map Location for Monohardi Substation Option-1 (Final)

415. **Option-2:** This place is situated at Harordia mouza of Manohardi Upazila under Dhaka district [24° 9'1.44"N; 90°42'25.53"E]. The land is mainly private where triple crops agricultural activities are carried out. There are gas lines within the proposed substation area. So permanent installation of the substation is not possible. Option-2 is harder to avoid human habitation than option-1. As the LILO line is very close, it will be a problem to in and out of the line from the substation in future. In some places it will be impossible to lay transmission lines.



Google Map Location for Monohardi Substation Option-2

416. **Option-3:** This place is situated at Madhupur mouza of Manohardi Upazila under Dhaka district [24° 7'56.78"N; 90°42'31.56"E]. The land is mainly private where triple crops agricultural activities are carried out densely populated area. Avoidance of human habitation is not possible. There are petrol

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

pumps in the substation area. A mini stadium has been proposed in the substation area. The market value of land is relatively high. As the existing line is very close, it will be a problem to in and out of the line from the substation in future.



Google Map Location for Monohardi Substation Option-3

417. The locations of the above-described siting options are shown in below figures while the technical, financial, economic, environmental and social aspects of these alternatives are presented in the below Table 7.5.



Google Map Locations of Three Sitting Options for Monohardi Substation

Table 7.5: Comparative Analysis of Site Selection at Monohardi 230/132/33kV AIS Substation

Attributes	Option-1 (Final)	Option-2	Option-3
Technical Aspects			
Land Use	Agriculture	Agriculture	Agriculture
Road Condition	Good	Moderately Good	Moderately Good

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Attributes	Option-1 (Final)	Option-2	Option-3
Transmission line shifting Required	No	No	No
Land filling work	Medium	High	High
Scope of future Expansion	Yes	Yes	Yes
Land ownership	Private	Private	Private
Complexity Level of Acquisition	Medium	High	High
Meet Present Demand	Yes	Yes	Yes
Power System Growth	Yes	Yes	Yes
Meets Future Demand	Yes	Yes	Yes
Financial and Economic Aspects			
Implementation Expense	Medium	High	High
Environmental and Social Aspects			
Construction related impacts	Medium	High	Medium
Nearby Water Body	No	No	No
Inundated or waterlogged land			
Loss of vegetation	Medium	High	Medium
Noise	Medium	High	High
Involuntary resettlement	No	No	No

418. **Observation:** In view of the lower cost and less significant environmental and social issues as shown in table above, the Option-1 is the preferred for final option and therefore it has been selected. All the inventory surveys and consultations were conducted for Option-1 only. Quality sampling was conducted by the PGCB consultant long ago and at that moment Option-3 was selected by PGCB. Though, Option-1 was ultimately confirmed by PGCB due to lower land price and other factors which is approximately 4.5 km away from Option-3. The land use pattern and topographical condition is similar. Environmental Quality Monitoring will be conducted again by the EPC Contractor at the final selected site along with detailed design.

7.3.4 Tungipara 132/33 kV Substation

419. The newly proposed Tungipara 132/33 kV AIS substation comprises double bus 2×80/120 MVA (132/33kV), and required AIS bay of 7 numbers of 132 kV including 3 future provision, will be built AIS type with a control room and transformers being placed outdoor in an area of 4 acres of land in Gopalganj district.

420. **Option-1:** This place is situated at Baladanga mouza of Tungipara Upazila under Gopalganj district [22°55'7.68"N; 89°54'12.99"E]. The land is mainly private where triple crops agricultural activities are carried out. The minimum population density and avoidance of human habitation is possible. Transmission lines can be moved in and out of the substation without any damage. The existing line is near. So, it will be very easy to in and out of the line from the substation. The market value of land is relatively low.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.



Google Map Location for Tungipara Substation Option-1 (Final)

421. **Option-2:** This place is situated at Tungipara Upazila under Gopalganj district [22°55'40.15"N; 89°54'23.86"E]. The land is mainly private where one crops agricultural activities are carried out. Option-2 is not much harder avoid human habitation than option-1. So, it will be a problem to in and out of the line from the substation in future. In some places it will be impossible to lay transmission lines.



Google Map Location for Tungipara Substation Option-2

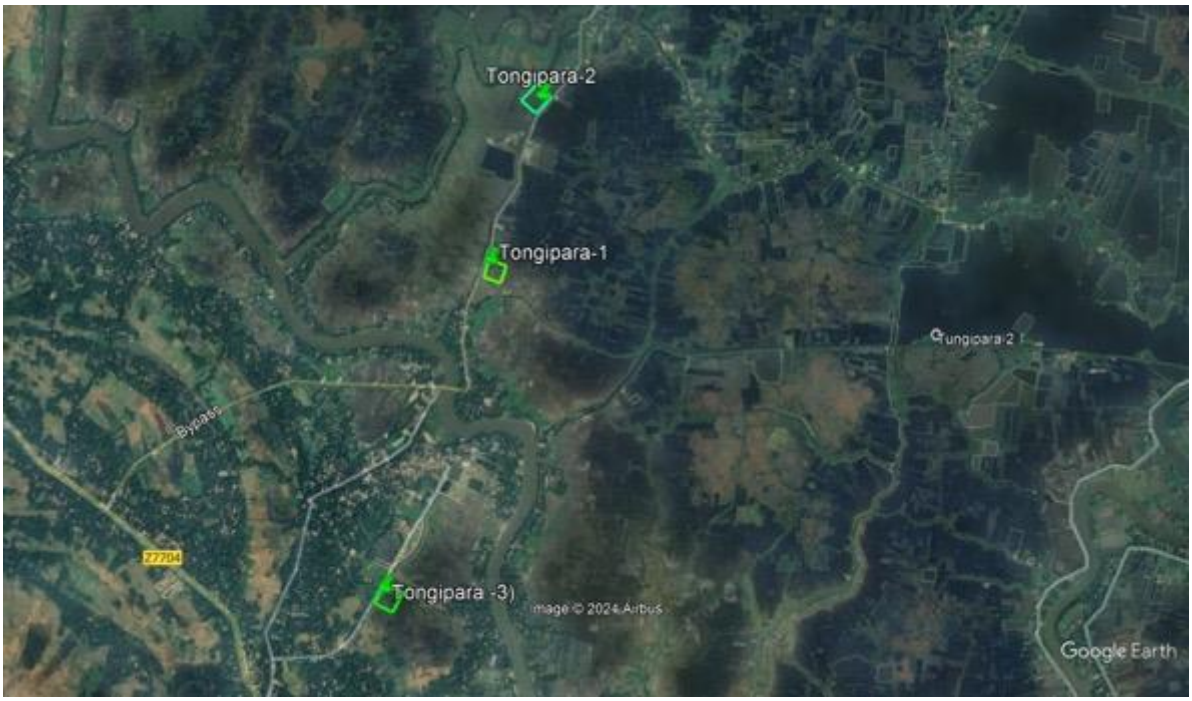
422. **Option-3:** This place is situated at Tungipara Upazila under Gopalganj district [22°54'2.63"N; 89°53'50.41"E]. The land is mainly private where one crops agricultural activities are carried out. Densely populated area. Avoidance of human habitation is not possible. The market value of land is relatively high. As the existing line is very close, it will be a problem to in and out of the line from the substation in future.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.



Google Map Location for Tungipara Substation Option-3

423. The locations of the above-described siting options are shown in below figures while the technical, financial, economic, environmental and social aspects of these alternatives are presented in the below Table 7.6.



Google Map Locations of Three Sitting Options for Tungipara Substation

Table 7.6: Comparative Analysis of Site Selection at Tungipara 132/33kV AIS Substation

Attributes	Option-1 (Final)	Option-2	Option-3
Technical Aspects			
Land Use	Agriculture	Agriculture	Agriculture
Road Condition	Good	Moderately Good	Moderately Good

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Attributes	Option-1 (Final)	Option-2	Option-3
Transmission line shifting Required	No	No	No
Land filling work	Medium	High	High
Scope of future Expansion	Yes	Yes	Yes
Land ownership	Private	Private	Private
Complexity Level of Acquisition	Medium	High	High
Meet Present Demand	Yes	Yes	Yes
Power System Growth	Yes	Yes	Yes
Meets Future Demand	Yes	Yes	Yes
Financial and Economic Aspects			
Implementation Expense	Medium	High	High
Environmental and Social Aspects			
Construction related impacts	Medium	High	Medium
Nearby Water Body	No	No	No
Inundated or waterlogged land	No	Yes	No
Loss of vegetation	Medium	High	Medium
Noise	Medium	High	High
Involuntary resettlement	No	No	No

424. **Observation:** In view of the lower cost and less significant environmental and social issues as shown in table above, the Option-1 is the preferred for final option and therefore it has been selected. Environmental Quality Monitoring will be conducted again by the EPC Contractor at the final selected site along with detailed design.

7.3.5 Dupchanchia 132/33 kV Substation

425. The newly proposed Dupchanchia 132/33 kV AIS substation comprises double bus 2×50/75 MVA (132/33kV) and required AIS bay of 9 numbers of 132 kV including 3 future provision, will be built AIS type with a control room and transformers being placed outdoor in an area of 3 acres of land in Bogura district.

426. **Option-1:** This place is situated at Islampur and Bhatahar mouza of Dhupchanchia Upazila under Bogura district [24°53'31.13"N; 89° 9'33.57"E]. The land is mainly private where one crops agricultural activities are carried out. The minimum population density and avoidance of human habitation is possible. Transmission lines can be moved in and out of the substation without any damage. The existing line is near. So, it will be very easy to in and out of the line from the substation. The market value of land is relatively low.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.



Google Map Location for Dupchachia Substation Option-1 (Final)

427. **Option-2:** This place is situated at Dhupchanchia Upazila under Bogura district [24°53'49.70"N; 89°10'29.81"E]. The land is mainly private where triple crops agricultural activities are carried out. Option-2 is harder to avoid human habitation than option-1. So, it will be a problem to in and out of the line from the substation in future. In some places it will be impossible to lay transmission lines.

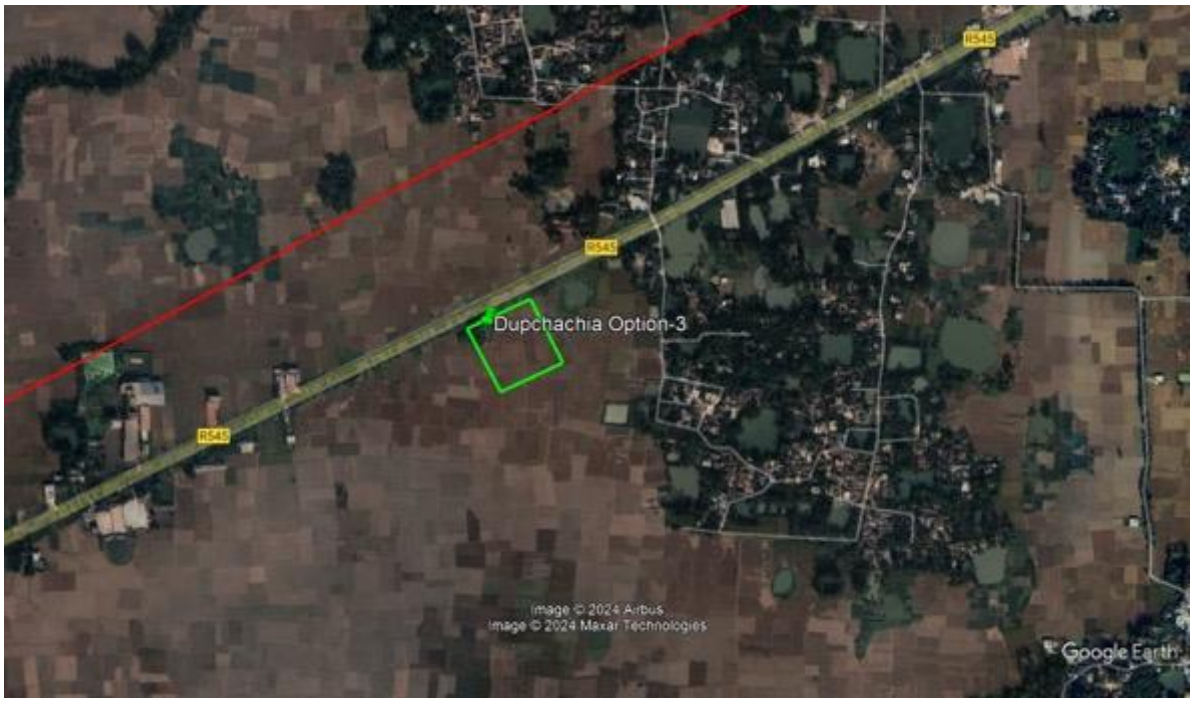


Google Map Location for Dupchachia Substation Option-2

428. **Option-3:** This place is situated at Dhupchanchia Upazila under Bogura district [24°51'24.40"N; 89° 8'32.76"E]. The land is mainly private where triple crops agricultural activities are carried out. Densely populated area. Avoidance of human habitation is not possible. The market value of land is relatively high. As the existing line is very close, it will be a problem to in and out of the line from the

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

substation in future.



Google Map Location for Dupchachia Substation Option-3

429. The locations of the above-described siting options are shown in below figures while the technical, financial, economic, environmental and social aspects of these alternatives are presented in the below Table 7.7.



Google Map Locations of Three Sitting Options For Dupchachia Substation

Table 7.7: Comparative Analysis of Site Selection at Dupchanchia 132/33kV AIS Substation

Attributes	Option-1 (Final)	Option-2	Option-3
Technical Aspects			

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Attributes	Option-1 (Final)	Option-2	Option-3
Land Use	Agriculture	Agriculture	Agriculture
Road Condition	Good	Moderately Good	Moderately Good
Transmission line shifting Required	No	No	No
Land filling work	Medium	High	High
Scope of future Expansion	Yes	Yes	Yes
Land ownership	Private	Private	Private
Complexity Level of Acquisition	Medium	High	High
Meet Present Demand	Yes	Yes	Yes
Power System Growth	Yes	Yes	Yes
Meets Future Demand	Yes	Yes	Yes
Financial and Economic Aspects			
Implementation Expense	Medium	High	High
Environmental and Social Aspects			
Construction related impacts	Medium	High	Medium
Nearby Water Body	No	No	No
Inundated or waterlogged land	No	No	No
Loss of vegetation	Medium	High	Medium
Noise	Medium	High	High
Involuntary resettlement	No	No	No

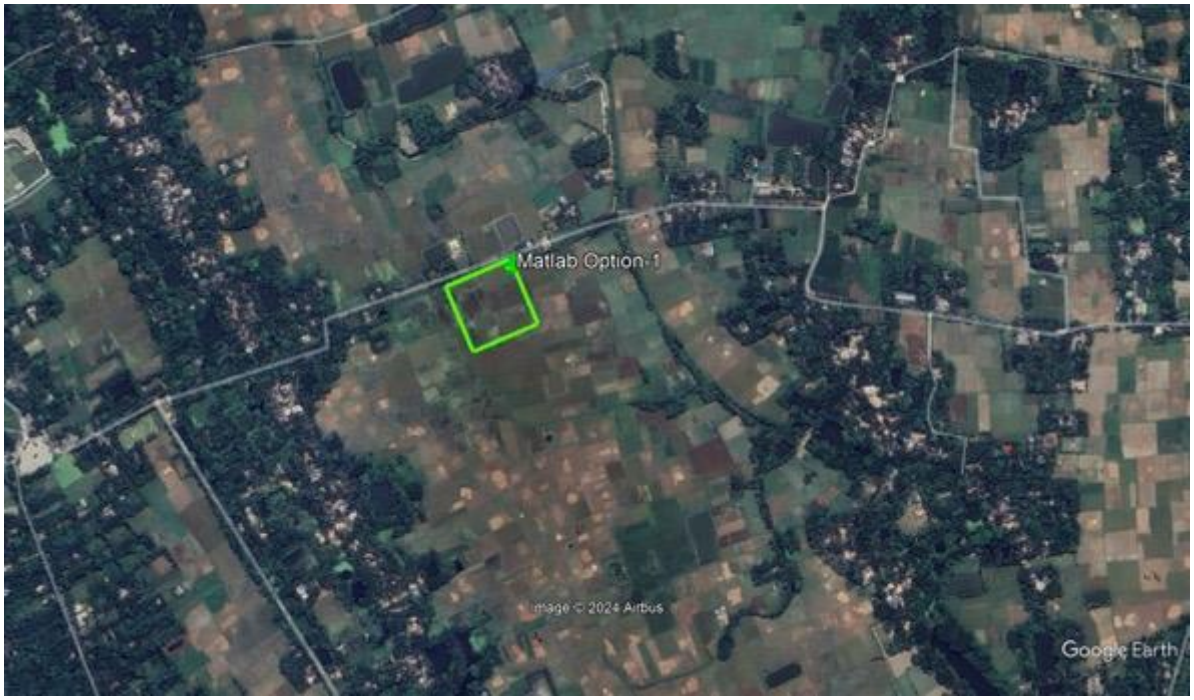
430. **Observation:** In view of the lower cost and less significant environmental and social issues as shown in table above, the Option-1 is the preferred for final option and therefore it has been selected. Environmental Quality Monitoring will be conducted again by the EPC Contractor at the final selected site along with detailed design.

7.3.6 Matlab North 132/33 kV Substation

431. The newly proposed Matlab North 132/33 kV AIS substation comprises double bus 2×50/75 MVA (132/33kV), and required AIS bay of 7 numbers of 132 kV including 3 future provision, will be built AIS type with a control room and transformers being placed outdoor in an area of 3 acres of land in Bogura district.

432. **Option-1:** This place is situated at Charpalalokodi mouza of Matlab (N) Upazila under Chandpur district [23°24'48.73"N; 90°38'3.58"E]. The land is mainly private where one crops agricultural activities are carried out. The minimum population density and avoidance of human habitation is possible. Transmission lines can be moved in and out of the substation without any damage. The existing line is near. So, it will be very easy to in and out of the line from the substation. The market value of land is relatively low.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.



Google Map Location for Matlab North Substation Option-1 (Final)

433. **Option-2:** This place is situated at Matlab (N) Upazila under Chandpur district [23°24'57.08"N; 90°42'3.34"E]. The land is mainly private where triple crops agricultural activities are carried out. Option-2 is harder to avoid human habitation than option-1. So, it will be a problem to in and out of the line from the substation in future. In some places it will be impossible to lay transmission lines.



Google Map Location for Matlab North Substation Option-2

434. **Option-3:** This place is situated at Matlab (N) Upazila under Chandpur district [23°25'16.85"N; 90°39'44.47"E]. The land is mainly private where triple crops agricultural activities are carried out. Densely populated area Avoidance of human habitation is not possible. The market value of land is

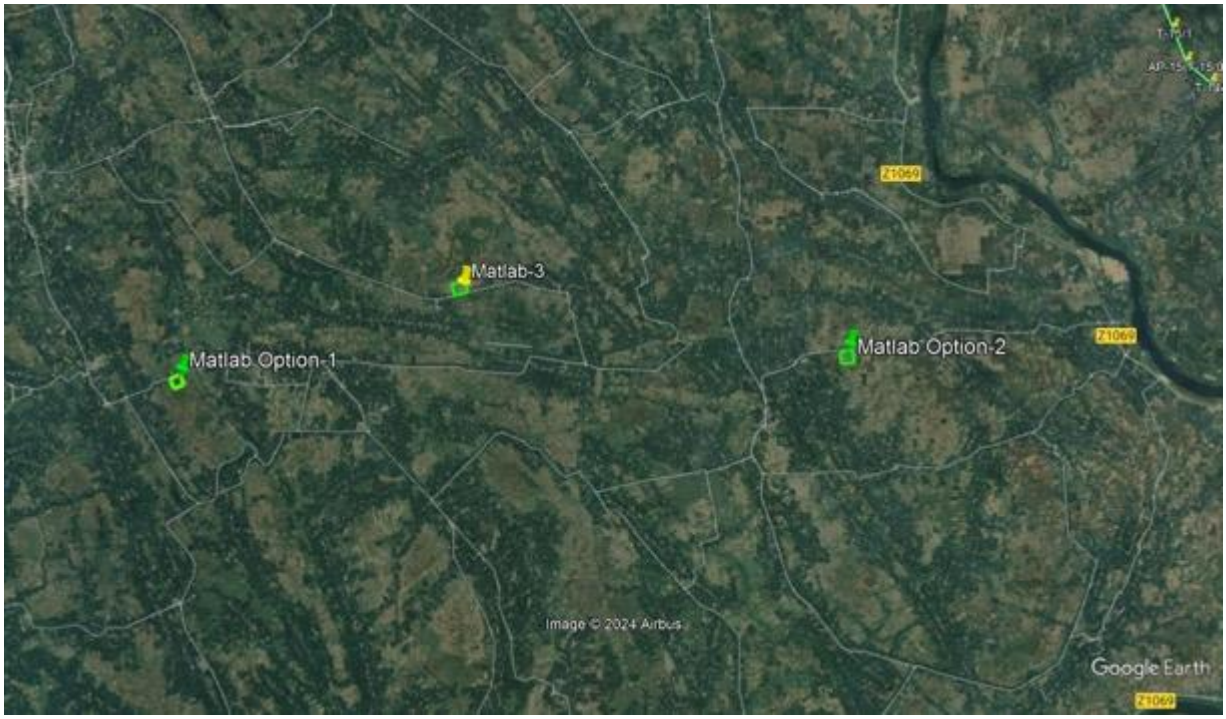
INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

relatively high. As the existing line is very close it will be a problem to in and out of the line from the substation in future.



Google Map Location for Matlab North Substation Option-3

435. The locations of the above-described siting options are shown in below figures while the technical, financial, economic, environmental and social aspects of these alternatives are presented in the below Table 7.8.



Google Map Locations of Three Sitting Options for Matlab North Substation

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Table 7.8: Comparative Analysis of Site Selection at Matlab North 132/33kV AIS Sub-Station

Attributes	Option-1 (Final)	Option-2	Option-3
Technical Aspects			
Land Use	Agriculture	Agriculture	Agriculture
Road Condition	Good	Moderately Good	Moderately Good
Transmission line shifting Required	No	No	No
Land filling work	Medium	High	High
Scope of future Expansion	Yes	Yes	Yes
Land ownership	Private	Private	Private
Complexity Level of Acquisition	Medium	High	High
Meet Present Demand	Yes	Yes	Yes
Power System Growth	Yes	Yes	Yes
Meets Future Demand	Yes	Yes	Yes
Financial and Economic Aspects			
Implementation Expense	Medium	High	High
Environmental and Social Aspects			
Construction related impacts	Medium	High	Medium
Nearby Water Body	No	No	No
• Inundated or waterlogged land	No	No	No
Loss of vegetation	Medium	High	Medium
Noise	Medium	High	High
Involuntary resettlement	No	No	No

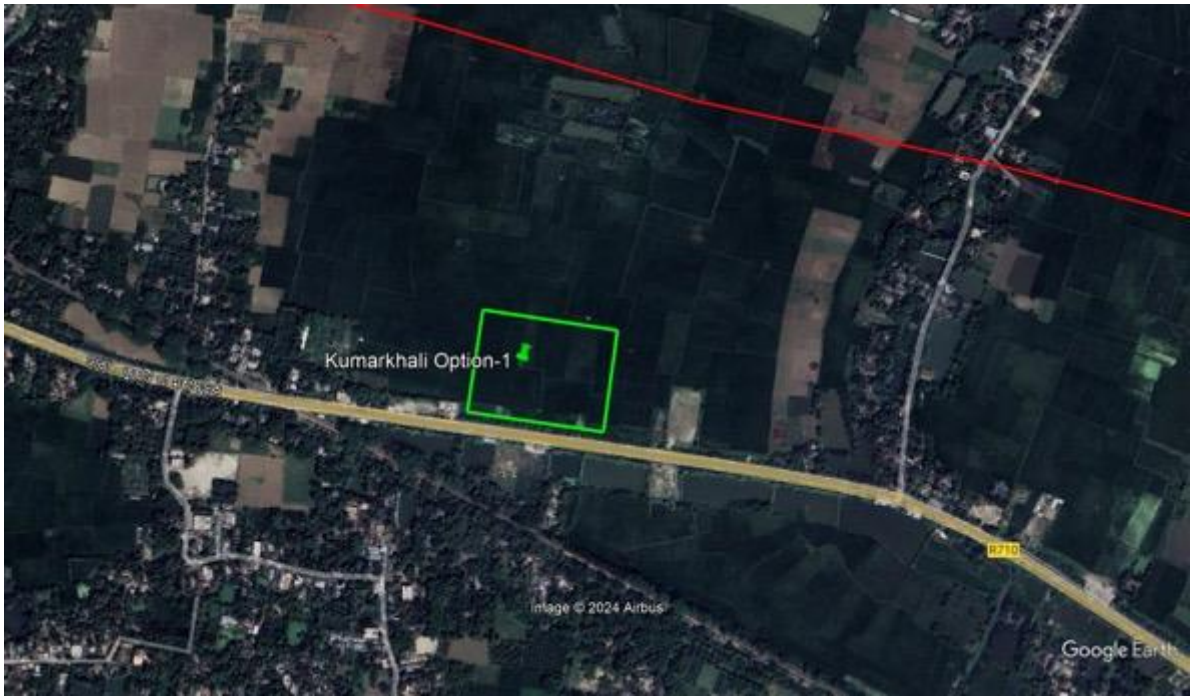
436. **Observation:** In view of the lower cost and less significant environmental and social issues as shown in table above, the Option-1 is the preferred for final option and therefore it has been selected. Environmental Quality Monitoring will be conducted again by the EPC Contractor at the final selected site along with detailed design.

7.3.7 Kumarkhali 132/33 kV Substation

437. The newly proposed Kumarkhali 132/33 kV AIS substation comprises double bus 2×50/75 MVA (132/33kV), and required AIS bay of 9 numbers of 132 kV including 3 future provision, will be built AIS type with a control room and transformers being placed outdoor in an area of 4 acres of land in Kusthia district.

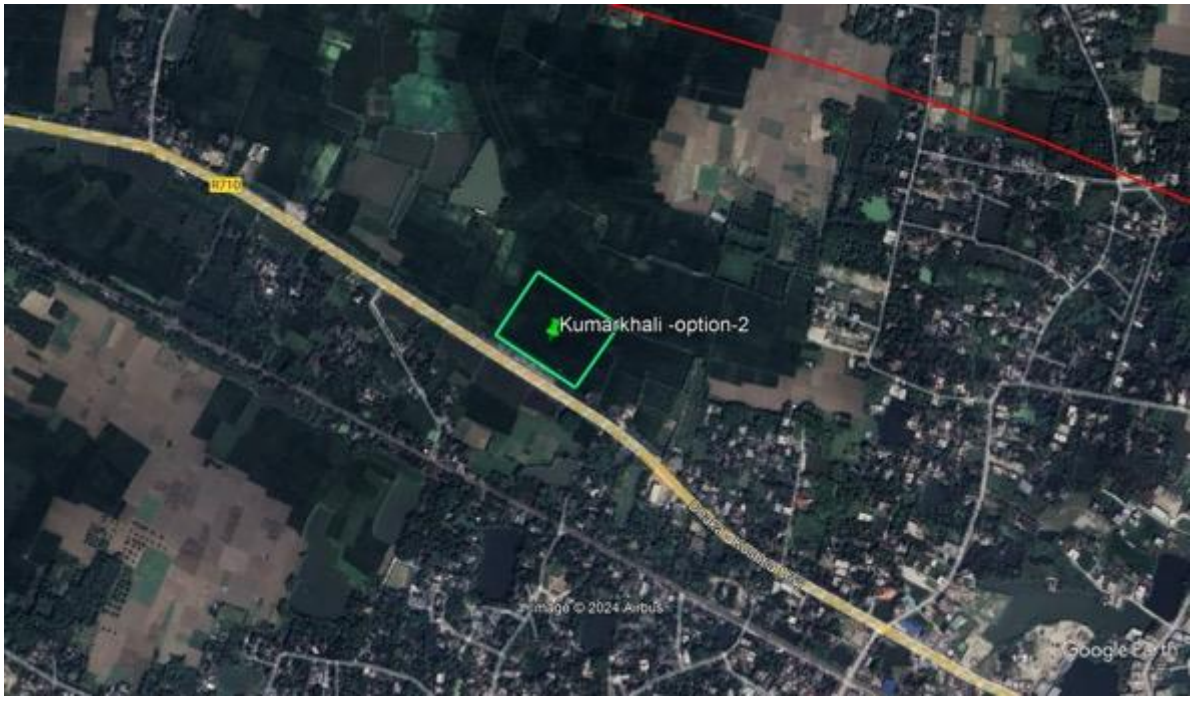
438. **Option-1:** This place is situated at Choraikol mouza of Kumarkhali Upazila under Kushtia district [23°52'16.04"N; 89°13'19.53"E]. The land is mainly private where one crops agricultural activities are carried out. The minimum population density and avoidance of human habitation is possible. Transmission lines can be moved in and out of the substation without any damage. The existing line is near. So, it will be very easy to in and out of the line from the substation. The market value of land is relatively low.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.



Google Map Location for Kumarkhali Substation Option-1 (Final)

439. **Option-2:** This place is situated at Kumarkhali Upazila under Kusthia district [23°52'2.05"N; 89°13'55.05"E]. The land is mainly private where triple crops agricultural activities are carried out. Option-2 is harder to avoid human habitation than option-1. So, it will be a problem to in and out of the line from the substation in future. In some places it will be impossible to lay transmission lines.

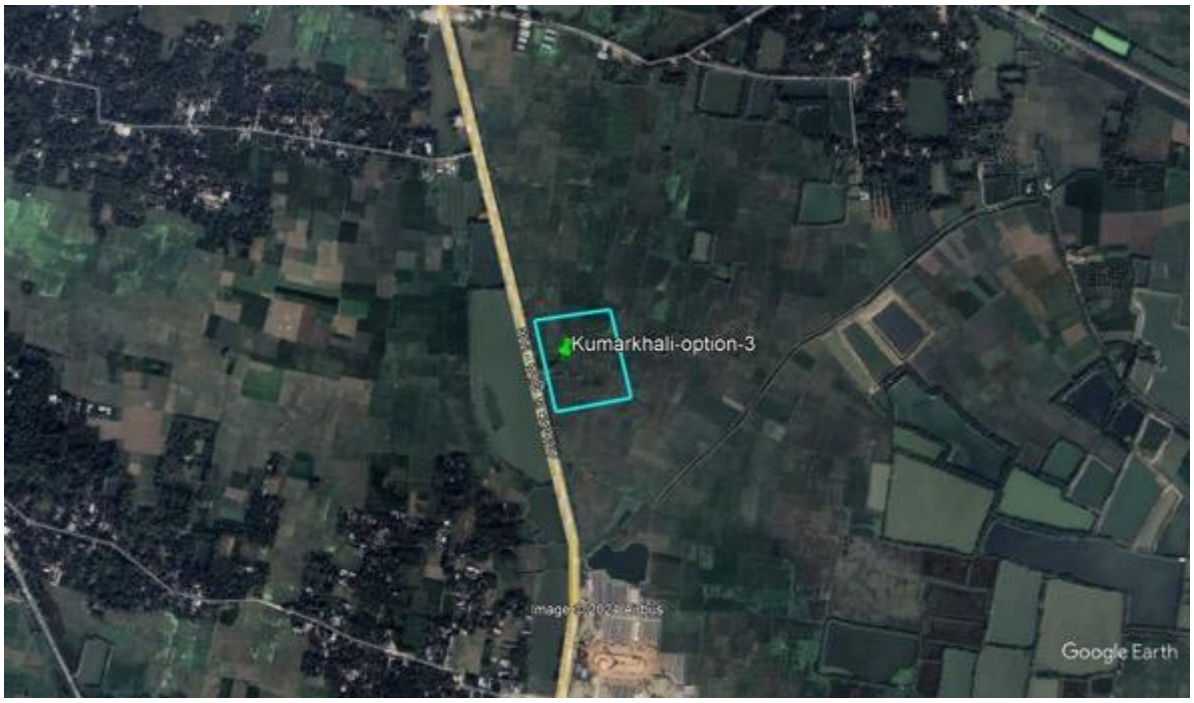


Google Map Location for Kumarkhali Substation Option-2

440. **Option-3:** This place is situated at Kumarkhali Upazila under Kusthia district [23°50'38.70"N; 89°15'30.28"E]. The land is mainly private where triple crops agricultural activities are carried out. Densely populated area Avoidance of human habitation is not possible. The market value of land is relatively high. As the existing line is very close, it will be a problem to in and out of the line from the

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

substation in future.



Google Map Location for Kumarkhali Substation Option-3

441. The locations of the above-described siting options are shown in below figures while the technical, financial, economic, environmental and social aspects of these alternatives are presented in the below Table 7.9.



Google Map Locations of Three Sitting Options for Kumarkhali Substation

Table 7.9: Comparative Analysis of Site Selection at Kumarkhali 132/33kV AIS Sub-Station

Attributes	Option-1 (Final)	Option-2	Option-3
Technical Aspects			

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Attributes	Option-1 (Final)	Option-2	Option-3
Land Use	Agriculture	Agriculture	Agriculture
Road Condition	Good	Moderately Good	Moderately Good
Transmission line shifting Required	No	No	No
Land filling work	Medium	High	High
Scope of future Expansion	Yes	Yes	Yes
Land ownership	Private	Private	Private
Complexity Level of Acquisition	Medium	High	High
Meet Present Demand	Yes	Yes	Yes
Power System Growth	Yes	Yes	Yes
Meets Future Demand	Yes	Yes	Yes
Financial and Economic Aspects			
Implementation Expense	Medium	High	High
Environmental and Social Aspects			
Construction related impacts	Medium	High	Medium
Nearby Water Body	No	No	No
Inundated or waterlogged land	No	No	No
Loss of vegetation	Medium	High	Medium
Noise	Medium	High	High
Involuntary resettlement	No	No	No

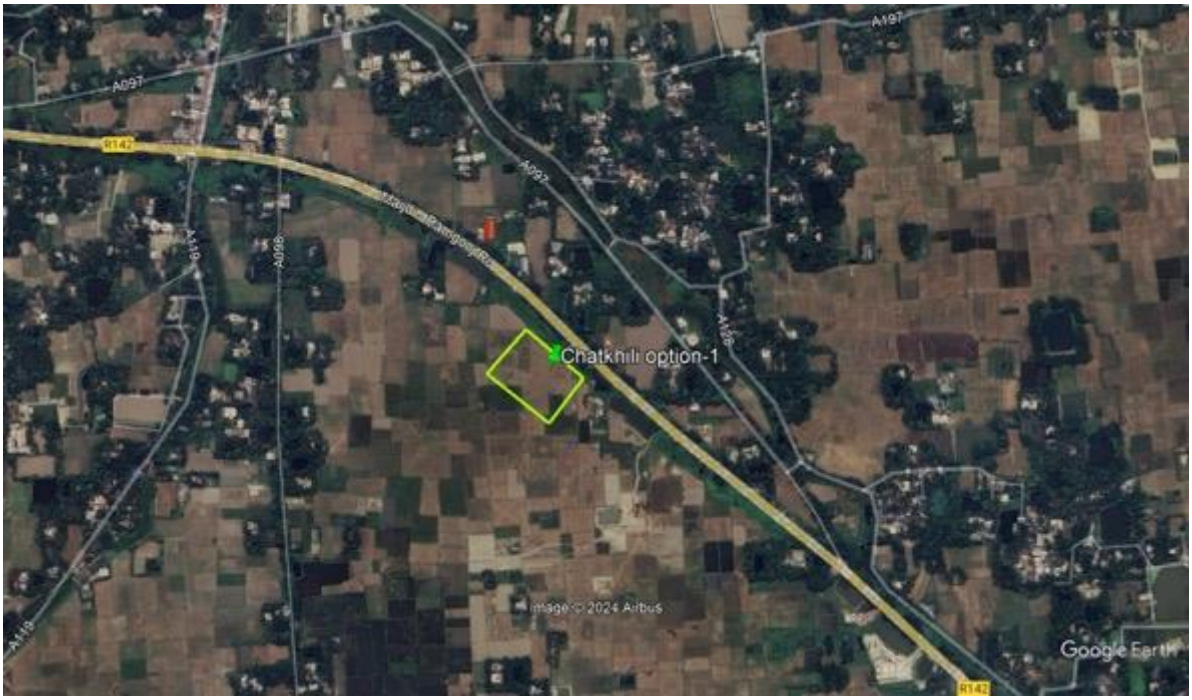
442. **Observation:** In view of the lower cost and less significant environmental and social issues as shown in table above, the Option-1 is the preferred for final option and therefore it has been selected. Environmental Quality Monitoring will be conducted again by the EPC Contractor at the final selected site along with detailed design.

7.3.8 Chatkhil 132/33 kV Substation

443. The newly proposed Chatkhil 132/33 kV AIS substation comprises double bus 2×80/120 MVA (132/33kV), and required AIS bay of 9 numbers of 132 kV including 3 future provision, will be built AIS type with a control room and transformers being placed outdoor in an area of 3 acres of land in Noakhali district.

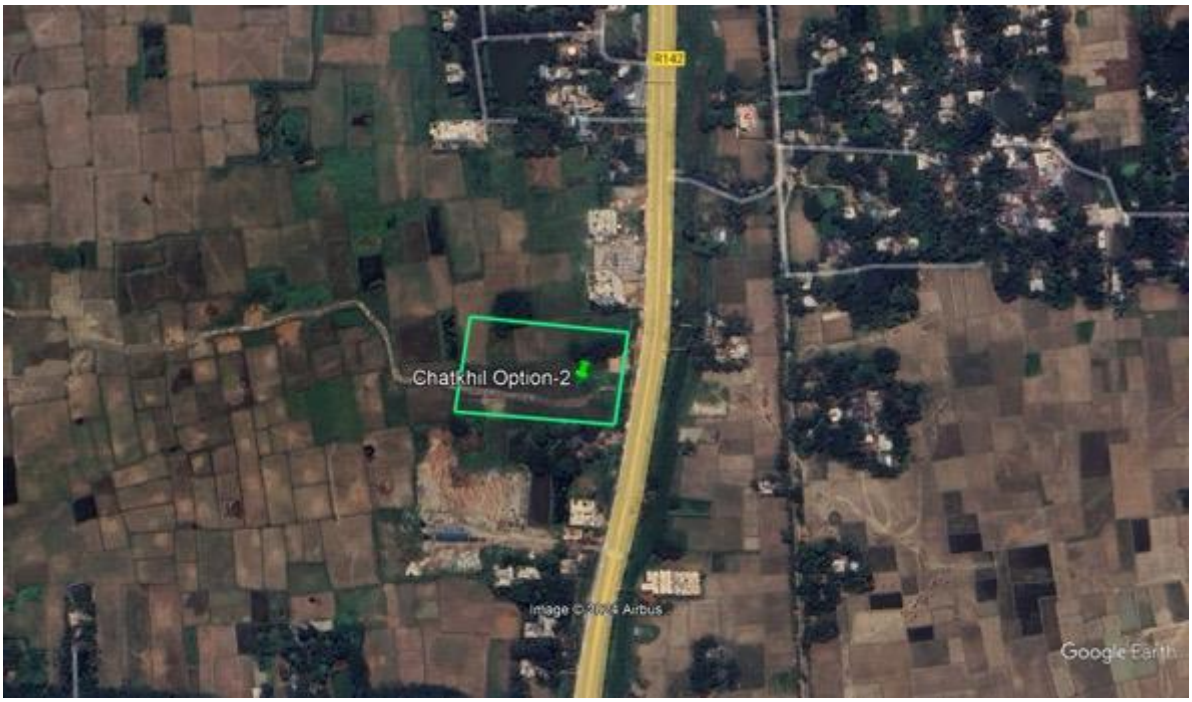
444. **Option-1:** This place is situated at Kaluai mouza of Chatkhil Upazila under Noakhali district [Lat: 23° 3'24.21"N, long: 91° 4'54.05"E]. The land is mainly private where one crops agricultural activities are carried out. The minimum population density and avoidance of human habitation is possible. Transmission lines can be moved in and out of the substation without any damage. The existing line is near. So, it will be very easy to in and out of the line from the substation. The market value of land is relatively low.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.



Google Map Location for Chatkhil Substation Option-1 (Final)

445. **Option-2:** This place is situated at Bagadia of Chatkhil Upazila under Noakhali district [Lat: 23° 1'31.69"N, Long: 91° 5'41.69"E]. The land is mainly private where triple crops agricultural activities are carried out. Option-2 is harder to avoid human habitation than option-1. So, it will be a problem to in and out of the line from the substation in future. In some places it will be impossible to lay transmission lines.

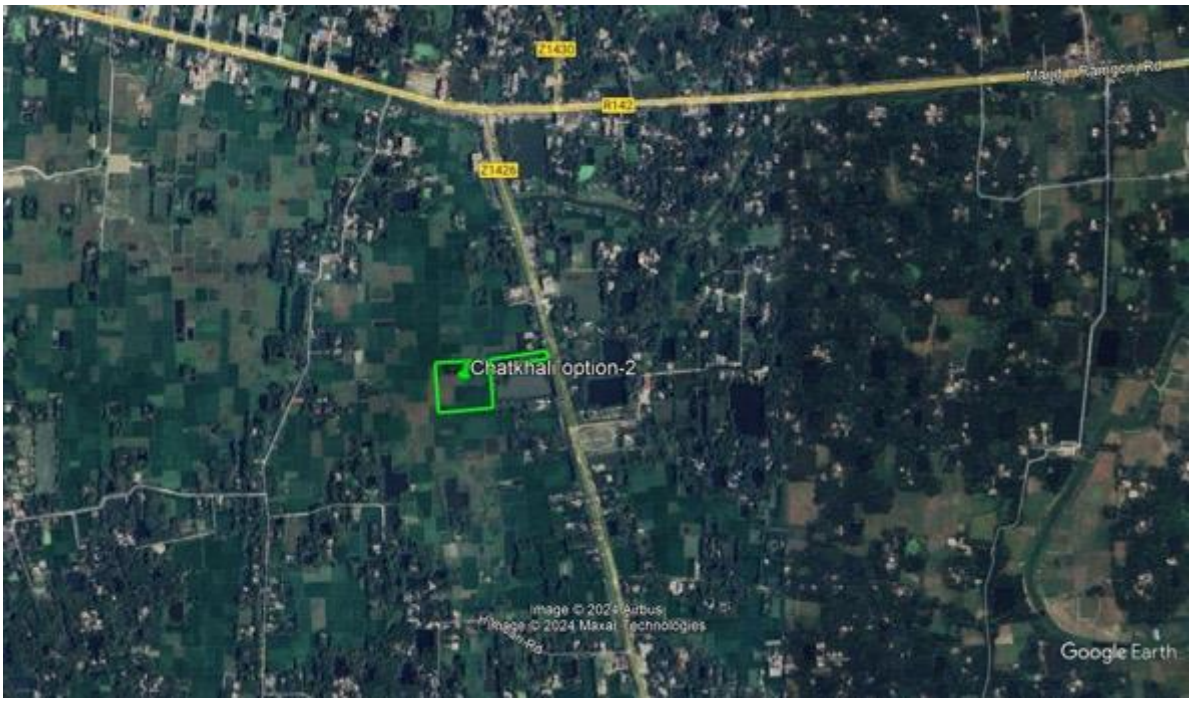


Google Map Location for Chatkhil Substation Option-2

446. **Option-3:** This place is situated at Tusi mouza of Chatkhil Upazila under Noakhali district [Lat: 23° 3'14.92"N, Long: 90°59'6.31"E]. The land is mainly private where triple crops agricultural activities are carried out. Densely populated area Avoidance of human habitation is not possible. The market value of

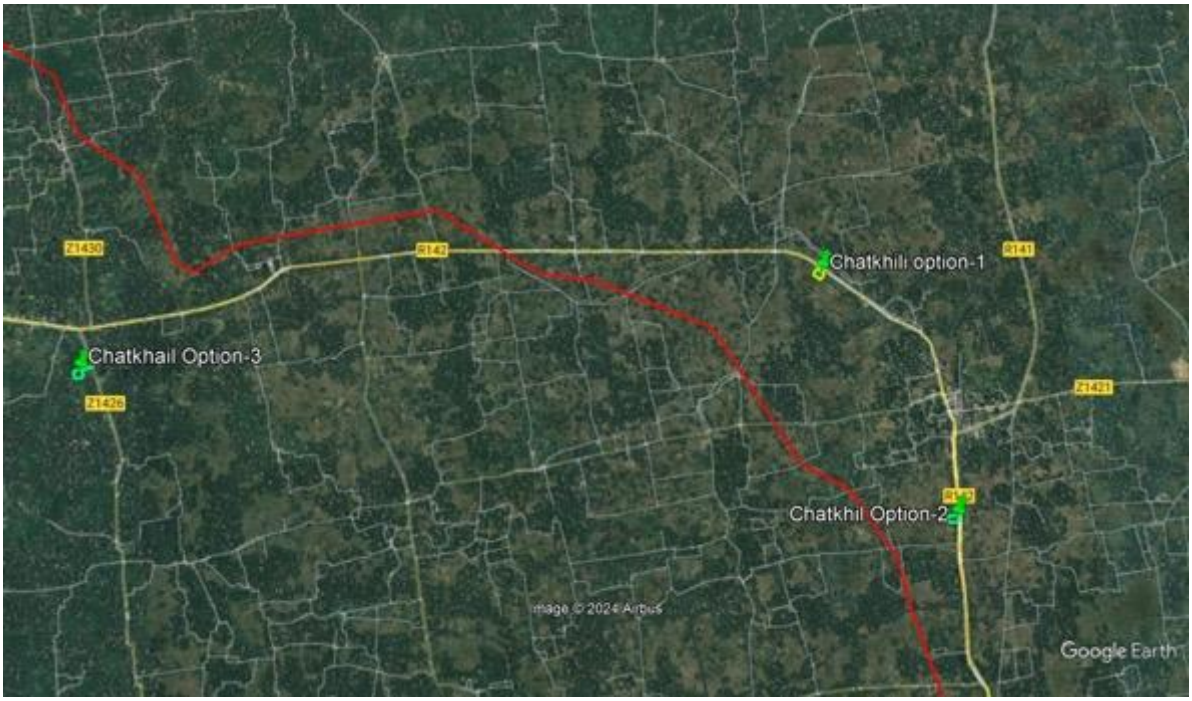
INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

land is relatively high. As the existing line is very close, it will be a problem to in and out of the line from the substation in future.



Google Map Location for Chatkhil Substation Option-3

447. The locations of the above-described siting options are shown in below figures while the technical, financial, economic, environmental and social aspects of these alternatives are presented in the below Table 7.10.



Google Map Locations of Three Sitting Options for Chatkhil Substation

Table 7.10: Comparative Analysis of Site Selection at Chatkhil 132/33kV AIS Substation

Attributes	Option-1 (Final)	Option-2	Option-3

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Attributes	Option-1 (Final)	Option-2	Option-3
Technical Aspects			
Land Use	Agriculture	Agriculture	Agriculture
Road Condition	Good	Moderately Good	Moderately Good
Transmission line shifting Required	No	No	No
Land filling work	Medium	High	High
Scope of future Expansion	Yes	Yes	Yes
Land ownership	Private	Private	Private
Complexity Level of Acquisition	Medium	High	High
Meet Present Demand	Yes	Yes	Yes
Power System Growth	Yes	Yes	Yes
Meets Future Demand	Yes	Yes	Yes
Financial and Economic Aspects			
Implementation Expense	Medium	High	High
Environmental and Social Aspects			
Construction related impacts	Medium	High	Medium
Nearby Water Body	No	No	No
Inundated or waterlogged land	No	No	No
Noise	Medium	High	High
Involuntary resettlement	No	No	No

448. **Observation:** In view of the lower cost and less significant environmental and social issues as shown in table above, the Option-1 is the preferred for final option and therefore it has been selected. Environmental Quality Monitoring will be conducted again by the EPC Contractor at the final selected site along with detailed design.

7.3.9 Paikgacha 132/33 kV Substation

449. The newly proposed Paikgacha 132/33 kV AIS substation comprises double bus 2×50/75 MVA (132/33kV), and required AIS bay of 7 numbers of 132 kV including 3 future provision, will be built AIS type with a control room and transformers being placed outdoor in an area of 5 acres of land in Khulna district.

450. **Option-1 (Final):** This place is situated at Chak Bogura mouza of Paikgacha Upazila under Khulna district [Lat: 22°34'44.78"N, long: 89°17'53.22"E]. The land is mainly private where one crops agricultural activities are carried out. The minimum population density and avoidance of human habitation is possible. Transmission lines can be moved in and out of the substation without any damage. The existing line is near. So, it will be very easy to in and out of the line from the substation. The market value of land is relatively low.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.



Google Map of Paikgacha Substation Location

Table 7.11: Comparative Analysis of Site Selection at Paikgacha 132/33kV AIS Substation

Attributes	Option-1 (Final)
Technical Aspects	
Land Use	under PGCB ownership
Road Condition	Good
Transmission line shifting Required	No
Land filling work	Medium
Scope of future Expansion	Yes
Land ownership	PGCB
Complexity Level of Acquisition	Completed in 2021
Meet Present Demand	Yes
Power System Growth	Yes
Meets Future Demand	Yes
Financial and Economic Aspects	
Implementation Expense	Medium
Environmental and Social Aspects	
Construction related impacts	Medium
Nearby Water Body	No
Inundated or waterlogged land	Inundated
Loss of vegetation	Medium
Noise	Medium
Involuntary resettlement	No

451. The proposed land for Paikgacha 132/33 grid substation has been acquired by PGCB in 2021. Survey for other options and comparative analysis is not required for Paikgacha. Environmental Quality Monitoring will be conducted again by the EPC Contractor at the final selected site along with detailed design.

7.3.10 Mathbaria 132/33 kV Substation

452. The newly proposed Mathbaria 132/33 kV AIS substation comprises double bus 2×50/75 MVA

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

(132/33kV), and required AIS bay of 7 numbers of 132 kV including 3 future provision, will be built AIS type with a control room and transformers being placed outdoor in an area of 4 acres of land in Perojpur district.

453. **Option-1:** This place is situated at Gulisakhali mouza of Rajapur Upazila under Jhalkathi district [Lat: 22°13'55.41"N, long: 89°58'16.31"E]. The land is mainly private where two crops agricultural activities are carried out. The minimum population density and avoidance of human habitation is possible. Transmission lines can be moved in and out of the substation without any damage. The existing line is near. So, it will be very easy to in and out of the line from the substation. The market value of land is relatively low.



Google Map Location for Mathbaria Substation Option-1 (Final)

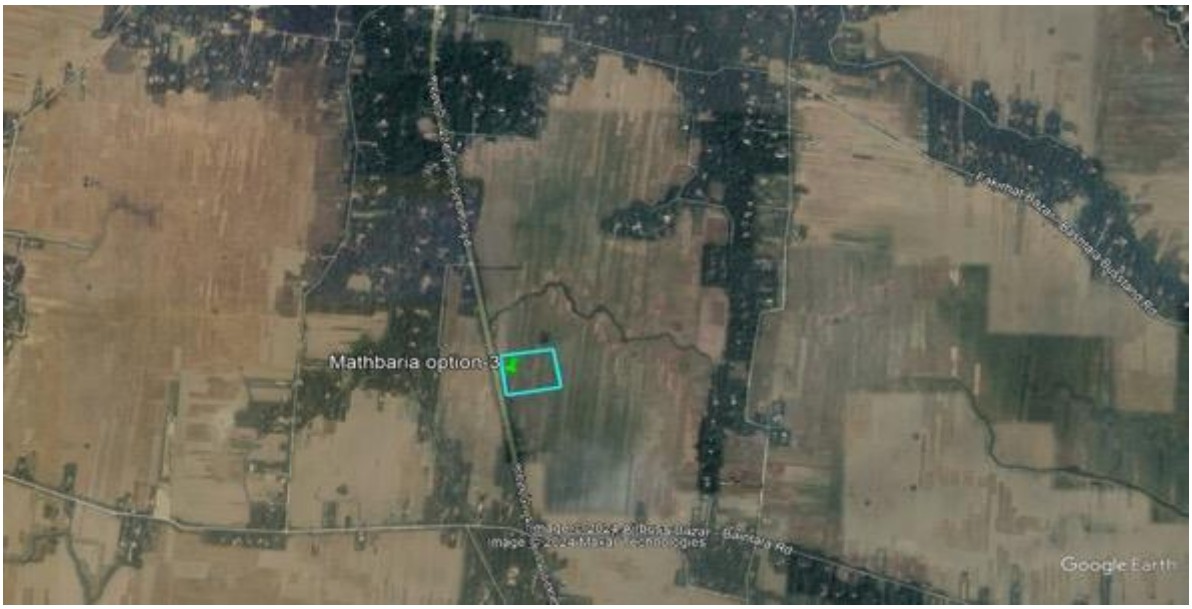
454. **Option-2:** This place is situated at Mathbaria Upazila under Pirojpur district [Lat: 22°10'0.90"N, Long: 89°57'49.88"E]. The land is mainly private where triple crops agricultural activities are carried out. Option-2 is harder to avoid human habitation than option-1. So, it will be a problem to in and out of the line from the substation in future. In some places it will be impossible to lay transmission lines.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.



Google Map Location for Mathbaria Substation Option-2

455. **Option-3:** This place is situated at Mathbaria Upazila under Pirojpur district [Lat:22° 9'7.43"N; Long: 89°57'51.14"E]. The land is mainly private where triple crops agricultural activities are carried out. Densely populated area Avoidance of human habitation is not possible. The market value of land is relatively high. As the existing line is very close, it will be a problem to in and out of the line from the substation in future.



Google Map Location for Mathbaria Substation Option-3

456. The locations of the above-described siting options are shown in below figures while the technical, financial, economic, environmental and social aspects of these alternatives are presented in the below Table 7.12.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.



Google Map Locations of Three Sitting Options for Mathbaria Substation

Table 7.12: Comparative Analysis of Site Selection at Mathbaria 132/33kV AIS Substation

Attributes	Option-1 (Final)	Option-2	Option-3
Technical Aspects			
Land Use	Agriculture	Agriculture	Agriculture
Road Condition	Good	Moderately Good	Moderately Good
Transmission line shifting Required	No	No	No
Land filling work	Medium	High	High
Scope of future Expansion	Yes	Yes	Yes
Land ownership	Private	Private	Private
Complexity Level of Acquisition	Medium	High	High
Meet Present Demand	Yes	Yes	Yes
Power System Growth	Yes	Yes	Yes
Meets Future Demand	Yes	Yes	Yes
Financial and Economic Aspects			
Implementation Expense	Medium	High	High
Environmental and Social Aspects			
Construction related impacts	Medium	High	Medium
Nearby Water Body	No	No	No
Inundated or waterlogged land	No	No	No
Loss of vegetation	Medium	High	Medium
Noise	Medium	High	High
Involuntary resettlement	No	No	No

457. **Observation:** In view of the lower cost and less significant environmental and social issues as shown in table above, the Option-1 is the preferred for final option and therefore it has been selected. Environmental Quality Monitoring will be conducted again by the EPC Contractor at the final selected site along with detailed design.

7.4 Alternatives of Transmission Line Routes

458. The following criteria were considered for selecting the alignment of the route:

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

- Ensuring the route length is optimal and the number of angle towers is minimized to reduce costs and construction complexity.
- Assessing the ease of excavation activities, considering the alignment and location of nearby structures to minimize construction difficulties.
- Evaluating the potential impact on local settlements to minimize displacement and disruption to communities.
- Reviewing environmental and social factors to ensure minimal negative impacts across all options.
- Ensuring the route is accessible for construction and maintenance activities.
- Considering current land use to avoid areas that would require significant changes or disruptions.
- Avoiding routes that would adversely affect natural habitats and protected areas (like reserve forests, wildlife sanctuary, national parks, etc.).
- Selecting routes that minimize vulnerability to natural and man-made disasters, such as floods, earthquakes, and industrial hazards.
- Existence of open agricultural land;
- Avoiding urban areas as much as possible;
- Avoiding river crossings, water bodies;
- As per ECR 2023, no ponds can be filled up, therefore all ponds are avoided;
- Considering railway crossings and existing power distribution lines;
- Considering restricted area (like cantonment, KPI, etc.);
- Future expansion plan of transmission system.

459. The criteria for selecting the transmission line alignment included optimizing route length and angle towers, minimizing excavation difficulties, reducing impact on local settlements, addressing environmental and social factors, ensuring accessibility for construction and maintenance, considering current land use patterns, avoiding disruption to natural habitats, and minimizing vulnerability to natural and man-made disasters.

460. Three alternatives transmission line routes are considered for each of the proposed new transmission lines. For these alternate routes, technical, financial, economic, environmental, and social aspects were considered through consultation with local stakeholders, analyzing of maps and underground utilities, satellite images, traffic condition. After detailed route survey and analysis, most suitable route has been selected considering the technical and financial aspects as well as environmental and social.

7.4.1 Alternative Routes for LILO of Matarbari PP – Banskhali PP 400kV Line at Pekua Transmission Line

461. The routing options for the LILO of Matarbari PP – Banskhali PP 400kV Overhead transmission line are analyzed in below Table 7.13.

Table 7.13: Routing Options for LILO of Matarbari– Banskhali 400kV Transmission Line

Attributes	Option-1 (Final)	Option-2	Option-3
Technical and Financial Aspects			
Considering Length	12.66 km	7.24 km	7.5 km
Difficulty of Implementation with respect to excavations	Medium	High	High
Crossing of any other existing or proposed transmission lines	Yes - 11kV - 33kV	Yes - 11kV - 33kV	Yes - 11kV - 33kV
Power line (Nos.) 11kV	3	3	3

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

33kV 132kV 230kV 400kV			
Angle Towers	9	11	13
Existing important infrastructure	No	No	No
Terrain (km)– Plain	6.75 km	7.24 km	7.5 km
Terrain (km)– Hilly	0	0	0
Implementation expense	Medium	High	High
Environmental and social aspects			
Construction related impacts (such as dust, noise, air emissions, OHS and public safety issues)	Moderate	High	High
Pucca Road Crossing	1	1	1
Katcha Road Crossing	11	10	11
Canal Crossing	12	11	13
River Crossing	Yes	Yes	Yes
Railway Crossing	No	No	No
Reserve Forest	No	No	No
Protected Area	No	No	No
Ecologically Critical Area (ECA)	No	No	No
Ramsar or IBA	No	No	No
River erosion	No	No	No
Impact on Settlements	Yes (Medium)	Yes (high)	Yes (high)
Involuntary Resettlement Impacts	No	No	No

462. **Inference:** Although Options 1 and 2 offer nearly the same route length and angle towers, the route survey indicates that Option 1 presents the least difficulty regarding excavation activities due to its alignment and proximity to nearby structures. Option 2 and Option 3 have a higher impact on settlements. All other environmental and social issues are quite similar across the three options. Therefore, Option 1 has been selected for the 12.66 km LILO of the 400kV transmission line from Matarbari PP to Banskhali PP. The routing options for the LILO of the Matarbari PP – Banskhali PP transmission line are shown in the figure below.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

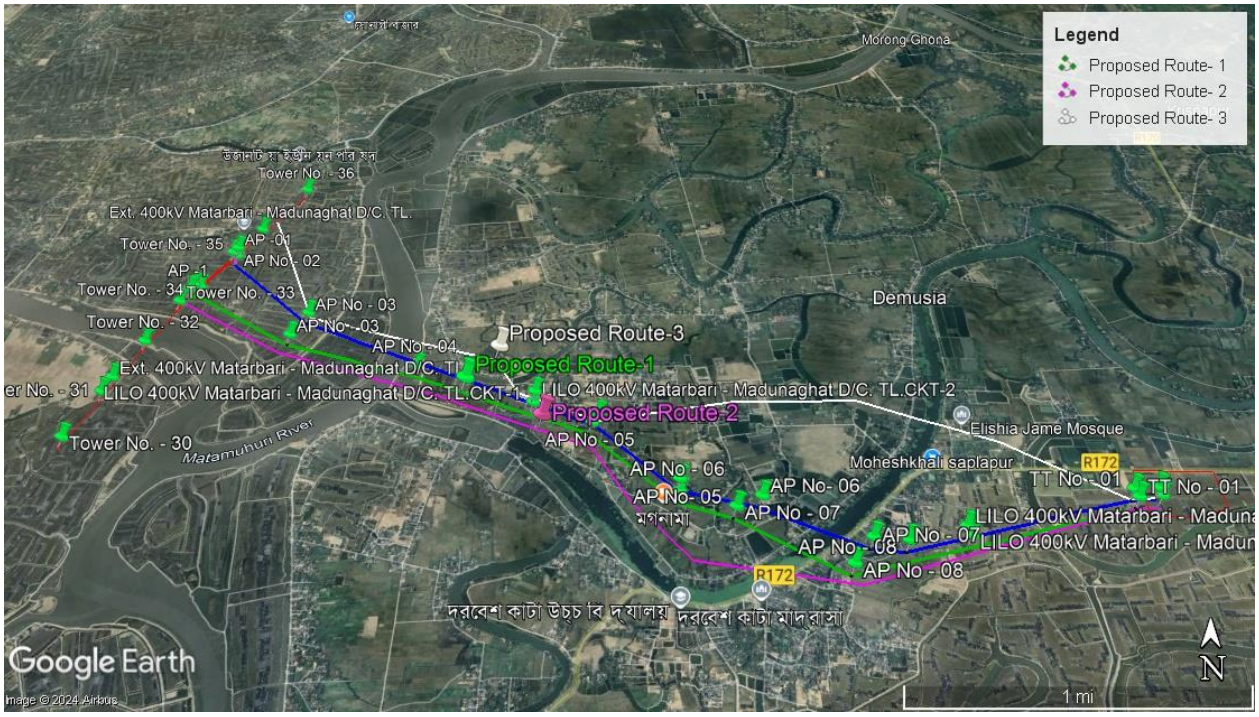


Figure 7.1: Google Map Location for Alternative Routes for LILO Of Matarbari PP – Banskhali PP Transmission Line

7.4.2 Alternative Routes for LILO of Anwara-Cox's Bazar 230kV Line at Pekua Transmission Line

463. The routing options for the LILO of Anwara-Cox's Bazar 230kV Overhead transmission line are analyzed in Table 7.14 below.

Table 7.14: Routing Options for LILO of Anwara-Cox's Bazar 230kV Line

Attributes	Option-1 (Final)	Option-2	Option-3
Technical and Financial Aspects			
Considering Length	0.5 km	0.7 km	0.85 km
Difficulty of Implementation with respect to excavations	Medium	High	High
Crossing of any other existing or proposed transmission lines	No -	No -	No -
Power line (Nos.) 11kV 33kV 132kV 230kV 400kV	0	0	0
Angle Towers	2	3	4
Existing important infrastructure	No	No	No
Terrain (km)– Plain	0.5 km	0.7 km	0.85 km
Terrain (km)– Hilly	0	0	0
Implementation expense	Medium	High	High
Environmental and social aspects			
Construction related impacts (such as dust, noise, air emissions, OHS and public safety issues)	Moderate	High	High
Pucca Road Crossing	0	0	0
Katcha Road Crossing	0	0	0

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Attributes	Option-1 (Final)	Option-2	Option-3
Canal Crossing	2	2	2
River Crossing	No	No	No
Railway Crossing	No	No	No
Reserve Forest	No	No	No
Ecologically Critical Area (ECA)	No	No	No
Ramsar or IBA	No	No	No
River erosion	No	No	No
Impact on Settlements	No	No	No
Involuntary Resettlement Impacts	No	No	No

464. **Inference:** Although three options offer almost same route length and angle towers, based on the route survey, it is identified that Option-1 will have the least difficulty with respect to excavation related activities due to its alignment and location of nearby structures. Impact on the settlements is comparatively low in option-1 with respect to option-2 and 3; all other environmental and social issues are quite similar for all three options. Therefore, Option-1 has been selected for the LILO of Anwara-Cox's Bazar 230kV double circuit transmission line.

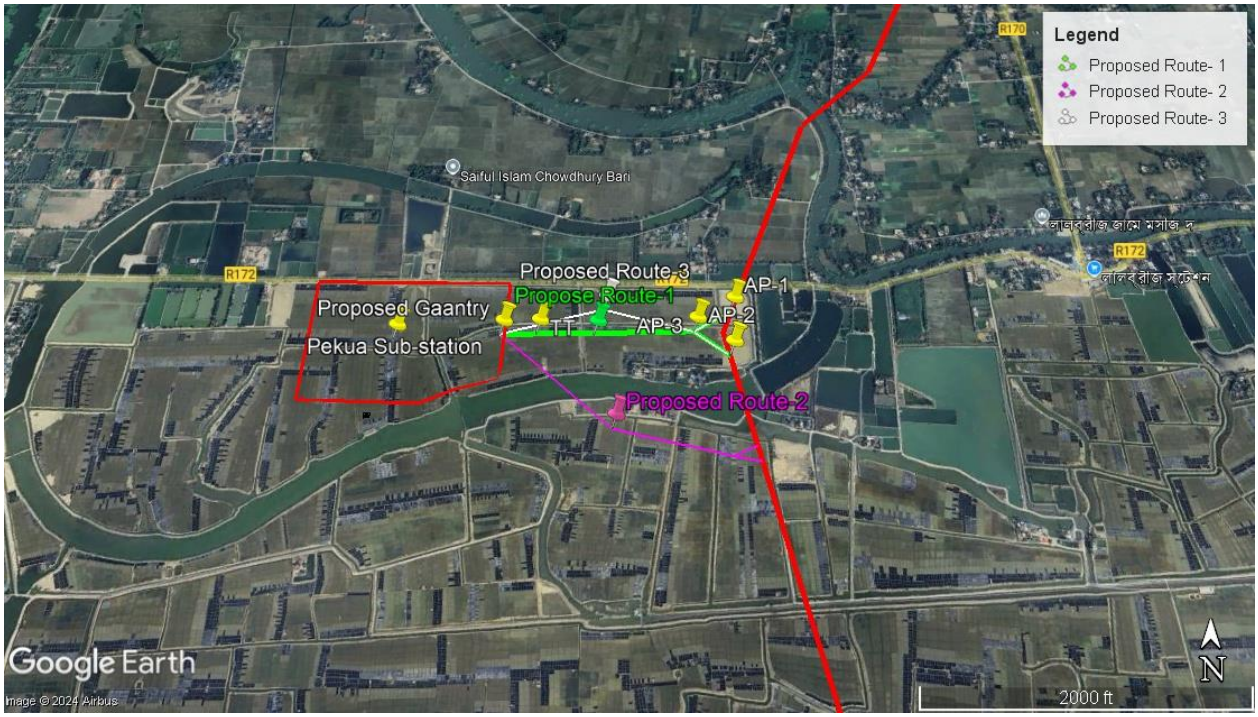


Figure 7.2: Google Map Location for Alternative Routes for LILO of Anwara-Cox's Bazar 230kV Transmission Line

7.4.3 Alternative Routes for LILO of Existing Matarbari – Chakaria 132kV Line at Pekua Transmission Line

465. The routing options for the LILO of Existing Matarbari – Chakaria 132kV line Overhead transmission line is analyzed in Table 7.15 below.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Table 7.15: Routing Options for LILO of Matarbari – Chakaria 132kV Transmission Line

Attributes	Option-1 (Final)	Option-2	Option-3
Technical and Financial Aspects			
Considering Length	1.3 km	1.4 km	1.45 km
Difficulty of Implementation with respect to excavations	Medium	High	High
Crossing of any other existing or proposed transmission lines	No -	No -	No -
Power line (Nos.) 11kV 33kV 132kV 230kV 400kV	0	0	0
Angle Towers	4	5	5
Existing important infrastructure	No	No	No
Terrain (km)– Plain	1.26 km	1.4 km	1.45 km
Terrain (km)– Hilly	0	0	0
Implementation expense	Medium	High	High
Environmental and social aspects			
Construction related impacts (such as dust, noise, air emissions, OHS and public safety issues)	Moderate	High	High
Pucca Road Crossing	0	0	0
Katcha Road Crossing Canal Crossing	0 1	0 1	0 1
River Crossing	No	No	No
Railway Crossing	No	No	No
Reserve Forest	No	No	No
Ecologically Critical Area (ECA)	No	No	No
Ramsar or IBA	No	No	No
River erosion	No	No	No
Impact on Settlements	No	No	No
Involuntary Resettlement Impacts	No	No	No

466. **Inference:** Based on the route survey, it is identified that the Option-1 have the least difficulty with respect to excavation related activities; and will have lower impact on settlements and structures with respect to other two options. At the same time, Option-1 offers the shortest route length for the transmission line as well, all other environmental and social issues are quite similar for all three options. Therefore, Option-1 has been selected for the LILO of Existing Matarbari – Chakaria 132kV transmission line. The routing options for the LILO of Existing Matarbari – Chakaria 132kV transmission line are shown below.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

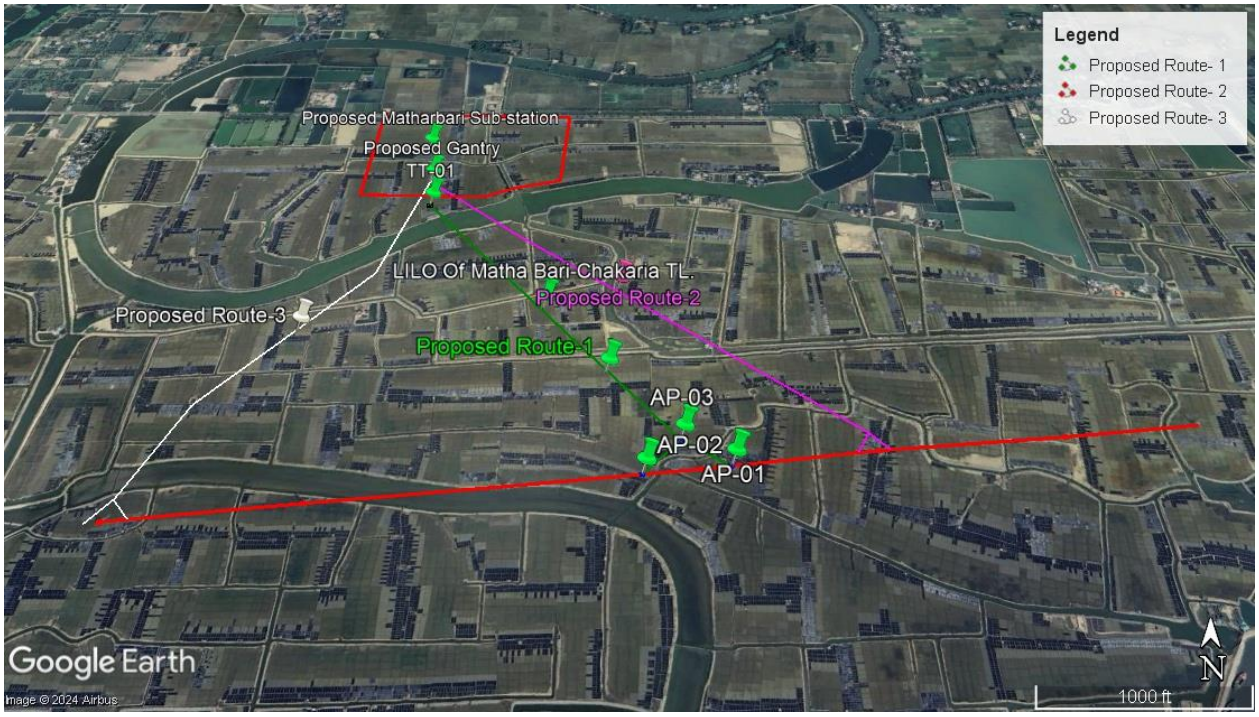


Figure 7.3: Google Map Location for Alternative Routes for LILO of Existing Matarbari – Chakaria 132kV Transmission Line

7.4.4 Alternative Routes for LILO of Sripur-Ashuganj 230kV Double Circuit Line at Monohardi Transmission Line

467. The routing options for the LILO of Sripur-Ashuganj 230kV Overhead transmission line are analyzed in below in Table 7.16.

Table 7.16: Routing Options for LILO of Sripur-Ashuganj 230kV Transmission Line

Attributes	Option-1 (Final)	Option-2	Option-3
Technical and Financial Aspects			
Considering Length	5.12 km	5.5 km	6.0 km
Difficulty of Implementation with respect to excavations	Medium	High	High
Crossing of any other existing or proposed transmission lines	Yes - 11kV - 33kV	Yes - 11kV d - 33kV	Yes - 11kV - 33kV
Power line (Nos.) 11kV 33kV 132kV 230kV 400kV	8	8	8
Angle Towers	7	8	9
Existing important infrastructure	No	No	No
Terrain (km)– Plain	5.19 km	5.5 km	6.0 km
Terrain (km)– Hilly	0	0	0
Implementation expense	Medium	High	High
Environmental and social aspects			
Construction related impacts (such as dust, noise, air emissions, OHS and public safety issues)	Moderate	High	High
Pucca Road Crossing	7	8	9

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Attributes	Option-1 (Final)	Option-2	Option-3
Katcha Road Crossing Canal Crossing	4 5	4 5	4 6
River Crossing	No	No	No
Railway Crossing	No	No	No
Reserve Forest	No	No	No
Ecologically Critical Area (ECA)	No	No	No
Ramsar or IBA	No	No	No
River erosion	No	No	No
Impact on Settlements	Yes (Medium)	Yes (high)	Yes (high)
Involuntary Resettlement Impacts	No	No	No

468. **Inference:** based on the route survey, it is identified that Option-1 have least angle tower and will have the least difficulty with respect to excavation related activities due to its alignment and location of nearby structures. Impact on the settlements and trees is low in option-1 where option-2 and 3 have the high impact in settlement and involuntary resettlement effects; all other environmental and social issues are quite similar for all three options. Therefore, Option-1 has been selected for the LILO of Sripur-Ashuganj 230kV transmission line. The routing options for the LILO of Sripur-Ashuganj 230kV transmission line are shown in below.

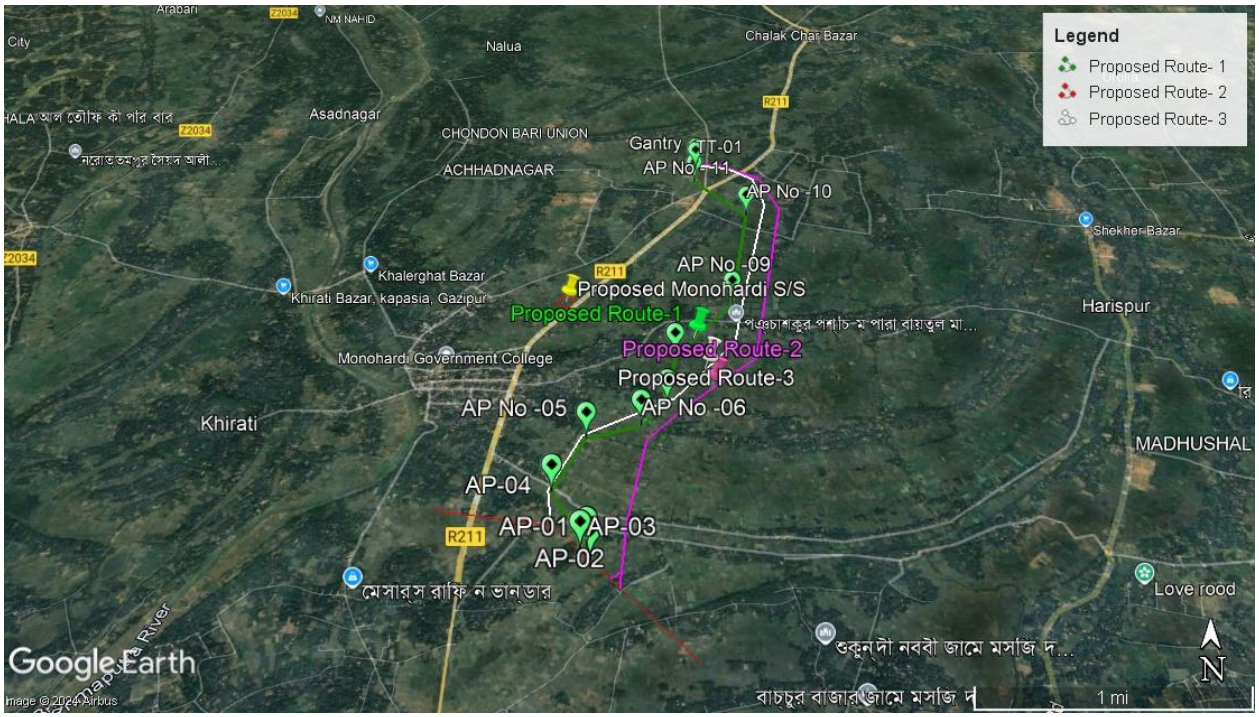


Figure 7.4: Google Map Location for Alternative Routes for LILO of Sripur-Ashuganj 230kV Double Transmission Line

7.4.5 Alternative Routes for LILO of Cumilla(N) – Shahjibazar PP 230kV Double Circuit Line at Madhabpur Transmission Line

469. The routing options for the LILO of Cumilla(N) – Shahjibazar PP 230kV double circuit Overhead transmission line is analyzed in table below.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Table 7.17: Routing options for the LILO of Cumilla(N) – Shahjibazar PP 230kV double circuit Overhead transmission line

Attributes	Option-1 (Final)	Option-2	Option-3
Technical and Financial Aspects			
Considering Length	• 1.2 km	1.0 km	1.2 km
Difficulty of Implementation with respect to excavations	Medium	High	High
Crossing of any other existing or proposed transmission lines	- No	- No	- No
Power line (Nos.) 11kV 33kV 132kV 230kV 400kV	0	0	0
Angle Towers	4	4	5
Existing important infrastructure	No	No	No
Terrain (km)– Plain	0.917 km	1.0 km	1.2 km
Terrain (km)– Hilly	0	0	0
Implementation expense	Medium	High	High
Environmental and social aspects			
Construction related impacts (such as dust, noise, air emissions, OHS and public safety issues)	Moderate	High	High
Pucca Road Crossing	1	1	1
Katcha Road Crossing Canal Crossing	1 0	1 0	1 0
River Crossing	No	No	No
Railway Crossing	No	No	No
Reserve Forest	No	No	No
Ecologically Critical Area (ECA)	No	No	No
Ramsar or IBA	No	No	No
River erosion	No	No	No
Impact on Settlements	No	No	No
Involuntary Resettlement Impacts	No	No	No

470. **Inference:** Based on the route survey, it is identified that although Option-1 have long route length but it will be the least difficulty with respect to excavation related activities due to its alignment and location of nearby structures. Impact on the settlements is low in option-1 where option-2 and 3 have the medium impact; all other environmental and social issues are quite similar for all three options. Therefore, Option-1 has been selected for the LILO of Cumilla(N) – Shahjibazar PP 230kV transmission line.

471. The routing options for the LILO of Cumilla(N) – Shahjibazar PP 230kV transmission line is shown in below Figure 7.5.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.



Figure 7.5: Google Map Location for Alternative Routes for LILO of Cumilla(N) – Shahjibazar PP 230kV at Madhabpur Transmission Line

7.4.6 Alternative Routes for Monohardi-Bajitpur 132kV Double Circuit Line Transmission Line

472. The routing options for the Monohardi-Bajitpur 132kV transmission line are analyzed in below in Table 7.18.

Table 7.18: Routing Options for Monohardi-Bajitpur 132kV Transmission Line

Attributes	Option-1 (Final)	Option-2	Option-3
Technical and Financial Aspects			
Considering Length	• 20.52 km	18.95 km	19.91 km
Difficulty of Implementation with respect to excavations	Medium	High	High
Crossing of any other existing or proposed transmission lines	Yes - 11kV - 33kV	Yes - 11kV - 33kV	Yes - 11kV - 33kV
Power line (Nos.) 11kV 33kV 132kV 230kV 400kV	 20 1	 23 1	 25 1
Angle Towers	31	15	31
Existing important infrastructure	No	No	No
Terrain (km)– Plain	20.52 km	18.95 km	19.91 km
Terrain (km)– Hilly	0	0	0
Implementation expense	Medium	Medium	High
Environmental and social aspects			
Construction related impacts (such as dust, noise, air emissions, OHS and public safety issues)	Moderate	Medium	High
Pucca Road Crossing	26	31	28

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Attributes	Option-1 (Final)	Option-2	Option-3
Katcha Road Crossing Canal Crossing	10 4	15 5	13 4
River Crossing	1 (68.03m)	1 (68.03m)	1 (68.03m)
Railway Crossing	No	No	No
Reserve Forest	No	No	No
Ecologically Critical Area (ECA)	No	No	No
Ramsar or IBA	No	No	No
River erosion	No	No	No
Impact on Settlements	Yes (Medium)	Yes (Medium)	Yes (high)
Involuntary Resettlement Impacts	No	No	No

473. **Inference:** Based on the route survey, it is identified that Option-1 will have the least difficulty with respect to excavation related activities due to its alignment and location of nearby structures. Impact on the settlements is very low in option-1 with respect to option-3; all other environmental and social issues are quite similar for all three options. Therefore, Option-1 has been selected for the Monohardi-Bajitpur 132kV transmission line. The routing options for the Monohardi-Bajitpur 132kV transmission line are shown below.

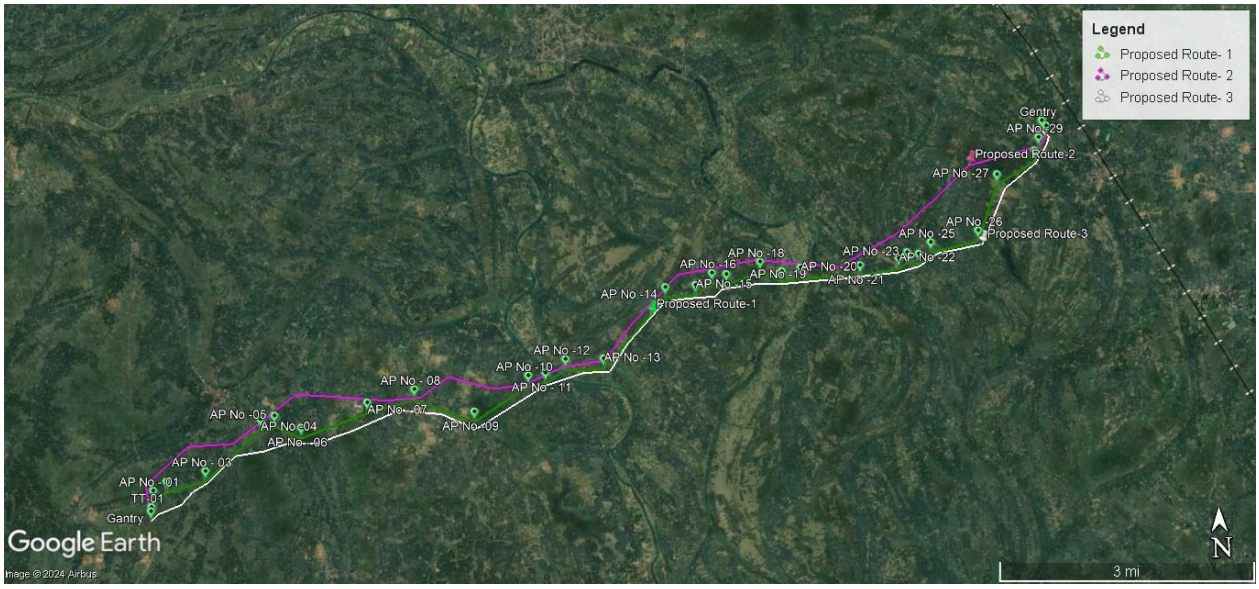


Figure 7.6: Google Map Location for Alternative Routes for Monohardi-Bajitpur 132kV Transmission Line

7.4.7 Alternative Routes for LILO of Shahjibazar – Brahmanbaria 132kV Double Circuit Line at Madhabpur Transmission Line

474. The routing options for the LILO of Shahjibazar – Brahmanbaria Overhead transmission line are analyzed in below Table 7.19.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Table 7.19: Routing Options for LILO of Shahjibazar – Brahmanbaria Transmission Line

Attributes	Option-1 (Final)	Option-2	Option-3
Technical and Financial Aspects			
Considering Length	• 1.2 km	1.4 km	1.5 km
Difficulty of Implementation with respect to excavations	Medium	High	High
Crossing of any other existing or proposed transmission lines	- No	- No	No
Power line (Nos.) 11kV 33kV 132kV 230kV 400kV			
Angle Towers	4	4	5
Existing important infrastructure	No	No	No
Terrain (km)– Plain	1.2 km	1.4 km	1.5 km
Terrain (km)– Hilly	0	0	0
Implementation expense	Medium	Medium	High
Environmental and social aspects			
Construction related impacts (such as dust, noise, air emissions, OHS and public safety issues)	Moderate	High	High
Pucca Road Crossing	0	0	0
Katcha Road Crossing Canal Crossing	0 1	0 1	0 1
River Crossing	No	No	No
Railway Crossing	No	No	No
Reserve Forest	No	No	No
Ecologically Critical Area (ECA)	No	No	No
Ramsar or IBA	No	No	No
River erosion	No	No	No
Impact on Settlements	No	No	No
Involuntary Resettlement Impacts	No	No	No

475. **Inference:** Based on the route survey, it is identified that Option-1 have least route length and will have the least difficulty with respect to excavation related activities due to its alignment and location of nearby structures. Impact on the settlements is comparatively low in option-1 with respect to option-2 and 3; all other environmental and social issues are quite similar for all three options. Therefore, Option-1 has been selected for the LILO of Shahjibazar – Brahmanbaria transmission line.

476. The routing options for the LILO of Shahjibazar – Brahmanbaria transmission line are shown in below.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.



Figure 7.7: Google Map Location for Alternative Routes for LILO of Shahjibazar – Brahmanbaria 132kV at Madhabpur Transmission Line

7.4.8 Alternative Routes for Gopalganj-Tungipara 132kV Double Circuit Line Transmission Line

477. The routing options for the Gopalganj-Tungipara Overhead transmission line are analyzed in below Table 7.20.

Table 7.20: Routing Options for Gopalganj-Tungipara Transmission Line

Attributes	Option-1 (Final)	Option-2	Option-3
Technical and Financial Aspects			
Considering Length	18.37 km	18.66 km	18.89 km
Difficulty of Implementation with respect to excavations	Medium	High	High
Crossing of any other existing or proposed transmission lines	Yes - 11kV - 33kV	Yes - 11kV - 33kV	Yes - 11kV - 33kV
Power line (Nos.) 11kV 33kV 132kV 230kV 400kV	 14 5 1 1	 16 5 1 1	 15 5 1 1
Angle Towers	13	14	15
Existing important infrastructure	No	No	No
Terrain (km)– Plain	18.36 km	18.66 km	18.89 km
Terrain (km)– Hilly	0	0	0
Implementation expense	Medium	High	High
Environmental and social aspects			
Construction related impacts (such as dust, noise, air emissions, OHS and public safety issues)	Moderate	High	High
Pucca Road Crossing	7	7	7

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Attributes	Option-1 (Final)	Option-2	Option-3
Katcha Road Crossing Canal Crossing	5 12	6 13	6 14
River Crossing	No	No	No
Railway Crossing	No	No	No
Reserve Forest	No	No	No
Ecologically Critical Area (ECA)	No	No	No
Ramsar or IBA	No	No	No
River erosion	No	No	No
Impact on Settlements	Yes (Medium)	Yes (high)	Yes (high)
Involuntary Resettlement Impacts	No	No	No

478. **Inference:** Although all the three options offer almost same route length and option-2 have the least angle towers however, based on the route survey, it is identified that Option-1 will have the least difficulty with respect to excavation related activities due to its alignment and location of nearby structures. Impact on the settlements is comparatively low in option-1 with respect to option-2 and 3; all other environmental and social issues are quite similar for all three options. Therefore, Option-1 has been selected for the Gopalganj-Tungipara 132kV transmission line.

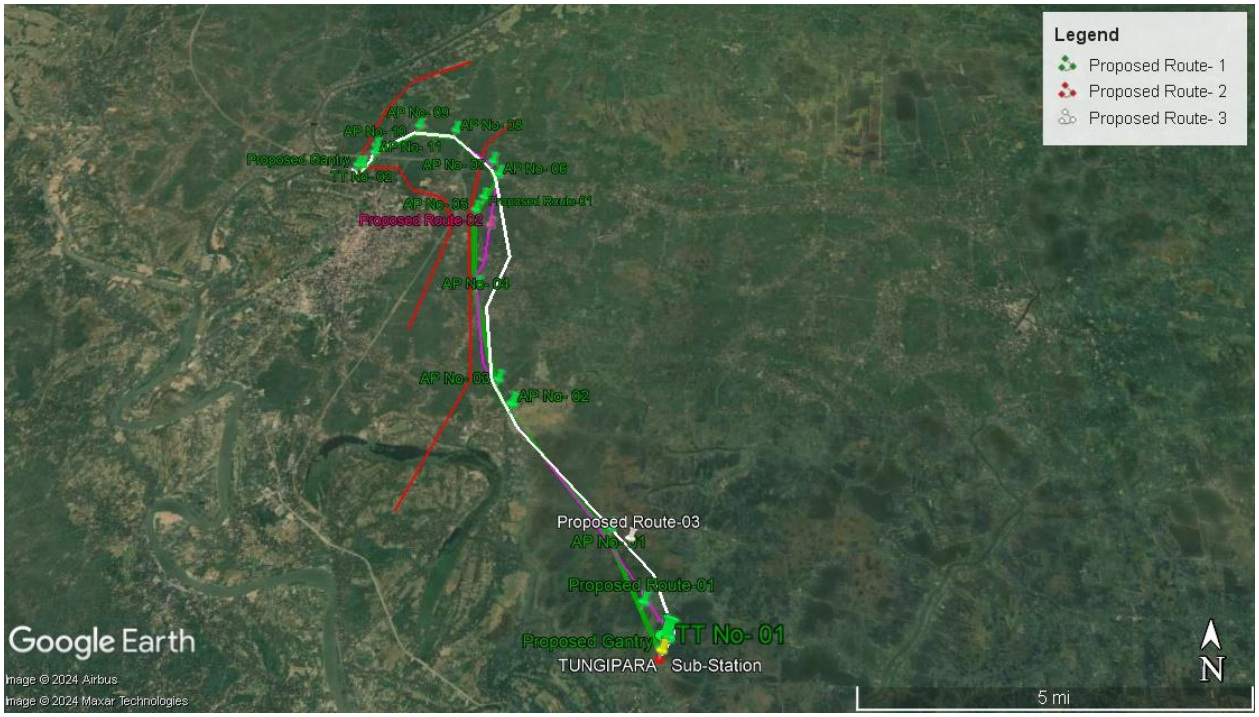


Figure 7.8: Google Map Location for Alternative Routes for Gopalganj-Tungipara 132kV Transmission Line

7.4.9 Alternative Routes Satkhira-Paikgacha 132kV Double Circuit Line Transmission Line

479. The routing options for the Satkhira-Paikgacha 132kV Overhead line in the

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

480. Table **7.21** below.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Table 7.21: Routing Options for Satkhira-Paikgacha 132kV Transmission Line

Attributes	Option-1 (Final)	Option-2	Option-3
Technical and Financial Aspects			
Considering Length	29.79 km	30.03 km	30.56 km
Difficulty of Implementation with respect to excavations	Medium	High	High
Crossing of any other existing or proposed transmission lines	Yes - 11kV - 33kV	Yes - 11kV - 33kV	Yes - 11kV - 33kV
Power line (Nos.) 11kV 33kV 132kV 230kV 400kV	25	28	32
Angle Towers	12	10	13
Existing important infrastructure	No	No	No
Terrain (km)– Plain	29.79 km	30.03 km	30.56 km
Terrain (km)– Hilly	0	0	0
Implementation expense	Medium	High	High
Environmental and social aspects			
Construction related impacts (such as dust, noise, air emissions, OHS and public safety issues)	Moderate	High	High
Pucca Road Crossing	10	12	11
Katcha Road Crossing Canal Crossing	23 27	26 32	24 30
River Crossing	No	No	No
Railway Crossing	No	No	No
Reserve Forest	No	No	No
Ecologically Critical Area (ECA)	No	No	No
Ramsar or IBA	No	No	No
River erosion	No	No	No
Impact on Settlements	Yes (Medium)	Yes (high)	Yes (high)
Involuntary Resettlement Impacts	No	No	No

481. **Inference:** Although all the three options offer almost same route length and option-2 have the least angle towers however, based on the route survey, it is identified that Option-1 will have the least difficulty with respect to excavation related activities due to its alignment and location of nearby structures. Impact on the settlements is comparatively low in option-1 with respect to option-2 and 3; all other environmental and social issues are quite similar for all three options. Therefore, Option-1 has been selected for the Satkhira-Paikgacha 132kV transmission line.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

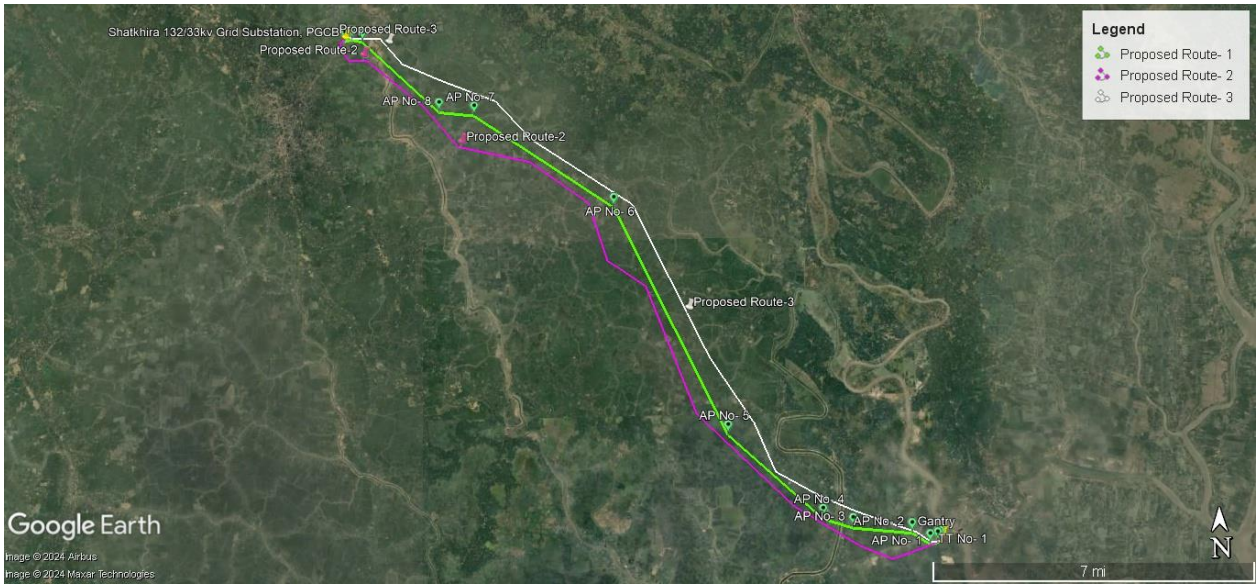


Figure 7.9: Google Map Location for Alternative Routes for the Satkhira-Paikgacha 132kV Transmission Line

7.4.10 Alternative Routes for Kachua- Matlab North 132kV Double Circuit Line Transmission Line

482. The routing options for the Kachua- Matlab North Overhead transmission line are analyzed in Table 7.22 below.

Table 7.22: Routing Options for Kachua- Matlab North Transmission Line

Attributes	Option-1 (Final)	Option-2	Option-3
Technical and Financial Aspects			
Considering Length	32.81 km	35.36 km	35.30 km
Difficulty of Implementation with respect to excavations	Medium	High	High
Crossing of any other existing or proposed transmission lines	Yes - 11kV - 33kV	Yes - 11kV - 33kV	Yes - 11kV - 33kV
Power line (Nos.) 11kV 33kV 132kV 230kV 400kV	 24 1	 28	 21
Angle Towers	43	35	48
Existing important infrastructure	No	No	No
Terrain (km)– Plain	32.81 km	35.36 km	35.30 km
Terrain (km)– Hilly	0	0	0
Implementation expense	Medium	High	High
Environmental and social aspects			
Construction related impacts (such as dust, noise, air emissions, OHS and public safety issues)	Moderate	High	High
Pucca Road Crossing	26	29	32
Katcha Road Crossing Canal Crossing	13 23	17 25	15 28
River Crossing	1 (260.75 m)	1 (260.75 m)	1 (260.75 m)

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Attributes	Option-1 (Final)	Option-2	Option-3
Railway Crossing	No	No	No
Reserve Forest	No	No	No
Ecologically Critical Area (ECA)	No	No	No
Bird habitat and declared IBA	No	No	No
River erosion	No	No	No
Impact on Settlements	Yes (Medium)	Yes (high)	Yes (high)
Involuntary Resettlement Impacts	No	No	No

483. **Inference:** Although all the three options offer almost same route length and option-2 & 3 offers least angle tower however, based on the route survey, it is identified that Option-1 will have the least difficulty with respect to excavation related activities due to its alignment and location of nearby structures. Impact on the settlements and trees is low in option-1 with respect to others; all other environmental and social issues are quite similar for all three options. Therefore, Option-1 has been selected for the Kachua- Matlab North transmission line. The routing options for the Kachua- Matlab North transmission line is shown in below.

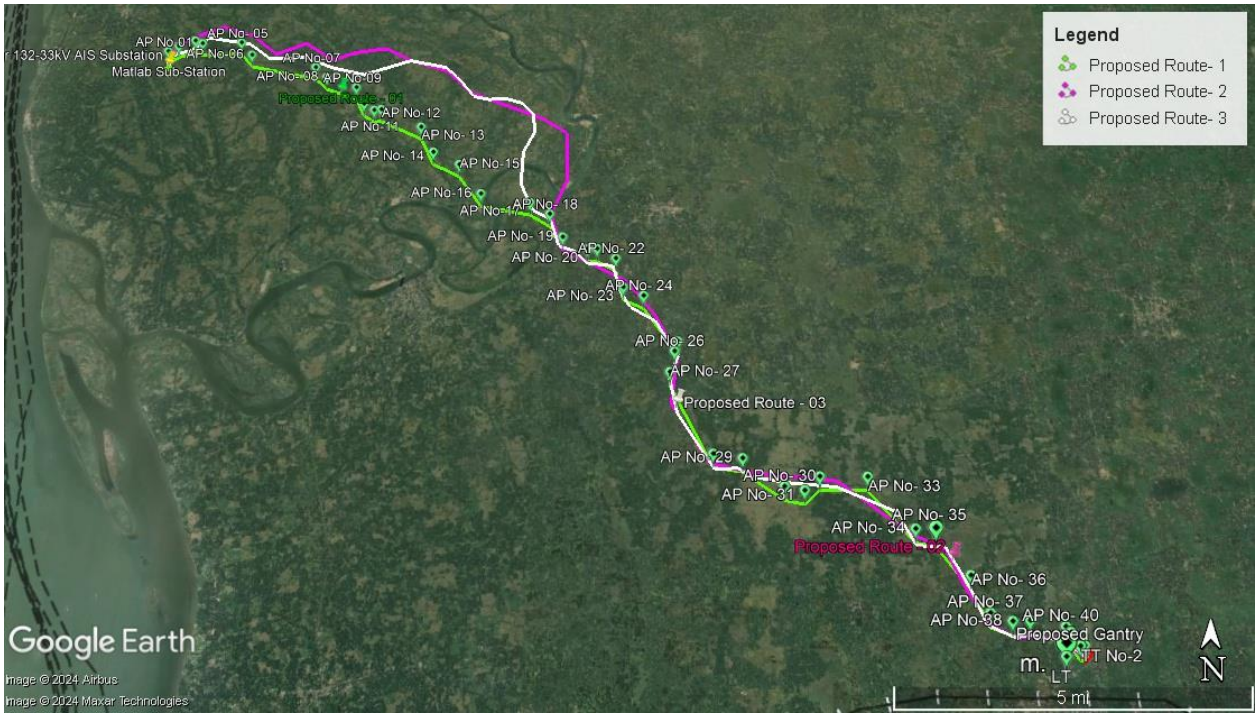


Figure 7.10: Google Map Location for Alternative Routes for Kachua- Matlab North Transmission Line

7.4.11 Alternative Routes for LILO of Chowmuhani-Ramganj 132kV Double Circuit Line at Chatkhil Transmission Line

484. The routing options for the LILO of Chowmuhani-Ramganj 132kV Overhead transmission line is analyzed in below Table 7.23.

Table 7.23: Routing Options for LILO of Chowmuhani-Ramganj 132kV Transmission Line

Attributes	Option-1 (Final)	Option-2	Option-3
Technical and Financial Aspects			
Considering Length	2.0 km	2.5 km	3.2 km

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Attributes	Option-1 (Final)	Option-2	Option-3
Difficulty of Implementation with respect to excavations	Medium	High	High
Crossing of any other existing or proposed transmission lines	Yes - 11kV - 33kV	Yes - 11kV - 33kV	Yes - 11kV - 33kV
Power line (Nos.) 11kV 33kV 132kV 230kV 400kV	 2 2	 2 2	 2 2
Angle Towers	4	5	7
Existing important infrastructure	No	No	No
Terrain (km)– Plain	2.0 km	2.5 km	3.2 km
Terrain (km)– Hilly	0	0	0
Implementation expense	Medium	High	High
Environmental and social aspects			
Construction related impacts (such as dust, noise, air emissions, OHS and public safety issues)	Moderate	High	High
Pucca Road Crossing	2	2	2
Katcha Road Crossing Canal Crossing	0 2	0 2	0 2
River Crossing	No	No	No
Railway Crossing	No	No	No
Reserve Forest	No	No	No
Ecologically Critical Area (ECA)	No	No	No
Ramsar or IBA	No	No	No
River erosion	No	No	No
Impact on Settlements	Yes (Medium)	Yes (high)	Yes (high)
Involuntary Resettlement Impacts	No	No	No

485. **Inference:** Based on the route survey, it is identified that Option-1 will have highest route length but it is the least difficulty with respect to excavation related activities due to its alignment and location of nearby structures. Impact on the settlements is low in Option-1 with respect to others; all other environmental and social issues are quite similar for all three options. Therefore, Option-1 has been selected for the LILO of Chowmuhani-Ramganj 132kV transmission line.

486. The routing options for the LILO of Chowmuhani-Ramganj 132kV transmission line are shown in below.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

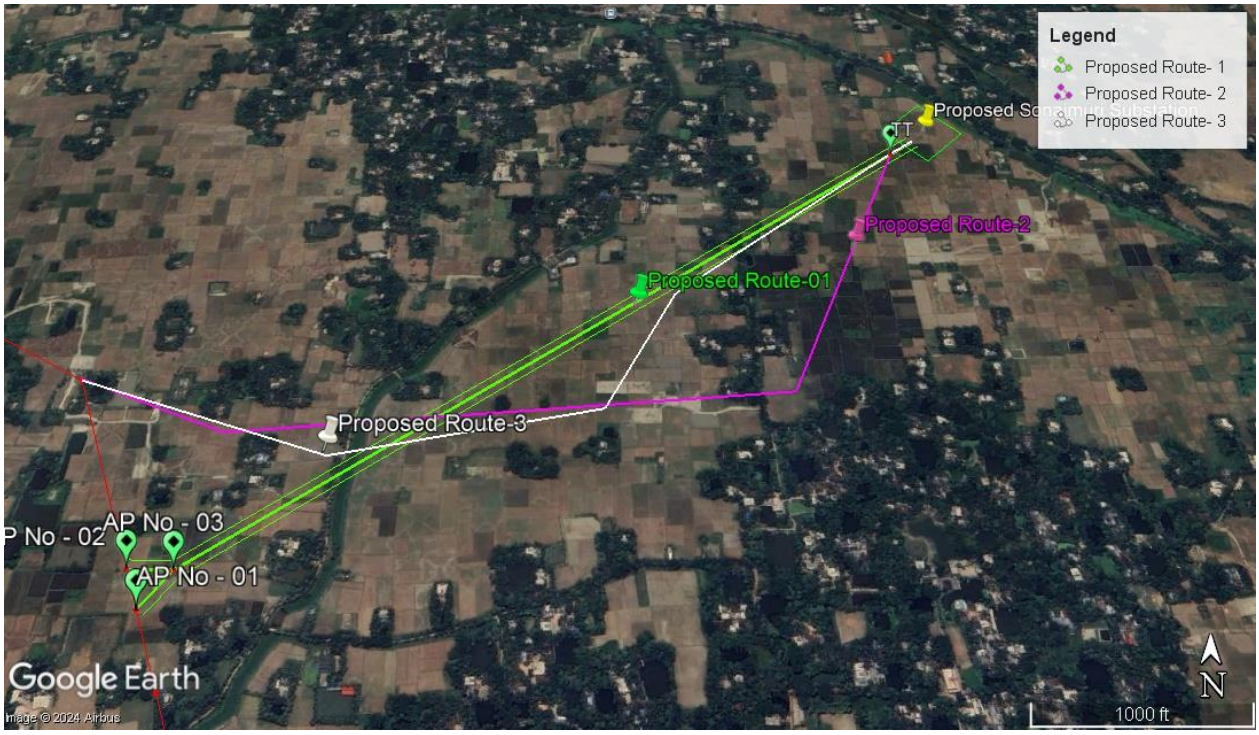


Figure 7.11: Google Map Location for Alternative Routes for LILO of Chowmuhani-Chandpur 132 at Ramganj Transmission Line

7.4.12 Alternative Routes for LILO of Bogura(S)-Naogaon 132kV Line at Dupchanchia Transmission Line

487. The routing options for the LILO of Bogura(S)-Naogaon 132kV Overhead transmission line is analyzed in Table 7.24 below.

Table 7.24: Routing Options for LILO of Bogura(S)-Naogaon 132kV Transmission Line

Attributes	Option-1 (Final)	Option-2	Option-3
Technical and Financial Aspects			
Considering Length	1.9 km	2.8 km	3.0 km
Difficulty of Implementation with respect to excavations	Medium	High	High
Crossing of any other existing or proposed transmission lines	Yes - 11kV - 33kV	Yes - 11kV - 33kV	Yes - 11kV - 33kV
Power line (Nos.) 11kV 33kV 132kV 230kV 400kV	 2 1	 2 1	 2 1
Angle Towers	4	4	5
Existing important infrastructure	No	No	No
Terrain (km)– Plain	2.5 km	2.8 km	3.0 km
Terrain (km)– Hilly	0	0	0
Implementation expense	Medium	High	High
Environmental and social aspects			
Construction related impacts (such as dust, noise, air emissions, OHS and public safety issues)	Moderate	High	High
Pucca Road Crossing	1	1	2

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Attributes	Option-1 (Final)	Option-2	Option-3
Katcha Road Crossing Canal Crossing	1 0	1 0	1 0
River Crossing	No	No	No
Railway Crossing	No	No	No
Reserve Forest	No	No	No
Ecologically Critical Area (ECA)	No	No	No
Ramsar or IBA	No	No	No
River erosion	No	No	No
Impact on Settlements	No	Yes (high)	Yes (high)
Involuntary Resettlement Impacts	No	No	No

488. **Inference:** Based on the route survey, it is identified that although Option-1 have long route length and it will have the least difficulty with respect to excavation related activities. Impact on the settlements is comparatively low in option-1 with respect to other options. Therefore, Option-1 has been selected for the LILO of Bogura(S)-Naogaon 132kV transmission line. The routing options for the LILO of Keraniganj- Nawabganj LILO of Bogura(S)-Naogaon 132kV transmission line are shown below.

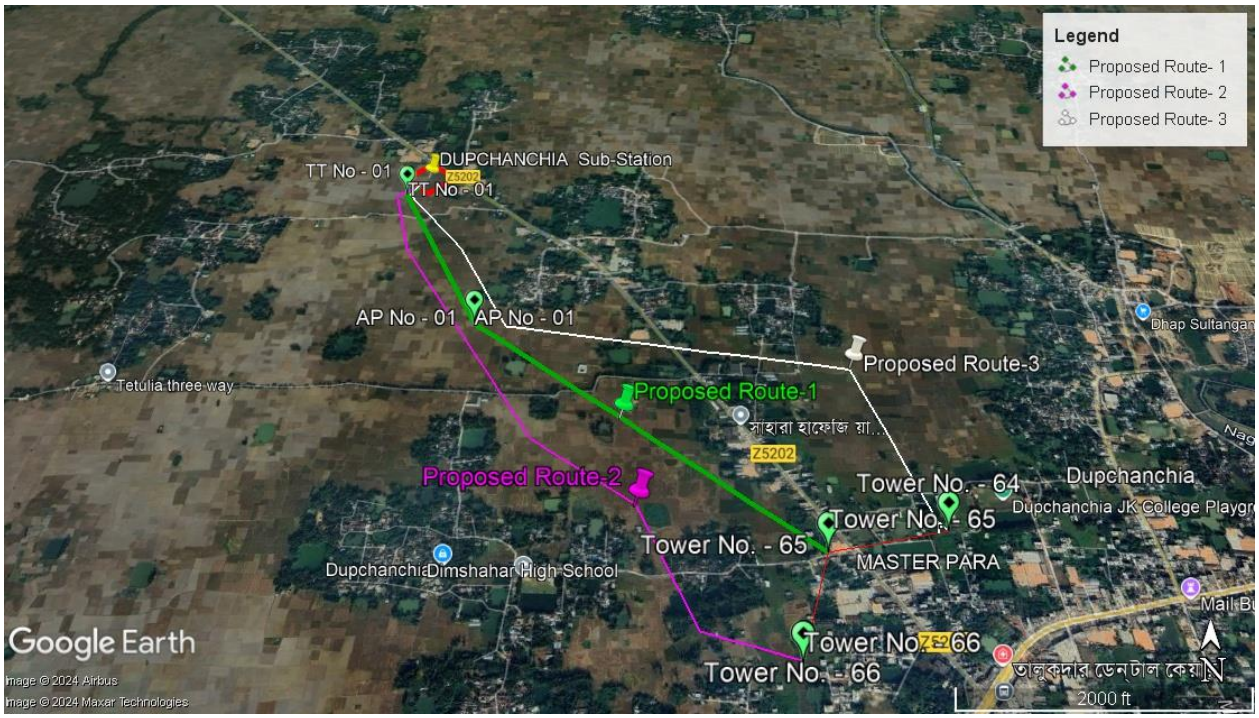


Figure 7.12: Google Map Location for Alternative Routes for LILO of Bogura(S)-Naogaon 132kV Transmission Line

7.4.13 Alternative Routes for LILO of Bheramara – Rajbari 132kV Line at Kumarkhali Transmission Line

489. The routing options for the LILO of Bheramara – Rajbari 132kV Overhead transmission line is analyzed in

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

490. Table **7.25** below.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Table 7.25: Routing Options for LILO of Bheramara – Rajbari 132kV Transmission Line

Attributes	Option-1 (Final)	Option-2	Option-3
Technical and Financial Aspects			
Considering Length	0.6 km	0.7 km	0.8 km
Difficulty of Implementation with respect to excavations	Medium	Medium	High
Crossing of any other existing or proposed transmission lines	- No	- No	- No
Power line (Nos.) 11kV 33kV 132kV 230kV 400kV	0	0	0
Angle Towers	3	4	4
Existing important infrastructure	No	No	No
Terrain (km)– Plain	0.6 km	0.7 km	0.8 km
Terrain (km)– Hilly	0	0	0
Implementation expense	Medium	Medium	High
Environmental and social aspects			
Construction related impacts (such as dust, noise, air emissions, OHS and public safety issues)	Moderate	High	High
Pucca Road Crossing	0	0	0
Katcha Road Crossing Canal Crossing	0	0	0
River Crossing	No	No	No
Railway Crossing	No	No	No
Reserve Forest	No	No	No
Ecologically Critical Area (ECA)	No	No	No
Ramsar or IBA	No	No	No
River erosion	No	No	No
Impact on Settlements	No	No	No
Involuntary Resettlement Impacts	No	No	No

491. **Inference:** Based on the route survey, it is identified that Option-1 have least route length and will have the least difficulty with respect to excavation related activities. Impact on the settlements is comparatively low in option-1 with respect to other options; all other environmental and social issues are quite similar for all three options. Therefore, Option-1 has been selected for the LILO of Bheramara – Rajbari 132kV transmission line.

492. The routing options for the LILO of Bheramara – Rajbari 132kV transmission line are shown in below.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

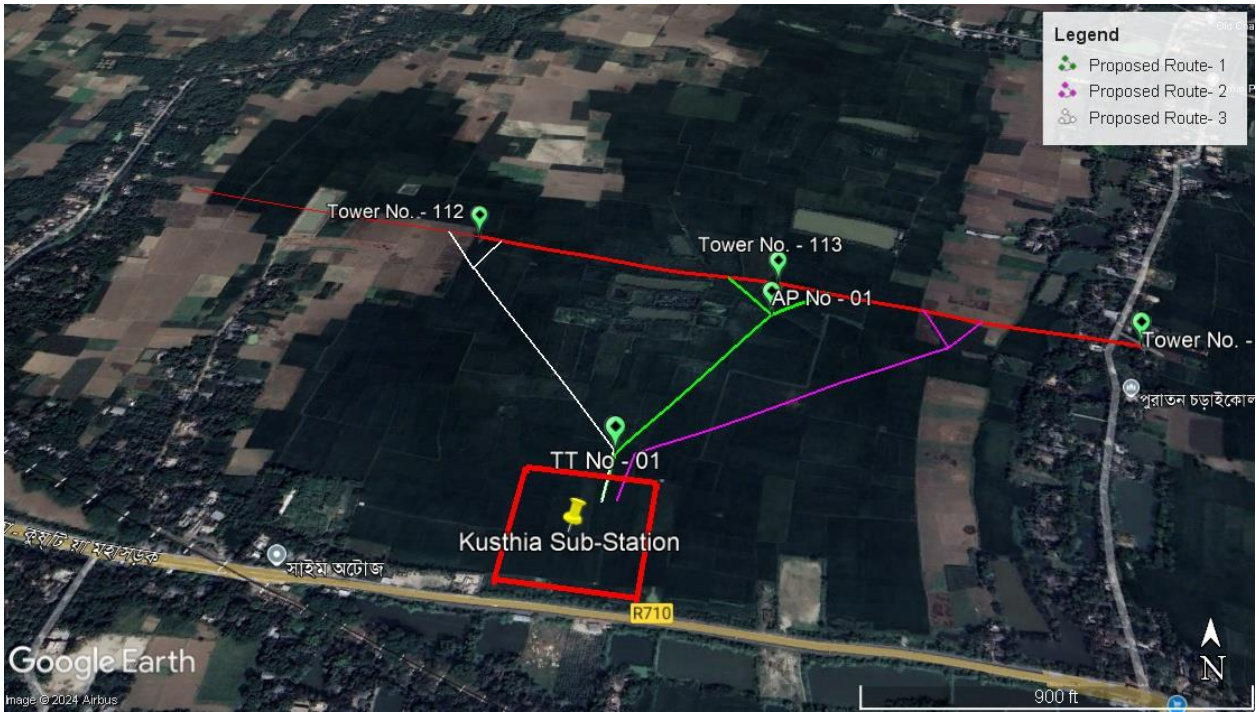


Figure 7.13: Google Map Location for Alternative Routes for LILO of Bheramara – Rajbari 132kV line at Kumarkhali Transmission Line

7.4.14 Alternative Routes for Bhandaria- Mathabaria 132kV Double Circuit Line Transmission Line

493. The routing options for the Bhandaria- Mathabaria 132kV Overhead transmission line are analyzed in Table 7.26 below.

Table 7.26: Routing Options for Bhandaria- Mathabaria 132kV Transmission Line

Attributes	Option-1 (Final)	Option-2	Option-3
Technical and Financial Aspects			
Considering Length	31.62 km	33.12 km	33.86 km
Difficulty of Implementation with respect to excavations	Medium	High	High
Crossing of any other existing or proposed transmission lines	Yes - 11kV - 33kV	Yes - 11kV - 33kV	Yes - 11kV - 33kV
Power line (Nos.) 11kV 33kV 132kV 230kV 400kV	27	29	32
Angle Towers	28	32	32
Existing important infrastructure	No	No	No
Terrain (km)– Plain	31.62 km	33.12 km	33.86 km
Terrain (km)– Hilly	0	0	0
Implementation expense	Medium	High	High
Environmental and social aspects			
Construction related impacts (such as dust, noise, air emissions, OHS and public safety issues)	Moderate	High	High
Pucca Road Crossing	23	22	24

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Attributes	Option-1 (Final)	Option-2	Option-3
Katcha Road Crossing Canal Crossing	10 32	12 34	11 30
River Crossing	No	No	No
Railway Crossing	No	No	No
Reserve Forest	No	No	No
Ecologically Critical Area (ECA)	No	No	No
Ramsar or IBA	No	No	No
River erosion	No	No	No
Impact on Settlements	Yes (Medium)	Yes (high)	Yes (high)
Involuntary Resettlement Impacts	No	No	No

494. **Inference:** Based on the route survey, it is identified that Option-1 have least route length and will have the least difficulty with respect to excavation related activities. Impact on the settlements is comparatively low in option-1 with respect to other options; all other environmental and social issues are quite similar for all three options. Therefore, Option-1 has been selected for the Bhandaria-Mathabaria 132kV transmission line. The routing options for the Bhandaria- Mathabaria 132kV transmission line are shown in below.

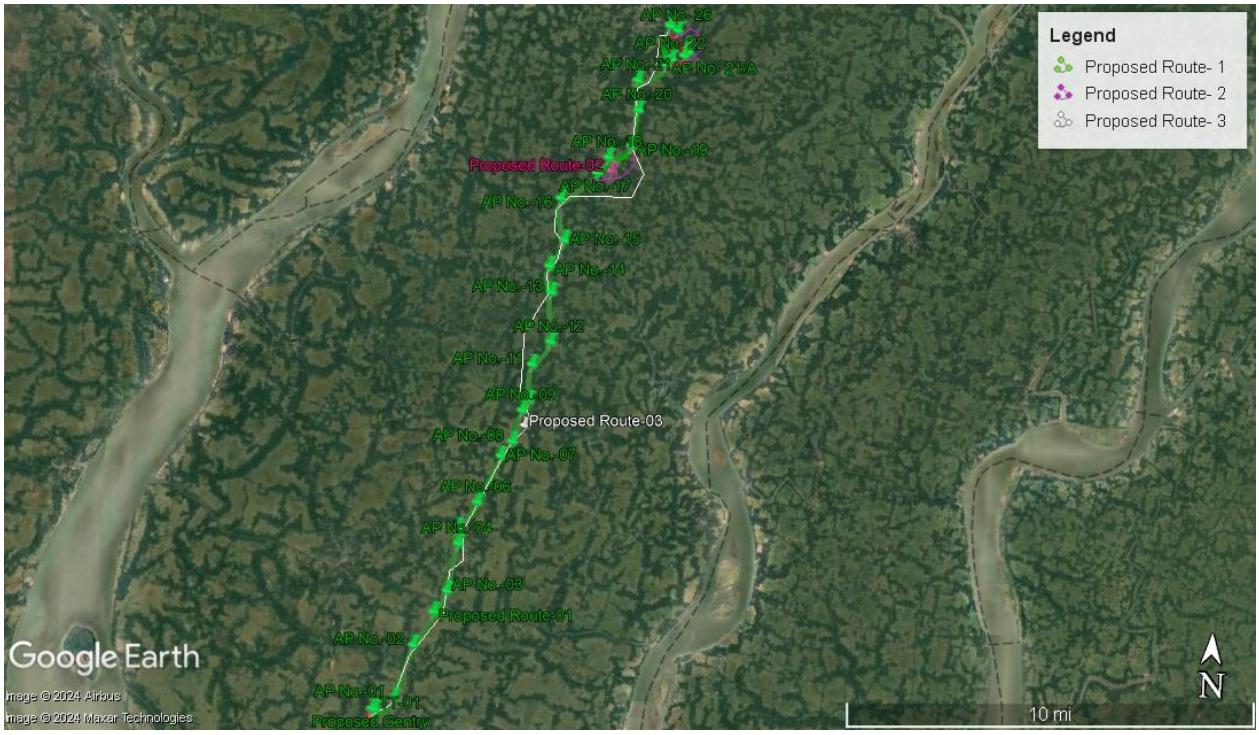


Figure 7.14: Google Map Location for Alternative Routes for Bhandaraia-Mathbaria 132 kV Transmission Line

7.4.15 Reconductoring of Shahjibazar-Brahmanbaria-Ashuganj Double Circuit 132kV Line

495. Since the existing transmission line will be reconductored, no additional alternative analysis was taken for this route.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

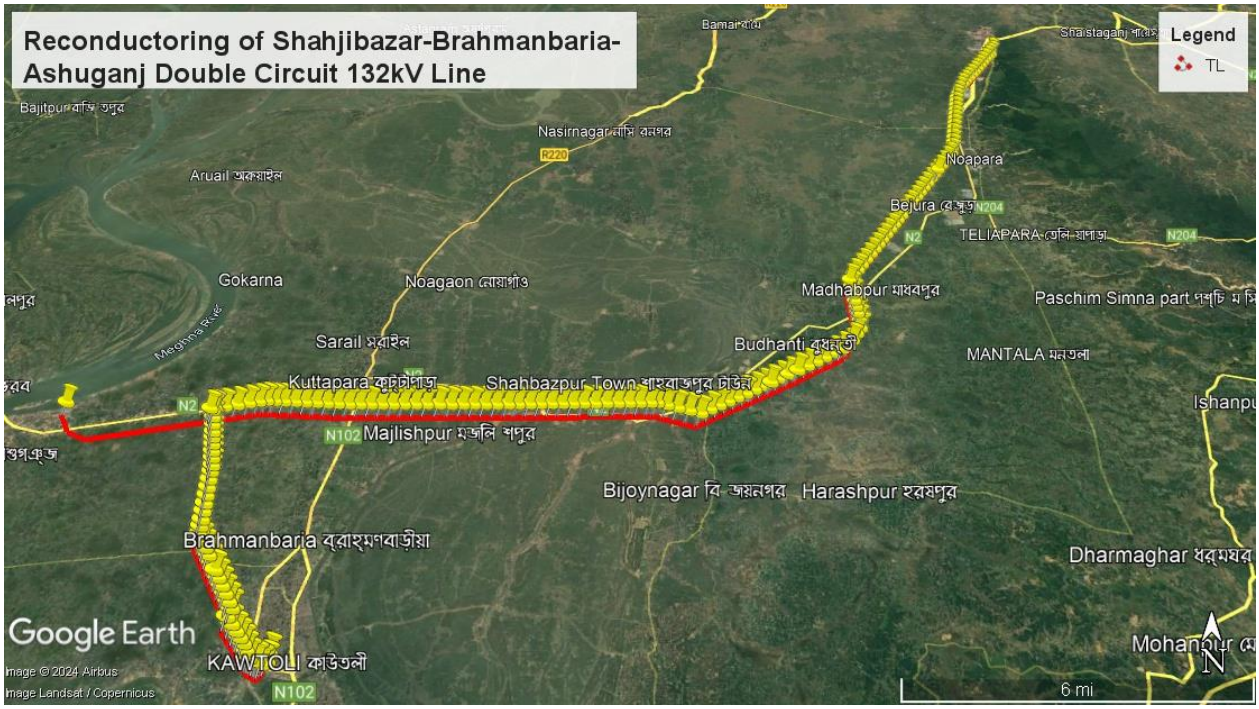


Figure 7.15: Google Map Location for Reconductoring of Shahjibazar-Brahmanbaria-Ashuganj Double Circuit 132kV Line

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

8 Important Environmental and Social Components

8.1 Overview

496. The Important Environmental and Social Components (IESC) likely to be impacted by the proposed interventions were selected and the rationales for their selection are presented below.

8.2 IESCs Related to the Project and Their Relation

497. Important Environmental Components (IECs) for the Physical Environment and Water Resources, Land Use and Agricultural Resources, and Ecological Resources along with their rationales are described in the following Tables 8.1- 8.4.

Table 8.1: IESCs on Physical Environment and Water Resources

IESCs	Rationale for selection
Noise and Vibration Levels	Noise and vibration will be generated from the equipment and machinery to be used in the construction work. Therefore, noise levels have been considered as an IESC.
Air Quality	Construction work and movement of construction vehicles might emit dust and other air pollutants in a degraded airshed. Hence, air quality has been considered as an IESC.
Water Quality and Resources	Leakage of fuel, oil and chemicals may spill over to nearby waterbodies or groundwater through the storm water drainage. Sediment laden runoff may also enter nearby waterbodies during construction. Untreated sanitary effluent may also enter surface or ground water. Water (groundwater) is needed for both construction and operation of the substations. Henceforth, water quality and resources have been considered as an IESC.
Topography and Floods	Raising the land for substations will change the elevation of the land and remove land from the floodplain. Topography and flood risk (to adjacent land) are taken into account as part of IESC.
Drainage and Waterlogging	Surface water drainage and groundwater recharge will be affected by the introduction of substations to currently undeveloped sites, particularly from raising of the lands; therefore, drainage and waterlogging have been considered as an IESC.
Natural Resources	Raw materials will be required for construction. Large volume of sand will be required for the infill of substations land. Therefore, use of natural resources has been considered as an IESC.
Solid and Hazardous Waste	Solid and hazardous waste will be generated from the installation of transmission lines and the construction of sub-stations. There will also be waste generated from substation operation. Therefore, solid waste has been considered as an IESC.
Climate change	SF6, a potent greenhouse gas is used as an insulation agent at the AIS and GIS type substations for switchgear. Its emission represents an environmental risk. Hence, climate change has been considered as an IESC.

Table 8.2: IESCs on Land Use and Agriculture Resources

IESCs	Rationale for Selection
Land Use including Crop Production	Construction of power transmission lines and substations will provide hindrance to the regular expansion of residential, commercial and industrial activities as well as agricultural practices. Intercropping may be affected due to the installation of towers. Hence, land use has been selected as an IESC. Land affected by the tower footings may experience devaluation and will be dealt separately in the RAP.
Fishes	Raising the land for certain substations e.g., at Pekua and Paikgacha. At the Pekua site, seasonal local fish and local varieties of shrimp cultivation take place there. The land of the Pekua substation is primarily used for salt production and short-term local fish cultivation. People engage in small-scale local fish and shrimp cultivation, mainly for local consumption, with no large-scale commercial fishing or export activities. At Paikgacha, the land is owned by PGCB, while the surrounding areas are used by local people for small-scale local fish and local varieties of shrimp cultivation using pumped water. The contractor must implement mitigation

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

IESCs	Rationale for Selection
	measures as per the EMP to ensure that local fish cultivation in the vicinity remains unaffected. The fish and shrimp cultivated are primarily local varieties.
Soil Quality	Construction will result in the loss of topsoil and subsoil beneath the substation sites. Leakage of fuel, oil and chemicals may spill to soil. Therefore, soil quality has been considered as an IESC.

Table 8.3: IESCs on Ecological Resources and Birds

IESCs	Rationale of Selection
Flora and fauna	Construction of sub-station and transmission lines might cause the clearance of vegetation and affect the habitat of dependent wildlife. For this reason, flora and fauna has been considered as an IESC.
Birds	Installation of towers and transmission lines will cause obstruction to regular movements of the resident and migratory and/or local birds particularly at Pekua and Paikgacha. In this context, birds travel route has been considered as an IESC.

Table 8.4: IESCs on Socio-economic Resources and Their Rationales

IESCs	Rationale of Selection
Employment Opportunity and Labor Management	Each of the steps of the Project might involve different levels of workers. Hence, employment opportunity and labor management has been selected as an IESC.
Occupational Health & Safety	Occupational Health and Safety (OHS) for the workers and PGCB employees is deemed important throughout the project from the construction to the operational phases. There are risks from undertaking working at height and working with electricity, risks associated with unsanitary conditions, communicable diseases etc. Therefore, occupational health and safety has been selected as an IESC.
Community Health & Safety	Installation of overhead lines and construction of substations might cause disturbance to the local community. There will be risks from construction, road closures/traffic congestion, and presence of electrical presence during operation. The construction workers may also introduce risk of social conflict, communicable disease etc. For this reason, community health and safety has been selected as an IESC.
Property and Physical Cultural Resources	Given the close proximity of substations and need for piling for buildings and towers, the adjacent properties may be damaged by vibration. They may also be inadvertently damaged during the construction works for overhead line works. Private property and physical cultural resources are therefore selected as an IESC.
Roads and Traffic Levels	There is an increased potential for traffic disruption and disruption to pedestrians and vehicles due the overhead line works along and across roads. For this reason, traffic disruption has been considered as an IESC.
Electricity Supply	Installation of substations in conjunction with the transmission lines might affect the distribution capacity of power along with quality. In this regard, distribution capacity and quality service are considered as an IESC.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

9 Potential Impact Prediction and Analysis

9.1 Scope of the Assessment

498. The scope of the assessment captures the understanding of the envisaged impacts and risks assessed during the scoping exercise of this EIA/IEE study as well as the impacts and risks identified during the subsequent baseline assessment and impact evaluation process. The key environmental and social issues and risks identified are further elaborated in the following sections. This impact assessment is draft given some baseline gaps and subject to confirmation of sites/routes. It will be updated in the final EIA/IEE for ADB review, clearance and disclosure before substation and transmission line works commence.

9.2 Impact Assessment Methodology

499. Impact identification and assessment starts with scoping of project intervention(s) and associated activities as discussed in Chapter 4. This section assesses potential impacts and risks in a manner in which the Project interacts with the elements of the physical, biological, socioeconomic-cultural or human environment to render impacts to resources/receptors. The feasibility study, field surveys including environmental quality baseline monitoring, ecological surveys, social surveys and stakeholder consultations assist in assessing environmental impacts due to project implementation. Impacts that are positive, negative, direct, or indirect, cumulative, or induced are considered. This EIA/IEE follows a set format during the impact assessment process. As shown in the Figure 9.1 flow chart and described further below.

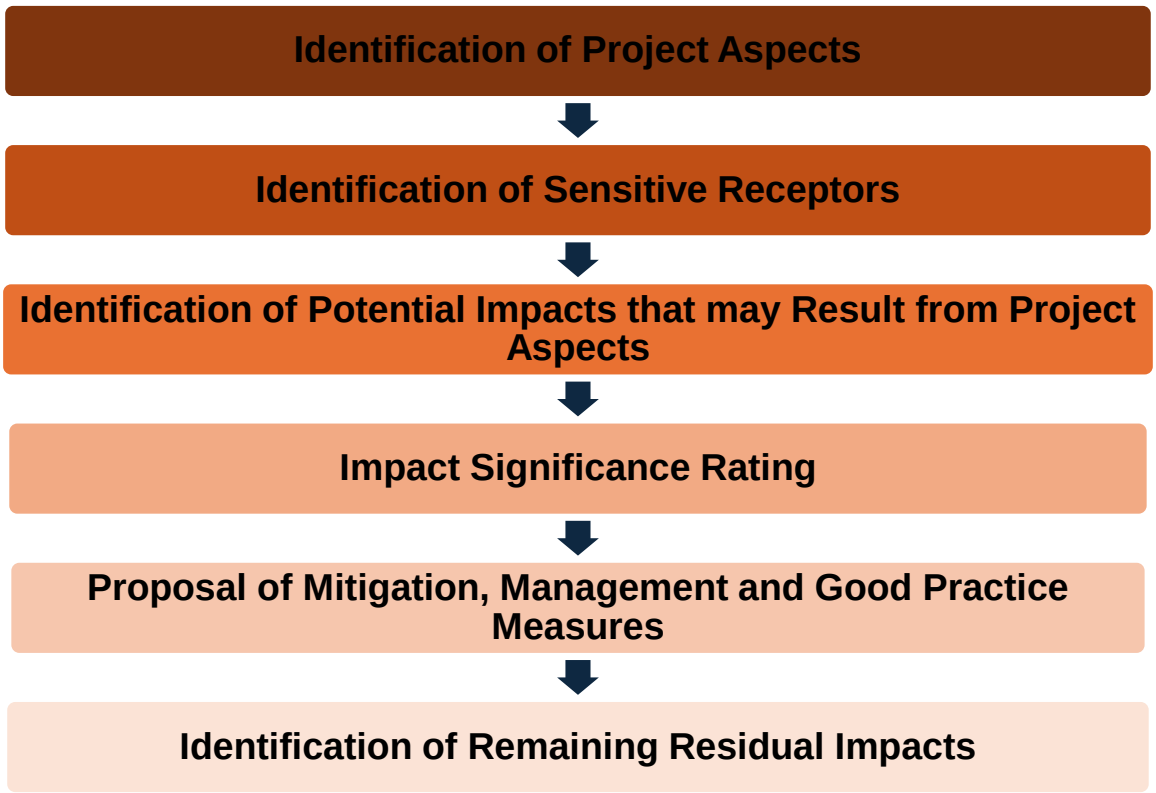


Figure 9.1: Impact Assessment Process

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

9.2.1 Project Aspects

500. Firstly, the main environmental aspects of the Project are noted. An environmental aspect is any activity of the Project that interacts with the environment. e.g., an aspect of the Project that may impact upon air quality will be the movement of construction vehicles on unpaved roads through rural settlements.

9.2.2 Identification of Sensitive Receptors

501. Once the main aspects of the Project have been identified, any sensitive receptors within the Project area of influence are noted. Examples of sensitive receptors include residents, rivers, groundwater, birds, etc. or even establishments such as hospitals, schools, places of worship etc. Identification of receptors is a key part of the impact assessment process as without a receptor there will be no impact evident. For example, if a substation generates significant noise but if there were are no sensitive receptors in its vicinity, then the noise impact on any other receptor is deemed as "not adverse".

9.2.3 Identification of Significant Environmental

502. Thirdly, the potential impacts of the identified aspects are outlined and how they could impact upon the identified receptors; in the case above, this could be the movement of a construction vehicles creating dust on an unpaved road which impacts upon local villagers/community living in the vicinity.

503. The significance of an impact is determined based on the product of the consequence of the impact and the probability of its occurrence. The consequence of an impact, in turn, is a function primarily of three impact characteristics:

- Magnitude
- Spatial Scale
- Timeframe

504. Magnitude is determined from quantitative or qualitative evaluation of several criteria including:

i. Sensitivity of existing or reasonably foreseeable future receptors.
ii. Importance value of existing or reasonably foreseeable future receptors, described using the following:
    a. level of public concern.
    b. number of receptors affected.
iii. Severity or degree of change to the receptor due to impact, measured qualitatively or quantitatively, and through comparison with relevant thresholds:
    a. legal or guideline thresholds—established by law or regulation, or international good practice guidelines
    b. functional thresholds if exceeded, e.g., impacts will disrupt the functioning of an ecosystem sufficiently to destroy resources important to the nation or biosphere irreversibly and/or irretrievably
    c. normative thresholds – established by social norms, usually at the local or regional level and often tied to social or economic concerns
    d. preference thresholds—preferences for individuals, groups or organizations only, as distinct from society at large
    e. reputational thresholds—the level of risk a company is willing to take when approaching or exceeding the above thresholds

505. Spatial scale is another impact characteristic affecting impact consequence. The spatial scale of

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

impacts can range from localized (confined to the proposed project sites) to extensive (national or international extent). They also may vary depending on the component being considered.

506. The impact Timeframe is the third principal impact characteristic defining impact consequence and relates to either its duration or its frequency (when the impact is intermittent). Impact duration can range from relatively short (less than a month) to long (beyond the life of the Project). Frequency ranges from high (more than 12 times a year) to low (less than once a year). These timeframes will need to be established for each Project based on its specific characteristics and those of the surrounding environment.

507. Once the impact consequence is described based on the above impact characteristics, the probability of impact occurrence is factored in to derive the overall impact significance. The probability relates to the likelihood of the impact occurring, not the probability that the source of the impact occurs. The characteristics are outlined in Table 9.1.

Table 9.1: Characteristics Used to Describe Impact

Characteristic	Sub-components	Terms Used to Describe the Impact
Type		Positive (a benefit), negative (a cost) or neutral
Nature		Biophysical, social, cultural, health or economic Direct, indirect or cumulative or induced
Phase of the Project		Pre-Construction, Construction and Operation & Maintenance
Magnitude	Sensitivity of Receptor	High, medium or low capacity to accommodate change High, medium or low conservation importance Rare, common, unique, endemic, threatened etc.
	Importance or value of receptor	High, medium or low concern to some or all stakeholders Locally, nationally or internationally important Protected by legislation or policy
	Severity or degree of change to the receptor	Gravity or seriousness of the change in the environment Intensity, influence, power or strength of the change Never, occasionally or always exceeds relevant thresholds
Spatial Scale	Area affected by impact boundaries at local and regional extents will be different for biophysical and social impacts	Area or Volume covered Local, regional (within Bangladesh), transboundary or global
Timeframe	Length of time over which an environmental impact occurs or frequency of impact when intermittent	Short term or long term Intermittent (what frequency) or continuous Temporary or permanent Immediate effect (impact experienced immediately after causative project aspect) or delayed effect (effect of the impact is delayed for a period following the causative project aspect)
Probability – likelihood or chance an impact will occur		Definite (impact will occur with high likelihood of probability) Possible (impact may occur but could be influenced by

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Characteristic	Sub-components	Terms Used to Describe the Impact
		either natural or project related factors) Unlikely (impact unlikely unless specific natural or Project related circumstances occur)

9.2.4 Impact Significance Rating

508. The impact significance rating process serves two purposes: firstly, it helps to highlight the critical impacts requiring consideration in the approval process; secondly, it shows the primary impact characteristics, as defined above, used to evaluate impact significance. The impact significance rating system is presented in Table 2 and described as follows:

- **Part A:** Define impact consequence using the three primary impact characteristics of magnitude, spatial scale and duration.
- **Part B:** Use the matrix to determine a rating for impact consequence based on the definitions identified in Part A; and
- **Part C:** Use the matrix to determine the impact significance rating, which is a function of the impact consequence rating (from Part B) and the probability of occurrence.

509. Using the matrix, the significance of each described impact is rated.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Table 9.2: Method for Rating Significance

PART A: DEFINING CONSEQUENCE IN TERMS OF MAGNITUDE, DURATION AND SPATIAL SCALE			
Definition		Criteria	
MAGNITUDE		Negative	Positive
	Major	• Large number of receptors affected • Receptors are highly sensitive and/or are of conservation importance • Substantial deterioration, nuisance or harm to receptors expected • Relevant thresholds often exceeded • Significant public concern expressed during stakeholder consultation • Receiving environment has an inherent value to stakeholders	• Large number of receptors affected • Receptors highly amenable to positive change • Receptors are likely to experience a big improvement in their situation • Relevant positive thresholds often exceeded
	Moderate	• Some receptors affected • Receptors slightly sensitive and/or of moderate conservation importance • Measurable deterioration, nuisance or harm to receptors • Relevant thresholds occasionally exceeded • Limited public concern expressed during stakeholder consultation • Limited value attached to the environment	• Some receptors affected • Receptors are likely to experience some improvement in their situation • Relevant positive thresholds occasionally exceeded
	Minor	• No or limited receptors within the zone of impact • Receptors not sensitive to change • Minor deterioration, nuisance or harm to receptors • Change not measurable or relevant thresholds never exceeded • Stakeholders have not expressed concerns regarding the receiving environment	• No or limited receptors affected • Receptors not sensitive to change • Minor or no improvement in current situation • Change is not measurable • Relevant positive thresholds never exceeded No stakeholder comment expected
TIMEFRAME		Duration of Continuous Aspects	Frequency of Intermittent Aspects
	Short term / low frequency	• Less than 1 month from onset of impact	• Occurs less than once a year
	Medium term / medium frequency	• Less than 1 year from onset of impact up to end the project implementation (approximately 5 years)	• Occurs less than 12 times a year but more than once a year
	Long term / high frequency	• Impact is experienced during and beyond the project implementation (greater than 5 years)	• Occurs more than 12 times a year
SPATIAL SCALE		Biophysical	Socio-economic
	Small	• Within the defined 'Project area' e.g., footprint	• Within the defined 'Project area' e.g., footprint
	Intermediate	• Within the district in which are the facilities are located	• Within the municipality in which the activity occurs
	Extensive	• Beyond the district in which the facilities are located	• Beyond the municipality in which the activity occurs

PART B: DETERMINING CONSEQUENCE RATING				
MAGNITUDE	TIMEFRAME	SPATIAL SCALE		
		Small	Intermediate	Extensive
Minor	Short term / low frequency	Low	Low	Medium
	Medium term / medium frequency	Low	Low	Medium

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

	Long term / high frequency	Medium	Medium	Medium
Moderate	Short term / low frequency	Low	Medium	Medium
	Medium term / medium frequency	Medium	Medium	High
	Long term / high frequency	Medium	High	High
Major	Short term / low frequency	Medium	Medium	High
	Medium term / medium frequency	Medium	Medium	High
	Long term / high frequency	High	High	High

PART C: DETERMINING SIGNIFICANCE RATING

		CONSEQUENCE			
		Negligible	Low	Medium	High
PROBABILITY (of exposure to impacts)	Definite	Not Significant	Low	Medium	High
	Possible	Not Significant	Low	Medium	High
	Unlikely	Not Significant	Low	Low	Medium
	Negligible	Not Significant	Not Significant	Not Significant	Not Significant

9.2.5 Mitigation, Management and Good Practice Measures

510. Wherever the Project is likely to result in negative impact on the environment, mitigation measures are proposed (over and above the incorporated and inherent design measures included in the Project description). In addition, good practice measures may be proposed, however these are unlikely to change the impact significance. In the case of positive impacts, management measures are suggested to optimize the benefits to be gained.

511. The following mitigation hierarchy will be utilized in selecting practical mitigation measures for unacceptable impacts as follows (in order of preference):

- Avoid the impact wherever possible by removing the cause(s).
- Reduce (minimize) the impact as far as possible by limiting the cause(s).
- Ameliorate (mitigate) the impact by protecting the receptor from the cause(s) of the impact.

9.2.6 Residual Impacts

512. Once mitigation measures are assessed and committed to, the next step in the impact assessment process is to assign residual impact significance. This is essentially a repeat of the impact assessment steps discussed above, considering the assumed implementation of the additional assessed mitigation measures.

513. The final step is providing compensatory measures to offset the impact, particularly where an impact is of high significance and none of the identified assessment measures are complete to mitigate and adverse impact, e.g., for impacts to natural and critical habitat..

9.3 Impact Assessment and Mitigation Measures

514. This portion of the report identifies the environmental and social impacts of the Project (all Components and sub-activities) and proposes mitigation measures to eliminate the impacts, or where this is not possible, reduce their significance.

9.3.1 Physical Environment

9.3.1.1 Air Quality and Greenhouse Gases

515. This section discusses emissions of atmospheric pollutants and greenhouse gases during construction and operation of the Project and associated mitigation measures to be adopted. Impacts of air pollution and greenhouse gas emissions, their mitigation and resulting residual impacts are discussed as follows:

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

9.3.1.1.1 Pre-construction Phase

Impacts

516. The project activities will give rise to emission of dust particles. According to Section 5.3 of air quality baseline, PM 10 and PM 2.5 are universally high in all project areas where primary air quality measurements were undertaken. The volume of soil being excavated at any site is relatively small for transmission towers, and impacts will be limited. However, most substations will involve raising of substation level by sand filling[41] with large volume and therefore dust impacts within 250m from the construction site will occur with impact being greatest immediately adjacent (50m) and which will diminish with the distance. Given the number of trucks that will be required for the import of sandfill by road impacts may also be felt on receptors within 50m adjacent to haul routes from source to site. Sourcing of dredged river sand/soil/gravel for filling inside substation is important for this project. The contractor must ensure sourcing/selection of government licensed sand gravel suppliers from legally permitted sites i.e. ensure no illegally extracted sand and gravel is used for the project which may negatively impact any sensitive aquatic life and hydrology of the adjoining river systems at the sites. They must also consider the impact of transporting the sand to the site in terms of dust etc. The option to pipe sand instead of importing it by road may exist, but brings with it a different set of impacts to be assessed.

Mitigation Measures

517. The IEE will be finalized based on the detailed design and EMP pre-construction requirements will be followed. To supplement the current baseline data and to provide a basis for monitoring the contractor will undertake air quality monitoring per the EMoP to confirm current background levels in the subproject area prior to the commencement of any activity on-site. Further on-going air quality monitoring will be completed at the baseline locations throughout construction and at areas where any complaints from residents are received. The contractor will prepare a pollution prevention plan for dust management, this will incorporate the project EMP measures as well as GIIP from the IFC EHS Guidelines etc.

518. To minimize the climate change impact of SF6 use at substations the following design measures will be taken:

- If no alternative the use of SF6 in gas insulated equipment must be minimized as part of design requirements.
- Design of any gas insulated equipment will comply with international norms and standards for handling, storage, and management of SF6.
- Equipment to be hermetically pressure sealed “sealed for life” units and be tested and guaranteed by the supplier at less than 0.1% leakage rate.
- Installation designed and operated so that any leakage will trigger an alarm requiring O&M staff to rectify the situation immediately.
- Provide SF6 leakage detector at each substation.

9.3.1.1.2 Construction Phase

Impacts

519. Project activities include sandfill, excavation and earthworks for substation and tower foundations, movement of vehicles carrying the construction materials and operation of equipment and plant. Exhaust emissions will be generated by construction equipment and plant during construction. Motor vehicles that will be used to carry construction materials and complete line stringing would cause air quality impact by emitting pollutants (e.g., NOx, SOx, PM) through exhaust emissions. Exhaust

[41] The contractors team will identify the nearest government approved sand sourcing site

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

emissions will also result in greenhouse gas emissions although not anticipated to be significant. The volume of traffic required for the sandfill to be imported to site would be the largest source of such exhaust emissions.

520. The project activities will also give rise to emission of dust particles. Transmission towers are mainly located in rural areas and will involve limited excavation and earthworks with few sensitive receptors immediately adjacent, so in the main un-mitigated impacts on ambient air quality will be low in magnitude and of low significance. Substation construction, however, will involve raising the substation level by sand filling and therefore significant impacts are anticipated up to 250m from the construction site with impact being greatest immediately adjacent (50m) and diminishing with distance. In the absence of mitigation to control air pollution, short term, localized exceedance of national air quality standards, or where already exceeded for PM10 and PM2.5 an increase in the existing baseline levels, may occur at the substation and their haul routes although impacts are readily mitigated and reversible in short term.

521. For new substations in the 250m area of impact, impacts will be more significant where sensitive human receptors are present at those substations. Paikgacha is particularly sensitive substation due to the school being within 20m, similarly Kumarkhali has a school in close proximity that is more vulnerable to dust. Upgrading of existing substations is unlikely to result in significant air quality impacts due to the limited scope of works at these sites with the main air quality impacts being associated with installation of new transformers and their associated bunding (requiring foundations) and the movement of construction vehicles to and from site, but the number of vehicles arriving and working at the sites will be relatively low and intermittent compared to the numbers needed for new substations and sandfill import.

522. Sensitive receptors with individual receptors in 150m of the sites are shown in Table 9.3 (and attached in Appendix XVI) – numbers of individual receptors within the PAI of 250m will be confirmed for the final IEE.

Table 9.3: Sensitive Air Quality Receptors

#	Sub-activity	Distance to nearest residential receptor	Approximate Number of Receptors within 150m	Volume of Landfilling (cft)
1	400/230/132kV AIS: Pekua/Chakaria, Cox's Bazar, LILO lines	200m	0	12993819.700
2	230/132/33 kV AIS: Madhabpur, Habiganj, LILO lines	50 m	2	5575652.356
3a	230/132/33kV AIS: Monohardi, Narshingdi, LILO lines and	No receptors	0	4482600.643
3b	Baljitpur bay extension	300m	1	0
4a	132/33kV AIS: Tungipara, Gopalganj, LILO lines and	0	0	1777654.920
4b	Gopalgunj old bay extension	40 m	1	0
5	132/33kV AIS: Dupchanchia, Bogura and LILO lines	0	0	737807.179
6a	132/33kV AIS: Matlab (N), Chandpur, LILO lines	50m	1	640010.656
6b	Kachua bay extension	0	3	0
7	132/33kV AIS: Kumarkhali, Kushtia and LILO	100m	1 School	1531800.320
8	132/33kV AIS: Chatkhil/, Noakhali, LILO lines	200 m	4	1087017.397
9a	132/33kV AIS: Paikgacha, Khulna, LILO line and	20 m	1 village + school	2116159.619
9b	Satkhira GS bay extension	20 m	2	0
10a	132/33kV AIS: Mathbaria, Pirojpur,	800m	0	1024393.836

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

#	Sub-activity	Distance to nearest residential receptor	Approximate Number of Receptors within 150m	Volume of Landfilling (cft)
	LILO line and			
10b	Bhandaria SS bay extension	50 m	4	0

Source: SES survey, June 2024

523. The impact of construction will be temporary in nature and reversible with ease in the short term but is of major significance at new substations wherever sensitive receptors are within 50m – notably new substations at Madhabpur SS, Matlab (N) SS and Paikgacha SS. For the bay extensions at Satkhira SS, Gopalganj SS and Bhandaria SS sensitive receptors are also within 50m but the significance will be less due to the magnitude of works.

Mitigation Measures

524. To manage dust and combustion emissions, a range of good practice measures will be applied to all project components. These measures are outlined in detail in the Project EMP mitigation plan as found in Table 12.4: Environment Management Plan. Specific measures to manage dust in areas where the impacts will be most significant, include:

- Ensure an adequate supply of bowsers and carry out watering for dust control at least twice a day within 50m of work sites but more often if needed: in dry weather with temperatures of over 25°C, or in windy weather. Dust control measures will also be implemented on all access roads within 50m of residential/sensitive receptors. Avoid overwatering as this may make the surrounding muddy.
- Soil scattered on pavements and roads shall be immediately swept up to avoid windblown dust.
- Vehicle movements will be restricted to defined access routes and demarcated working areas (unless in the event of an emergency).
- A strict Project speed limit of at most 30km/hr will be enforced for Project vehicles using unmade tracks.
- Excavated materials will be stockpiled where practical away from sensitive receptors, such as homes, schools, and health facilities. Where this is not possible, ensure regular watering of stockpiles to prevent dust impacts.
- Keep stockpiles of soil, aggregate and waste materials covered with canvas or tarpaulin when spoil heaps are not active to avoid suspension or dispersal of fine soil particles during windy days and to prevent disturbance by stray animals.
- Locating material storage areas with larger stockpiles at least 50m from residential property and other sensitive receptors to avoid fugitive dust.
- Positioning any stationary emission sources (e.g. diesel generators, compressors, etc.) as far as practical from sensitive receptors (houses, schools, clinics, mosques, etc.)
- Imposing speed limits on construction vehicles to minimize exhaust and dust emissions along haulage routes where sensitive receptors are located (houses, schools, clinics, mosques, etc.) and limiting engine idling to maximum 5 minutes.
- Vehicles carrying fine aggregate materials will be sheeted with canvas or tarpaulin to help prevent dust blow and spillages.
- Cleaning dust from the metaled access road immediately after construction work is completed.
- Only use cutting, grinding, or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays or local extraction, e.g., suitable local exhaust ventilation systems.
- Undertake weekly dust soiling checks of surfaces of adjacent properties during earthworks and help with cleaning of external surfaces of property if dust is evident.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

- If there is an increase in existing background air pollution or complaints are received contractor will be required to implement additional dust mitigation e.g., barricading/isolating sources of dust, use of wheel wash etc.
- Ensure all pavements and excavated areas are restored as soon as construction activities within each works section are completed (within 15 days).

9.3.1.1.3 Operation Phase

Impacts

Climate Change

525. The air quality impact of the operational phase will be minimal. In relation to climate change, SF6 is a non-toxic greenhouse gas used as a dielectric in gas insulated substations (GIS) as well as switch gear and other electrical equipment. 1 kg has a global warming potential of 22,800 carbon dioxide equivalent (CO2e) i.e., equivalent to an average car covering 160,000 km. Due to high global warming potential, SF6 contributes to climate change if it is released into the atmosphere during operation, maintenance or during end of-life disposal. Since AIS is being used the amount of SF6 is already minimized but may still be found in switchgear to be installed. The SF6 contained in switchgear equipment varies greatly according to type and manufacturer.

526. Major leak of SF6 from project-installed equipment is the worst-case scenario but could easily occur during operation if equipment is not well maintained, or at end of life if the equipment is not appropriately disposed. Climate change is a global concern, however, the impact of a worst-case SF6 release from the project will be negligible in percentage terms compared to the 36 billion annual global CO2e emissions.

527. The greenhouse gas (GHG) emissions from implementation of the proposed project are estimated using the World Bank's Guidance Manual: Greenhouse Gas Accounting for Energy Investment Operations, Version 2.0 January 2013 (hereinafter "Guidance Note") and IPCC 2006 guidelines. The sources of emissions are considered for accounting GHG from the Project. Impacts relevant to this source result from technical loss reductions in the transmission line facilities being supported by the project. Losses can be reduced by upgrading overloaded or not properly sized transformers, increasing conductor capacity, installing reactive power equipment, and undertaking other types of maintenance interventions. The losses in the transmission lines in Bangladesh are generally estimated as 3.13 percent. The direct generation emissions associated with these losses (emission factor: 0.6545 tCO2/MWh) is estimated to be 0.2 million tCO2e per year and 6.03 million tCO2e for the entire life of the project, assuming that the life of the project is 30 years. (5370 MVA = 1456 MW. 1456 x 365 x 24 = 12,754,560 MWh. 0.6545 x 12,754,560 x 0.0313 = 261,288 tons of CO2 equivalent; 261,288 x 30 = 7.83 million tons of CO2 equivalent.)

Mitigation Measures

Climate Change

528. Operational phase mitigation will focus on the management of SF6. Specific requirements for substations include:

- SF6 in fire extinguishers provided at substations to be avoided.
- During operation, regular visual and technical inspections will be undertaken, SF6 leakage detection kits will be provided at each substation, and remote gas pressure alarms are to be installed where daily inspection is not an option, such that any leaks can be immediately addressed.
- Regular monitoring of SF6 switchgear will also be undertaken to ensure no leaks of SF6, in line with national regulations.

529. On disposal at end-of-life PGCB must ensure SF6 is first removed in accordance with

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

International Electrotechnical Commission (IEC) standard 61634 to a very low pressure so losses of SF6 are less than 0.5% at end of life and then reused, recycled, or destroyed in a high-temperature incinerator. PGCB will need to define a safe SF6 retrieval arrangement, with appropriate handling, storage, disposal process for end-of-life equipment in accordance with international good practice.

Impact Summary and Assessment of Significance

530. Table 9.4 provides an assessment of the significance of potential Air Quality and Greenhouse Gas impacts before implementation of the proposed mitigation measures that are discussed in this section.

Table 9.4: Project Air Quality and Greenhouse Gas Potential Impacts

Phase	Potential Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
C	*Release of exhaust gases*	*Local community*	*H*	*H*	*M*	*H*	*MAJ*	*ST*	*MED*	*MT*	*DEF*	***H***
C	*Dust*	*Local community*	*H*	*H*	*H*	*H*	*MAJ*	*ST*	*MED*	*MT*	*DEF*	***H***
O	*Climate change*	*Global*	*L*	*L*	*L*	*L*	*MIN*	*LT*	*MED*	*LT*	*DEF*	***L***

Key: *H: High / M: Medium / L: Low / MAJ: Major / MOD: Moderate / MIN: Minimum / H/F: High Frequency / M/F: Medium Frequency / L/F: Low Frequency / LT: Long term / MT: Medium Term / ST: Short term / MED: Medium / DEF: Definitely / POSS: Possible: / UNLIKE: Unlikely. Cells shaded in blue are positive impacts.*

9.3.1.1.4 Residual Impacts

Table 9.5: Project Air Quality and Greenhouse Gas Residual Impacts

Phase	Potential Impact	Potential Impact Significance	Residual Impact	Residual Impact Significance
C	*Release of exhaust gases*	***High***	*Generic mitigation measures will ensure residual impacts will be reduced to low significance.*	***Low***
C	*Dust*	***High***	*Generic mitigation measures will ensure residual impacts will be reduced to medium significance.*	***Medium***
O	*Climate change*	***Low***	*Generic mitigation measures will ensure residual impacts will be reduced to no significance.*	***Not significant***

9.3.1.2 Noise and Vibration

531. This section discusses noise pollution during construction and operation of the Project and associated mitigation measures to be adopted. Impacts of noise pollution, their mitigation and resulting residual impacts are discussed as follows:

9.3.1.2.1 Pre-construction Phase

Impacts

532. The project will give rise to noise emissions during construction and to a lesser extent in operation – transformer hum, corona etc. According to Section 5.3 of noise baseline, Leq is high some project areas where primary measurements were undertaken. Leq (daytime) and (nighttime) are observed for some locations to be high when compared to GOB and WBG/IFC guidelines; the significant

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

reasons behind noise in the project area might be high wind speed, vehicle movement, public gathering and so on.

Mitigation Measures

533. Key mitigation during the design phase relates to siting of equipment within substations and selecting equipment that guarantees noise levels. Specifically, EPC Contractors will ensure that the design enables operation to always comply with 1-hour LAeq 70 dB(A) at the site boundary, 55dB(A) outside the fence line if located within a commercial zone, 45 dB(A) at the nearest residential properties including located those in commercial zones, and 40dB(A) within 100m distance from silent zones. This shall be achieved by:

- Use low noise generating equipment e.g., less than 55dBA sound pressure level at 1m; and
- Layout substations so transformers are the furthest distance possible from the adjacent receptors to minimize corona noise/transformer hum experienced.

534. However, as a precautionary approach, an acoustically designed enclosure or fence will be installed around transformers to enable the required noise level to be met as a permanent installation as part of the design. Specific substations where receptors have been identified within 50m require this for installation.

Audible Noise and Radio Interference from Transmission Lines

535. Exposure to noise and radio interference from transmission lines will be considered during the design of the transmission line conductors and right of way to ensure compliance with the national and international standards.

536. EPC Contractors for all components will be responsible for the preparation and implementation of a Pollution Prevention Plan covering noise management, this will incorporate the project EMP measures as well as GIIP from the IFC EHS Guidelines etc. The noise assessment will be updated once the construction method is confirmed.

9.3.1.2.2 Construction Phase

Impacts

General

537. During construction, noise will be generated from the removal and/or cutting of vegetation, during the movement of construction vehicles, the operation of plant, equipment, and machinery on-site, presence of construction workers at the construction site, temporary worker camps and any overnight accommodation etc. Depending on ground conditions encountered, piling will likely be required for tower foundation construction (specifically near rivers and waterlogged areas) and substation construction, resulting in a large increase compared to the background noise level, as well as ground vibration.

538. The project activities will create noise impacts and in the absence of mitigation, short term, localized exceedance of noise standards/guidelines may occur although impacts are readily mitigated and reversible with ease in short term. Per the Government of Bangladesh noise standards and WHO community noise guidelines, noise levels should not exceed 50 dBA (daytime) and 40 dBA (nighttime) in 'silent zones', 55 dBA (daytime) and 45 dBA (nighttime) in residential settings, 70 dBA (daytime) and 60 dBA (nighttime) in commercial areas, and 75dBA in daytime and 70 dBA in night time in industrial areas.

Piling

539. Piling operations present a number of potential risks to environmental receptors if not correctly managed. These can include noise, vibration and ground movement hazards. The scale of the project will affect the source magnitude, with both the number and depth of piles, and the duration of piling affecting the impact on receptors. Noise from piling activities can affect both human communities and

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

wildlife

LILO / OHL Construction Noise

540. The combination of machinery being used at any one time during the construction phase will vary and noise levels will fluctuate accordingly. Table 9.8 indicates the timescale for various activities and the types of equipment required.

Table 9.6: Construction Activities and Sound Levels

#	Activity	Timescale Per Tower	Equipment	Typical Sound Level Data at 10m*
1	Clearing and grading activities	2 days	Grader**	82
			Bulldozer (20t)	81
			Pick-up truck	75
2	Transporting materials to the tower site	2 days	Pick-up truck	78
			Lorry (4 axle)	80
3	Constructing foundations and anchors Piling	2 weeks	Excavator (22t)	71
			Bulldozer (20t)	81
			Backhoe (8t)	88
			Pneumatic Tools	95
			Pick-up truck	75
			Lorry (4 axle)	80
			Pile Rig/driver	82/120
4	Assembling and raising the towers	1 week	Crane (110t)	67
			Pick-up truck	75
			Lorries (4 axle)	80
5	Earthing tower	2 days	Auger drill	79
			Pick-up truck	75
			Backhoe (8t)	88
6	Unreeling and Installing the Conductors	2/3 days	Mobile Bullwheel tensioners	85
			Crane (110t)	67
			Mobile Winch	85
			Pick -up trucks	75
			Lorries (4 axle)	80
7	Restoring the Site	2 days	Bulldozer (20t)	81
			Backhoe (8t)	80

* Based on BS 5228 – 1:2009 – Assumes each piece of equipment working 25% of the day

** Based on data from US DOT FHA (https://www.nrc.gov/docs/ML1805/ML18059A141.pdf)

541. Based on these activities the following noise levels can be assumed based on each piece of equipment in operation for 25% of a ten-hour working day.[42]

Table 9.7: Estimated Noise Levels for Various Construction Activities

Sl. No.	Activity	Sound Level dBA $_{LAEQ\ 10\ HR}$		
		10m	100m	150m[43]
1	Clearing and Grading	79	59	55
2	Transporting materials to the tower site	75	56	53
3	Constructing foundations and anchors	90	70	67
4	Assembling and raising the towers	75	55	52
5	Earthing Tower	83	63	59

[42] Assumptions are based on the IEE consultants experience of High Voltage transmission line construction projects in Uzbekistan (Northwest Region Power Transmission Line Project). Construction noise levels are also aligned with other recent ESIAs prepared by NEGU for EBRD (Navoi - Besopan Transmission Line Upgrade, Uzbekistan).

[43] Contractor will develop appropriate baseline indicators at 10m, 100m. 150m. 200m and above as required after analysis.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

6	Unreeling and Installing the Conductors	83	63	59
7	Restoring the Site	83	63	59

542. Table 9.7 indicates that most of the construction activities are likely to result in some intermittent elevated noise levels for short periods of time (approximately 8 weeks in the location of each tower), especially during foundation works. It is possible that piling could be required at some tower sites, this could result in high levels of localized noise and vibration around the work sites.

Substation Construction / Rehabilitation Noise

543. The combination of machinery being used at any one time during the substation works phase will vary and noise levels will fluctuate accordingly. In general noise levels at 15m distance from the source are anticipated to be no greater than 85 dBA[44], and around 66 dBA at 100m, based on equipment operation for 50% of a ten-hour working day. However, the magnitude of impact will increase where piling is required. Substation works may take approximately 6 months to complete at each site, meaning that elevated noise levels during the construction phase can be anticipated for at least 6 months at the identified receptors.

544. The impact of construction will be temporary in nature and reversible with ease in the short term but is of major significance at new substations wherever sensitive receptors are within 50m – notably new substations at Madhabpur SS, Matlab (N) SS and Paikgacha SS. For the bay extensions at Satkhira SS, Gopalganj SS and Bhandaria SS sensitive receptors are also within 50m but the significance will be less due to the magnitude of works.

Mitigation Measures

545. To manage potential noise impacts during construction of all components a range of GIIP measures will be applied to all project components. The important mitigation measures will be to inform people in advance of noisy activities and to ensure that construction in residential areas is only undertaken during daytime periods. Work close to schools will be scheduled for holiday periods to avoid disturbance to students. The EPC contractor must schedule construction activities so as to minimize nuisance to sensitive receptors (houses, schools, clinics, mosques, etc.) i.e. avoid works at night, on weekend, during holidays, school exam periods, etc. Other measures such as installation of temporary noise barriers can also be applied.

546. Where possible EPC Contractors will avoid soil compaction, piling, and other vibration inducing activities as much as possible. In locations where this is unavoidable the EPC Contractor will identify properties within the zone of influence and undertake pre-construction structural surveys to identify level of risk. If risk of structural damage to properties identified due to current condition consideration of alternative construction methods or temporary relocation of occupants during works if at risk shall be undertaken. During any piling works the EPC Contractor shall install monitor during construction to monitor structural movement. Structural or cosmetic damage to be repaired by the EPC Contractor to at least pre-project condition at their own cost.

547. It is recommended to use the ear PPE and maintain the EHS rules to lessen the health hazard while working in the project boundary.

9.3.1.2.3 Operation Phase

Impacts

Audible Noise and Radio Interference from Transmission Lines

548. Audible noise from transmission lines occurs primarily in wet weather. In dry weather conditions, the conductor usually operates below corona inception level and generates few corona

[44] https://ia.cpuc.ca.gov/environment/info/ene/mesa/attachment/A1503003%20ED-SCE-01%20Q.PD-01%20Attachment%20(Revised%20Noise%20Levels%20Construction%20Equipment).pdf

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

sources for audible noise. However, in wet conditions, water drops impinging or collecting on conductor produce a large number of corona discharges and thereby creating bursts of noise. Therefore, the audible noise increases to such an extent that sometimes it represents one of the limitations for the design of transmission line conductor. The audible noise for the proposed transmission lines has been estimated and presented in Table 9.8. The noise levels during fair weather are generally within the national standards. However, during rainy periods, the noise levels will exceed the night time standards up to 100m from the center of transmission line alignment.

549. Radio interference also called radio influence is a noise type that occurs in the Amplitude Modulation Radio reception including the standard broadcast band from 0.5 to 1.6 MHz. It does not take place in Frequency Modulation bands. Power line interference tends to be roughly in inverse proportion to the frequency. Radio interference can be predicted by applying Empirical or Comparative formula as a result of regression analysis performed on experimental data of Radio Interference of various variables such as conductor diameter, surface gradient, and lateral distance from the line. Instead of using absolute noise level, as a criterion for rating interference level, it is more logical to use a relative measure as signal to noise ratio. This parameter is generally employed to affect the effect of transmission noise on AM Radio broadcast. The radio interference is calculated and presented in Table 9.10.

550. No standard limit exists for Radio Interference but Canadian Standard Association (CSA) has developed the recommended limits for Electromagnetic Noise based on the line voltage. For high voltage level of 400kV, the acceptable limit is 60 dBA in fair weather measured at the distance 40 meter from center of tower. The estimated radio interference levels from the proposed transmission lines will be within these standards.

Table 9.8: Electrical and Magnetic Fields from Transmission Line

Distance from Centre of transmission lines Alignment (m)	Audible Noise (dBA)		Radio Interference (dBuV/m)	
	Rain Weather	Fair Weather	Rain Weather	Fair Weather
40 (edge of RoW)	51.5	26.5	59.6	42.6
50	50.8	25.8	57.4	40.4
60	50.1	25.3	55.2	38.2
70	49.4	24.4	53.5	36.5
80	48.9	23.9	52.1	35.1
90	48.4	23.4	50.9	33.9
100	47.9	22.9	49.7	32.7

Source: Techvy and Feedback Infra 2024

OHL / LILO Corona Noise

551. Literature studies indicates that “Corona Noise” only becomes a significant issue from 350-500 kilovolts (kV) and above. The Public Utilities Commission of California also indicate that corona noise is usually not a problem below 230kV.[45] This would suggest that significant “Corona Noise” impacts may only be likely on the 400 kV Matarbari PP – Banskhali PP Line (6.75 km). However, there are no sensitive receptors close to this LILO.

New Substation Noise

552. Large zone substations typically have at least two step-down transformers that emit noise most commonly in the low frequencies between 100Hz and 200Hz. In addition, the noise hum is specific to each site. During the day the noise hum from the transformer is typically hidden, or masked, behind noise from traffic and industry. At night, when the background noise drops, the hum becomes more perceptible, annoying residents and in some cases impacting on their health.

[45] https://ia.cpuc.ca.gov/Environment/info/aspen/tri-valley/17%20-%20Corona%20and%20Induced%20Current%20Effects.pdf

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

553. Baseline noise monitoring at substations shows an average of 55dB (approximately) daytime and 35dB (approximately) night time at the substation boundary, lower than IFC guideline limits and national standards for nighttime noise in a residential area. The difference in ambient noise levels is associated with daytime human activities around the substation. Substation noise is not anticipated to change throughout the day (unless for maintenance). Several of the new substations are to be located close to residential receptors. The Project will take a precautionary approach to operational noise to ensure that operational noise levels[46] do not impact negatively upon residential receptors which are in close proximity.

Existing Substation Noise

554. For existing substations, the Project involves the installation of new modern equipment which will have noise levels lower than, or at a maximum, the same as existing equipment meaning that there is unlikely to be an increase in noise levels from the SS of more than 3dBA above existing ambient noise levels.

Mitigation Measures

Impact Summary and Assessment of Significance

555. Table 9.11 provides an assessment of the significance of potential noise and vibration impacts before implementation of the proposed mitigation measures that are discussed in this section.

Table 9.9: Noise and Vibration Potential Impacts

Phase	Potential Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
C	*General construction activities*	*Local community*	*H*	*H*	*H*	*M*	*MAJ*	*ST*	*SMA*	*MOD*	*DEF*	***H***
O	*New and Existing Substation Noise*	*Local community*	*L*	*M*	*L*	*M*	*MOD*	*LT*	*SMA*	*MOD*	*DEF*	***L***
O	*New Transmission Line Noise*	*Local community*	*L*	*M*	*L*	*L*	*Low*	*LT*	*SMA*	*Low*	*DEF*	***L***

Key: *H: High / M: Medium / L: Low / MAJ: Major / MOD: Moderate / MIN: Minimum / H/F: High Frequency / M/F: Medium Frequency / L/F: Low Frequency / LT: Long term / MT: Medium Term / ST: Short term / MED: Medium / DEF: Definitely / POSS: Possible: / UNLIKE: Unlikely. Cells shaded in blue are positive impacts.*

9.3.1.2.4 Residual Impacts

Table 9.10: Residual Noise and Vibration Impacts

Phase	Potential Impact	Potential Impact Significance	Residual Impact	Residual Impact Significance
C	*General construction activities*	***High***	*Some short-term elevated noise impacts may occur during the daytime. Keeping work to short durations and the use of temporary mobile noise barriers should reduce the noise levels to acceptable levels during the working*	***Low***

[46] Install noise attenuating screens (such as concrete wall) near residential receptors

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

			day.	
O	*New and Existing Substation Noise*	***Low***	*Noise barriers will reduce noise levels to within acceptable limits.*	***Not significant***
O	*New Transmission Line Noise*	*Low*	*No significant corona noise below 230kV lines. Noise most prominent in rainy season*	***Low***

9.3.1.3 Soils

556. This section discusses potential impacts on soils during construction and operation of the Project and associated mitigation measures to be adopted.

9.3.1.3.1 Pre-construction Phase

Impacts

Historical Contaminated Land

557. Soil conditions at the 5 existing substations were similar with some degree of contamination of oil from spillage/leaks in one or more spots, mostly under the transformers – corrective action is required to remediate this.

Aggregate Requirements

558. Any aggregate required for construction of tower foundations (e.g., fill material beneath tower pads), or for substation works, including sandfill, will be obtained from existing licensed quarries and/or borrow pits. Extraction and use of aggregates constitutes a depletion of non-renewable natural resources.

Mitigation Measures

559. Existing substations will be surveyed during the design phase to confirm the extent of contaminated land present in the proposed installation works area. If signs of potential contamination are present in this area, e.g., oil storage tanks, operational or old leaking transformers, oil staining, etc. further soil sampling and testing shall be undertaken in the work area to determine the level of soil contamination (for oil/hydrocarbons and PCBs). If soil contamination is noted in the work area, a method statement for the management and disposal of the contaminated soil will be prepared and submitted to PGCB. The method statement will follow the requirements for disposal as noted below under waste management.

560. To manage leaks from oil containing equipment substations designs will include at minimum 110% impermeable bunds to transformers/storage areas used for oils etc. including Soak Pit and Oil collecting pit as follows:

- An oil soak pit shall be designed and provided below each oil filled transformer / reactor to accommodate at least 150% of total quantity of oil contained in the transformer / reactor with minimum 300 mm thick layer of gravels / pebbles of approximately 40 mm size (spread over a steel iron grating / trans rack) providing free space below the grating.
- Alternatively, an oil soak pit shall be provided below each transformer or reactor, to accommodate one third of total quantity of oil contained in the transformer / reactor with minimum 300 mm thick layer of gravels/ pebbles of approximately 40 mm size (spread over a steel iron grating/ trans rack) providing free space below the grating provided a common remote oil collecting pit of capacity at least equal to oil quantity in the largest size transformer or reactor is provided for a group of transformers or reactors and bottom of the soak pit below the transformer or reactor shall be connected to the common remote oil collecting pit with drain pipe of minimum 150 mm diameter with a slope not less than 1/96 for fast draining of oil or water through gravity from soak pit to the common remote oil collecting pit.
- Every soak pit below a transformer or reactor shall be designed to contain oil dropping from any part of the transformer or reactor.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

- The common remote oil collecting pit and soak pit shall be provided with automatic pumping facility, to always keep the pit empty and available for an emergency.
- The disposal of transformer oil shall be carried out in an environmentally friendly manner.

561. Fuel and other lubricants will need to be stored at the construction sites. GIIP will be required to ensure that accidental spills and discharge to the soil are avoided. A 110% bunded, secure storage area will also be provided at SS sites for oil and waste.

562. EPC Contractors for all components will be responsible for the preparation and implementation of a Pollution Prevention Plan covering and environmentally sound and safe storage, use, and disposal of all fuels, chemicals and oils used on site and an emergency preparedness and response plan in the event of any leaks or spills (e.g., of oil, etc.). The plan is to reflect the EMP requirements and IFC EHS guideline requirements. It will also include procedures for managing contaminated sites as well as restoring disturbed work zones beyond the boundary of the completed infrastructure. Both will form part of Contractors Site Specific EMP (CSEMPs).

9.3.1.3.2 Construction Phase

Impacts

563. During construction phase, there is a high risk of accidental spills and leakages that may occur from fuel and oil tanks, vehicles and machinery, and storage of chemicals used in construction areas, storage yards, batching plants – if required, and worker camps. Sources include transformer oil; battery acid (battery backup systems); maintenance chemicals (paints, lubricants, gases); waste transformer oil; and others. These spills can pollute soils and contaminate soils in the project areas. Wastewater effluents from temporary facilities such as camps and offices can also contaminate soil in the vicinity of works.

564. Disturbance of soils during construction including (and particularly) from movement of vehicles, may lead to destruction of the integrity of upper soil layers. Damaged soil is more readily eroded and washed into water courses during rainfall events and can also form dust during dry periods. This effect will be significant along off-road access which will further damage the integrity of soil apart from vehicle movement.

565. Sourcing of dredged river sand/soil/gravel for filling inside substations is important for this project. The contractor must ensure sourcing/selection of government licensed sand gravel suppliers from existing legally permitted sites i.e. ensure no illegally extracted sand and gravel is used for the project which may negatively impact any sensitive aquatic life and hydrology of the adjoining river systems at the sites.

Soil Properties and Compaction

566. Soil compaction of topsoil and subsoil may occur around tower pad sites and areas beneath lines during stringing – although methods can be employed to ensure that disturbance beneath lines is kept to a minimum during stringing.

Soil Erosion and Soil Loss

567. Erosion is a natural process by which wind and rain wear away soils that have poor cohesion or are steeply sloping – all substation sites are flat. Excavation for construction of transmission line towers and substations particularly near the rivers and khals can cause soil erosion. Where the land surface is disturbed and when vegetation and topsoil are removed, erosion rates increase. After reinstatement of topsoil temporarily removed from the worksites during construction or at the temporary storage areas, the soil is less cohesive and is much more easily erodible in wet weather. High rainfall events can the potentially cause accelerated erosion in excavated areas. The significance of impact on soil pollution and soil erosion is characterized as medium.

Soil Contamination During Construction

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

568. The principal potential contaminants associated with the construction activities are the same as those listed below for hydrology. The soil can also be contaminated if substances from hazardous waste storage leach into the ground or if raw sewage is discharged onto the ground. This can occur at both work sites and camp sites. Impact significance will be greater in agricultural areas, where the substations are sited.

Spoil Disposal

569. Excavated material from substation foundations and the tower footings will be backfilled into the excavated area and compacted. Excess spoil material will not be spread around the base of the tower and piling mud disposal will need to be managed to not affect farming activities after the tower is erected.

Mitigation Measures

570. To manage topsoil and prevent soil erosion and pollution from contaminated land disturbance and hazardous materials a range of international good practice measures will be applied to all project components per the project EMP.

571. The following mitigation measures will be implemented:

- Contractor will prepare and implement a Pollution Prevention Plan prior to the start of the work. Proper baseline data will be collected.
- Contractor will be required to implement the measures prescribed in the Environmental Code of Practices (ECP), which will be included in the contracts.
- Contractor will be required to take appropriate measures to avoid and contain any spillage and pollution of the soil
- Contractor will confine the contaminants immediately after such accidental spillage
- Contractor will collect contaminated soils, treat and dispose them in environment friendly manner
- All areas intended for storage of hazardous materials to be quarantined and provided with adequate facilities to combat emergency situations complying all the applicable statutory stipulation
- Top soil to best ripped and stock piled where practical.
- Temporary stock piles to be protected from erosion.
- For sewage waste, appropriate treatment arrangement such as septic tanks and soakage pits will be installed on site. Water will percolate into the ground so there will be no discharge. Alternatively, sewage from construction camps and other facilities will be collected and transported to nearby municipal sewage treatments plans.
- The monsoon season will be avoided to carry out construction activities particularly excavation to the extent possible to minimize soil erosion.

9.3.1.3.3 Operation Phase

Impacts

Leaks and Spills

572. Without suitable containment measures, it is possible that leaks of oil from oil containing equipment could impact upon soils (and groundwater). However, all new substations will be constructed and existing substations upgraded (in accordance with Corrective Action Plan in Table 6.4: Corrective Action Plan) in accordance with GIIP with oil bunds to 110% capacity etc. An oil soak pit to be designed and provided below each oil filled transformer / reactor to accommodate at least 150% of total quantity of oil contained in the transformer. However, there remains a risk that spills and leaks of oil could occur from oil storage areas and old oil containing equipment.

Impact summary and assessment of significance

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

573. provides an assessment of the significance of potential soil quality impacts before implementation of the proposed mitigation measures that are discussed in this section.

Table 9.11: Potential Impacts to Soils

Phase	Potential Impact	Receptors	Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
C	Changes in Topography		L	L	L	-	MAJ		SMA	LOW	DEF	M
C	Soil Compaction	Soils including agricultural land	M	M	L	-	MOD	MT	SMA	LOW	POSS	L
C	Soil Erosion	Soils including agricultural land, and local vegetation	L	M	L	-	MOD	ST	SMA	LOW	POSS	L
C	Soil contamination from spills and leaks	Soils including agricultural land, local vegetation	L	H	L	L	MAJ	LF	SMA	MED	POSS	M
C	Aggregate requirements	Soils including agricultural land, local vegetation	L	H	M	L	MAJ	LF	SMA	MED	POSS	L
C	Contaminated land from substations	Soils adjoining substation	M	H	L	-		LF	SMA	MED	DEF	M
O	Spills and leaks at substations	Soils at substations	H	H	L	-		LF	SMA	HI	DEF	H

Key: H: High / M: Medium / L: Low / MAJ: Major / MOD: Moderate / MIN: Minimum / SMA: Small/ H/F: High Frequency / M/F: Low Frequency / L/F: Low Frequency / LT: Long term / MT: Medium Term / ST: Short term / MED: Medium / DEF: Definitely / POSS: Possible: / UNLIKE: Unlikely. Cells shaded in blue are positive impacts

Mitigation Measures

574. The following mitigation measures will be implemented:

- PGCB O&M staff will be required to implement the measures prescribed in the Environmental Code of Practices (ECP), which will be included in the contracts.
- PGCB O&M staff will be required to take appropriate measures to avoid and contain any spillage and pollution of the soil
- PGCB O&M staff will confine the contaminants immediately after such accidental spillage
- All areas intended for storage of hazardous materials to be quarantined and provided with adequate facilities to combat emergency situations complying all the applicable statutory stipulation

9.3.1.3.4 Residual Impacts

Table 9.12: Soils Residual Impacts

Phase	Potential Impact	Potential Impact Significance	Residual Impact	Residual Impact Significance

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Phase	Potential Impact	Potential Impact Significance	Residual Impact	Residual Impact Significance
C	Changes in Topography	Low	Towers installed in the area as well as substation lands raised and change in water channels near substation	Not significant
C	Soil Compaction	Low	Soil compaction and soil erosion is not likely to result in significant impacts during the construction phase. Implementation of the proposed mitigation measures will further limit the potential for impacts to occur.	Not significant
C	Soil Erosion	Low		Not significant
C	Soil contamination	Medium	Mitigation will ensure that any residual impacts are of low significance.	Low
C	Aggregate requirements	Low	No residual impacts are anticipated if licensed existing sources are used.	Not significant
C	Contaminated land from Substations	Medium	The measures outlined above will ensure that any potentially significant soil contamination is identified and removed from the site to authorized disposal locations. No highly significant residual impacts are identified as long as these procedures are followed.	Low
O	Spills and leaks at substations	High	Construction of containment measures according to GIIP will ensure that leaks and spills at substations do not result in highly significant impacts.	Low

9.3.1.4 Hydrology, Water Resources and Water Quality

9.3.1.4.1 Pre-construction Phase

Impacts

575. The substations will result in infilling of low-lying land which is waterlogged at several substations and the land raising at Pekua and Paikgacha substations which are flooded during the monsoon and waterlogged respectively. There are khals and small drains adjacent to some of the substation sites. Thus, significant impacts on waterbodies and any locally important aquatic ecology are anticipated. The proposed transmission lines would cross over the river, water bodies, waterlogged areas and small streams which are usually seasonal in nature. Significant impacts on water bodies and aquatic ecology are envisaged, if any footings are located near or inside any waterbody or waterlogged land due to the need for piling. There needs to careful selection of the construction time and tower sites near the water body and rivers, to avoid surface water pollution and disturbance to the aquatic fauna of the area during the monsoon period.

576. Surface runoff from substation drainage can discharge construction wastewater, seepage/leakages of sanitary wastewater, piling mud as well as washing of construction vehicles etc. that can lead to pollution of water bodies. Similarly, contamination of water on land/near bodies of water nearby tower construction sites could be affected adversely. Selection of temporary lands (such as labor camps, storage areas etc.) used for the project must also be at least 500m away. The proposed transmission lines would cross over the river, water bodies and waterlogged areas as per local site conditions from highly populated areas, water bodies, natural flow paths, agricultural lands, important ecological habitats and residential areas. Removal of trees and green cover vegetation must be minimised. Piling can cause the creation of new pathways for contamination from slurry and waste soil generated. The scale of the project will affect the source magnitude, with both the number and depth of piles, and the duration of piling affecting the release rate of mud and slurry particles into adjoining areas.

577. The Project will involve the use or generation of some or all the following materials that have the potential to contaminate surface waters:

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

- Fuels and lubricating oils.
- Paints and solvents.
- Leachate from hazardous waste storage areas at camp sites and work zones.
- Raw sewage from camp sites.

578. Water needs during construction of the project would be limited to sanitary water and minimal amounts of water for construction (such as spraying for dust prevention). There would be a negligible impact on water resources considering the abundant water resource in the area. It is important that selection of temporary lands is at least 50m away, depending on practicability as per local site conditions from highly populated areas, water bodies, natural flow paths, agricultural lands, important ecological habitats and residential areas. Removal of trees and green cover vegetation should be minimised during preparation of facilities. The substation sites are located close to surface waters (or they are low lying land which is inundated year around) and groundwater sources, per Table 9.13 and Table 9.16. These waterbodies may be affected by sediment laden surface water runoff, spills, leaks of hazardous materials and untreated sanitary wastewater – open defecation may also be an issue during construction if toilets are not provided for workers. There may also be wastewater from washing of construction equipment and vehicles. There is also a risk that there could be untreated disposal of sanitary wastewater and spills and leaks of oil and other hazardous liquids during substation works and any pollution could impact upon any local groundwater users. However, the risk of major spills and leaks during construction is relatively low.

Table 9.13: Ground and Surface Water Receptors near substations

#	Location	Groundwater	Surface water
1	Pekua Substation	Submersible – 200 m	Salt Pan
2	Madhabpur Substation	-	Low land area (north boundary)
3	Tungipara Substation	Submersible	Low land area inside boundary
4	Chatkhil Substation	-	Khal adjoining boundary
5	Paikgacha substation	Submersible– 20 m	Low land area, water body at the site
6	Bajitpur Substation	Submersible	Water body (low land area)
7	Paikgacha Substation	Submersible	Low land area inside PGCB campus
8	Kachua Substation	Submersible	Khal adjoining substation
9	Dupchancia substation	Submersible	Water body (Low land area)
10	Matlab (N) substation	Submersible	-

Source: SES survey, June 2024 and Resettlement Plan

Table 9.14: Ground and Surface Water Receptors near Transmission Lines Angle Towers

(other receptors may exist at closer distance along the remainder of the transmission line)

#	Location	Groundwater No and distance in m	Surface water Nos and distance in m
1	LILO of Existing Matarbari PP – Banskhali PP 400 kV line at Matarbari: 6.75 Km	50-350 m	100-350 m
2	Monohardi-Bajitput 132kV double circuit line: 21.00 km	50-500m	50-350m
3	Reconductoring of Shahjibazar-Brahmanbaria-Ashuganj 132kV line: (58+17) = 75.00 km)	50-500m	100-450m
4	Satkhira-Paikgacha 132kV double circuit line: 30.00 km	50-350 m	100-350 m
5	Bhandaria-Mathbaria 132kV double circuit transmission line: 32.00 km	50-400m	50-450m
6	Kachua – Matlab (N) 132kV double circuit line:	50-350m	50-450m

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

#	Location	Groundwater No and distance in m	Surface water Nos and distance in m
	33 km		
7	Gopalganj – Tungipara 132kV double circuit line: 19.00 km	50-300m	50-400m
8	LILO of Chowmuhani – Ramganj 132kV double circuit line at Chatkhil/ Chatkhil: 2.00 km	50-300m	100-300m
9	LILO of Bheramara – Rajbari 132kV line at Kusthia (E): 0.60 km	100-300m	150-350m
10	LILO of Bogura (S) – Naogaon 132kV line at Dupchanchia: 2.50 km	100-300m	150-3500m
11	LILO of Anwara -Cox's Bazar 230kV line at Pekua : 0.50 km	50-500m	100-350m
12	LILO of Existing Matarbari (132/33) - Chakaria 132kV line at Pekua: 1.30 km	50-350m	100-400m
13	LILO of Cumilla (N) - Shahjibazar PP 230kV double circuit line at Madhabpur: 1.20 km	50-350 m	100-350 m
14	LILO of Shahjibazar - Brahmanbaria 132kV double circuit line at Madhabpur: 1.20 km	50-400m	100-450m
15	LILO of Sripur - Ashuganj 230kV double circuit line at Monohardi: 5.50 km	50-350m	50-450m

Source: TA Consultant, 2024

579. A number of OHL lines cross rivers and streams, but this is not considered a significant issue in terms of hydrology as the lines can easily be designed to cross over the rivers and streams with no impacts to these areas. No towers are planned to be constructed in rivers. However, water bodies etc. (if any) in immediate vicinity can get contaminated from sediment laden surface water from the construction site. The possibility of minor groundwater contamination also exists from any spills or leaks of hazardous liquids. Discharge of the piling discharge if not carefully controlled may impact on surface water.

580. Although large volumes of water are not anticipated to be required at each worksite, there will be the need for technical and drinking water supplies during the construction phase. For the substations new borewells will be provided. Uncontrolled exploitation of water resources could impact upon the existing users of the water resources.

Mitigation Measures

581. At substations all new transformers; oil and waste storage areas; and septic tanks/soak aways shall be located at least 50m from waterbodies and borewells to reduce pollution risk. If closer proximity is required due to site layout further assessment will be carried out to demonstrate using a source-pathway-receptor model there will be no adverse impact on aquatic ecology or human health. Wastewater will be connected to existing sewerage system or septic tank with soak away so no untreated wastewater will be disposed of to surface water or ground in operation, septic tank/soak-away effluent to meet national general wastewater standards.

582. During the design phase, the EPC Contractor will identify all water supply systems and water pumps and ensure that alignments avoid any interference with these areas. However, it is possible that temporary disruptions could occur.

583. Regarding drainage, adequate drainage design taking into account extreme floods and climate change will be provided at the substations to manage runoff during operation. The capacity of the drainage system installed will need to ensure flood risk at the adjacent lands to the substation is not

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

increased. The rainwater channels at Tungipara SS, Monohardi SS will be diverted away from the site[47]. Consultation with community undertaken to confirm routing site and works schedule to avoid loss of rainwater collection. PGCB shall identify the storm drainage outfalls in consultation with local residents to ensure that the discharge from the SS drainage system does not cause waterlogging on adjacent private or agricultural land with oil interceptors provided. The outfall can be connected to a natural waterbody or an existing drainage system, if available.

584. At this stage, the EPC Contractors for all components will prepare and implement their Pollution Prevention Plan covering the protection of water resources and environmentally sound and safe storage, use, and disposal of all fuels, chemicals and oils used on site and an emergency preparedness and response plan in the event of any leaks or spills (e.g., of oil, etc.) or an incident such as flood. If will reflect the project EMP and IFC EHS guideline requirements with particular attention to piling mud management.

585. For surface waterbodies or groundwater sources within 50m of any sub-activity (except 2nd circuit stringing), baseline water quality sampling will be required (per EMoP) to confirm their current water quality status at least one week prior to the commencement of any actively onsite. The identified sources of hydrology should be confirmed by the EPC Contractor as part of this activity. Any drilling or excavation works within 50m of boreholes and wells for any component sub-activity will require pre-construction and post construction water quality monitoring against national drinking water standards to ensure no contamination of the local community supply. If any water pumps and water supply networks are damaged during works the contractor must provide the affected users with an adequate, alternative drinking water supply meeting national standards whilst immediately repairing the damage caused.

586. Permissions for any new borewell installation at any new substation shall be obtained including NOC from relevant authorities together with agreement of local communities before drilling and abstraction. A water meter will be provided on the borewell for monitoring of water abstracted.

9.3.1.4.2 Construction Phase

Impacts

Water Quality

587. Surface water quality will be degraded due to discharge of waste water from the construction work at new substation site, at bay extensions and installation of transmission towers especially the river crossing towers. In addition, wastes from labor camps and material stockyards may potentially degrade or pollute the both surface water and groundwater quality.

588. The construction and operation of the substation and transmission lines will increase turbidity levels temporarily e.g., where the proposed alignment is crossing small village pond (waterbody) and if the surface runoff during construction meets the river. This can be avoided by careful selection of the tower sites and the temporary access roads so that the surface runoff does not meet the river. Soil erosion can adversely affect the water quality of the rivers/water bodies through sediment laden runoff.

Piling operations

589. In most cases the receptor will be a potable groundwater abstraction which could be operated either for public supply or by a private operator. Groundwater fed surface waters may also be considered if in close proximity to the foundation works. Other receptors includes waterways, salt pans, fisheries, agricultural fields, water ponds, khals, bheels as well water canals created for irrigation causing high turbidity, waste residue to slurry and mud that blocks channels, affects fish life and cause loss of livelihoods and prevents access to fields and waterways.

[47] To be designed by contractors after award during detailed design of the site layout before approval.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

590. Environmentally sound management of piling fluid from tower footings/substations is essential to safeguard surrounding ecosystems and prevent the potential contamination of water resources and soil. Contamination of water bodies may result due to construction of access road to the substation site, spilling of construction materials and surface runoff from the construction site joining the waterbody.

591. Proposed activities can create temporary impacts to the existing drainage system in the area including irrigation canals, natural flow paths and also earth and line drains in the agricultural fields.

592. The significance of this potential unmitigated impact has been assessed as Medium on the basis of impact magnitude and receptor sensitivity.

Liquid Waste Disposal

593. There will be no oil or chemical waste generated during the construction of transmission line. For substations, this is the main constituent of the liquid stored. The transformer oil shall be stored as per IFC EHS guidelines and IEC-60422/1998 codes[48] and any waste oil shall be disposed as per Hazardous Waste and Ship Breaking Waste Management Rules, 2011 and any waste oil removed from transformer will be sold to government approved recycler and will not be disposed of in the ground or any rivulet/stream as per EMP.

594. Fuel and other lubricants will need to be stored on bunded impermeable surface with 110% volume at the construction sites. GIIP will be required to ensure that accidental spills and discharge to the soil and aquatic environments are prevented. Any fuel (including drums and tanks, if any) should be placed at least 50 m away from waterways and no equipment is to be refueled within this distance.

595. After the completion of work, the contractor will be required to rehabilitate and clean up all work sites. This includes repairing damage to pavements, roads, and drainage systems. All waste is to be removed from the sites and recycled or disposed of to licensed, engineered, sanitary landfill.

Damage to Khals and Tube-wells

596. Several tube-wells falls under the RoW of transmission lines but no deep tube-wells exist in the project areas which provide irrigation water to the crops of the area.

597. Notwithstanding, the construction activities can potentially cause damage to these khals and tube-wells, which can in turn affect the irrigation system of the area and ultimately affecting the crops of the area. Significance of these impacts is High.

Mitigation Measures

Water Quality

598. If any footings are located near any waterbody, the EPC contractor shall ensure the waterbody is not contaminated from wastewater/muck or construction material run off from the piling, digging and erection for reinforced cement concrete (RCC) base tower footings. The contractor shall construct silt traps, erect barriers to avoid such contamination of the water body that may be used for ecological support by birds, animals and humans alike in the area.

599. The following measures should be implemented to address the above concerns:

- Contractor will prepare and implement a Pollution Prevention Plan prior to the start of the work. Proper baseline data will be collected.
- Contractor will be required to implement the measures prescribed in ECP, which will be included in the contracts.
- Contractor will be required to comply with the national and WBG EHS Guidelines for waste water discharges in to the rivers.

[48] Supervision and maintenance guide for mineral insulating oils in electrical equipment.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

- Contractor will be required to establish 150% storage area for oil in bounded platform
- All areas intended for storage of hazardous materials to be quarantined and provided with adequate facilities to combat emergency situations complying all the applicable statutory stipulation
- For the treatment of effluent to be discharged, sedimentation ponds will be provided to allow sediment to settle for periodic removal for disposal in designated site spoil areas. Water being discharged from these ponds will be regulated to ensure they are within turbidity limits.
- Oil and water separators and settling ponds will be installed where appropriate to minimize the risk of contaminated construction water entering the river or groundwater and degrading water quality
- Construction works near river and khals will be carried out ensuring that no debris or excavated soil fells in water,
- Fuel and other lubricants will need to be stored at the construction sites. Best industry practice will be required to ensure that accidental spills and discharge to the soil and aquatic environments are prevented. Any fuel (including drums and tanks, if any) should be placed at least 50 m away from waterways and no equipment is to be refueled within this distance

Drainage.

600. Incorporation of following measures will minimise anticipated impact due to obstruction of natural flow paths and existing drainage:

- Provisions of temporary drainage facilities and routing low land area to the particular locations if existing drains are obstructed due to construction activities.
- Maintenance of all drainage paths by avoiding blockages at all times.
- Contractor should minimise excavation of beds of any streams, irrigation systems, and other water resources available in the project area.
- Stagnant water should be cleared by the contractor.
- If piling is required, method statement for management of piling mud needs to be prepared to ensure the immediate adjacent waterbody is protected, there must be no discharge of piling mud to surface water.

Construction Camps

601. Care shall be taken to locate the temporary day-time construction worker sheds 500m away from waterbody. Drinking water facilities, enclosed sanitary facilities (with soak pit) and drainage in the temporary sheds of construction workers must be provided to avoid the surface water pollution. Provision of washing and toilet facilities in numbers and facility is made obligatory.

Damage to Khals and Tube-wells

602. Tube well will be decommissioned to prevent the contamination of groundwater. Environmentally safe well decommissioning consists of removing pump, fittings, pipes and debris from tube well casing. The tube well is then filled from the bottom up with sealant materials. Sealing materials are used to prevent water from migrating into or between aquifers. They are commonly less permeable to water than the soil or rock on site. Bentonite chips or pellets, neat cement, concrete, grout, and high solids bentonite slurry are approved for tubewell decommissioning. A new tube well within a 500m radius from the existing tube well will be constructed. The same volume of water will be provided as this area consists of the same aquifer. No additional impacts will be expected due to the tube well relocation. Following measures will be implemented to avoid/minimize impacts on khals and tube- wells of the area:

- During river crossings, the sags to be considered to ensure sufficient vertical clearance.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

- Any excavation and other construction work near khals and tube-wells will be planned and implemented in a manner to avoid any damage to these structures.
- The vehicle movement near khals and tube-wells will be minimized. If unavoidable, it will be closely monitored to avoid any damage to these structures.
- No excavated material or debris will be released into the khals. The contractor will repair and restore any damage the construction activities may cause to khals and tube-wells. It will be ensured that the construction activities do not affect the water flow/availability in the khals or from the tube-wells.

Piling.

603. If the piling foundation solution cannot be changed to reduce risks of water pollution, then groundwater monitoring for turbidity during piling is recommended with work ceasing if adverse effect. The frequency and duration of each monitoring period will be site specific and should be agreed with the stakeholders at the earliest opportunity. The site monitoring data should be complemented with turbidity data from the receptor borehole to show any seasonal trends or other events that affect turbidity.

604. Sentinel monitoring boreholes must be suitably located down-hydraulic gradient of the piled area, installed to similar depth as the pile bases and fitted with a filter pack representative of the aquifer material. An upgradient borehole is required to assess changes in groundwater flow direction and changes in background turbidity from natural causes such as heavy rainfall.

Prevention techniques.

- *Precision in Planning*: By meticulously planning the piling layout, habitat fragmentation is reduced, preserving the integrity of wildlife corridors and ecosystems.
- *Advanced Techniques:* Utilising the latest piling methods, soil disturbance is minimised, lessening the impact on the surrounding soil structure and its inhabitants.
- *Water Protection*: Measures are taken to prevent water contamination, ensuring that nearby waterways and their aquatic life remain untainted by construction byproducts.
- *Ecosystem Recovery:* Post-construction, efforts are made to rehabilitate any disrupted areas, fostering a return to the pre-construction ecological balance.
- *Noise and vibration control*: Reducing these impacts through stringent vibration control measures by employing state-of-the-art equipment and techniques to ensure that the reverberations caused by piling work are kept to a minimum, thereby lessening the disturbance to nearby residents and sensitive animal habitats.

9.3.1.4.3 Operation Phase

Impacts

605. Flood events associated with climate change could impact upon project infrastructure given most of the sites are on the low-lying land. This issue is addressed through land raising of the substations and climate change adaptation measures to be included in the detailed design and below under geohazards.

606. Leaks of oil from substation equipment and stores could impact upon groundwater, but the requirements outlined above under Soils will ensure that leaks and spills are managed in accordance with national guidelines and best practice. Adequate drainage needs to be provided at new substations to manage site run-off during the operational phase.

Mitigation Measures

607. Majority of substation sites are situated in low-lying areas, necessitating the elevation of the ground level. This construction may alter the local hydrology. To maintain natural water flow, the substation design needs cross-drainage structures with adequate openings. Regarding drainage, adequate drainage design will be provided at the substations to manage runoff during operation.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

608. PGCB staff will be required to implement the measures prescribed in ECP and will comply with the national and WBG/IFC EHS Guidelines for waste water discharges in to the rivers. All areas intended for storage of hazardous materials to be quarantined and provided with adequate facilities to combat emergency situations complying all the applicable statutory stipulation

609. Oil and water separators and settling ponds to be maintained where appropriate to minimize the risk of contaminated construction water entering the river or groundwater and degrading water quality. For the treatment of effluent to be discharged, sedimentation ponds will be provided to allow sediment to settle for periodic removal for disposal in designated site spoil areas. Water being discharged from these ponds will be regulated to ensure they are within turbidity limits.

Impact Summary and Assessment of Significance

610. Table 9.15 provides an assessment of the significance of potential impacts to hydrology, water resources and water quality before implementation of the proposed mitigation measures that are discussed in the rest of this section.

Table 9.15: Potential Impacts to Hydrology, Water Resources and Water Quality

Phase	Potential Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
C	*Changes in drainage and flood risk*	*Ground and surface water, local community, wildlife*	*M*	*H*	*M*	*L*	*MAJ*	*ST*	*SMA*	*MED*	*POSS*	***M***
C	*Contamination of surface water*	*Ground and surface water, local community, wildlife*	*L*	*H*	*L*	*L*	*MAJ*	*ST*	*SMA*	*MED*	*POSS*	***M***
C	*Water use*	*Ground water, local community*	*L*	*M*	*L*	*-*	*MOD*	*ST/LT*	*SMA*	*LOW*	*DEF*	***L***
C	*Contamination of groundwater*	*Groundwater*	*L*	*M*	*L*	*L*	*MOD*	*ST/LT*	*SMA*	*LOW*	*POSS*	***L***
C	*Damage to water supply*	*Local community*	*M*	*H*	*H*	*-*	*MAJ*	*ST*	*SMA*	*MED*	*POSS*	***M***
O	*Contamination of water resources*	*Ground and surface water, local community, wildlife*	*L*	*H*	*L*	*L*	*MAJ*	*LT*	*SMA*	*HIG*	*POSS*	***H***

9.3.1.4.4 Residual Impacts

Table 9.16: Residual Impacts – Hydrology, Water Resources and Water Quality

Phase	Potential Impact	Potential Impact Significance	Residual Impact	Residual Impact Significance
C	Changes in drainage and flood risk	Medium	The mitigation measures outlined above will ensure that residual impacts are less significant.	Low

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

C	Contamination of surface water	Medium	The mitigation measures outlined above will ensure that residual impacts are not significant.	Low
C	Water use	Low	The mitigation measures outlined above will ensure that residual impacts are not significant.	Not significant
C	Contamination of groundwater	Low	The mitigation measures outlined above will ensure that residual impacts are not significant.	Low
C	Disruption of water supply	Medium	Temporary disruptions may still occur. Residual impacts will be low as impacts will be short term.	Low
O	Contamination of water resources	High	Measures adopted as part of designs should ensure there are no leaks and spills that would affect surface and groundwater	Not significant

9.3.1.5 Geohazards and Climate Risks

9.3.1.5.1 Pre-construction Phase

Impacts

Climate

611. The relevance of ensuring substation and line design that incorporates flood return data for the Bangladesh for the area as well increase in climatic conditions such incremental rainfall etc. will incorporated from the IPCCC climate change data for 50 years for land locked as well as entire Bangladesh. PGCB and Contractor to include this climate resilience information and provide ADB with adaptation and mitigation information.

Floods

612. Several sub-activity sites are located close to rivers, or in low lying areas. No specific information has come to light during site visits which indicates that new infrastructure is in flood prone areas, other than those lands that are already waterlogged due to being low lying where landfill is needed to raise the land above the flood level.

Seismic Events

613. Much of the Project areas are highly seismic. Seismic activity could damage project infrastructure leading to secondary impacts such as power outages and accidents involving people living close to damaged lines.

Landslides

614. There are no Landslide prone areas in project areas.

Forest Fires

615. No other sub-activity sites have been reported as being affected by forest fires.

Mitigation Measures

616. In the first instance all designs will incorporate specific measures, as required by national design and construction codes, to mitigate the risk of damage from seismic events, and other natural hazards including flooding and landslides. All structural designs will be checked for building and seismic safety by an independent expert, separate to the design team, to confirm national and international good practice standards are met.

617. During topographic and route surveys for tower line, the EPC Contractor will identify the presence of any unstable land or any depressions that get waterlogged in the rainy season and in the first instance avoid these areas by adjusting the design. Tower foundation designs will incorporate soil stability measures as per specific site requirement.

618. At substations and tower sites the EPC Contractors design team will conduct flood and drainage

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

risk assessment and incorporate effective drainage design (allowing for climate change) to prevent possible flooding or waterlogging during the wet season, whilst ensuring that surface runoff from the project site is no more than the greenfield runoff rate. The areas requiring special foundations and those prone to flooding should be avoided.

Coastal Area:

619. Pekua SS will be used for solar and wind power evacuation from the Chittagong area. This is the most challenging site which is located 11 km away from the Bay of Bengal coast. Also, this site is surrounded by a horseshoe shaped tributary. The site map shows the area location is preceded by powerplant and port at the coast, the design for this substation and power evacuation line to consider incremental project costs for climate proofing vulnerable infrastructure in the coastal areas can be viewed as providing "financial additionality" - salinity, wind-force, tidal/coastal impacts, flooding in backwater areas etc. Adherence to relevant coastal regulations and Building Code of Bangladesh in coastal areas to be ensured.

- The substation or switchyard shall be constructed above the highest flood level and, wherever required, flood protection walls shall also be provided.
- The substation shall be designed for seismic requirement of the site.

9.3.1.5.2 Construction Phase

Impacts

620. At substations and tower sites the EPC Contractors will ensure proper flood and drainage at all construction sites is implemented (allowing for climate change) to prevent possible flooding or waterlogging during the wet season, whilst ensuring that surface runoff from the project site is no more than the greenfield runoff rate. The contractor shall ensure that any areas requiring special foundations and those prone to flooding should be avoided during construction in rainy season.

Mitigation Measures

621. The final surface level of tower sites shall be at least 0.5 m above the existing ground level and highest flood level and shall be constructed in such a way as to be adequately drained to prevent washouts and flooding impacts to adjacent properties. The surface level shall also consider the findings of the climate change assessment prepared by ADB.

9.3.1.5.3 Operation Phase

Impacts

622. The substation yard can be submerged during rainy season due to water logging in adjoining drainage in the area. All substations are located in low lying areas that would be filled using sand.

623. During rainy season, the substations and towers are susceptible to lightning strikes which may result in electrocution and fires.

Mitigation Measures

624. PGCB staff shall ensure that ensure flood and drainage management measures are provided at all substations, drainage must be cleaned and maintained to prevent possible flooding or waterlogging during the wet season.

625. All power transformers and transmission towers to be provided with ground earthing through strips and wires respectively for suitable earthing. Every substation to have lightning arrestors at the boundaries as well as equipment to avoid such strikes. PGCB staff during operation must ensure all these are in working condition.

626. ***Impact Summary and Assessment of Significance*** Table **9.17** provides an assessment of the significance of potential geohazards before implementation of the proposed mitigation measures that are discussed in the rest of this section.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Table 9.17: Potential Geohazard Impacts

Phase	Potential Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
O	*Floods*	*Project infrastructure*	*L*	*H*	*L*	*-*	*MAJ*	*LF*	*SMA*	*MED*	*POSS*	***M***
O	*Seismic Events*	*Project infrastructure*	*L*	*H*	*L*	*-*	*MAJ*	*LF*	*SMA*	*MED*	*POSS*	***M***
O	*Landslides*	*Project infrastructure*	*-*	*-*	*-*	*-*	*LOW*	*LF*		*MED*	*UNLIJKE*	***NIL***
O	*Lightning strikes*	*Project infrastructure*	*L*	*H*	*L*	*-*	*MAJ*	*LF*	*SMA*	*MED*	*POSS*	***M***
O	*Forest Fires,*	*Project infrastructure*	*-*	*-*	*-*	*-*	*LOW*	*LF*	*-*	*MED*	UNLIKE	***NIL***

Key: H: High / M: Medium / L: Low / MAJ: Major / MOD: Moderate / MIN: Minimum / H/F: High Frequency / M/F: Medium Frequency / L/F: Low Frequency / LT: Long term / MT: Medium Term / ST: Short term / MED: Medium / DEF: Definitely / POSS: Possible: / UNLIKE: Unlikely. Cells shaded in blue are positive impacts.

9.3.1.5.4 Residual Impacts

Table 9.18: Residual Impacts – Geohazards

Phase	Potential Impact	Potential Impact Significance	Residual Impact	Residual Impact Significance
O	*Floods*	***Medium***	*Ensuring designs account for potential flood risks will help reduce potential impacts, but given the uncertainties associated with climate change impacts areas cannot be ruled out.*	***Low***
O	*Seismic Events*	***Medium***	*None identified, as long as earthquake loading, and national design standards are considered.*	***Not significant***
O	*Landslides*	***NIL***	*None identified*	***Not significant***
O	*Lightning strikes*	***Medium***	*Ensuring designs account for potential lightning strike risks will help reduce potential impacts, but given the uncertainties associated with climate change impacts in cannot be ruled out.*	***Low***
O	*Forest Fires, strikes*	***NIL***	*None identified*	***Not significant***

9.3.2 Ecological Environment

A. Designated Sites, Critical Habitat and Wildlife Corridors

9.3.2.1.1 Pre-construction Phase

Impacts

627. Screening of Project sub-activities has shown that:

Environmental Sensitive Area:

628. Mathbaria Substation is located 10 km far from the Sundarbans Mangrove Forest separated by the Baleshwari River.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

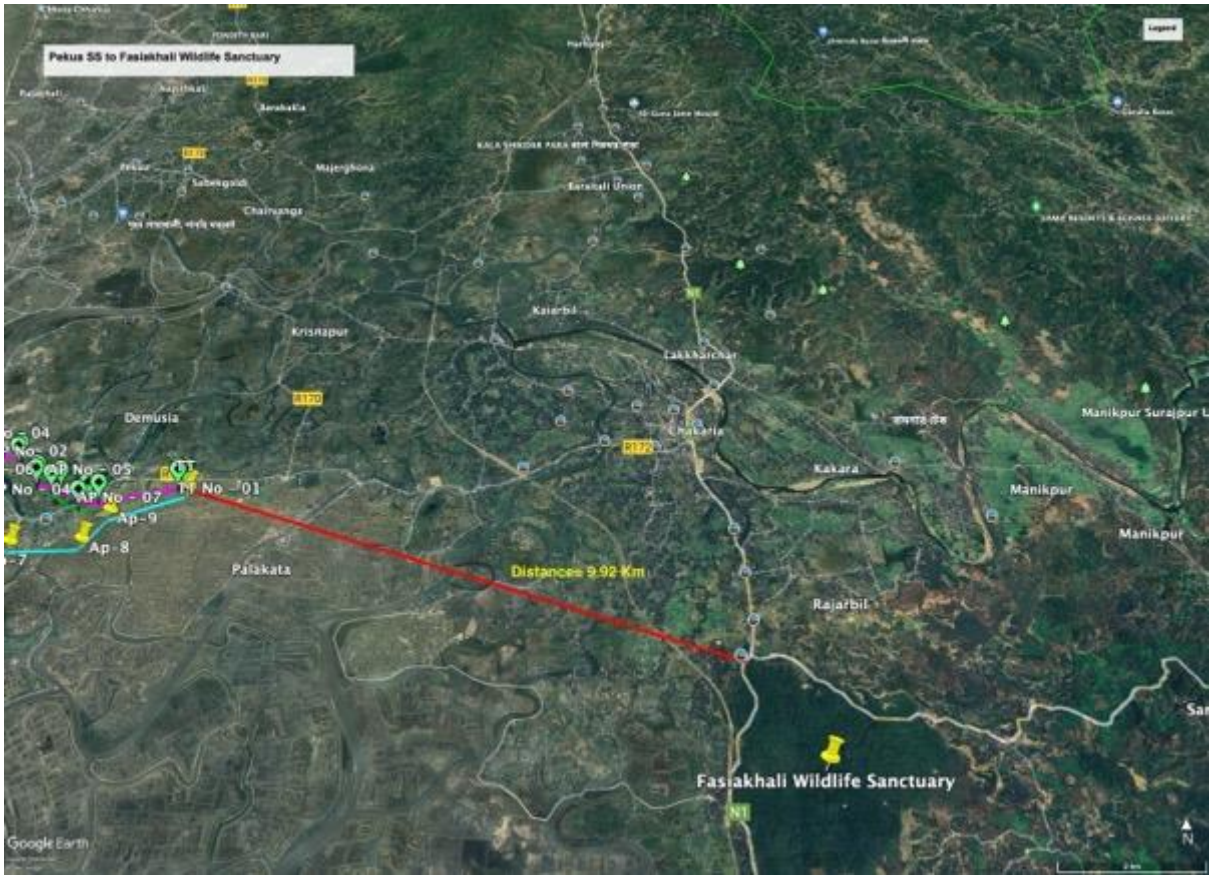
629. Paikgacha Substation is located 18 km far from the Sundarbans Mangrove Forest. The land is owned by PGCB, while the surrounding areas are used by local people for small-scale local fish and local varieties of shrimp cultivation using pumped water. The contractor must implement mitigation measures as per the EMP to ensure that local fish cultivation in the vicinity remains unaffected.

630. ***400/230/132 kV Pekua:*** the proposed Pekua substation is located approximately 13km away from the Bay of Bengal coastline. Presently the site is being used for salt cultivation by the local farmers. Usually, people produce salt in the land for four months in a year when the day has longer and intense sunshine. However, during the monsoon period the area is flooded with high tidal force and rainwater and people use the land for crab and small-scale local fish and shrimp cultivation, mainly for local consumption, with no large-scale commercial fishing or export activities. The contractor must implement mitigation measures as per the EMP to ensure that local fish cultivation in the vicinity remains unaffected.

631. The proposed site is a low land and approximately 2-3m sand filling is required to raise the land from the existing road surface. The Consultants team had several consultations with the local farmers and neighbors, house owner, and they are informed that large number of migratory birds are coming to the area during winter period in search of fishes and foods (types of migratory birds were confirmed by showing some pictures of migratory birds along with domestic species). All the respondents replied that migratory birds in large numbers along with other local species visit the area and they usually stay at the surrounding low-lying areas during the winter months. Consultation by ADB with experts in the birds supported in nearby coastal habitat did not flag any significant concern with works at this substation or the transmission lines.

632. The Consultants team also run the IBAT for the proposed substation and found that the Fasiakhali Wildlife Sanctuary is located within the 10km proximity. Furthermore, to check the details of this sanctuary the consultants also created another report of this sanctuary and found that there are three more Protected Areas (Bangabandhu Safari Park Coxbazar-12.66 km, Medhakachhapia-15km, and Sangu-30km from proposed Pekua Substation) within the 10km proximity of that sanctuary. However, all the sites including Fasiakhali are located towards Chattogram district and a separate from the substation site by small towns and a national highway also.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.



633. ***Mathbaria 132/33 kV:*** the proposed site for the Mathbaria substation is being used as agricultural land and it is a two-cropping agricultural field. Since the area has problem with withdrawal of groundwater, therefore, irrigation is not available for agricultural purpose. The proposed land needs to be raised with 2m sand filling. Though the location is approximately 10km away from the Sundarbans, the local people confirmed that this area does not have any such place where local or migratory birds can visit. Birds often visit this area, but this is usual like other coastal districts of Bangladesh. An IBAT assessment was also conducted around 10km proximity and found that there is no protected or key biodiversity area around the substation.

634. ***Paikgacha 132/33 kV:*** the proposed Paikgacha substation is located at the Kobodak river which has tidal influence. The land of the proposed substation has already been purchased by the PGCB almost two years ago and compensation to the affected persons has also been paid. There are approximately 12 families, and a government primary school is located just beside the proposed land area (within 50 m). The entire village has 600 families in the area. This area needs to be raised with approximately 3 m sand filling to make level with the road surface. The ADB TA consultant team carried out consultations with the local people and were informed that every year thousands of migratory birds are visiting this area during winter season. The local people were provided some photographs of migratory birds, and they confirmed the presence of these birds in some places around the site. Therefore, PGCB needs to conduct a bird survey during winter season or have to find relevant secondary sources to develop appropriate mitigation measures. An IBAT assessment was also conducted around 10km proximity and found that there is no protected or key biodiversity area around the substation. Like other coastal areas of Bangladesh, this place also has problem with groundwater having excessive iron and salinity. People of this area have to rely on bottled water for drinking purpose and surface water for bathing and washing purposes. The contractor must implement mitigation measures as per the EMP to ensure that local fish cultivation in the vicinity remains unaffected.

Mitigation Measures

635. To ensure there are no impacts to designated sites of ecological importance the following

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

mitigation measures will be applied:

- Pre-construction ecology surveys need to be conducted to confirm no unanticipated impacts; this includes bird surveys during appropriate periods round the year for the migratory and local birds in the project area of influence for the works in proximity to waterbodies (salt pans/low lying land) at Pekua SS and Paikgacha SS.
- Include avoidance measures for avian electrocution collision with transmission lines through bird sensitive design and the installation of "Bird Divertors" at suitable intervals in locations where birds are determined to be at risk.

9.3.2.1.2 Construction Phase

Impacts

636. Contractor to avoid, where possible, homestead areas or crossing of rivers/sensitive area/bamboo groves to reduce negative impacts during construction and operational phases. Such considerations at the project formulation stage greatly reduce the possible negative impacts and facilitate proper environmental management of a project.

Mitigation Measures

637. Awareness training for workers will help limit potential construction phase impacts on biodiversity. Trainings will need to be provided to workers on identification of threatened species, dos and don'ts in relation to disturbance to local and migratory birds.

638. Technical design to ensure use of Bird divertors as and where required or recommended following ecological study.

9.3.2.1.3 Operation Phase

Impacts

639. Bird collision and mortality of migratory birds of big wingspan is a residual concern during operations despite installation of bird divertors and other suitable measures.

Mitigation Measures

640. To ensure proper O&M of bird divertors installed at the lines is conducted by PGCB staff through patrolling of lines.

9.3.2.1.4 Residual Impacts

Table 9.19: Residual Impacts – Critical Habitat and Designated Sites

Phase	Potential Impact	Potential Impact Significance	Residual Impact	Residual Impact Significance
C/O	*Impacts to PAs*	***Low***	*No significant residual impacts to PAs.*	***Not significant***
C/O	*Impacts to KBA*	***Low***	*Ensuring no works are allowed in the KBAs/IBAs.*	***Not significant***
C/O	*Impacts to migratory birds*	***Medium***	*Awareness training[49] for workers will help limit potential project impacts to this area, but it is still possible that they could stray into this area due to its proximity.*	***Low***

9.3.2.2 Flora & Fauna

9.3.2.2.1 Pre-construction Phase

Impacts

[49] Trainings will be provided to workers on identification of threatened species, dos and don'ts in relation to disturbance to local and migratory birds

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Natural Vegetation

641. None of the substations are within natural habitat, they are all located within modified landscapes, e.g., agricultural land, existing substations, or rural areas – as such no specific ecological studies of these sites are required, other than an ecological walkover and confirming the number and types of trees to be felled at these sites, unless recommended by the contractor's ecologist. The exception is Pekua, Paikgacha SS where birds may be using salt pan and low lying waterlogged area on the site.

Mitigation Measures

Natural Vegetation

642. During the design phase the EPC Contractor shall complete a habitat survey in order to confirm the area and type of modified and natural habitat at the substations and situated beneath towers and right of ways. The detailed survey shall include the number and species of trees and the quality of any forest cover lost, not anticipated, to calculate the compensatory reforestation required for the detailed design. During the detailed route surveys of all power lines a field ecologist will also record any fauna observed in the project area.

643. Alignment designs and the locations of all OHL shall follow the measures outlined below:

- Contractor to employ field ecologists to undertake ROW walkover, map habitat and species encountered, and enumerate the number and species of trees requiring to be cut and lopped, submit survey report alongside design.
- Presence or absence of sensitive receptors and critical habitat species identified in IEE to be confirmed by field ecologists during route surveys. Adaptive management measures to be applied according to the findings of the surveys, e.g., realignment of route towards road center to avoid tree roots, etc.

644. Prior to the cutting of any tree ecologists will survey the tree to ensure there are no nesting birds present in the tree. If nests are present the Contractor will consult with Ecologists to determine the most suitable actions to avoid harm to the nests and birds. If any special status species (IUCN VU, EN, CR) are observed in the trees, ADB will be informed by PGCB and tree cutting ceased until appropriate mitigation plans have been prepared by the Contractor.

9.3.2.2.2 Construction Phase

Impacts

Biodiversity

645. The Pekua substation is located to the coast area where migratory and/or local birds visit during winter season. Paikgacha substation is a waterlogged area. Therefore, some mitigation measures are required to ensure that birds are not impacted due to the proposed substation and the transmission lines construction during its operating period. The construction of power transmission lines can have both direct and indirect impacts on biodiversity.

- **Habitat Loss and Fragmentation:** Clearing land for transmission line corridors can result in the loss of natural habitats, including forests, grasslands, wetlands, and other ecosystems. This habitat loss can directly harm plants, animals, and microorganisms that depend on these habitats for survival. Additionally, the linear nature of transmission line corridors can fragment habitats, isolating populations and disrupting ecological processes such as migration, dispersal, and gene flow.
- **Species Displacement and Mortality:** The disruption and destruction of habitats during construction can directly harm or kill individual organisms. Species that are unable to adapt or find suitable alternative habitats may be displaced or extirpated from the area. Birds, mammals, reptiles, amphibians, and invertebrates are all susceptible to these impacts.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

- **Electrocution and Collision Risks:** Birds and bats are particularly vulnerable to collision and electrocution on transmission lines. Collisions with power lines, towers, and guy wires can result in injury or mortality, while electrocution can occur when birds come into contact with energized components.

Fisheries

646. Raising the land for the substations will impact fish habitats, leading to changes in land use that could affect fish production potential. Impact on fisheries resources (fish habitat and fish production) will be affected in the current fishery area of the Paikgacha SS, and, Pekua SS and potentially other SS. Mitigation measures must be taken by the contractor to protect the aquatic ecology in the substation sites.

Natural Vegetation

647. During the construction phase, the key potential impacts to flora and fauna relate to vegetation clearance within the working corridors and work sites, vehicle movements, the siting of construction camps and the presence of workers. Table 9.22 discusses these generic impacts in more detail.

Table 9.20: Generic Construction Phase Impacts

Activity	Impact
Habitat loss, degradation, fragmentation and simplification	Impacts will arise because of vegetation clearance for the preparation of the tower sites; construction of camp facilities / laydown areas etc. Impacts associated with vehicle use include soil compaction, dust emissions from vehicles affecting flora and habitats. However, the total length of new lines is under 250km, nearly all which traverse agricultural land and modified habitat.
Direct mortality of fauna	Vegetation clearance can lead to direct fatalities of fauna. In particular nesting birds, which in the study area includes some threatened species, may be impacted during vegetation clearance and burrowing animals during earthworks. Indirect fatalities can also occur when excavations (for foundations) are left open Impacts are likely to be at individual not population level. Collisions with construction vehicles can also occur.
Disturbance to sensitive species	Construction dust, noise and visual disturbance can result in short term, localised effects, although many animals will become habituated to the noise. The nosiest activities associated with the development are those from static plant used to excavate trenches and clear vegetation. This may result in a short-term adverse effect. Impacts are likely to be at an individual level, not a population level.
Spread of non-native or invasive species	Spread of non-native or invasive species will reduce the ecological value of an area.
Poaching and deliberate killing of animals	The introduction of a temporary workforce to the area may increase the risk of poaching / deliberate killing of animals by workers at or near temporary construction camps.
Avifauna and fishes	Raising the land for the substations will impact fish habitats, leading to changes in land use that could affect fish production potential.

648. During construction works one of the most immediate impacts of transmission line construction is the removal of trees along the path of the line. This clearance is necessary to create a corridor for the transmission towers and wires. Depending on the width of the corridor required, this can result in the removal of large numbers of trees, including mature and ecologically significant specimens. Construction activities associated with transmission line installation, such as excavation and installation of tower foundations, can disturb the soil structure and impact tree roots. Soil compaction, erosion, and changes in drainage patterns can affect the health and stability of trees in the vicinity of the construction site.

649. The Project will also require removal of trees of various sizes and species. The Census and SES survey and tree inventory survey found varieties of trees on proposed substations lands and transmission lines. Different species of trees are divided into three categories by height viz., big (> 10 m height), medium (5-10 m height) and small (< 5 m height). Due to the construction of 232.55 km of transmission lines (including reconductoring of 75.00 km of 132kV transmission line), there are different

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

types of trees will be affected like fruit bearing (2382), Timber (4424), Medical (121), Banana (3820) and Bamboo (461). The survey found that a total of 11,211 numbers of trees were found in the ROW by the transmission line. The above number of trees consists trees that belong to various heights. For the project purpose, only trees above 5 meters will be cut for transmission lines. It is estimated that 4,079 number of trees will be cut.

Table 9.21: Trees to be affected by Transmission Lines

Type of Trees	Trees Height			Total	%
	(> 10 m)	(5-10 m)	(< 5 m)		
Fruits Trees	366	1020	996	**2382**	**34.37**
Timber/Wood	464	1935	2025	**4424**	**63.84**
Medicinal	20	40	64	**124**	**1.79**
Sub-Total	**850**	**2995**	**3085**	**6930**	**100**
Banana	1021	1430	1369	**3820**	**89.23**
Bamboo	129	185	147	**461**	**10.77**
Sub-Total	**1150**	**1615**	**1516**	**4281**	**100**
Grand Total	**2000**	**4610**	**4601**	**11211**	

Source: Socio Economic Survey (SES) survey and Tree Inventory Survey, June 2024

Table 9.22: Affected Trees on the Clearing Row on Private Land

Type of Trees	Trees Height			Total	%
	(> 10 m)	(5-10 m)	(< 5 m)		
Fruits Trees	350	998	978	**2326**	**35.50**
Timber/Wood	417	1797	1890	**4104**	**62.64**
Medicinal	20	38	64	**122**	**1.86**
Sub-Total	**787**	**2833**	**2932**	**6552**	**100**
Banana	935	1364	1319	**3618**	**88.92**
Bamboo	124	180	147	**451**	**11.08**
Sub-Total	**1059**	**1544**	**1466**	**4069**	**100**
Total	**1846**	**4377**	**4398**	**10621**	

Source: SES survey and Tree Inventory Survey, June 2024

Table 9.23: Affected Trees on the Clearing Row of TLs/LILO on Government Land

Type of Trees	Trees Height			Total	%
	(> 10 m)	(5-10 m)	(< 5 m)		
Fruits Trees	16	22	18	**56**	**13.11**
Timber/Wood	61	156	152	**369**	**86.42**
Medicinal	0	2	0	**2**	**0.47**
Sub-Total	**77**	**180**	**170**	**427**	**100**
Banana	37	66	50	**153**	**93.87**
Bamboo	5	5	0	**10**	**6.13**
Total	**42**	**71**	**50**	**163**	**100**
Total	**119**	**251**	**220**	**590**	

Source: SES survey and Tree Inventory Survey, June 2024

650. Out of the 10 substations, three substations, Tungipara, Paikgacha, and Bhandaria will affect trees. A total of 114 trees have been counted in the Tungipara substation area, at Paikgacha and Bhandaria a total of 7 trees each have been counted. The project will require the removal of trees of various sizes and species. The Census and SES survey and tree inventory survey found varieties of trees on proposed substations land. Different species of trees are divided into three categories by height viz.,

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

big (> 10 m height), medium (5-10 m height) and small (< 5 m height). A total of 128 trees counted in substation area.

Table 9.24: Trees to be affected by Substations

SN	Name of	Fruit Trees			Timber/Wood			Medicinal			Total
	Substation	Big	Medium	Small	Big	Medium	Small	Big	Medium	Small	Trees
	Tungipara	12	23	8	11	25	23	0	8	4	114
	Paikgacha	0	2	2	0	1	2	0	0	0	7
	Bhandaria	5	0	1	0	1	0	0	0	0	7
Total		17	25	11	11	27	25	0	8	4	128

Source: SES survey and Tree Inventory Survey, June 2024

Local and Migratory Birds

651. The project indeed has various impacts on local bird populations. Construction activities often involve clearing vegetation and altering the landscape, leading to the destruction of nesting sites and foraging areas for birds. This loss of habitat can disrupt local bird populations and may force them to relocate to less suitable areas. Birds can be electrocuted if they come into contact with power lines or associated infrastructure. This risk is particularly high for large birds, such as raptors, which may use the structures for perching or nesting. Construction activities can generate noise and disturbance, which may disrupt nesting behaviors, communication, and feeding patterns of local bird populations. Some birds may abandon nesting sites or exhibit stressed behaviors in response to prolonged disturbance.

652. Most important impact of tower line placement is mostly related to local and/or migratory birds colliding with the conductors which are usually at the varying heights from 50m to 25m. Many bird populations migrate long distances along a flyway. The most common pattern involves flying north in the spring to breed in the temperate or Arctic summer and returning in the fall to wintering grounds in warmer regions to the south. Normally the migratory birds fly at higher altitudes but sometimes perch temporarily on locations enroute on their way to breeding points in flyways. At Pekua, local farmers and neighbors, house owner, informed that large number of migratory birds are coming to the area during winter period in search of fishes and foods. Similarly, at Paikgacha, local people and informed that every year thousands of migratory birds are visiting this area during winter season.

653. It is assumed that the migratory/local birds avoid existing transmission lines and substations and any other avoid habitat owing to existing roads and buildings. The most important potential Project impact on birds is mortality from collision with overhead powerlines. Although a range of bird species suffer mortality from collisions with wires, birds of prey with wing spans are particularly susceptible to collisions with power lines. The majority of Project infrastructure comprises high voltage transmission lines. Electrocution of birds on such lines will be avoided if earthed and live infrastructure are isolated by a distance greater than the wrist-to-wrist span of priority bird species.

Wildlife

654. The wildlife species found in the area are the ones that have adapted to human presence. These wildlife species, including mammals, reptiles and birds, are likely to be affected by construction through habitat loss/degradation, disturbance (presence of people, artificial lighting and noise), injury or death owing to construction works (including trapping in deep excavations) and increased traffic, and temporary habitat fragmentation. The natural vegetation and habitats in the area are mostly river and canals, small ponds, and on the periphery of cultivation fields, etc. The significance of the impact has been assessed as Medium.

Mitigation Measures

Biodiversity

655. Developing a Biodiversity Management Plan (BMP) is essential to mitigate the impacts of substation and power transmission line construction on biodiversity and to promote the conservation

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

and sustainable management of local ecosystems.

a. Baseline Assessment:

- Conduct a thorough biodiversity assessment of the project area, including flora, fauna, and ecosystems. Identify key species, habitats, and ecological processes.
- Assess the potential impacts of transmission line construction on biodiversity, considering factors such as habitat loss, fragmentation, species displacement, and disturbance.

b. Ecology Surveys: Most project components are reported to be outside any protected areas and mostly in modified habitats - Pekua situated on salt pan area (also used for seasonal local fish and local varieties of shrimp cultivation. People engage in short-term local fish cultivation at small-scale local fish and shrimp cultivation, mainly for local consumption, with no large-scale commercial fishing or export activities) located 15 km from coastal area that supports shorebirds and migratory and local birds; Paikgacha is situated lowland flooded for fishing and has wintering domestic and migratory birds in the area, the land is owned by PGCB, while the surrounding areas are used by local people for small-scale local fish and local varieties of shrimp cultivation using pumped water. The contractor must implement mitigation measures as per the EMP to ensure that local fish cultivation in the vicinity remains unaffected.

- Since there is no specific information on those inland areas especially salt pans/waterlogged area regarding presence of any threatened or vulnerable species or presence of any natural and critical habitat, ecology surveys are required for all substations and the transmission lines with overwintering bird surveys at Pekua and Paikgacha.

c. Legal and Regulatory Compliance:

- Ensure compliance with relevant environmental laws, regulations, and permits governing biodiversity conservation, habitat protection, and species management.

d. Stakeholder Engagement:

- Engage with local communities, indigenous peoples, landowners, conservation organizations, and other stakeholders to gather input, address concerns, and incorporate traditional knowledge and community perspectives into the BMP.

e. Mitigation Measures:

- Identify specific measures to mitigate the impacts of transmission line construction on biodiversity, including:
- Habitat restoration and enhancement efforts to compensate for habitat loss.
- Implementation of wildlife corridors or green bridges to facilitate movement of species across the transmission line corridor.
- Use of wildlife-friendly design and construction practices to minimize disturbance and reduce collision risks.
- Installation of bird flight diverters, perch deterrents, and other avian protection measures to prevent electrocution and collisions.
- Establishment of buffer zones and setbacks to protect sensitive habitats and species.
- Implementation of erosion control measures to prevent soil degradation and habitat loss.
- Development of vegetation management plans to minimize impacts on vegetation and promote native plant diversity.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

- Integration of adaptive management strategies to monitor and adjust mitigation measures based on ongoing monitoring and research.

f. Monitoring and Adaptive Management:

- Develop a comprehensive monitoring program to assess the effectiveness of mitigation measures and track changes in biodiversity over time.
- Establish baseline monitoring protocols to document pre-construction conditions and identify key indicators for monitoring.
- Implement regular monitoring of key biodiversity indicators during and after construction to evaluate the success of mitigation measures and identify any unforeseen impacts.
- Use monitoring data to inform adaptive management decisions and adjust mitigation measures as needed to achieve conservation goals.

g. Capacity Building and Training:

- Provide training and capacity building opportunities for project staff, contractors, and local communities on biodiversity conservation principles, monitoring techniques, and best management practices.
- Foster collaboration with local universities, research institutions, and conservation organizations to leverage scientific expertise and build local capacity for biodiversity management.

h. Public Awareness and Education:

- Develop educational materials, outreach programs, and public awareness campaigns to raise awareness about the importance of biodiversity conservation, the potential impacts of transmission line construction, and the role of the BMP in mitigating these impacts.

i. The risk to birds is anticipated to be low-medium, but at Pekua and Paikgacha, due to the nearby coastal habitats and waterlogged land, ecology studies regarding overwintering bird surveys need to be conducted to understand the type of migratory birds and aquatic fauna that could be affected at the site in the absence of any primary data prior to the award of contract or, if included in the contractor's scope, prior to the approval of detailed designs site-specific measures for the transmission component. Provision of bird diverters on transmission lines will need to be made based on ecology studies to avoid avian collision and electrocution in such areas.

Natural Vegetation

656. Any trees cut, not within private land, but within the substation or the RoW alignment will need to be compensated according to national requirements. No additional tree felling will be permitted associated with transmission lines. Tree felling will be completed in accordance with national requirements.

657. Compensatory tree plantation will be conducted against the tree cutting. However, there are some factors would be considered while planting trees in the project area as per compensatory policy.

a. **Selection of Tree Species:** Choose native tree species that are well-adapted to the local climate, soil conditions, and ecological context.

b. **Planting Design:** Develop a planting design that takes into account the specific requirements of each tree species, including spacing, planting depth, and site preparation.

c. **Timing and Phasing:** Determine the optimal timing for tree planting based on seasonal weather patterns and local growing conditions. Consider phasing the planting effort to coincide with the construction schedule of the transmission line, focusing first on areas

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

where construction activities have been completed to minimize disturbance to newly planted trees.

d. **Implementation:** Procure high-quality seedlings or saplings from reputable nurseries or sources. Ensure proper site preparation, including soil amendment and weed control, to promote successful establishment of planted trees.

e. **Maintenance and Monitoring:** Develop a maintenance plan outlining tasks such as watering, mulching, pruning, and weed control to support the growth and health of planted trees. Establish a monitoring program to track the survival, growth, and health of planted trees over time.

f. **Long-Term Management:** Consider opportunities for agroforestry or other land management practices that integrate tree planting with agricultural or other land uses to maximize benefits and resilience.

658. The Tree Plantation Plan will set out details of trees to be lost and how the requirement for 1:3 compensatory plantations will be achieved. The plan will be prepared and finalized by the Contractor after the final route selection for the transmission lines. The objective of the tree plantation and replacement programme is to compensate for the loss of trees due to the proposed implementation of transmission lines. The species for the proposed tree plantation have been selected based on the statistics of the lost vegetation and in consultations with the concerned officials of the Forest Department (FD) of respective divisional office. A list of trees has been included below which would be considered under the tree plantation program. This tree plantation program would be implemented without using the trees which are harmful for ecology or biodiversity such as Eucalyptus (*Eucalyptus citriodora*), Akashmoni (*Acacia aurculiformis*). All the trees have been selected as per the criteria mentioned above.

Table 9.25: Selected Trees for Plantation

Scientific Name	Local Name or English Name	Habit	Habitat	National Status	Global Status
Timber/Wood Trees					
Swietenia mahagoni	Mahogony	T	RS, HS	C	EN
Azadirachta indica	Neem	T	HS	C	LC
Dalbergia sisoo	Shishu	T	RS, HS	C	-
Samanea saman	Raintree	T	RS, HS	C	-
Bombax ceiba	Shimul (Cotton Tree)	T	RS, HS	LC	-
Ficus benghalensis	Banyan tree	T	RS	C	-
Polyalthia longifolia	Debdaru	T	RS	LC	-
Tectona grandis	Shegun	T	RS, HS	LC	-
Terminalia arjuna	Arjun	T	HS, RS	LC	-
Delonix regia	Krishnachura	T	HS	LC	LC
Artocarpus heterophyllus	Jack fruit	T	HS	C	-
Phaleria macrocarpa	Dewa	T	HS	C	-
Instia bijuga	Ipil	T	HS	LC	-
Polyalthia longifolia	Debdaru	T	HS, RS	C	-
Diospyros discolor	Gab	T	HS	C	-
Lagerstroemia speciosa	Jarul	T	RS	C	-
Litchi chinensis	Lichi	T	HS	C	-
Mangifera indica	Mango	T	HS	C	DD
Phyllanthus emblica	Amloki	T	HS, RS	LC	-
Olea europaea	Olive	T	HS	C	-
Borassus flabelilifer	Tal	T	HS, RS	C	-
Fruit Trees					
Cocos nucifera	Narikel (Coconut)	T	HS	C	-
Moringa oleifera	Sajna	T	HS	LC	-
Zizyphus jujuba	Boroi	T	HS	LC	-
Citrus grandis	Jambura/Badam	S	HS	C	-
Aegle marmelos	Bel	T	HS	C	-
Limonia acidissima	Kodbel/ woodapple	T	HS, RS	C	-
Phoenix dactylifera	Date Tree (Khejur)	T	HS, RS	C	LC

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Scientific Name	Local Name or English Name	Habit	Habitat	National Status	Global Status
Areca catechu	Supari (Betel Nut)	T	HS	C	-
Annona squamosa	Ata	T	HS	C	-
Averrhoa carambola	Kamranga	T	HS	C	-
Fruit cum Timber Trees					
Artocarpus heterophyllus	Kathal (Jackfruits)	T	HS	LC	-
Mangifera indica	Aam (Mango)	T	HS	C	DD
Syzygium cumini	Jam (Blackberry)	T	HS	C	-
Tamerindus indica	Tetul (Tamarind)	T	HS	C	-
Borassus flabellifer	Tal (Palm Tree)	T	RS	LC	CR
Elaeocarpus robustus	Jolpai (Olive)	T	HS	LC	
Diospyros peregrina	Gub	T	HS, RS	LC	
Medicinal Trees					
Azadirachta indica	Neem	T	HS	C	LC
Teominalia arjunna	Arjun	T	HS, RS	LC	-
Ocimum canum	Tulshi	H	HS	LC	-
Coccinea cordifolia	Telakachu	S	HS	C	-
Fuel Trees					
Ficus benghalensis	Bot (Banyan Tree)	T	RS	LC	-
Acacia nilotica	Babla	T	HS	C	LC
Ricinus communes	Venna	T	HS	C	-
Ficus hispida	Dumoor	T	RS	C	-
Anthocephalus cadamba	Kadom	T	HS	C	-
Aesthetic					
Delonix regia	Krisnochura	T	HS	LC	LC
Cassia fistula	Sonalu	T	HS	LC	LC
Codiaeum variegatum	Patabahar	S	HS	LC	-
Lawsenia inermis	Mehendi	S	HS	C	-
Gardenia coronaria	Gandha raj	S	HS	C	-
Casuarina littorea	Jaw	T	HS	LC	-
Nymphaea nouchalli	Shapla	H	Wild	C	-

C = Common, H = Herb, HS = Homestead, LC = Less Common for National status and Least Concern for Global status, DD = Data Deficient, EN = Endangered, RS = Road Side, S = Shrub, T = Tree. The two globally endangered species are not endangered but common or less common in Bangladesh.

Local & Migratory Birds

659. To mitigate these impacts, developers and authorities may implement measures such as:

- Conducting thorough environmental assessments prior to construction to identify sensitive bird habitats and migration corridors.
- Implementing measures to minimize habitat disturbance, such as timing construction activities to avoid nesting seasons or using wildlife-friendly construction techniques. Avoid creating louder noises during night time from construction works.
- Installing bird flight diverters or marking power lines to reduce collision risks.
- Implementing measures to prevent electrocution, such as insulating power line components using avian-safe designs.
- Establishing buffer zones or wildlife corridors to mitigate the barrier effect of transmission lines.
- Monitoring bird populations before, during, and after construction to assess impacts and effectiveness of mitigation measures.
- Engaging with local communities and conservation organizations to incorporate their input and concerns into project planning and decision-making processes.
- Checks for breeding birds: To minimize the potential impact to all breeding bird species, vegetation clearance will be undertaken outside of the main bird breeding period if possible. Where this is not possible, there as to be cleared will be checked for breeding birds prior to the clearance and if nesting birds are found.
- Where conductors or existing transmission lines are parallel, bird collisions can be further minimized by keeping lines as closely spaced as safety clearances allow and having conductors at the same heights (rather than slightly offset in height, which would make collisions with the overall set of conductors/lines more likely)

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

- Minimize bird collisions by marking medium risk powerlines. The Project is planning of 232.55 km of new transmission lines (including reconductoring of 75.00 km of 132kV transmission). There is a requirement for installation of bird flight diverters. These diverters can increase visibility and bird avoidance of powerlines.
- Addition of bird flight diverters to Project powerlines will precautionarily reduce the collision risk.

Fisheries

- Conducting thorough fish catch assessments prior to construction to identify potential areas for fish hatchery or high production within proposes substation.
- Implementing measures to minimize habitat disturbance, such as timing construction activities to during fishing period.
- Ensure construction workers do not poach fish from adjoining areas of the substations.

Wildlife

- Reduction and control of artificial lighting: Artificial lighting used on construction sites and camps at night will be shaded and directed downwards to avoid light spillage and disturbance to nocturnal birds, bats and other wildlife.
- Ban on hunting and poaching: A ban on hunting and poaching by construction and operation staff will be implemented to reduce pressure on threatened and protected species in the Project areas and surroundings. All construction and operation staff will be required to follow company rules and code of conduct. Signage will be installed illustrating the hunting ban on any species throughout the Project areas.

9.3.2.2.3 Operation Phase

Impacts

Bird Collision and Electrocution

660. The overhead transmission lines can potentially cause bird collision and electrocution. Fatal collisions occur mostly with cables hanging perpendicular to the flight direction particularly with the top earthwire because of its poor visibility. The bird collision may occur in river and forest crossing areas of the project, near coastal areas and waterlogged habitat on the flyways being used by the migratory birds.

661. Power line structures (towers) provide perching, roosting, and nesting substrates for some avian species. Due to their large wingspans, such birds may simultaneously come in contact with two energized parts or one energized and one neutral/grounded part of the transmission lines/their towers, potentially resulting in electrocution. Although raptors are most often considered when addressing electrocution risk, other birds such as crows, ravens, magpies, small flocking birds and wading birds can also be electrocuted. Closely-spaced exposed equipment, such as jumper wires on transformers, poses an electrocution risk to small birds.

662. The electrical design factor most crucial to avian electrocutions is the physical separation between energized and/or grounded structures, conductors, hardware, or equipment that can be bridged by birds to complete a circuit. As a general rule, electrocution can occur on structures with the following characteristics:

- Phase conductors separated by less than the wrist-to-wrist or head-to-toe (flesh-to-flesh) dimensions of a bird. The wrist is the joint toward the middle of the leading edge of a bird's wing. The skin covering the wrist is the outermost fleshy part on the wing.
- Distance between grounded hardware (e.g., grounded wires, metal braces) and any energized phase conductor that is less than the wrist-to-wrist or head-to-toe (flesh-to-flesh) distance of a bird.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Mitigation Measures

Bird Collision and Electrocution

663. The electrocutions from HV power lines are rare nonetheless the project will take a precautionary approach. According to recent technical papers electrocution can be far more controlled than collision since the problem is a physical one, whereby a bird bridges between earth and live, so my increasing the separation distance or giving insulation it can be ensured that a bird cannot touch the relevant components. The maximum length and wingspan of the largest birds likely to be encountered in the project areas are generally 1.5m and 3m respectively. Hence, mitigation to prevent or reduce the bird electrocution is possible by maintaining a minimum vertical distance of 1.5m and horizontal distance of 3m between the energized parts of the transmission line. Project will ensure OHL tower designs are adapted to ensure that additional clearances are provided between live wires and grounded surfaces to accommodate the largest at-risk species. The phase to phase and phase to ground separations of 132 kV and 230 kV towers are likely larger than this requirement. For 400 kV distances between conductor separation is even higher so avoidance distance for the bird to avoid electrocution is larger.

664. Certain locations within the Project area are more likely to see bird activity, including areas around surface waters, Pekua and Paikgacha. In these areas, the risk of collisions with HV power lines is greater. In these locations bird divertors (wire markers) are recommended. The contractor's ecologist will identify all locations on HV power lines where wire marking is required due to their locations close to or above surface water, near coastal habitat etc. PGCB will install bird diverters on the earth wire of the transmission line segment crossing 500m either side of the river etc. Bird divertors shall be spaced at 10m intervals.

Impact Summary and Assessment of Significance

665. Table 9.26 provides an assessment of the significance of impacts to flora and fauna before implementation of the proposed mitigation measures that are discussed in the rest of this section.

Table 9.26: Potential Impacts to Flora and Fauna

Phase	Potential Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
C	*Loss, degradation/ fragmentation of agricultural*	*Terrestrial wildlife – birds etc.*	*L*	*H*	*M*	*-*	*MAJ*	*MT*	*SMA*	*MED*	*DEF*	***M***
C	*Loss of salt pan and aquatic habitat*	*Avifauna*	*M*	*M*	*M*	*M*	*MED*	• *LT*	*MED*	*MED*	*DEF*	***M***
C	*Loss of trees*	*Trees*	*M*	*M*	*M*	*M*	*MED*	*LT*	*MED*	*MED*	*DEF*	***M***

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Phase	Potential Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
C	*Physical damage (road kills, accident, loss of roosts/nesting sites, etc.)*	*Terrestrial wildlife – birds etc.*	*L*	*H*	*M*	*-*	*MAJ*	*MT*	*SMA*	*MED*	*POSS*	***M***
C/O	*Poaching Fishing*	*Terrestrial wildlife*	*L*	*H*	*L*	*-*	*MAJ*	*MT*	*SMA*	*MED*	*UN*	***L***
C	*Vehicle Movements*	*Terrestrial wildlife*	*H*	*H*	*L*	*-*	*MAJ*	*MT*	*SMA*	*MED*	*POS*	***M***
C	*Spread of non-native / invasive species*	*Terrestrial Habitats*	*L*	*M*	*L*	*-*	*MAJ*	*MT*	*SMA*	*MED*	*POSS*	***M***
O	*Bird Electrocution*	*Birds*	*M*	*H*	*M*	*-*	*MAJ*	*LF*	*SMA*	*MED*	*POS*	***M***
O	*Bird Collisions*	*Birds*	*L*	*H*	*M*	*-*	*MAJ*	*LT*	*SMA*	*HIGH*	*POSS*	***M***
O	*Other wildlife electrocution*	*Other wildlife*	*L*	*M*	*M*	*-*	*MED*	*LT*	*SMA*	*MED*	*POSS*	***M***

Key: H: High / M: Medium / L: Low / MAJ: Major / MOD: Moderate / MIN: Minimum / H/F: High Frequency / M/F: Medium Frequency / L/F: Low Frequency / LT: Long term / MT: Medium Term / ST: Short term / MED: Medium / DEF: Definitely / POSS: Possible: / UNLIKE: Unlikely.

9.3.2.2.4 Residual Impacts

Table 9.27: Residual Flora and Fauna Impacts

Phase	*Potential Impact*	Potential Impact Significance	Residual Impact	Residual Impact Significance
C	*Loss, degradation/ fragmentation of agricultural habitat*	Medium	Revegetation and tree compensation payments should help ensure that there are no significant residual impacts in the project area which is generally a modified environment.	Not significant
C	*Loss of salt pan and aquatic habitat*	Medium	The proposed mitigation measures should ensure that residual impacts are low.	Low
C	*Loss of trees*	Medium	The proposed mitigation measures should ensure that residual impacts are low.	Low
C	*Physical damage (road kills, accident, loss of roosts/nesting sites, etc.)*	Medium	The proposed mitigation measures should ensure that residual impacts are low.	Low
C/O	*Poaching Fishing*	Low	Awareness training for workers will help limit potential project impacts, but it is still possible that they could stray into sensitive areas or fishing areas of local population.	Low
C	*Vehicle Movements*	Low	The proposed mitigation measures should ensure that impacts are not significant.	Not significant
C	*Spread of non-native/ invasive species*	Medium		Not significant
O	*Bird Electrocution*	***Medium***	*Risk pre-mitigation is low, adoption of additional mitigation measures should ensure that impacts are not significant.*	***Not significant***
O	*Bird*	***Medium***	*Bird diverters should help reduce the impact*	***Low***

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Phase	*Potential Impact*	Potential Impact Significance	Residual Impact	Residual Impact Significance
	Collisions		*significance, but not entirely eliminate the possibility of bird collisions on the line.*	
O	*Other wildlife electrocution*	***Medium***	*Following national regulations for OHL clearances should ensure that impacts are minimized. Residual impacts will not be significant*	***Low***

9.3.3 Socio-Economic Environment

A. Social Infrastructure (including Utilities)

9.3.3.1.1 Pre-construction Phase

Impacts

666. During construction, ingress and outgress of equipment, materials, manpower and waste management will require transportation of all items by road to its final destination. Accordingly, the contractor needs to plan all contingencies regarding construction.

Mitigation Measures

667. During this phase the EPC Contractors for all components will be responsible for preparing and implementing a Traffic Management Plan. They will also provide information to the public about the scope and schedule of construction activities and expected disruptions and access restrictions at least 72 hours before the disruptions.

668. EPC contractors must meet their environmental safeguard obligations including prompt reinstatement of damaged utilities etc. and must also ensure that all public spaces are restored to their original condition within 15 days of works completion.

669. Prior to the start of works the EPC Contractor will survey routes to see what utilities are located near the alignment and if agreements are needed to be made with providers to remove them. Prior to the commencement of works all activities will be announced in local papers, at least one month in advance of works.

9.3.3.1.2 Construction Phase

Impacts

670. Construction of HV OHL and LILO are less likely to impact upon physical infrastructure as towers can be sited to avoid sensitive sites or pass over them. However, impacts such as safety beneath lines during construction still needs to be considered. Further, checks will need to be completed around tower bases to be excavated to ensure they are free of utilities. Traffic impacts from OHL are likely, but the volumes of construction traffic moving between tower sites will be low. Impacts associated with second stringing of Brahmanbaria line will be limited and only low levels of impacts relating to traffic are anticipated.

671. Substation construction/rehabilitation in rural areas will have a relatively low impact to social infrastructure.

672. No significant pressure on social infrastructure such as hospitals and clinics are anticipated as the number of workers at any one sub-activity will not be significant and it is unlikely that the health facilities would be impacted by periodic visits resulting from accidents at work sites.

673. No significant impacts to water supply are anticipated if permits are obtained for the drilling of boreholes and associated water extraction.

Mitigation Measures

674. During construction mitigation measures relating to maintaining access to properties, schools, businesses, etc. and managing access roads according to best practice will be implemented by all EPC

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Contractors. They will also be responsible for liaising with utilities to identify, avoid and maintain their operation throughout the construction period, e.g., by obtaining necessary clearances from other utilities that could be affected by the Project (water, sewerage, telecommunications, road, rail etc.), and checking with relevant local authorities (water, telecoms) whether there are known pipes, cables, or other utility lines and carry out a scan using cable avoidance tool to identify any unknown underground utilities prior to excavation.

675. Road safety will also be a key aspect during the construction phase. Of specific relevance to these types of works the following measures shall be applied:

- Stockpiling of spoil and any new equipment (conductor reels, etc.) shall be away from properties and only in designated areas where no access will be blocked.
- Where the execution of the works requires single-lane operation on/beside the public road the contractor will provide and maintain all necessary barriers, warning signs and traffic control signals per the EMP and to the satisfaction of the local authority. Wherever traffic diversions, warning signs, traffic control signals, barriers and the like are required, the contractor will install them prior to commencing work in that area.

9.3.3.1.3 Operation Phase

Impacts

676. No significant impacts to social infrastructure and utilities are anticipated during the operational phase. No impacts to power supply are foreseen. Potential impacts from noise and EMF are discussed in other parts of this report.

Mitigation Measures

677. Since no significant impacts to social infrastructure and utilities are anticipated during the operational phase there are no mitigation measures required.

9.3.3.1.4 Residual Impacts

Table 9.28: Social Infrastructure Residual Impacts

Phase	Potential Impact	Potential Impact Significance	Residual Impact	Residual Impact Significance
C	*Impacts to utilities, road and rail*	***Medium***	*Implementation of the Traffic Management Plan and other mitigation measures should ensure that no significant residual impacts remain.*	***No significant impact***
C/O	*Impacts to water supply*	***Medium***	*Mitigation measures included in this IEE should ensure that all utilities are identified and impacts to them, including water supply networks, are avoided.*	***No significant impact***
C	*Impacts to schools and other social infrastructure*	***Medium***	*Implementation of the Traffic Management Plan and other mitigation measures should ensure that no significant residual impacts remain.*	***No significant impact***

9.3.3.2 Land Acquisition and Temporary Damages

9.3.3.2.1 Pre-construction Phase

Impacts

678. Construction of the substations (SSs) will cause permanent impacts as land will be acquired. On the other hand, construction of the transmission lines (TLs), LILOs, and towers will cause temporary impacts as no land will be acquired. Towers and lines will be constructed mainly on crop and government lands. Thus, landowners will be able to continue their livelihood activities as usual, except during the construction period. Project impacts include the loss of land, primary and secondary

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

structures, trees, and other assets resulting from construction of 10 new substations and the installation of transmission towers, along with the relevant lines, including TLs, reconducting lines, and LILOs.

Land Use

679. Construction of the substations (SSs) will cause permanent impacts as land will be acquired. On the other hand, construction of the transmission lines (TLs), LILOs, and towers will cause temporary impacts as no land will be acquired. Towers and lines will be constructed mainly on crop and government lands. Thus, landowners will be able to continue their livelihood activities as usual, except during the construction period.

680. A total of 122.01 acres of land is required for this project, of which 78 acres are for substations, resulting in permanent impacts. For the Paikgacha substation, 5 acres of land have already been acquired by PGCB. For the remaining 9 substations, 73 acres of land will be acquired following ARIPA 2017 and the RP of the project.

681. The construction of 633 towers, of which 199 are angle towers and 434 are suspension towers, requires a total of 44.01 acres of land where the impacts will be temporary. According to the new Electricity Rules 2020 and the amendment of 2022, compensation will be paid to the landowners of tower footing land where towers will be constructed. However, tower footing lands will not be acquired, and ownership will remain with the landowners. Owners will be able to cultivate the lands with the permission of PGCB. The exact number of landowners will be identified during the implementation stage once the detailed design is completed.

682. A total of 459.51 acres of cropland will be affected temporary due to the construction of transmission lines, and an estimated 11,211 standing trees have been found in ROW, comprising 4,424 timber trees, 2,382 fruit-bearing trees, 124 medicinal plants, and 4,281 banana and bamboo plants. The above number of trees consists trees that belong to various heights. For the project purpose, only trees above 5 meters will be cut for transmission lines. It is estimated that 4,079 number of trees will be cut.

683. Vulnerable Affected Land Owners: The affected land owners of the towers are expected to experience the following impacts:

- Severe loss of access to tower-base area which will be in the range of 350 sqm to 450 sqm depending on the voltage level and tower design for each tower.
- Damage to agriculture land and standing crops in an area of 575sqm to 675 sqm area during construction of each tower.
- Any affected land owner whose total land holding is less than 4,000 sqm (approximately less than 1 acre or is a marginal farmer) is expected to experience the impact for more than 10% of their land holding. Therefore, any affected land owner for tower base area whose total land holding is less than an acre shall be treated as vulnerable.

684. The alignment of high voltage power lines passes through predominantly agricultural areas which are privately owned. Although, women are given equal rights in inheritance, land ownership (single or jointly) among women is very low in project area. Hence, it is anticipated that the compensation paid for the ROW will mostly go to men. The project should carry out consultation with women of the project affected families and inform them about the compensation amount and understand their concerns and feedback. Where a woman is the land owner and she needs assistance for completing the required procedures for receiving the compensation, the project shall provide such special assistance.

Table 9.29: Land used for Substations and Transmission lines

SL	Impacts/Types of losses All units in acres	Sub-stations	Transmission Lines/Towers			Overall (acres)
			TLs/towers	LILO/towers	Total	
A	**Total land required/acquired for the**	**78.00**	**33.97**	**10.04**	**44.01**	**122.01**

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

SL	Impacts/Types of losses All units in acres	Sub-stations	Transmission Lines/Towers			Overall (acres)
			TLs/towers	LILO/towers	Total	
	substations/tower footings (in acre)					
1	Required Land Acquisition for the substation (in acre) (includes Private Land 71.78 acres and Government Land 1.22 acres. This includes 32 acres of salt land)	73.00	0.00	0.00	0.00	73.00
2	Already acquired land by PGCB (Paikgacha substation)	5.00	0.00	0.00	0.00	5.00
3	Required Land for Tower Foundation Area (Private Land)	0.00	33.97	10.04	0.00	44.01
4	Affected crops land (Acre)		249.98	209.55	459.53	

Mitigation Measures

685. To avoid land acquisition and resettlement the EPC Contractor's design team shall carefully select the route/siting to minimize impacts on existing structures (e.g., buildings) etc. and avoid or minimize crop disturbance where power lines cross private land. Any temporary disturbance related to this issue will be compensated for in accordance with the RP and its entitlements matrices. Where properties cannot be avoided in the design and where they are present within national safety clearances the properties will be expropriated following the procedures outlined in the Project RP.

686. All temporary construction facilities required, including laydown and storage areas, will be located within the boundaries of PGCB land (substations) except for overnight accommodation that could be provided in existing properties off-site. Where this is not possible the EPC Contractor will provide a central covered warehouse for storage of construction materials. No public or private land requiring clearance of vegetation or supporting forest habitat or having waterbodies is to be used.

687. Temporary impacts (e.g., land rentals) that are not within the assessed corridor of impact to be compensated based on negotiations between the Contractor and affected persons.

9.3.3.2.2 Construction Phase

Impacts

688. The construction stage impact on agricultural land and damage to the crops will be at two stages, i.e. (i) during construction of towers, and (ii) during stringing of conductors between towers.

Mitigation Measures

689. In this phase a range of mitigation shall be applied to limit the significance of impacts:

- Where the Project results in loss of loss of fruit-bearing trees that have economic value compensate in accordance with the entitlement matrix in the Project Resettlement Plan (RP); the contractor will pay any subsequent compensation for loss or damage to private trees due to the fault of the contractor's work
- Schedule works to avoid or minimize crop disturbance where lines cross private land, such as undertaking works in between crops.
- Provide advance notice to harvest the crops and where feasible, adjust the construction schedule harvest crops; construction works shall not exceed more than one crop season at a particular stretch.
- Repair any temporary damage caused to agricultural fields after construction is completed.
- Saving the top-soil and restoration of land will be done by the Contractor to previous use and farmers will be allowed to continue their cultivation post the construction.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

690. Further, it is very important that continuous consultation with affected households and residents continues throughout the construction phase.

691. In addition to the advance payment to civic authorities for reinstating the damaged civic properties, the unintentional damage to the private properties during construction process will be compensated by the EPC contractor.

9.3.3.2.3 Operation Phase

Impacts

692. No land acquisition is foreseen currently during operations; however temporary damages may occur during lightning and floods as well if any conductor breaks during operations. It may adversely harm the community by causing electrocution, result in damage to property or result in mortality of livestock.

Mitigation Measures

693. O&M department will work with requisite field staff to minimize the impact.

Impact Summary and Assessment of Significance

694. Table 9.30 provides an assessment of the significance of impacts due to Land Acquisition and Temporary Displacement before implementation of the proposed mitigation measures that are discussed in the rest of this section.

Table 9.30: Potential Impacts due to land acquisition and Temporary Displacement

Phase	Potential Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
C	*Land Acquisition and Crop and tree loss*	*Local population*	*L*	*H*	*M*	*-*	*MAJ*	*MT*	*SMA*	*MED*	*DEF*	***M***
C	*Unintentional private property damage*	*Local population*	*L*	*H*	*M*	*-*	*MAJ*	*MT*	*SMA*	*MED*	*POSS*	***M***

Key: H: High / M: Medium / L: Low / MAJ: Major / MOD: Moderate / MIN: Minimum / H/F: High Frequency / M/F: Medium Frequency / L/F: Low Frequency / LT: Long term / MT: Medium Term / ST: Short term / MED: Medium / DEF: Definitely / POSS: Possible: / UNLIKE: Unlikely.

9.3.3.2.4 Residual Impacts

Table 9.31: Residual due to land acquisition and Temporary Displacement

Phase	Potential Impact	Potential Impact Significance	Residual Impact	Residual Impact Significance
C	*Land Acquisition and Crop and tree loss*	***Medium***	*No significant impacts are anticipated if the RP is implemented correctly. A GRM has been prepared to manage complaints received during this process. Other temporary impacts during the construction phase will be managed by the RP as noted above.*	***Not significant***

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Phase	Potential Impact	Potential Impact Significance	Residual Impact	Residual Impact Significance
C	*Unintentional private property damage*	***Medium***	*No significant residual impacts are anticipated if the RP is implemented correctly.*	***Not significant***

9.3.3.3 Waste Management & Hazardous Materials

9.3.3.3.1 Pre-construction Phase

Impacts

695. The construction works for substation and lines usually generate large quantities of excess materials from construction sites (concrete, steel cuttings, discarded material, vegetation), demolition wastes (dismantled transformers and other facilities), and wastes from field camps and construction yards, including garbage, recyclable waste, food-waste, and other debris. A large part of this waste is biodegradable or recyclable. In addition, small quantities of hazardous waste will also be generated mainly from the vehicle maintenance activities (liquid fuels; lubricants, hydraulic oils; chemicals, such as anti- freeze; contaminated soil; spillage control materials used to absorb oil and chemical spillages; machine/engine filter cartridges; oily rags, spent filters, contaminated soil, and others). If this waste is not responsibly disposed, it can cause adverse environmental, human health and aesthetic impacts.

Mitigation Measures

696. In the design/pre-construction phase it will be important to ensure that substation waste management / hazardous materials storage areas are well designed, and that consideration is given to the battery types and battery room design.

697. The EPC Contractor for substations will provide a well-designed, covered area where materials can be segregated. The waste storage area will be of sufficient size to accommodate all anticipated storage requirements and can be locked, is well-ventilated and will not reach extreme temperatures. Fuel/oil/chemical/waste storage areas must have an impervious floor and be bunded so that the capacity of each bund is sufficient to contain at least 110% of the maximum design storage capacity within storage area, not connected to the surface water drainage system. Batteries will ideally be lithium-ion type instead of lead acid or nickel cadmium to reduce hazardous waste generation although all battery types are e-waste. A separate room for substation batteries will be provided with ventilation and exhaust fan for taking out fume gases and provision of remote monitoring of substation batteries (if not staffed) and exhaust fan will also be made.

698. The EPC Contractors for all components will prepare and implement a Waste Management Plan dealing with all solid and hazardous waste as well as wastewater generated in an environmentally sound and safe manner. Where possible it will ensure surplus materials will be reused or recycled, disposal will be the last resort.

699. Old electrical and mechanical equipment will need to be removed from some sites. This equipment will be transported to PGCB designated workshop/store for reuse or recycling using authorized vendors as per the condition of the equipment, if fit for use they will be stored for reuse by PGCB or they will be auctioned off as scrap material. Disposal of old transformers and other hazardous wastes shall be per national regulations. Other wastes will be recycled using authorized vendors or suitably engineered and licensed waste management facilities for inert or solid waste. If any PCB contaminated transformers are to be disposed the use of facilities capable of safely transporting (closed trucks) and disposing of hazardous waste containing PCBs will be a requirement.

700. PGCB will also be responsible for implementing the corrective actions specified in the corrective action plan in Table 6.4.

9.3.3.3.2 Construction Phase

Impacts

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Waste

701. Disposal of waste materials, both hazardous and non-hazardous, from linear power line worksites can be difficult to manage due to the de-centralized nature of the works along the alignments. Without suitable waste containers and without adequate training, workers could dump waste materials haphazardly around the work sites which could create pollution events. Waste management is, however, easier to control at the substations.

702. Various waste types will be generated at worksites during the construction phase, including:

- Inert construction waste – e.g., concrete, bricks, soil, packaging waste (cardboard, plastic, wood)
- Domestic waste – e.g., food waste.
- Liquid waste, some of which will be classed as hazardous – e.g., waste oil (non-PCB), sanitary discharge.
- Contaminated soil from existing substations. Soil conditions at the 5 existing substations show some degree of contamination of oil from spillage/leaks in one or more spots, mostly under the transformers. Some of the electrical equipment to be replaced may also be removed and sent to other substations for re-use at these sites PGCB will make the decision on the equipment to be re-used based on the functionality of the equipment to be replaced and the needs of other substations.

703. In addition, 10 new substation bays will be established at five existing substations. Site visits to these sites has indicated that old electrical equipment is stored in these areas. This equipment will need to be removed by PGCB. At this stage, it is not possible to say that any such equipment should be disposed of as it is possible that they are still classified as assets by the utility, and it is possible that they could be used for spare parts in the future. Any equipment for disposal must be done in an environmentally safe and sound manner with no debris and residual contamination from oil spills and leaks on handover.

704. This Project includes the requirement for the EPC Contractors to remove and dispose of existing decommissioned equipment. This activity is the responsibility of PGCB who will be responsible for following national waste management regulations relating to disposal of the waste.

Hazardous Materials

705. Sulphur Hexafluoride (SF6) - SF6 can have impacts to health of workers and the environment, all of which is discussed above under air quality.

706. Polychlorinated Biphenyls (PCBs) - PCBs are a persistent organic pollutant; a highly hazardous chemical. PCBs can potentially be found in oil containing equipment at substations, specifically in older equipment such as transformers and circuit breakers. PCBs, when they leak from equipment, are hazardous to human health as well as an environmental pollutant.

Other Hazardous Liquids

707. Other general hazardous liquids will be stored at work sites and at substations, e.g., fuel, solvents, etc. Spills and leaks of these liquids can result in soil and water pollution. This issue is discussed above under Soils and Hydrology.

708. Batteries in substations are used for back-up power supply. The environmental audit of 5 existing substations identifies the presence of batteries (usually Ni-Cd type) in many of the substation. Laws and regulations related to battery use are relevant. There is a risk of pollution incidents and health impacts from the use and management of cadmium nickel batteries at substations as well as this resulting in hazardous waste for disposal.

Mitigation Measures

709. During the construction phase, typical waste management issues can be managed through simple mitigation measures outlined in Table 12.4. Waste materials will be disposed of at licensed

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

facilities in Bangladesh.

710. Regarding spoil material, two specific mitigation measures are required to be implemented by EPC Contractors:

- Any spoil material from trenches and substation foundations which cannot be re-used will be removed from the site and sent to an appropriate state licensed waste management facility to be identified by the Contractor.
- Any areas of oil leaks beneath existing equipment to be removed will be excavated, stored in labelled metal drums and returned to the Contractors facilities for storage according to method statements. The labelled containers will include a reference number which correlates with the removed transformer which will be tested for PCBs using rapid test kits. If the PCB tests indicate that the transformer oil is contaminated, the container containing the soils will be labelled as PCB waste. PCB waste shall be stored, handled and disposed of in line with national regulations. Oil contaminated waste, not PCB contaminated, will be disposed of according to national regulations.

9.3.3.3.3 Operation Phase

Impacts

711. Various waste types will be generated at worksites during the operations phase, including:

- Domestic waste – e.g., food waste.
- Liquid waste, some of which will be classed as hazardous – e.g., waste oil (non-PCB), sanitary discharge.
- Contaminated soil from leaking drums and transformers at site.

Mitigation Measures

712. During this phase PGCB will be responsible for ensuring waste management and disposal in line with national waste management regulations. They will also be responsible for implementing the corrective measures specified in the corrective action plan (Table 6.4).

Impact Summary and Assessment of Significance

713. Table 9.32 provides an assessment of the significance of impacts due to waste and spoil management before implementation of the proposed mitigation measures that are discussed in the rest of this section.

Table 9.32: Potential Impacts due waste and spoil management

Phase	Potential Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
C	*Improper management and disposal of solid / liquid waste*	*Local population*	*H*	*H*	*M*	*-*	*MAJ*	*MT*	*SMA*	*MED*	*DEF*	**M**

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Phase	Potential Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
C	*Improper management and disposal of hazardous waste (Including contaminated soil)*	*Local population*	*H*	*H*	*M*	*-*	*MAJ*	*MT*	*SMA*	*MED*	*POSS*	***M***
O	*Management of lead acid batteries*	*Local population*	*L*	*H*	*M*	*-*	*MAJ*	*MT*	*SMA*	*MED*	*POSS*	***M***

Key: H: High / M: Medium / L: Low / MAJ: Major / MOD: Moderate / MIN: Minimum / H/F: High Frequency / M/F: Medium Frequency / L/F: Low Frequency / LT: Long term / MT: Medium Term / ST: Short term / MED: Medium / DEF: Definitely / POSS: Possible: / UNLIKE: Unlikely.

9.3.3.3.4 Residual Impacts

Table 9.33: Waste and Spoil Material Residual Impacts

Phase	Potential Impact	Potential Impact Significance	Residual Impact	Residual Impact Significance
C	*Improper management and disposal of solid / liquid waste*	***Medium***	*Following the requirements of this IEE and the need to ensure proper handling of waste and transportation management by contractors will ensure that there will be no residual solid/liquid waste impacts on local population. No significant residual impacts anticipated.*	***Not significant***
C	*Improper management and disposal of hazardous waste (Including contaminated soil)*	***Medium***	*Following the requirements of this IEE and the need to audit waste management contractors will ensure that there will be no significant residual hazardous waste impacts.*	***Not significant***
O	*Management of lead acid batteries*	***Medium***	*No significant residual impacts anticipated.*	***Not significant***

9.3.3.4 Occupational and Community Health & Safety

9.3.3.4.1 Pre-construction Phase

Impacts

714. Contractor needs to plan for community safety and security due to rapid movement of vehicles bringing in material, equipment, wastes and manpower to construction sites. The incoming of outsiders from different areas for tower installation and maintenance can make people, especially women and children frightened in terms of outstation labor, material movement and erection works during

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

construction phase. Besides, the overhead transmission lines may go over structures such as home steads, commercial spaces and temporal establishment as well if not planned well. The contractor needs to ensure design feature includes enumeration of the above and dissemination of similar impacts to the neighboring community.

Mitigation Measures

715. During the design/pre-construction phase, it is important that all infrastructure is designed with the safety of the community in mind. The design requirements will be different for the various sub-activities; however, the general theme of design phase is that all Project infrastructure will be constructed in accordance with national safety codes and safety clearances. On a sub-activity basis, the following safety measures will need to be followed by the EPC Contractors designers.

Substations

- The separation walls or fire barrier walls shall be provided between the transformers / reactors or between transformer / reactor and nearby building.
- Designs will ensure that there can be no illegal access to substations.
- Include a secure boundary fence or wall around the substations that is sufficiently high it cannot be climbed over, provide a gated, surfaced vehicular access for entry/exit off public highway having adequate sight lines for all drivers and warning signs of entranceway for road users. Ensure this is applicable to all substations with bay extensions, as per the Corrective Action Plan.

EHTL

- Barbed wire type anti-climbing device shall be provided and installed by the Contractor for all structures. The height of the anticlimbing device shall be provided approximately 3 m above ground level. The barbed wires shall be given chromating dip.
- Include in the design of all towers anti-climb features together with posting of written and visual warning signs to include the “Hazard Type: Electrical Symbol” warning of the risk of electrocution.
- Each tower shall be fitted with a number plate, danger plate and a set of phase plates per circuit. The arrangement for fixing these accessories shall not be more than 4.5 m above the ground level.

EMF

- The EPC Contractor for the OHL will provide EMF calculations to PGCB for review. If the results show that EMF levels above ICNIRP reference levels at properties close to the substation the use of shielding equipment/materials to decrease electromagnetic field exposure included will be provided.

716. During this phase the EPC Contractors for all phases will be responsible for the preparation and implementation of a Community Health and Safety Plan outlining all of the relevant measures in this EMP relating to community health and safety. The Community Health and Safety Plan shall include flow chart and contact details to deal with that situation should any community member be impacted during the works. Additionally, a Traffic Management Plan (to be developed by contractors) will be prepared considering both the safety of pedestrians and vehicles and need to avoid traffic congestion; it is to be developed in consultation with relevant local authorities to ensure proper execution of traffic controls including where temporary blockage of one lane of the road or footpath is needed for installation. The requirements of CHS Plan are included in Appendix VI.

717. Communications with the community will be critical to the success of the Project. Specific mitigation measures to ensure communications with the community are effective include:

- Local disclosure of the IEE including an executive summary translated into Bengali via the PGCB website, PGCB offices, existing substations, and other construction site offices.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

- Provide brochures and posters on the main findings of the IEE and where the full version can be accessed, as well as a translation of the executive summary of the IEE, will be printed in Bengali and made available/displayed for public scrutiny at places easily accessible to affected persons.
- Provide notice boards at all substations, construction site offices and active work sites including details of the GRM including the name, designation, contact numbers, address of both the PGCB and contractor's GRM focal persons plus the timeline and process of redressal together with a suggestion box that will be regularly checked for any grievances received.
- Prepare a Project Safety Awareness leaflet to be distributed to all homes within the vicinity of the work sites. The leaflets shall provide information relating to the risks of interfering with the HV network. The leaflets will be written in non-technical language and will provide illustrations where practical. Leaflets will also explain the risk of kite flying close to OHLs and SS.
- Provide EMF awareness sessions at villages within 500m of LILO OHL and Substations. The awareness sessions should provide information regarding the findings of the IEE on EMF and specifically discuss best practice reference limits for EMF and how they have been applied to the Project.
- Local communities as well as individual property owners within 500m are to be consulted for transmission lines and when selecting sites for temporary construction facilities outside of substations prior to finalization of their location.
- PGCB will create a WhatsApp Group of Ward member. Before construction community leaders/ ward members will be informed through WhatsApp messages

9.3.3.4.2 Construction Phase

Impacts

718. The Project has the potential to increase the threats to community safety and security during the construction phase. The key types of impacts are likely to be:

- Potential conflict between workers, security personnel and local community members resulting in upset or injuries, in particular, Sexual Exploitation and Sexual Harassment (SAEH) issues due to interaction between Project workers and women in the local communities.
- Increased hazards (e.g., open excavations and worksites) and increased risk of accidents. Children are specifically vulnerable to these types of hazards.
- Increased risk of road/traffic accidents causing injuries or fatalities. Project activities will result in increased traffic flows on certain roads that are used by local residents. Children are also specifically vulnerable to road accidents.
- In other semi-urban and rural areas, the risk of impacts to the community will be lower, but still needs to be managed. The most likely potential impacts on community health in the construction phase are:
- Increase in dust, noise and water pollution.
- Increase in disease vectors such as rodents (if food/drink is not stored properly and solid/liquid wastes are not managed adequately) with accompanying increased incidence of vector-borne diseases.
- Increased risk of enhanced incidences of communicable diseases arising from interaction between workers living in the construction camps with local people. There will be a risk of communicable diseases (e.g., TB, and sexually transmitted diseases such as HIV/AIDS) passing through the workforce and possibly into the community.
- Increased risk of water-borne diseases if liquid and solid waste management is not implemented effectively.

Mitigation Measures

719. The project CSEMP to be developed based on the generic EMP attached to this IEE shall incorporate mitigation measures for all the above issues.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

9.3.3.4.3 Operation Phase

Impacts

720. Due to the presence of security staff and security perimeter fencing, no operational phase impacts are anticipated relating to the substations as long as they are maintained.

721. However, measures should be put in place to warn the public about the dangers of other electrical equipment in public spaces, e.g., towers etc. to avoid potential accident and fatalities during the operational phase, specifically relating to the issue of kite flying.

Electromagnetic Field (EMF)

722. Based on a recent in-depth review of the scientific literature, the World Health Organization (WHO) concluded that current evidence does not confirm the existence of any health consequences from exposure to low level electromagnetic fields. However, to be prudent, this issue has been considered further as part of this IEE.

OHL HV

723. All of the OHL EHV power line voltages range from 132kV to 230kV located in agricultural land with no human receptors within 100m of the line. According to data provided by the United Kingdom National Grid maximum fields beneath a 132kV line are below GIIP exposure levels (mentioned below).

724. Due to the presence of security staff and security perimeter fencing, no operational phase impacts are anticipated relating to the substations as long as they are maintained.

725. Minimum ground clearance for conductor shall be maintained, however, requirement of maintaining electrostatic and electromagnetic interference, radio interference voltage, audible noise etc. within acceptable limits becomes ruling condition specifically for HV power lines. Further, all OHL will be designed to account for safety zones which for 132 kV/220 kV power lines is 5.8m vertical and 4.1m horizontal.

726. Given the fact that all new lines will be constructed to respect safety zones (with no people living directly beneath lines) and the typical fields referenced above no significant EMF impacts are anticipated from OHL EHV power lines.

727. The maximum permissible exposure level for the general public to electric fields is 5 kV/M, except on transmission line rights-of-way where the limit is 10 kV/M. The EPC contractor shall ensure the design to be compliant with above mentioned international standards and the EMF along the transmission line will be complaint with international standards. This will minimize the community-based health risks associated with 400 kV transmission lines.

Substations

728. Monitoring electromagnetic field strength for substation workers to determine if they are exposed to and ensure occupational exposures are within the limits of the International Commission on Non-Ionizing Radiation Protection (ICNIRP) reference level. In areas where EMF levels could be exceeded posting of written and visual warning signs. If EMF limits are likely to be often reached, provide substation staff with personal radiation monitors that shall set off an alarm when exposure limits are reached.

729. Beyond the substation fence, the magnetic field produced by the equipment within the station is typically indistinguishable from the background levels from other sources. Studies undertaken in the United Kingdom showed mean values of 1.1 µT at substation boundaries and 0.2 up to 1.5m from the boundary.[50] Further, there is a misconception that the transformers within substations are a high source

[50] Gajsek P, Ravazzani P, Grellier J, Samaras T, Bakos J, Thuroczy G. Review of studies concerning Electromagnetic Field (EMF) exposure assessment in Europe: low frequency fields (50 Hz-100 kHz). Int J Environ Res Public Health.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

of magnetic field. Modern power transformers are built to keep the magnetic field in the core of the transformer to maximize its efficiency.[51] Accordingly, no significant impacts to residential receptors are anticipated. However, a precautionary approach has been taken to this issue and additional checks during the design phase will be undertaken.

Mitigation Measures

730. During the operational phase, PGCB will be responsible to ensure that all required operational phase corrective actions for existing substations to be rehabilitated are completed per the Corrective Action Plan (Table 6.4). Although no significant impacts have been identified associated with EMF, PGCB should still undertake periodic monitoring of EMF at substations to ensure ICNRP occupational and community EMF exposure levels (reference and peak values) are be achieved within the substation and outside of the fence line respectively.

Impact Summary and Assessment of Significance

731. provides an assessment of the significance of impacts to community health and safety before implementation of the proposed mitigation measures that are discussed in the rest of this section.

Table 9.34: Potential Impacts on Community Health and Safety

Phase	Potential Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
C	*Accidents at work sites (including traffic accidents)*	*Local population*	*H*	*H*	*M*	*-*	*MAJ*	*MT*	*SMA*	*MED*	*DEF*	**M**
C	*Social conflicts*	*Local population*	*H*	*H*	*M*	*-*	*MAJ*	*MT*	*SMA*	*MED*	*POSS*	***M***
O	*Accidents involving electrical equipment*	*Local population*	*H*	*H*	*M*	*-*	*MAJ*	*MT*	*SMA*	*MED*	*POSS*	***H***

Key: H: High / M: Medium / L: Low / MAJ: Major / MOD: Moderate / MIN: Minimum / H/F: High Frequency / M/F: Medium Frequency / L/F: Low Frequency / LT: Long term / MT: Medium Term / ST: Short term / MED: Medium / DEF: Definitely / POSS: Possible: / UNLIKE: Unlikely

[51] Understanding Electric and Magnetic Field. https://www.bchydro.com/content/dam/BCHydro/customer-portal/documents/corporate/safety/understanding-emf-booklet.pdf

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

9.3.3.4.4 Residual Impacts

Table 9.35: Community Health and Safety Residual Impacts

Phase	Potential Impact	Potential Impact Significance	Residual Impact	Residual Impact Significance
C	*Accidents at work sites (including traffic accidents)*	***Medium***	*A range of mitigation measures have been provided to help manage the risk of accidents occurring. However, despite these measures it is still possible that accidents could occur due to unforeseen circumstances.*	***Low***
C	*Social conflicts*	***Medium***	*Proposed mitigation measures, including the development of and implementation of a community health and safety plan should ensure that social conflicts are minimized during the construction and operational phases. No significant impacts anticipated.*	***No significant impact***
O	*Accidents involving electrical equipment*	***High***	*The safety measures recommended in this IEE, coupled with national safety standards, should ensure that all infrastructure is constructed and maintained to a standard which prevents significant impacts to community health and safety.*	***No significant impact***

9.3.3.5 Occupational Health & Safety

9.3.3.5.1 Pre-construction Phase

Impacts

732. There are accidental risks coming out from several hazards or events associated with different types of construction activities. The following table shows the type of hazards/ Event/ risks, along with their sources and consequences for workers that need to be considered during design stages:

Table 9.36: Occupational health and safety issues during construction stage

Hazard/Event/risks	Source(s)	Consequence(s)
Struck by	Falling/moving pipe, tools/debris dropped from elevated location, vehicles;	Health injury and loss of life
Falls	Fall from elevated areas, towers, high heights etc.	Health injury and loss of life
Electrocution	Cutting and welding, cable gallery, Switch yard etc.	Health injury and loss of life
Fire and Explosion	Cable gallery, power transformer, switch yard, switch yard control, flammable chemical, power transformer, etc.	Health injury and loss of life
Noise Pollution	Noise and vibration from heavy Machinery and civil construction work;	Hearing complexity, scaring to wildlife, livestock, human being, etc.
Traffic Accident	On site and off site;	Health injury, life loss, property damage etc.
Unsafe Working Place	Lack of safe working condition, employee having contagious disease;	Health injury, electrocution, organ disease outburst, loss of health, loss of life

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Mitigation Measures

733. Most mitigation measures for the design phase relate to EMF and the safe design of substation buildings to protected workers. The provided mitigation measures Table 12.4 are based primarily on national safety standards and the requirements of WBG EHS Guidelines. The measure ensures that such as fire safety, sanitation and noise levels are all accounted for in building designs.

734. Further, for all component construction works, EPC Contractors will be required to undertake a health and safety risk assessment through a workshop during the design (and at other key stages) so it can inform both design and pre-construction preparations, considering both occupational and community H&S risks resulting from subsequent stages of the project. The facilitated workshop will involve the design and construction team of the EPC Contractors and operational staff.

735. A range of design measures have been proposed to ensure the safe management of SF6 under the topic of air quality, above.

736. During the pre-construction phase an important focus will be on the establishment of plans and workers contracts to ensure that provisions are in place to manage the health and safety of workers and ensure workers' rights are respected. Specifically, the following are required:

- Occupational Health and Safety Plan & Emergency Response Plan(s). H&S plan to include emergency preparedness and response plan including flow chart and contact details to deal with situation should any construction worker or community member in the event of an incident during the works. The requirements of OHS Plan are included in Appendix VI. The plan will also include an OHS training Plan.
- Labor Management Plan addressing employment of migrant workers, sanitation and welfare, gender-based violence/sexual exploitation, abuse, and harassment prevention etc.
- Camp / Accommodation Management Plans depending upon the site location and requirements of EPC Contractor.
- Environmental Code of Practice (ECP) and information video/brochure/leaflet for distribution to all workers during induction addressing culturally acceptable practices etc. CoC must be informed by the SEMP and address the following aspects:
- Zero tolerance in respect of health and safety.
- Requirement on always wearing PPE on site.
- Zero tolerance of bribery or corruption.
- Respect for local community and customs, avoiding community conflict situations.
- Zero tolerance of illegal and unacceptable activities/behavior, including but not limited to engagement in: prostitution; gender-based violence/sexual exploitation, abuse, and harassment; illegal sale or purchase of alcohol; sale, purchase, or consumption of drugs; gambling; fighting.
- Alcohol and drugs policy and testing regime.
- Role of workers in good housekeeping.
- Role of workers in maintaining good hygiene including COVID-19 measures e.g., social distancing.
- Respect of wildlife and the environment.
- Description of disciplinary measures for infringement of the code of conduct and other employer rules (e.g., immediate removal from site, fine etc.) will be included in staff contracts.

737. During pre-construction, EPC Contractors shall also establish, through their Labour Management Plan, code of conduct, procedures for engagement of the workforce, for example through setting targets

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

for local employment based on initial assessment of the labor market for unskilled and semi-skilled work force. EPC Contractors shall also ensure mitigation measures included in Table 12.4 and Table 12.5 are included in workers contracts, including measures relating to working hours and salary and provision of insurance for workers.

9.3.3.5.2 Construction Phase

Impacts

738. The Project is expected create at least 50-100 direct employment opportunities per EHV power line and 50 per substation during the peak of the construction period. Most workers will be engaged by the EPC Contractor and will consist of an unskilled, semi-skilled to skilled workforce. During the operational phase maintenance works will be undertaken by existing PGCB staff.

739. The expected impacts on worker rights and H&S because of construction, activities and Project operation are as follows:

- Risk to workers H&S due to hazardous construction activities and inadequate living conditions; and
- Violation of workers' rights.

740. Risks exist to construction workers particularly those who have not have received adequate training or are familiar with the hazards associated construction of electrical infrastructure projects or medically unfit for the work involved. Inexperience workers under the age of 18 would be particularly vulnerable from working on a hazardous construction site. Health and safety hazards faced while working at construction sites, handling machines, plant and equipment, driving vehicles etc. could result in minor or major injuries, potentially in the worst-case even death. In particular, work at heights and work with electricity are particularly dangerous activities required to implement the project. Only trained, medically fit workers are permitted to work with electricity and at height. Construction workers will be required to handle materials such as cement, chemicals, fuels, etc. which will increase health risks if personal protective equipment is not used.

741. Poorly designed temporary worker camp/overnight accommodation and sanitation and welfare facilities may pose a health threat and nuisance to the workers due to unsanitary and unhealthy conditions. Uncontrolled vending of food and drinking water at worksites may also pose a risk with respect to the transmission of diseases like typhoid, diarrhea, and dengue fever. Migrant and illiterate workers can be particularly vulnerable.

Mitigation Measures

742. Extensive provisions for the health and safety of workers during the construction phase are included in Table 12.4: Environment Management Plan. These measures are based on the requirements of national regulations and WBG EHS Guidelines. The measures relate to all components, except for the following items which focus more specifically on certain sub-activities:

- OHL - Require workers to test the structural integrity of towers prior to proceeding with the work and use fall protection measures when working on towers, i.e. mobile elevated working platform. All workers are also required to wear body harness when working at height.
- Existing Substations - Unless transformers have been certified PCB free, workers interacting with them must wear suitable chemical and/or oil resistant gloves, goggles, and protective clothing whilst taking samples and/or working with transformers. Water supply to sink/shower and eye wash station to be provided on-site during works due to risk of PCB meeting skin. Health and safety risk assessment for exposure to PCBs to be undertaken before removal/maintenance/repair/connection work is undertaken on any existing transformers.

9.3.3.5.3 Operation Phase

Impacts

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

743. The National Institute for Occupational Safety and Health (NIOSH) and other US government agencies do not consider EMF a proven health hazard.[52] However, according to the WBG. electric utility workers typically have a higher exposure to EMF than the general public due to working in proximity to electric power lines.[53]

744. Spot EMF reading using smartphone-based app undertaken for the environmental audit of 5 substations indicated that levels were mostly low at all locations, inside office and near gates, varying between 21 uT – 52 uT. In one case the EMF levels were recorded to exceed 55 uT near the transformer and are likely in mid to high range. However, this is compared to ICNIRP exposure limits for occupational exposure of 415-500 uT.

745. Working with live equipment during maintenance of lines and operation of the substations also involves safety risks specifically relating to working at height and electrocution. The environmental audit completed for 5 substations noted that safety requirements and training and awareness of PGCB staff was found to be woefully inadequate. There are no written hazardous materials or solid and hazardous waste management systems and guidelines for substation personnel; there were no written Environment, Health and Safety procedures or trainings to prepare staff for emergencies. Inadequate Personal Protective Equipment (PPE) and first aid was recorded at all substations.

746. When an arc is formed in SF6 gas. small quantities of lower order gases are formed. Some of these by-products are toxic and can cause irritation to eyes and respiratory systems. This is a concern if the interrupters are opened for maintenance or at disposal of the interrupters. Normally these impacts only occur in enclosed areas.

Mitigation Measures

747. During the operational phase, PGCB will be responsible for following all national labour laws and health and safety laws and regulations (including those for sanitation and welfare). Other best practice measures will also be employed during the operational phase at substations, such as ensuring all electrical hazards feature written and visual warning signs that meet the IEEE standards to include the ISO 7010 "Hazard Type: Electrical Symbol" warning of the risk of electrocution and that potable water will be supplied that meets national drinking water standards and ISO 10500 drinking water parameters (full suite).

Impact Summary and Assessment of Significance

748. Table 9.37 provides an assessment of the significance of impacts on community health and safety before implementation of the proposed mitigation measures that are discussed in the rest of this section.

Table 9.37: Potential Impacts on Worker safety

Phase	Potential Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
C	*Accidents involving workers*	*Workers*	*H*	*H*	*M*	*-*	*MAJ*	*MT*	*SMA*	*MED*	*DEF*	**M**

[52] https://www.cdc.gov/niosh/docs/96-129/default.html
[53] WBG EHS Guidelines. Electric Power Transmission and Distribution. 2007.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Phase	Potential Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
C	*Workers' rights ignored.*	*Workers*	*M*	*M*	*M*	*-*	*MAJ*	*MT*	*SMA*	*MED*	*POSS*	***M***
C/O	*Inadequate sanitation and welfare*	*Workers and Local population*	*M*	*M*	*M*	*-*	*MAJ*	*MT*	*SMA*	*MED*	*POSS*	***M***
O	*Accidents involving workers*	*Workers*	*H*	*H*	*M*	*-*	*MAJ*	*MT*	*SMA*	*MED*	*POSS*	***M***

Key: H: High / M: Medium / L: Low / MAJ: Major / MOD: Moderate / MIN: Minimum / H/F: High Frequency / M/F: Medium Frequency / L/F: Low Frequency / LT: Long term / MT: Medium Term / ST: Short term / MED: Medium / DEF: Definitely / POSS: Possible: / UNLIKE: Unlikely.

9.3.3.5.4 Residual Impacts

Table 9.38: Worker Residual Impacts

Phase	Potential Impact	Potential Impact Significance	Residual Impact	Residual Impact Significance
C	*Accidents involving workers*	***Medium***	*Inclusion of specific mitigation measures recommended by the WBG for power line projects as well as the requirements for preparation and implementation of an OHS plan, training of staff and provision of health and safety specialist on the EPC Contractors team should ensure that no significant residual OHS impacts remain during the construction phase. In addition, the EPC Contractor will be responsible for following all of the relevant national health and safety standards.*	***Not significant***
C	*Workers' rights ignored.*	***Medium***	*Impacts anticipated not to be significant after application of mitigation measures.*	***Not significant***
C/O	*Inadequate sanitation and welfare*	***Medium***	*Provision of adequate sanitation and worker welfare conditions should ensure that there are no significant residual impacts.*	***Not significant***
O	*Accidents involving workers*	***Medium***	*Mitigation measures proposed should help reduce the potential for accidents to occur. However, accidents cannot be completely ruled out during the lifecycle of the Project.*	***Low***[54]

9.3.3.6 Physical Cultural Resources

9.3.3.6.1 Pre-construction Phase

Impacts

[54] Despite mitigation, working near high-voltage equipment presents risks of electric shock, arc flash, or electrocution, which can be severe or fatal. Moreover, workers exposed to EMF, noise, and other hazards over extended periods may still face health risks, albeit reduced through controls.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

749. Sites of Cultural, Archaeological and Historical Significance (PCR) need to be conserved and protected during project design.

Mitigation Measures

750. EPC Contractor for all components will be required to conduct an inventory of physical cultural resources (PCR) in and adjacent to the RoW and within 50m of substations prior to the start of any works. Where any PCR is identified within the RoW they will be demarcated and where any are found to be directly impacted, due to their presence within the RoW micro-alignment changes will be made to avoid impacts to the sites.

751. All local PCR adjacent to worksites will be identified and temporary barriers placed around them to ensure no damage by equipment and machinery.

9.3.3.6.2 Construction Phase

Impacts

752. There are no international or nationally important archaeological, historical, religious or cultural sites at the substation sites or along the indicative OHL alignments. Local PCRs such as mosques are found in the wider project area as discussed in Physical Cultural Resources baseline, they may be indirectly disturbed by dust, noise etc. It is also possible that chance finds could occur during excavation works for all components.

Mitigation Measures

753. A Chance Find Procedure will be developed for implementation for all components in the event physical cultural resources are found. The procedure will include at least the following:

- If suspected physical cultural resources are encountered, all works at the find site should be immediately halted.
- The find should be assessed by a competent local official managing cultural issues, and procedures to avoid, minimize or mitigate impacts to such physical cultural objects should be agreed in writing with them.
- Work should not begin until the procedures to avoid, minimize or mitigate impacts to the physical cultural resources have been agreed and implemented in full.
- If avoidance is not feasible, and no alternatives to removal exist, and the Project benefits outweigh the anticipated cultural heritage loss from removal which is unlikely unless in case of resource of local value, following clearance of ADB the physical cultural resources should be removed and preserved using the best available technique in accordance with relevant provisions of national heritage protection laws and decrees.
- Records should be maintained of all finds, including chain of custody instructions for movable finds.
- All construction workers to be made aware of the chance-find procedure (attached in Appendix XIII) and types of finds to be reported.

9.3.3.6.3 Operation Phase

Impacts

754. No impacts are anticipated during operation.

Mitigation Measures

755. No mitigation measures are required.

Impact Summary and Assessment of Significance

756. Table 9.39 provides an assessment of the significance of impacts to Physical culture resources before implementation of the proposed mitigation measures that are discussed in the rest of this section.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Table 9.39: Potential Impacts on PCR & Cultural Landscape

Phase	Potential Impact	Receptors	No. of Receptors Affected	Sensitivity of Receptors	Level of Public Concern	Risk of Exceeding Legal Threshold	Magnitude	Timeframe	Spatial Scale	Consequence	Probability	Significance
C	*Unanticipated PCR*	*Local Population*	*L*	*L*	*M*	*-*	*MIN*	*MT*	*SMA*	*LOW*	*POS*	**L**
C	*Local PCR*	*Local Population*	*L*	H	*M*	*-*	*MIN*	*MT*	*SMA*	*LOW*	*POS S*	**L**

Key: H: High / M: Medium / L: Low / MAJ: Major / MOD: Moderate / MIN: Minimum / H/F: High Frequency / M/F: Medium Frequency / L/F: Low Frequency / LT: Long term / MT: Medium Term / ST: Short term / MED: Medium / DEF: Definitely / POSS: Possible: / UNLIKE: Unlikely.

9.3.3.6.4 Residual Impacts

Table 9.40: Residual PCR & Cultural Landscape Impacts

Phase	Potential Impact	Potential Impact Significance	Residual Impact	Residual Impact Significance
C	*Unanticipated PCR*	***Low***	*Implementation of a chance find procedure (Appendix XIII) will ensure that residual impacts are not significant*	***Not significant***
C	*Local PCR*	***Low***	*Mitigation measures provided should ensure that there are no significant residual impacts*	***Not significant***

9.4 Impact Matrix

757. An Impact Matrix is a tool used to assess the potential effects of a project on various factors such as the environment, society, economy, and other relevant aspects. It helps in evaluating the significance of these impacts and prioritizing them for mitigation or management.

758. The basic template for constructing an Impact Matrix includes:

– **Identify Key Factors**: List down the key factors or aspects that could be impacted by the project. This could include environmental factors (e.g., air quality, water quality, biodiversity), social factors (e.g., community well-being, cultural heritage), economic factors (e.g., employment, local businesses), and regulatory factors (e.g., compliance with laws and regulations).

– **Impact Assessment**: For each factor identified, assess the potential impact of the project. This could be done using qualitative or quantitative measures, depending on the availability of data and the complexity of the project. For example, impacts could be categorized as high, medium, or low, or they could be assigned numerical scores based on their severity.

– **Stakeholder Consultation**: Consult with relevant stakeholders, including community members, environmental experts, government agencies, and other interested parties, to gather input on potential impacts and their significance.

– **Matrix Construction**: Construct a matrix where the identified factors are listed along the rows and columns. The cells of the matrix will then be populated with the assessed impacts. You can use a color-coding system or numerical scores to indicate the severity of each impact.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

- **Risk Prioritization**: Analyze the populated matrix to identify the most significant impacts that require prioritized attention. This could involve focusing on factors with high severity impacts or those that are of particular concern to stakeholders.

- **Mitigation Strategies**: Develop mitigation strategies and action plans to address the identified impacts. This could include measures such as implementing environmental safeguards, conducting community outreach and engagement, adjusting project designs, or seeking alternative siting options.

- **Monitoring and Review**: Establish a monitoring and review process to track the effectiveness of mitigation measures and ensure ongoing compliance with regulations and stakeholder expectations. Periodic reviews of the Impact Matrix may be necessary to update assessments and adjust strategies as needed.

759. Potential impacts in relation to environmental resources/topic issues during the detailed design and pre-construction, construction, and operation & maintenance phases of the project pre-mitigation, but including standard design features which would be incorporated by PGCB, for example, lightening protection, were identified and are presented in a matrix form in Table 9.41. Potential impacts on the following environmental resources/topic issues of concern were identified:

- Land use, topography, soil erosion and crop production
- Climate change
- Ambient air quality e.g. fugitive dust and other emissions from vehicle traffic etc.
- Ambient noise from operation of equipment and vehicle traffic
- Surface and ground water resources e.g. sediment control, wastewater disposal
- Natural resource use (materials)
- Use of hazardous materials including fuel, oil and chemicals, potential presence of PCBs in old transformers
- Waste generation, including from construction sites
- Habitat and vegetation loss
- Bird electrocutions or collisions; migratory and/or local birds
- Disturbance to other wildlife
- Occupational and community health and safety issues, such as electric and magnetic fields (EMF)
- Physical cultural resources
- Socioeconomic development, including employment

760. Potential impacts which were considered to be of major-critical significance prior to mitigation being adopted were scoped into detailed assessment as detailed in earlier sections. For other impacts, mitigation measures are still required to reduce the residual adverse impacts to an acceptable level/increase beneficial residual impacts. Prior to construction, activities undertaken during the detailed design and pre-construction phase will influence the subsequent impacts of the project. Mitigation for construction, including site establishment, mobilization and clearance for construction work, and operational impacts will need to be considered upfront during these stages. Preparations for construction include establishing the contractor's environment, health and safety management arrangements to mitigate construction related impacts, as detailed in the EMP will occur during pre-construction. This will include the development of a Contractors site-specific environmental management plan (CSEMP) and a health and safety risk assessment and plan to provide details on how the contractor plans to implement the EMP and relevant parts of the IFC EHS Guidelines on Construction and Demolition.

761. The results of the scoping assessment indicate that, with some exceptions, there are not expected to be any major-critical significant residual negative impacts from the implementation of the project, given the mitigation measures that have been proposed and which are discussed in the EMP. However, where major adverse impacts still remain compensation (offsets) will be required e.g. to

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

compensate for temporary damages and compensatory plantation to ensure no net loss of biodiversity as a result of the project. Further discussion and more detailed impact analyses for each of the environmental resources/topic issues are found in previous section. Potential environmental impacts related to maintenance activities are similar but of lesser magnitude that those during construction and are not discussed under the operational phase which concentrates on the operational impacts of the project infrastructure.

762. As per the Safeguard Requirements 1: Environment in Appendix 1 of ADB's SPS 2009 "During the design, construction, and operation of the project the borrower/client will apply pollution prevention and control technologies and practices consistent with international good practice, as reflected in internationally recognized standards such as the World Bank Group's Environment, Health and Safety Guidelines.[55] These standards contain performance levels and measures that are normally acceptable and applicable to projects. When host country regulations differ from these levels and measures, the borrower/client will achieve whichever is more stringent. If less stringent levels or measures are appropriate in view of specific project circumstances, the borrower/client will provide full and detailed justification for any proposed alternatives that are consistent with the requirements presented in this document". Accordingly, Appendix X lists relevant applicable WBG/IFC and WHO standards for the project.

763. The assessment presented in Table 9.41 is qualitative.

Significance of Impacts by Project Components:

764. The analysis of impacts pre- and post- and mitigation was documented in tabular form in order to be able to capture visually in one place different types of impacts resulting from the various Project activities since the impact of some activities is more significant than the others. The impacts are illustrated on Table 9.42 and the residual impacts after mitigation are shown on Table 9.43.

[55] World Bank Group, 2007. Environmental, Health, and Safety General Guidelines. Washington, DC

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Table 9.41: Impact Matrix

Resources/ Topic Issues	Potential Impacts	Stage	Type	Sensitivity	Magnitude	Duration/ Temporal Extent	Spatial Extent	Significance Prior to Mitigation	Mitigation	Significance Post Mitigation
Physical-Chemical Resources										
Land use	Land lost due to construction, restrictions on use of right of way reduces the chance of land use change beneath transmission lines	Construction, location results from project design	Direct	Low–scrub or agricultural land	Moderate for new SS Minor for new tower footprints	Permanent change in land use to power sector	Site specific to new SS and tower footprints	Low Adverse	Yes	Low Adverse
Topography	Sandfill for levelling the SS and tower erection will change the topography of land used for construction	Construction, extent of cut and fill results from project design	Direct	Low–generally topography is flat	Minor	Permanent change in topography	Site specific to new SS and tower footprints	Low Adverse	Yes	Low Adverse
Soil erosion	Fragile soil may be eroded during land clearance and earthworks. Disturbance to soil structure as a result of earthworks and presence of heavy equipment and machineries in project area.	Construction and to a lesser extent during O&M (ROW maintenance)	Direct	Medium-fertile agricultural Low-other	Moderate	Short Term risk, but long time to recover when disturbed	Site Specific restricted to construction footprint	Medium Adverse	Yes	Low Adverse
Climate change	Fugitive emission of SF6 a potent GHG from GIS, especially if technical specification used by PGCB does not require low leakage rate	Construction and O&M, SF6 use needs to be considered during detailed design	Indirect	Very High (a global concern)	Minimal (at a global scale)	Permanent change in global climate	Widespread (a global concern)	Medium Adverse	Yes	Low Adverse
Ambient air quality	Suspended particulate matter (dust) from land clearance, material	Construction, and to lesser extent during	Direct	High - mostly rural area, agricultural with some	Moderate where receptors	Short Term, Temporary during	Site specific within <50m of SS and	High Adverse where receptors <50m of SS and	Yes	Medium Adverse where receptors <50m

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Resources/ Topic Issues	Potential Impacts	Stage	Type	Sensitivity	Magnitude	Duration/ Temporal Extent	Spatial Extent	Significance Prior to Mitigation	Mitigation	Significance Post Mitigation
	stockyards, excavation works and traffic movements on unsurfaced roads may be nuisance and affect workers and communities' health. Increased dust on crops can affect crop production.	O&M (ROW maintenance)		settlement and ecological receptors but already degraded for dust levels compared to WHO guidelines	<50m of SS and <500m from ROW of transmission lines	construction	<500m from ROW of transmission lines construction footprint, although greatest impact immediately adjacent	<500m from ROW of transmission lines		of SS and <500m of ROW of transmission lines
	Diesel emissions from mobilization and use of construction vehicles, heavy equipment and machineries may be nuisance and affect workers and communities' health	Construction, and to lesser extent during O&M (ROW maintenance)	Direct	Medium - mostly rural area, agricultural with some settlement and ecological receptors	Minor where receptors <50m of SS and <500m from ROW of transmission lines	Short Term, Temporary during construction	Site Specific restricted to construction footprint and immediate vicinity (50m)	Medium Adverse where receptors <50m of SS and <500m from ROW of transmission lines	Yes	Low Adverse where receptors <50m of SS and <500m from ROW of transmission lines
Ambient noise	Mobilization and use of construction vehicles, heavy equipment and machineries, and general construction activities e.g. drilling/piling if required may increase ambient noise level. Exposure to high level ambient noise may be nuisance causing anxiety and affecting workers and communities' health.	Construction, and to lesser extent during O&M (ROW maintenance)	Direct	Medium, mostly rural area, agricultural with some settlement and ecological receptors	Moderate where receptors <50m of SS and <500m from ROW of transmission lines	Short Term, Temporary during construction	Site specific within 500m construction footprint, although greatest impact immediately adjacent	High Adverse where receptors <50m of SS and <500m from ROW of transmission lines	Yes	Medium Adverse where receptors <50m of SS and <500m from ROW of transmission lines

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Resources/ Topic Issues	Potential Impacts	Stage	Type	Sensitivity	Magnitude	Duration/ Temporal Extent	Spatial Extent	Significance Prior to Mitigation	Mitigation	Significance Post Mitigation
	Noise in the form of buzzing or humming can often be heard around transformers or high voltage power lines producing corona. Exposure to high level ambient noise may be nuisance causing anxiety and affecting workers and communities' health.	O&M, pollution prevention needs to be considered during detailed design	Direct	Medium mostly rural area, agricultural land, with some settlement and ecological receptors	Moderate where receptors <50m of SS and <500m from ROW of transmission lines	Long Term	Site specific within 500m of TLs and SS, although greatest impact immediately adjacent	Medium Adverse where receptors <50m of SS and <500m from ROW of transmission lines	Yes	Low Adverse where receptors <50m of SS and <500m from ROW of transmission lines
Surface and ground water resources	Surface and groundwater quantity may be affected if abstracted or collected for use as drinking water source for workers.	Construction, and to lesser extent during O&M (ROW maintenance)	Direct	PIA is in water stress region	Moderate	Short Term, Temporary during construction	Site specific to water sources used for abstraction	Medium Adverse	Yes	Low Adverse
	Surface water bodies (irrigation canals or ponds) may be affected when directly crossed by transmission lines. E.g. erosion of canal banks by construction of tower footings	Construction, location results from project design	Direct	Low –irrigation Medium- ecological receptor	Moderate where receptors <50m of SS and <500m from ROW of transmission lines	Permanent change in water flow etc.	Site Specific, restricted to construction footprint	Medium Adverse	Yes	Low Adverse
	Surface water quality may get affected where the SS or tower footings are within 500m of a surface water body due to sediment laden surface water runoff, this and waste may choke	Construction, and to lesser extent during O&M (ROW maintenance) -- location chosen as a result of	Direct	Low – used for irrigation Medium - ecological receptor	Moderate where receptors <500m	Short Term risk, if pollution incident occurs; effects reversible in time/with intervention	Site Specific, surface water within 500m, although greatest impact immediately adjacent	Medium Adverse where receptors <50m of SS and <500m from ROW of transmission lines	Yes	Low Adverse where receptors <50m of SS and <500m from ROW of transmission lines

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Resources/ Topic Issues	Potential Impacts	Stage	Type	Sensitivity	Magnitude	Duration/ Temporal Extent	Spatial Extent	Significance Prior to Mitigation	Mitigation	Significance Post Mitigation
	waterbodies and thus affect their aquatic ecology	detailed design								
	Surface or groundwater quality may get affected due to sanitary wastewater from labor camps and work sites discharging untreated to adjacent surface water bodies or percolating untreated to groundwater.	Construction, and to lesser extent during O&M (ROW maintenance)	Indirect	Low – irrigation Medium - drinking or ecological receptor	Moderate where receptors <500m	Short Term risk, if pollution incident occurs; effects reversible in time/with intervention	Site Specific, ground water within 500m, although greatest impact immediately adjacent	Medium Adverse where receptors <500m	Yes	Low Adverse where receptors <50m of SS and <500m from ROW of transmission lines
	Surface or groundwater quantity may be affected if abstracted or collected from surface ponds used by community or for substation operations e.g. used as drinking water source.	O&M, water resource use needs to be considered during detailed design	Direct	PIA is in water stress region	Moderate	Long Term	Site specific to water sources used for abstraction	Medium Adverse	Yes	Medium Adverse
	Changes in greenfield runoff rates exacerbating waterlogging or flood risk on adjacent/downstream land to SS and tower footings	O&M, location chosen as a result of detailed design	Indirect	Low	Moderate	Long Term	Site Specific within about <50m of SS and <500m from ROW of transmission lines	Medium Adverse	Yes	Low Adverse
	Surface or groundwater quality may get affected due to sanitary wastewater from substations discharging	O&M, pollution prevention needs to be considered	Indirect	Low – irrigation Medium - drinking or ecological receptor	Moderate where receptors <50m of SS and <500m	Long Term risk, if pollution incident occurs; effects	Site Specific <50m of SS and <500m from ROW of transmission	Medium Adverse where receptors <50m of SS and <500m from	Yes	Low Adverse where receptors <500m

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Resources/ Topic Issues	Potential Impacts	Stage	Type	Sensitivity	Magnitude	Duration/ Temporal Extent	Spatial Extent	Significance Prior to Mitigation	Mitigation	Significance Post Mitigation
	untreated to surface water or percolating untreated to groundwater.	during detailed design			from ROW of transmission lines	reversible in time/with intervention	lines, although greatest impact immediately adjacent	ROW of transmission lines		
Use of natural resources	Use of materials (e.g. concrete) during construction	Construction, and to lesser extent during O&M	Indirect	Low	Minor (at a national scale)	Permanent use of materials	National (materials may be sourced country-wide)	Low Adverse	Yes	Low Adverse
Use of hazardous materials	Surface or groundwater quality may get affected due to spills or leaks of fuel/oil/chemicals from work sites	Construction, and to lesser extent during O&M (ROW maintenance)	Indirect	Low –irrigation Medium - drinking or ecological receptor	Moderate where receptors <50m of SS and <500m from ROW of transmission lines	Short Term risk, if pollution incident occurs; effects reversible in time/with intervention	Site Specific, waterbodies within 500m construction footprint, although greatest impact immediately adjacent	Medium Adverse where receptors <50m of SS and <500m from ROW of transmission lines	Yes	Low Adverse where receptors <500m
	Surface or groundwater quality may get affected due to spills or leaks of fuel/oil/chemicals especially transformer oils at substations	O&M, pollution prevention needs to be considered during detailed design	Indirect	Low –irrigation Medium - drinking or ecological receptor	Moderate where receptors <50m of SS and <500m from ROW of transmission lines	Long Term risk, if pollution incident occurs; effects reversible in time/with intervention	Site Specific, waterbodies <50m of SS and <500m from ROW of transmission lines, although greatest impact immediately adjacent	Medium Adverse where receptors <50m of SS and <500m from ROW of transmission lines	Yes	Low Adverse where receptors <500m
	Spills or leaks of fuel/oil/chemicals from work sites may	Construction and to a lesser extent during	Direct	Medium-fertile agricultural Low-other	Moderate	Short Term risk, if pollution	Site specific within 500m construction	Medium Adverse	Yes	Low Adverse

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Resources/ Topic Issues	Potential Impacts	Stage	Type	Sensitivity	Magnitude	Duration/ Temporal Extent	Spatial Extent	Significance Prior to Mitigation	Mitigation	Significance Post Mitigation
	contaminate soils	O&M (ROW maintenance)				incident occurs; effects reversible in time/with intervention	footprint, although greatest impact immediately adjacent			
	Spills or leaks of fuel/oil/chemicals at substations may contaminate soils	O&M	Direct	Medium-fertile agricultural Low-other	Moderate	Long Term risk, if pollution incident occurs; effects reversible in time/with intervention	Site specific within 50m SS, although greatest impact immediately adjacent	Medium Adverse	Yes	Low Adverse
Waste generation	Inappropriate disposal of inert spoil, solid and hazardous waste from construction like metal scraps, wooden packing material, polythene as well as domestic wastes from workers to land or waterbodies resulting in disfigurement of landscape and pollution	Construction and to lesser extent during O&M (ROW maintenance)	Direct	Medium (a district/ community concern)	Moderate	Short Term risk, if pollution incident occurs; effects reversible in time/with intervention	Upazila	Medium Adverse	Yes	Low Adverse
	Generation and inappropriate disposal of solid and hazardous waste from substations including transformer oil to land or waterbodies resulting in disfigurement of landscape and	O&M	Direct	Medium (district/community concern)	Moderate	Long Term risk, if pollution incident occurs; effects reversible in time/with intervention	Upazila	Medium Adverse	Yes	Low Adverse

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Resources/ Topic Issues	Potential Impacts	Stage	Type	Sensitivity	Magnitude	Duration/ Temporal Extent	Spatial Extent	Significance Prior to Mitigation	Mitigation	Significance Post Mitigation
	pollution									
Biological Resources (Flora and Fauna)										
Habitat loss	Habitat lost due to construction, restrictions on use of right of way reduces the chance of habitat loss beneath transmission lines in longer term although habitat use by species may be affected (see below)	Construction, location results from project design	Direct	Low –modified	Moderate for new SS Minor for new tower footprints	Permanent change in habitat to developed land at new SS and tower footings	Site specific to construction footprint	Medium Adverse	Yes	Medium Adverse
Terrestrial vegetation loss	Vegetation clearing for construction of substations, tower footings and in the RoW to allow line stringing – there will then be vegetation control within grounds of substations and along ROWs with restriction on long-term vegetation height up to maximum 5m.	Construction and to a lesser extent during O&M, location results from project design	Direct	Low –modified	Moderate for new SS Minor for new tower footprints	Permanent loss of vegetation at new SS and tower footings, loss under ROW may naturally regenerate over time and takes a long time to recover when disturbed	Site specific to SS, tower footings and ROW	Medium Adverse	Yes	Medium Adverse
	Cutting of vegetation (trees) by workers in the vicinity of the labor camps and substations for firewood	Construction and to a lesser extent during O&M	Indirect	Low –modified	Minor	Long Term risk at SS, Short Term risk for TLs	Site specific within about 500m of locations where workers are present	Medium Adverse	Yes	Medium Adverse
Collision and	Flyway path of critically	O&M	Indirect,	High – critical	Major	Long Term	Birds	Medium	Yes	Medium

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Resources/ Topic Issues	Potential Impacts	Stage	Type	Sensitivity	Magnitude	Duration/ Temporal Extent	Spatial Extent	Significance Prior to Mitigation	Mitigation	Significance Post Mitigation
electrocution of birds in Project Area	endangered, endangered and/or other migratory species may be affected by the transmission lines resulting in electrocution and/or collision fatality		Cumulative with other power lines	habitat species Medium – other species		risk, in worst case risk of death	supported by project area, risk greatest where protected areas or IBA within 10km or waterbodies <50m of SS and <500m from ROW of transmission lines	Adverse		Adverse as although less likely to occur collision risk remains despite mitigation, offset is required
Disturbance to wildlife	Habitat loss due to presence of transmission lines and substations in the project area, disturbance from noise or lights	O&M	Indirect	High – critical habitat species Medium – other species	Minor (as % of available natural and modified habitat in the Project Area)	Permanent change in opportunity for habitat use due to presence of infrastructure	Project area	Medium Adverse	Yes	Medium Adverse, offset for residual habitat loss is required
	Disturbance to wildlife from construction workers and substation workers e.g. keeping of dogs, hunting and poaching	Construction and to a lesser extent during O&M	Direct	High – critical habitat species Medium – other species	Minor	Long Term risk at SS, Short Term risk for transmission lines	Project area where protected areas <10km and waterbodies <50m of SS and <500m from ROW of transmission lines	Medium Adverse	Yes	Medium Adverse but likelihood reduced
Socioeconomic Resources										

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Resources/ Topic Issues	Potential Impacts	Stage	Type	Sensitivity	Magnitude	Duration/ Temporal Extent	Spatial Extent	Significance Prior to Mitigation	Mitigation	Significance Post Mitigation
Crop production	Permanent loss of land at the substations and tower footings – see RP for further assessment.	Construction, location results from project design	Direct	Low	Minor	Permanent	Site specific, new SS and tower footings	Low Adverse	Yes	Low Adverse (apply RP for compensation)
	Site clearance work and stringing of lines in ROW may result in crop loss or damage – see RP for further assessment	Construction and to a lesser extent during O&M (ROW maintenance)	Direct	Low	Minor	Short Term, Temporary	Site specific, ROWs	Low Adverse	Yes	Low Adverse (apply RP for compensation)
	Restrictions on land use beneath ROW of transmission lines (limitations on structures within security clearance of ROW; etc.) which may also affect land price	O&M, location results from project design	Direct	Low	Minor	Permanent	Site specific, ROWs	Low Adverse	Yes	Low Adverse
	Occupied structures within the ROWs/safety clearance of transmission lines require relocation	Construction, location results from project design	Direct	Low	Minimal (none)	Permanent	Site specific, ROWs	Low Adverse	Yes	Low Adverse
Physical cultural resources	Loss or damage to identified physical cultural resources	Construction and to a lesser extent during O&M	Direct	Low	Minor	Short Term risk, permanent if damage is caused	Site specific, new SS and ROWs and immediately adjacent (50m)	Low Adverse	Yes	Low Adverse
	Potential for chance finds being damaged	Construction	Direct	Unknown, but likely to be low sensitivity local resources	Major if loss of resource	Short Term risk, Permanent if damage is caused	Site specific, within 50m construction footprint	Medium Adverse	Yes	Low Adverse
Occupational human health	Including: - Hazards created during	Construction and O&M	Direct	Medium, on average although some may	Major, in worst case	Short Term risk –	Construction and O&M	Medium Adverse	Yes	Medium Adverse, but

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Resources/ Topic Issues	Potential Impacts	Stage	Type	Sensitivity	Magnitude	Duration/ Temporal Extent	Spatial Extent	Significance Prior to Mitigation	Mitigation	Significance Post Mitigation
and safety (OHS)	the construction period, e.g. movement of heavy equipment, vehicles, and machineries, working conditions, etc. Hazards relating to working with electricity and working at height, as well as from handling any PCBs or asbestos present at existing substations. Falling down of towers, lines especially during installation works etc. Communicable diseases as workers from outside local area come into contact with local communities, including communicable diseases, and creation of breeding habitat for mosquitoes etc. Change in ambient air quality with impacts on the health of workers Exposure to high levels of ambient noise may affect hearing of workers			be more vulnerable that others due to gender, education level, existing health etc.		construction, Long Term risk – O&M, may be Permanent as worst case is the risk of fatality	workers, formally or informally employed			less likely worst case will occur
Community human health and safety (CHS)	Risks related to presence of works and workers including: - Social disturbances	Construction and O&M	Direct	Medium, on average although some may be more vulnerable that others due to	Major in worse case	Short Term risk – construction, Long Term risk	Local communities in project area, risk of	Medium Adverse	Yes	Medium Adverse but less likely worst case will occur

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Resources/ Topic Issues	Potential Impacts	Stage	Type	Sensitivity	Magnitude	Duration/ Temporal Extent	Spatial Extent	Significance Prior to Mitigation	Mitigation	Significance Post Mitigation
	related to in-migration of workers, workers camps, construction traffic on roads Social conflict related to demands on local services and facilities (e.g. water sources, clinics and hospitals) by workers Communicable diseases as communities come into contact with workers from elsewhere, including communicable diseases, and creation of breeding habitat for mosquitoes etc. Changes in ambient air quality with impacts on the health of community Exposure to high levels of ambient noise may cause anxiety and disturbance to community Inappropriate disposal of wastewater and wastes like metal scraps to the environment resulting in pollution etc.			gender, education level, existing health etc.		– O&M, may be Permanent as worst case is the risk of fatality	interaction greatest <50m to SS and transmission lines			
	Disruption to traffic flows during construction haulage of works crossing	Construction and to a lesser extent during	Direct	Low as not heavily trafficked	Major, in worst case risk of death	Short Term risk during any works	Local communities along haulage	Medium Adverse	Yes	Medium Adverse but less likely worst case

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Resources/ Topic Issues	Potential Impacts	Stage	Type	Sensitivity	Magnitude	Duration/ Temporal Extent	Spatial Extent	Significance Prior to Mitigation	Mitigation	Significance Post Mitigation
	over running roads etc.	O&M			if traffic accident		routes			will occur
	Damage to roads, drains, other utilities, structures and community facilities during construction haulage or works, mechanical damage or increased vibration from drilling causing damage to neighbouring structures, etc.	Construction and to a lesser extent during O&M	Direct	Medium, although some structures may be more fragile	Major, in worst case risk of death if structure occupied	Short Term risk during any works	Local communities in project area	Medium Adverse	Yes	Medium Adverse, but less likely worst case will occur and contractor to repair any damages caused
	Risks related on infrastructure including: - Presence of electricity infrastructure within local communities and EMF Falling down of towers, lines especially during installation works etc.	Construction and O&M	Direct	Medium, on average although some may be more vulnerable that others due to gender, education level, existing health etc.	Major in worse case	Short Term risk – construction, Long Term risk – O&M, may be Permanent as worst case is the risk of fatality	Local communities in project area	Medium Adverse	Yes	Medium Adverse but less likely worst case will occur
	Impairment of visual aesthetics due to transmission towers partially visible on the skyline	O&M	Direct	Medium	Moderate, already existing feature of landscape	Permanent	Local communities in project area	Medium Adverse	Yes	Medium Adverse
Socioeconomic development	Employment opportunity as both skilled and unskilled laborers will be required.	Construction and to a lesser extent during O&M	Direct	Low	Minor	Short Term, Temporary employment for construction	District	Low Beneficial	Yes	Low Beneficial

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Resources/ Topic Issues	Potential Impacts	Stage	Type	Sensitivity	Magnitude	Duration/ Temporal Extent	Spatial Extent	Significance Prior to Mitigation	Mitigation	Significance Post Mitigation
						Long Term, Permanent employment for substations				
	Electricity supplies may be impacted by construction activities	Construction	Direct	Low	Minor	Short Term, Temporary disruption	District	Low Adverse	Yes	Low Adverse
	Increased availability of a stable and reliable RE power supply connected to the national grid	O&M	Cumulative	High – state level	Moderate	Permanent	National	High Beneficial	N/A	High Beneficial
	May result in expansion of RE development, as well as development in general due to improved transmission network (induced impact)	O&M	Induced	High – for socioeconomic, state level	Major (1572 MW)	Permanent	National	High Beneficial for socioeconomic	N/A as any future development is entirely independent of project,	High Beneficial for socioeconomic Critical Adverse for environment

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Table 9.42: Total Project Anticipated Impacts Before Mitigation

Output/ Activity	Land Use	Topography	Soils	Climate Change	Air	Noise	Water resources	Natural resources	Hazardous Material	Waste	Habitat	Vegetation	Threatened Species	Other Birds Collision	Disturbance wildlife	Crop production	Employment opportunity	PCR	OHS	CHS	Economic development
Pre-Construction Enabling Works and Construction																					
New Lines/LILO					*	*					#	#									
Uprating of Lines											#	#									
New Substations					**	**					#	#									
Existing Substations																					
Operation & Maintenance																					
New Lines/LILO																					##
Updating of lines***																					
New Substations						**															
Existing Substations***																					

* Impacts reduce with distance and based on Table 5.73 there **are** only a few villages which will experience adverse impacts with most receptors over 100m from the indicative transmission line routes; therefore, in the majority of cases the impacts will be medium to high as sand is filled to level the site, and piling will be is required. In the event piling is being undertaken, required noise impacts will be for short period and require mitigation in order to ensure the noise standards/guidelines can be met.

** Paikgacha SS with school within 20m, substations with houses located at 50m, all substations will require sand filling works/earthworks to level the site; other new SS have low adverse impact due to absence of sensitive human receptors in zone of influence. Provided no properties are closer than 50m to the new SS and the operational noise level at the substation boundary of 70dB(A) is achieved residential noise levels will also be met due to attenuation by distance (corresponding noise level at 50m will be 36dBA, at 100m will be 30dBA).

***No significant change to the existing situation (see CAP for existing substations in Table 6.4)

#Ecological field survey required to confirm natural/modified habitat and number of trees to be lost

no color for beneficial impacts

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Table 9.43: Illustration of Residual Impacts with Mitigation Applied Post EMP Implementation

Output/ Activity	Land Use	Topography	Soils	Climate Change	Air	Noise	Water resources	Natural resources	Hazardous materials	Waste	Habitat	Vegetation	Threatened Species	Other Birds Collision	Disturbance Wildlife	Crop production	Employment opportunity	PCR	OHS	CHS	Economic development
Pre-Construction Enabling Works and Construction																					
New Lines/LILO					*	*					#	#			^						
Uprating of lines											#	#									
New Substations					**	**					#	#			^						
Existing Substations																					
Operation & Maintenance																					
New Lines/LILO													^	^	^						##
Uprating of lines***													~	~							
New Substations						**									^						
Existing Substations***																					

* Impacts reduce with distance and based on Table 5.59 there are only a few villages which will experience adverse impacts with most receptors over 100m from the indicative transmission line routes; therefore, in the majority of cases the impacts will be medium to high as sand is filled to level the site, and piling will be is required. In the event piling is being undertaken, required noise impacts will be for short period and require mitigation in order to ensure the noise standards/guidelines can be met.

** Paikgacha SS with school within 20m, substations with houses located at 50m, all substations will require sand filling works/earthworks to level the site; other new SS have low adverse impact due to absence of sensitive human receptors in zone of influence. Provided no properties are closer than 50m to the new SS and the operational noise level at the substation boundary of 70dB(A) is achieved residential noise levels will also be met due to attenuation by distance (corresponding noise level at 50m will be 36dBA, at 100m will be 30dBA).

***No significant change to the existing situation (see CAP in Table 6.4)

#Ecological field survey required to confirm natural/modified habitat and number of trees to be lost

^If there will be residual habitat loss and collision risk remaining biodiversity impacts need to be offset to ensure “no net loss of biodiversity”

~Marking of existing lines will have a beneficial impact on any existing collision risk

no color for beneficial impacts

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

9.5 Cumulative and Induced Impacts

765. Cumulative impacts[56] are defined as the combination of multiple impacts from existing projects, the proposed project, and anticipated future projects that may result in significant adverse and/or beneficial impacts that cannot be expected in the case of a stand-alone project. Given the wide coverage of the Project across Bangladesh it is possible that other projects may be on-going at the time of sub-activity construction which could lead to cumulative impacts. However, it is not possible at this stage to make regional assessment of such projects without extensive consultations across the whole of the state.

766. One key cumulative impact of the Project relates to the cumulative nature of all the proposed sub-activities. Some of them will be constructed in close proximity to each other, e.g., substations and LILO / OHLs, but these activities will be completed by the same contractor or at least under the same PMU and therefore works at these sites can be closely coordinated, equipment and camp sites will be shared, and environmental and social issues can be managed by the same contractor's EHS staff. Thus, the risk of significant negative cumulative impacts occurring will minimal. Another key cumulative impact will be that of air quality, dust and health and safety close to Project sites. Here particular attention to dust management should be given and close coordination between PGCB and the RHD/LGED is needed to ensure that works in close proximity to one another are avoided as far as practical to reduce the potential for significant cumulative impacts.

767. The cumulative effect of all projects in the operational phase will be hugely beneficial to the local population and will induce growth in the regional economy.

768. Induced impacts are the adverse and/or beneficial impacts on areas and communities from unintended but predictable developments caused by a project, which may occur later or at a different location.

769. No changes to land use are anticipated to be induced. The project will have an induced impact of rapid socio-economic development/power evacuation options for new wind and solar park projects in South Chattogram.

9.5.1 Cumulative Impact on Biodiversity

770. The cumulative impact of existing power lines, new project power lines and future power lines on bird collision/electrocution needs to be considered given the presence of ADB critical habitat along the coastline near Pekua SS for several bird species at high risk from power lines. There are already a number of existing power lines in the project area, on one hand these will have already reduced the area of suitable terrestrial habitat for bird species but on the other they present a collision/electrocution risk to birds that are using the airspace. Therefore, the cumulative impact of power lines on biodiversity was considered as part of the ecology assessment.

9.5.2 Cumulative Impact on Electricity Supply

771. The project will increase the availability and reliability of power. With the improvement of the transmission network, a number of prevailing issues in electricity supply to load centers in Bangladesh will be resolved. It will provide a solution to the low voltage problems encountered and improve the reliability of electricity supply to consumers of said areas. This will be a positive cumulative impact of the project that will have benefits to the local communities living in the areas with unreliable power supplies. However, project benefits may not be directly felt in the project areas and it is important compensation will be paid by PGCB in accordance with Government of Bangladesh's regulations and the

[56] Environment Safeguards- A Good Practice Sourcebook Draft Working Document (December 2012).

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

project's Resettlement Plan so that any income gap is not increased a result of project impacts on livelihoods.

9.5.3 Cumulative Impact of Renewable Energy Integration

772. In alignment with the global resolve to address climate change, Bangladesh made a commitment during the 2021 COP26 conference to integrate up to 40% clean energy sources into its power generation portfolio. The Southern Chattogram region, encompassing Pekua, Chakaria, Matarbari, and Moheskhali of Cox's Bazar district, is a promising prospect for solar and wind power generation has been identified as per the study conducted by NREL engaged by SREDA. Solar radiation in southern Chattogram areas is 1450-1534 kWh/kWp. Coastal areas of Bangladesh have considerable potential for wind energy generation, particularly in the southern regions along the Bay of Bengal. However, wind power development in Bangladesh is still at a nascent stage compared to other renewable energy sources. This recognition of solar energy potential has catalyzed a series of proactive measures, instigated by various government bodies and private enterprises.

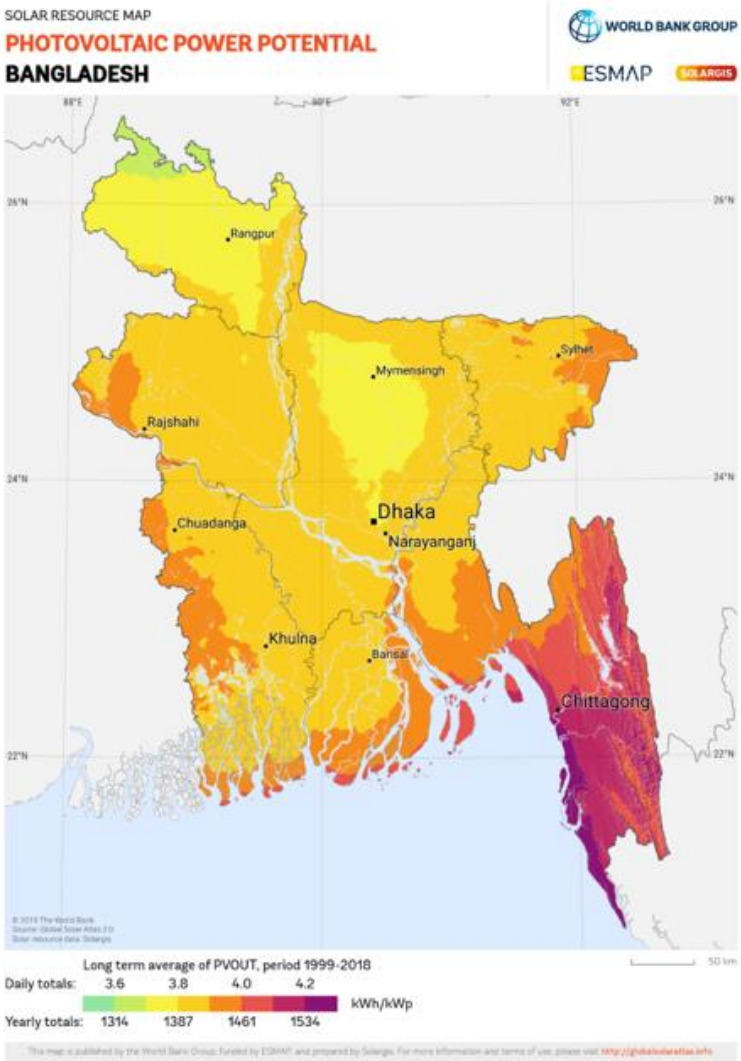


Figure 9.2: Solar Potential Map of Bangladesh

773. Noteworthy initiatives include government entities Bangladesh Power Development (BPDB), CPGCBL, etc. are going to construct several Renewable Energy Generation Projects in the Matarbari, Moheskhali area. Private companies invest capital in renewable energy projects, including solar, wind of renewable energy generation. They provide funding for project development, construction, and operation, often in partnership with government agencies, international organizations, and financial

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

institutions. These investments help to accelerate the deployment of renewable energy infrastructure in southern Chattogram areas. Government and Private companies proposed many renewable energies projects southern Chattogram area mainly at Cox's Bazar, summing up to an impressive 1,590 MW capacity, which have been submitted to PGCB through the power division for power evacuation readiness of the transmission grid, all geared towards renewable energy-based generation expected to be connected to the grid by 2030.

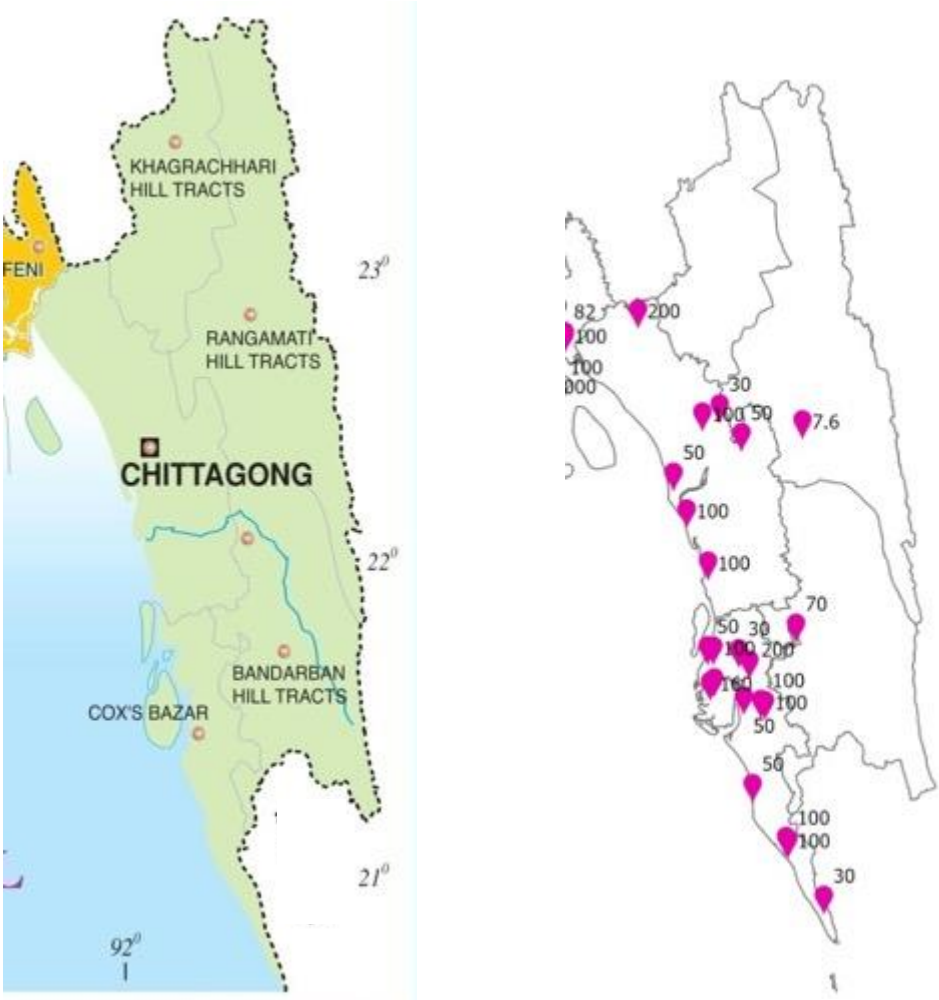


Figure 9.3: Proposed Renewable Energy Power Plants at Chattogram Area

774. The paramount challenge that emerges is the inadequacy of the existing transmission system in the Southern Chattogram region to efficaciously evacuate the power generated from these renewable energy generation ventures as the southern Chattogram area which is radially connected to the grid network via a 132 kV double circuit transmission line at present. A maximum of 450 MW of renewable energy generation could be accommodated through present transmission infrastructures. PGCB has sent power evacuation clearance considering the proposed network expansion at Pekua 400/230/132 kV grid substation.

775. On the other hand, the present coal base power generation plant at Banshkhali and Matarbari is not connected to the load center of the Cox's Bazar and Matarbari area under the present network topology. Consequently, power generated in Matarbari and Banshkhali area is transmitted through a 400 kV system at Chattogram and sent back to Cox's Bazar and Matarbari area via a 132 kV radial system. Moreover, it is standard practice worldwide to facilitate the penetration of high amounts of renewable energy the existing fossil fuel-based generation must be backed down. The forecasted demand of Cox's Bazar area during the daytime is 250-300 MW in the 2028 timeline. Its expected full power can be supplied from renewable energy generation. Bangladesh government also considering installing an

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

energy storage system (ESS) at solar power plants to support evening time demand. The surplus renewable energy generation shall be transferred to other parts of the Chattogram area which also reduces the fossil fuel generation.

776. Consequently, a comprehensive network expansion at the Pekua area encompassing 400 kV, 230 kV, and 132 kV networks is inevitable to evacuate the impressive additional 1,140 MW variable renewable energy generation plan at the Southern Chattogram area by 2028-2030 timeline. The Pekua 400/230/132 kV grid substation shall not only facilitate the evacuation of the 1,140 MW VRE plant it shall also meet the growing power demand of the southern Chattogram area at evening hours in a resilient and efficient way to reduce the carbon emission throughout the day.

777. The cumulative impact of the VRE Hub facilitated by the Pekua substation and transmission line has been considered. None of the proposed sites of the associated facility are within a protected area or KBA/IBA. However, one site “New Tech Solar” is within 200m of a WLS and one “Taknaf” is within 700m of a WLS so the impacts on species supported would need to be considered. It will need to be ensured through IEE/EIA (a national requirement) that these sites do not have significant impacts on ecology – this will depend on the design and layout of the solar plants and related transmission line connections. For wind farms the additional concern of collision needs attention. Loss of habitat suitable for species supported by the WLS and KBA/IBA is to be avoided whilst the operation of the wind farm will need to avoid collision risk (e.g., curtailment during the migration season) and routing and design of any transmission lines to evacuate power will need to be minimized in length and adopt a bird sensitive design per GIIP to minimize the risk to birds. None of the associated facility sites are fixed and can be dropped by the private sector if environmental clearance is not forthcoming. However, it is important for GOB to consider the impact of all associated facility sites (and other sites coming up in future) in respect of impacts on birdlife given the AoA for the VRE Hub is critical habitat for spoon billed sandpiper, spotted greenshank etc. In this respect ecological constraints mapping and guideline on the assessment of solar, wind and related power lines in line with GIIP including IFC EHS Guidelines on Wind Energy and its Good Practice Handbook on Post-construction Bird and Bat Fatality Monitoring and developed in consultation with the flyway initiative stakeholders is needed to ensure adequate consideration is given.

778. The recommendation of an “SEA” undertaken for the Integrated Energy and Power Master Plan (IEPMP) 2023 with support of JICA is that “MOPEMP will create Environmental Unit covering both the Power Division and Energy and Mineral Resources Division. It should also work closely with the Department of Environment of the Ministry of Environment, Forest and Climate Change (MOEFCC). Their work will include ensuring that all investors in the energy sector comply with the SEA’s objectives, indicators and targets for their individual subprojects and ensure implementation of all the recommended measures in collaboration with all the relevant line agencies/sectors.” To address habitat and avifauna risk, before connecting any project from the VRE hub with Pekua substation and the transmission network in South Chattogram, PGCB will need to ensure the private sector has obtained ECC, and work with MOPEMP, BPDB, and MOEFCC/DOE on ecological constraints mapping and to develop guidelines on avifauna assessment and management.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

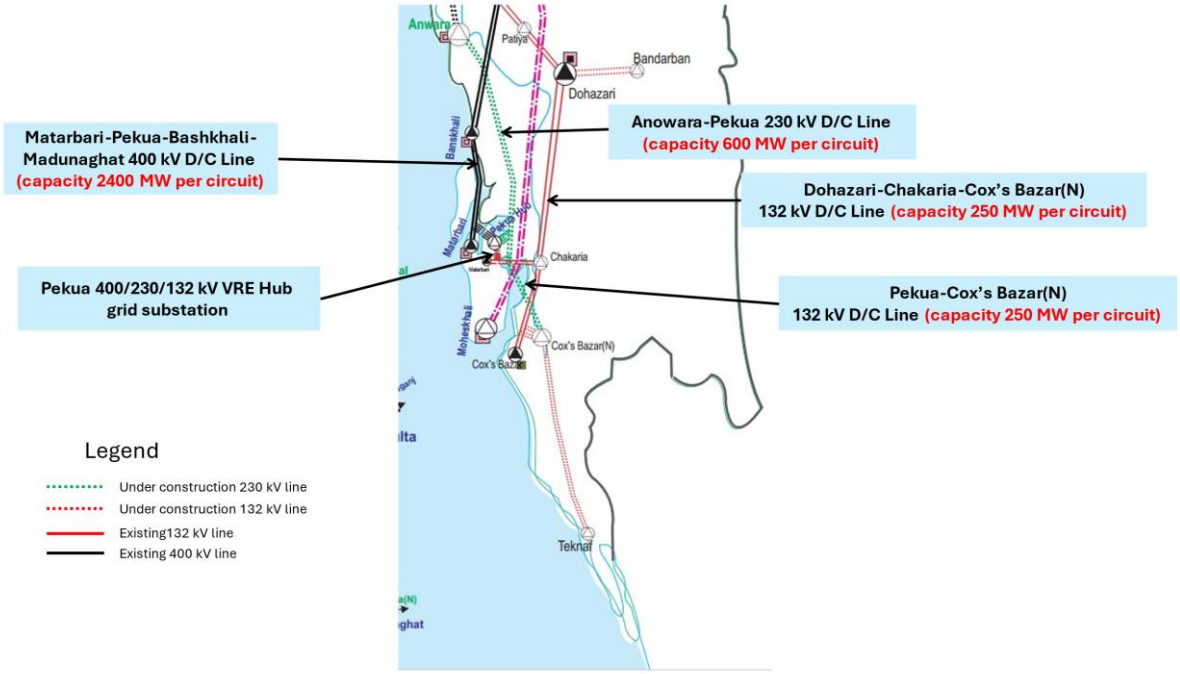


Figure 9.4: Grid Map Showing Pekua 400/230/132 kV Substation Connection

Table 9.44: Renewable Energy Power Plant Proposed List in Cox's Bazar Area

SL.	Name of Power Plant	Type of RE	Capacity (MW)	Place	Owner
1	Teknaf Solartech	Solar	22	Teknaf, Cox's Bazar	IPP
2	US-OK Green Energy (BO) Ltd.	Wind	60	Cox's Bazar Sadar, Cox's Bazar	IPP
3	OITROLIC Powernetic Consortium	Solar	100	Machuakhali, Cox's Bazar	IPP
4	JT New Energy Co. Limited, Hong Kong Consortium of Fujian Yongfu Power	Wind	200	Chakaria, Cox's Bazar	IPP
5	Engineering Co. Ltd. & Pinnacle Omni Traders Ltd.	Solar	70	Lama, Bandarban	IPP
6	KAI-Altech Consortium	Solar	100	Machuakhali, Cox's Bazar	IPP
7	Joules Power Limited	Solar	50	Chowfoldondi, Cox's Bazar	IPP
8	Bay of Bengal Solar	Solar	160	Moheshkhali, Cox's Bazar	IPP
9	Inani Wind PP	Wind	50	Inani, Cox's Bazar	IPP
	Consortium of NewTech solar Energy BO				
10	Limited, O.H Euro Hitech Co. Ltd. (South Korea) and ERS Energy Sdn Bhd (Malaysia)	Solar	30	Chakaria, Cox's Bazar	IPP
11	Suntricity Renewables Ltd.	Solar	100	Teknaf, Cox's Bazar	IPP
12	Consortium of BFBIL and BLPGL	Solar	100	Teknaf, Cox's Bazar	IPP
13	CPCL-POL-GREENE SOLAR POWER Ltd.	Solar	30	Teknaf, Cox's Bazar	IPP
14	BFBIL-BLPGL-ZVCHCL Consortium	Solar	160	Teknaf, Cox's Bazar	IPP
15	China Energy International Group Co. Ltd.	Solar	270	Ukhia, Cox's Bazar	IPP
16	Shandong Hi-Speed International Pte.	Solar	70	Maheshkhali, Cox's Bazar	IPP

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

SL.	Name of Power Plant	Type of RE	Capacity (MW)	Place	Owner
	& Renovo Ltd.				
	Total		**1572**		

9.6 Transboundary Impacts

779. The Project will not result in any significant transboundary impacts.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

10 Stakeholder Consultations

10.1 Introduction

780. This chapter presents the objectives, processes, and findings of the consultation meetings carried out with the key stakeholders of the project during the IEE study.

781. Stakeholder consultations (or public consultations) in the IEE process of development projects are increasingly considered an important means of understanding community and other stakeholder perceptions about the project and statutory requirements, which increases the authenticity and acceptability of the assessment itself but more importantly can possibly enhance the quality of decisions making as well. The statements, conversations and commitments from both ways (Proponent-Stakeholders) are meant to be inclusive, meaningful, and transparent. Stakeholder consultation/participation during various stages of developmental projects helps improve the decision-making processes and ultimately leads toward sustainable development.

782. Stakeholder consultation is a two-way process. For stakeholders, the consultation process is an opportunity to obtain project information, raise issues and concerns and ask questions. For the project proponents, the consultation process offers the opportunity to understand the stakeholders and their concerns about the project, their needs, aspirations, perceptions and their suggestions that can potentially help shape the project. Listening to stakeholder concerns and feedback can be a valuable source of information, that can help improve project design and outcomes and help the project proponent identify and control external risks. It can also form the basis for future collaboration and partnerships.

783. Stakeholder consultation is recommended for the IEE study of any development Project according to the EIA Guidelines for Industries published by the Department of Environment (DoE) in 2021. Similarly, ADB's Safeguard Policy Statement (SPS), 2009 emphasizes on 'Enhancing Consultation and Participation' with a 'Meaningful Consultation' process.

10.2 Regulatory/ Requirements

10.2.1 Bangladesh Guidelines

784. The EIA guideline formulated by DoE in 2021 (Chapter 9) meant that since the public is the ultimate recipient of the economic benefit and environmental damages, an EIA study should involve the public as part of decision-making process development. Consultation is an important step of the EIA process. To achieve effective public participation, it is necessary to communicate with as many people as possible, as early as possible and through as many ways as possible. This requires pre-planning, adequate resources, identification of target groups and several techniques for effective communication.

10.2.2 Asian Development Bank Requirements

785. ADB's Safeguard Policy Statement (SPS) 2009 emphasizes on 'Enhancing Consultation and Participation' with a 'Meaningful Consultation' process. This means, it would refer to a process that (i) begins in the project planning and preparation stage and rolls over throughout the project cycle; (ii) provides timely disclosure of relevant and adequate information to the affected people; (iii) is undertaken in an atmosphere free of intimidation or coercion; (iv) is gender inclusive and responsive and tailored to the needs of disadvantaged and vulnerable groups and (v) enables the incorporation of all relevant views of affected people and other stakeholders into decision making, such as project design, mitigation measures, the sharing of development benefits and opportunities, and implementation issues. Consultation will be carried out in a manner commensurate with the impacts on affected communities. The consultation process and its results are to be documented and reflected in the environmental assessment report.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

10.3 Objectives and Purpose of Stakeholder Consultation

786. The main objectives of the stakeholder consultations/meetings were to:

- inform local people about the goal and objective of the proposed project;
- make people knowledgeable about the components and interventions of the proposed project;
- make people aware about the problems that could be created from the proposed project;
- obtain suggestions (mitigation measures, enhancement measures, contingency measures,
- compensation measures) to resolve those problems; and
- confirm that all the affected parties and stakeholders have been adequately consulted and have been part of the various decision-making processes.

10.4 Identification of Stakeholders

787. Stakeholders include all those who may affect or who are being affected by policies, decisions or actions within a particular system. Stakeholders can be a group(s) of people, organizations, institutions and sometimes even individuals. Stakeholders can be divided into primary and secondary categories. In the consultation meeting, both the primary and the secondary stakeholders have been selected.

788. Table 10.1 presents the types of stakeholders identified and engaged for consultation meetings.

Table 10.1: Types of Stakeholders Engaged in the Project

Sl. No.	Type of Stakeholders	Description	Stakeholders
1	Primary	Primary stakeholders are people who would be directly benefited or impacted by a project intervention.	Local representatives, land owners, small business community, shopkeepers, pedestrians, women's groups, local leaders and stakeholders of community properties.
2	Secondary	Secondary stakeholders pertain to those who are not directly affected but have interests that could contribute to the IEE study, play a role in project implementation at some stage, or affect the decision making on project aspects.	Local Government Institutions (LGIs), PGCB, Government Departments and Officials, Civil society representatives, NGOs and others.

10.5 Approaches and Methodology

789. A participatory approach was followed for the consultation of the project:

- The consultants used a checklist to maintain uniformity and relevancy in discussion and recording of the opinions and views of the participants;
- Socio-economic, agricultural, hydrological, fisheries, and ecological issues were discussed in detail, including potential impacts of the interventions on the environmental and social parameters; and
- Institutional issues were also discussed regarding which the participants provided their opinions and suggestions freely.

790. The issues of the overall project planning for intervention and probable impacts on the environment, socio-economy and institutions were incorporated in the checklist. A multi-disciplinary study team facilitated the consultations with different groups of local people to collect/record their opinions and views. At the very beginning of each consultation meeting, a representative from the IEE study team presented all the activities related to the project. The team used maps of the project area in establishing the baseline condition to identify proper interventions for the participants of the consultation meetings. At the same time, the purpose of the IEE study was described briefly so that the stakeholders could understand the purpose and importance of this consultation meeting. After receiving

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

an overview of project activities, the participants shared their concerns in terms of working time, compensation (if required), probable risks, working environment, and period of implementation.

791. During Stakeholder Consultation Meetings, the following process was followed with sequences.

Greetings: At the beginning, the team spelled greetings to all participants, welcomed them for attending and stated the entire design of the meeting.

Introduction: The team members introduced themselves to the participants and gave a detailed description of the project, spelled out about the objectives and anticipated outcome of the meeting.

Respect to the Participants: The study team showed respect to all participants. They respected not only to the individuals but also their values, cultural practices and social structures.

Ensuring Peoples' Voice: Generally, all participants cannot participate equally. The study team encouraged all to participate willingly through explaining the ethics of the study.

Note Taking: Discussed issues and opinions were written in notebook carefully by the team members. All issues were given equal importance.

Recapitulation and Closing the Session: The team member summarized the session and responded to the queries. Finally, the facilitator closed the session thanking the participants.

10.6 Meaningful Stakeholder Consultations

792. **Stakeholder Consultation Meeting (SCM)**: The public/community consultation, discussion and participation processes start by identifying the stakeholders of the Project. The stakeholders of the Project were identified through a 'stakeholder mapping exercise' conducted by the field survey team members. The exercise was done by categorizing the potential affected persons and host communities, who have a stake in the Project. The identified primary stakeholders are the landowners, traders, farmers, service holders, day laborer, drivers, etc. who will be directly and/or indirectly affected by the project interventions.

793. **Focus Group Discussions (FGDs)** to be held with the communities who live in close to the proposed substations and transmission lines. The participation of the women was less in the consultation and FGDs due to religious and cultural matters.

However, the overall discussions and outputs from the SCM/FGDs are:

- General perception about the project and the awareness about the proposed project;
- During construction stage all of the affected households will get proper compensation;
- During winter season transmission line wire make noise which is disturbing;
- Status of current environmental conditions in the area – air, dust, noise levels, status of soil in the area;
- Community Health and Safety;
- Labor availability in the Project area or requirement of outside labor involvement.;
- Women development; etc.

794. **Key Informant Interviews (KIIs)**: The secondary stakeholders identified included the public representatives, local government administration, the executing agency, financing institutions etc. The secondary stakeholder for the project includes PGCB, Deputy Commissioners of the respective districts, Department of Agriculture (DAE), Department of Forest (DF), Roads and Highways Division (RHD), Bangladesh Railways (BR), Bangladesh Water Development Board (BWDB), Department of Fisheries, public representatives and Upazila level administration. PGCB site officials were also present during the consultations to address the concern of people.

795. **Public Consultation Meeting (PCM):** Meetings are held by project proponent to disclose the project and its documentation to the concerned stakeholders, NGOs, CBOs, thinktanks, public and policy

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

makers in presence of the officials of the concerned officials of the Department of Environment.

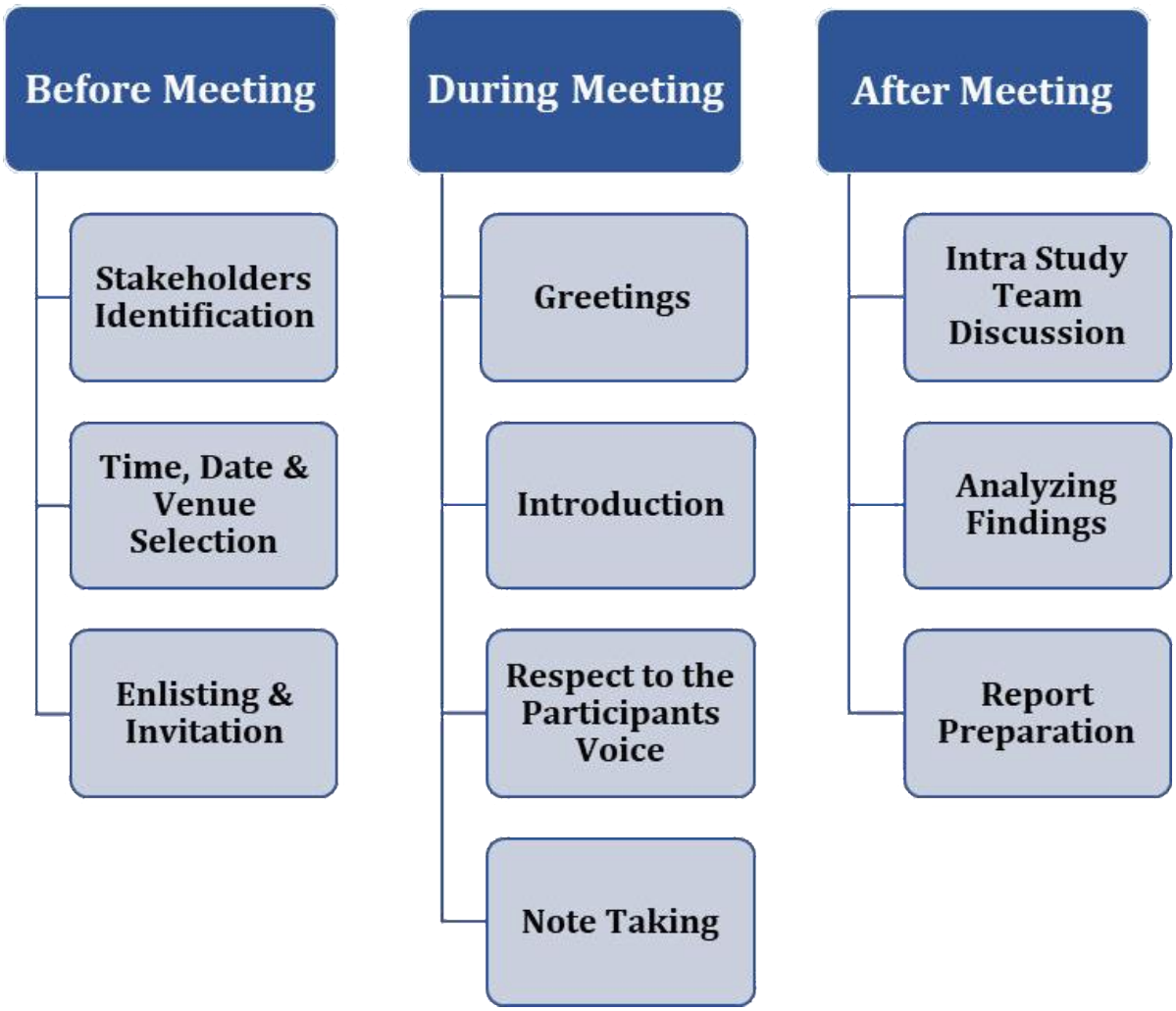


Figure 10.1: Overall Process of Stakeholder Consultation Meetings

10.7 Consultation Details and Summaries

796. During the IEE study, a series of consultation meetings were held with the local community and project stakeholders in June 2024 during the census survey (Appendix XI contains Sample consultation survey forms to be used for any IEE/EMP updation before award or during implementation). The consultation meetings and gender consultations were conducted using a Participatory Rapid Appraisal (PRA) approach to ensure the participation and inclusion of views and opinions from the affected persons. The meetings were arranged according to the convenience of the local people and focused on disclosing both positive and negative impacts of the project on the community and stakeholders. Key Informant Interviews were ensured through personal meetings and phone.

797. In order to assess stakeholder needs, expectations, perceptions, and choices, and to ensure their rights and voices, a two-fold consultation processes was carried out during the survey. Thus, SCMs were conducted firstly with both the primary and secondary stakeholders during survey period at June 2024. Later, affected persons of different occupations and gender-based groups were consulted through 27 FGDs.

798. A total of 32 SCMs and gender consultations were carried out at 32 different locations of the project areas during the survey period at June 2024. The total number of participants were 825 which includes 448 male and 377 women participants were carried out during the field visits. Table 10.2

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

presents details of all consultations conducted.

799. Summary Stakeholder Consultation meeting is presented in Table 10.2. Appendix VIII contains lists of attendees and photographs from all consultations.

Table 10.2: Summary Table for Stakeholder Consultation Meetings

Components	Number of Consultations (Locations)	Public Consultation including Gender		Total participants
		Male	Female	
New Substations	10	131	93	224
Bay Extension	5	44	58	102
Lines	17	273	226	499
Grand Total	**32**	**448**	**377**	**825**

Source: SES survey, June 2024 and Resettlement Plan

800. SCM's places, venues, dates and number of participants attended the meetings are presented below

Table 10.3: Venue, Date and Number of Participants of Stakeholder Consultation Meetings

Component Name	Date	Location	Type of participants	Public Consultation including Gender consultation		
				Male	Female	Total
New Substations						
Pekua VRE Hub Station400/230/132 kV AIS	12-Jun-24	Elisha, Pacchim Boro Vaula, Chakaria, Coxs Bazar	Housewife, Business, Service, Raj Mistri, Farmar and Student	13	7	20
Madhabpur : 230/132/33 kV AIS Double Bus	3-Jun-24	Bakshayer, Andiura, Madhabpur, Hobiganj	Housewife, Agriculture and Business	16	13	29
Monohardi 230/132/32 kV AIS Double Bus	2-Jun-24	Hafizpur, Chalakchor, Monohardi, Narsindi	Housewife and Agriculture	7	9	16
Tungipara 132/33 kV AIS	12-Jun-24	Balaganj, Baladanga, Patgati, Tungipara, Gopalganj	Housewife, Business, Driver Agriculture, Service, & Student	10	8	18
Dupchanchia 132/33kV AIS	10-Jun-24	IslampurKoshor, Islampur, Dupchacia, Bogura	Housewife, Business, Teacher, Agriculture and Service	25	0	25
Matlab (N)132/33 kV AIS	7-Jun-24	Kolakanda, Charpalolokdi, Matlab Uttar, Chandpur	Housewife, Business, Driver, Teacher, Agriculture, Retired, Probasi and Driver	23	0	23
Khustia (kumarkhali) 132/133 kV AIS	13-Jun-24	Choraikul, Shelaidah, Kumarkhali, Khustia	Housewife, Business, Agriculture, Service and farmer	15	14	29
Chatkhil 132/33 kV AIS	10-Jun-24	Kaloyai, Nadona, Chatkhil, Noyakhali	Housewife, Business, Agriculture and Service	8	10	18
Paikgacha 132/33 kV AIS	12-Jun-24	Soronkhali, Chakbogura, Loskar, Paickgacha, Khulna	Housewife, Agriculture, Service and Business	15	14	29
Mathbaria 132-33kV AIS Substation	11-Jun-24	Gulishakhali, Mathbaria, Pirojpur	Housewife, Teacher, Tailor, Business, CNG Driver, Service, Agriculture	11	6	17
Sub-Total				**131**	**93**	**224**
132kV AIS bay extensions						
Bajitpur Substation	4-Jun-24	Dulirchor, Halimpur, Bajitpur, Kishorganj	Housewife, Business, Agriculture, Probashi,	5	19	24
Gopalganj (Old) Substation	12-Jun-24	Karargati, Gopalganj Sadar, Gopalganj	Housewife, Business, Mechanic, Atu Driver, Rickshaw Driver and Student	10	8	18
Kachua	7-Jun-	Bodorpur, Turagor, Haziganj,	Housewife, Business,	6	7	13

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Component Name	Date	Location	Type of participants	Public Consultation including Gender consultation		
				Male	Female	Total
230/132 kV Substation	24	Chandpur	Service, Agriculture			
Satkhira Substation	12-Jun-24	Binerputa, Satkhira Sadar, Satkhira	Housewife, Business, Engineer, Service, Agriculture	14	13	27
Bhandaria	12-Jun-24	Bhandaria, BhandariaPowrashava, Pirojpur.	Housewife, Teacher, Business, Agriculture, Day labor, Student.	9	11	20
Total				44	58	102
Grand Total substations				**175**	**151**	**326**
Transmission Lines						
Reconductoring of Shahjibazar-Brahmanbaria-Ashuganj 132kV line	5-7 Jun-24	Gulanagar, Fatapur, Noapara, Andiura, Chandora, Kalikapur, Mirpur, Rampur, Chandura, Bijoy Nagor, B. Baria, Madhobpur, Hobiganj	Service, Business, Farmer, Driver and Student, Teacher, Police, Mechanic, Farmer, Politics, Housewife, service and Remittance	72	40	112
Monohardi - Bajitpur 132kV double circuit line	7-13, Jun-24	South Purbachor, Chorpakhia, lohajora, kotyadi, kishorganj, Monohardi, Norshindi, Birmisdia	Housewife, Business, farmer, Driver, labor and Student	28	19	47
Gopalganj - Tungipara 132kV double circuit line	13-Jun-24	Balaganj, Baladanga, Patgati, Tongipara, Gopalganj	Housewife, Service, Business, Driver, Day labor, Agriculture and Student	10	7	17
Kachua-Matlab(N) 132kV double circuit line	13-Jun-24	Bajirgao, Turagor, Hajiganj, Chandpur Begumpur, Ludhya, Uttar motlob, Chandpur Kolakanda, Gozra, Motlab(N), Chandpur Kashimnogar, Maisdi, Gajra, Motlab, Chandpur	Housewife, Business, Service and Agriculture	13	17	20
Satkhira - Paikgacha 132kV double circuit line	13-Jun-24	Binerputa, polashpur, Sathkhira Sadar, Sathkhira Soronkhali, Chakbogura, Loskor, Paickgacha, Khulna	Housewife, Service, Business, Driver, Farmer and Student	22	23	45
Bhandaria - Mathbaria 132kV double circuit transmission line	7-Jun-24	Porvovandaria, Vandaria, Pirojpur Choto Harzi, Mirulia, Mathbaria, Pirojpur	Housewife, Service, Teacher, Business, Driver, Farmer and Student	17	14	21
LILO of Existing Matarbari PP-Danskhat PP 400kV line at Matarbari (6.75 km)	4-Jun-24	Ilishia, PoschimVoroVeula, Chokoria, Cox's Bazar	Housewife, Teacher, Business, Farmer, Labor, Fisherman and Student	37	25	63
LILO of Anwara-Cox's Bazar 230kV line at Matarbari	13-Jun-24	Ilishia, PoschimVoroVeula, Chokoria, Cox's Bazar	Housewife, Teacher, Service, Business, Agriculture, Mechanic, Driver and Student	8	9	17
LILO of Cumilla(N) - Shahjibazar PP 230kV double circuit line at Madhabpur	11-Jun-24	Malihata, B.Baria Sadar, B.Baria	Housewife, Teacher, Service, Business, Farmer, Remittance, Driver and Student	10	9	19
LILO of Shahjibazar -	11-Jun-24	Malihata, B.Baria Sadar, B.Baria	Housewife, Teacher, Service, Business, Farmer, Driver and	11	20	20

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Component Name	Date	Location	Type of participants	Public Consultation including Gender consultation		
				Male	Female	Total
Brahmanbaria 132kV double circuit line at Madhabpur			Student			
LILO of Sripur - Ashuganja 230kV double circuit line at Monohardi	11-Jun-24	South Purbachor, Chorpakhia, kotyadi, kishorganj Pirispur, Bijitpur	Farmer, Remittance and student, Housewife and Service	14	11	25
LILO of Bogura(S) - Naogaon 132kV line at Dupchanchia		Koshohor, Islampur, Dupchachia Sadar, Bogura	Housewife, Service, Business, Farmer, Van puller, Driver and Student	10	12	22
LILO of Bheramara - Rajbari, 132 kV line at Kushtia		Choraikul, Kumarkhali, khustia	Housewife, Service, Business, Farmer, Driver and Student	10	10	20
LILO of Chowmuhani - Ramganj 132kV double circuit line at Chatkhil		Kaluyai, Nodna, Chatkhil, Nuakhali	Housewife, Service, Teacher, Business, Day Labor and Farmer.	9	15	24
Grand Total (Lines+LILO)				**273**	**226**	**499**
ALL COMPONENTS				**448**	**377**	**825**

Source: SES survey, June 2024 and Resettlement Plan

10.8 Issues Identified and Suggested Measures through Consultation

10.8.1 Stakeholder Consultation Meetings (SCM)

10.8.1.1 Stakeholder Consultations

801. The consultants discussed with the stakeholders about the proposed project interventions and the process of people participation in preparing the IEE. The people of the project area learned about the proposed project from the officials of PGCB and consultants who frequently visited the project area. The people of the project area are aware of probable impacts of the project. Local people identified impacts (problems, benefits) of the project in the consultation meetings. Irrespective of region, project impacts likely to be happened are identified.

Table 10.4: Summary of stakeholder consultation meetings

Issues Discussed	People's Views and Perception[57]
General perception about the project	Most the people opined that they were aware about the proposed project. People in general felt that the project is very necessary for the regular and sufficient power supply with proper voltage. Some are pointed out that the project will provide benefit to students as they will get assured power supply during evening for studying.

[57] PGCB will respond to any perception, complaints, compensation queries once detailed design is complete and PAPs shortlisted. TA team of surveyors had no direct role in responding to the people of how the project will alleviate their issues.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Issues Discussed	People's Views and Perception[57]
Support of local people for the proposed project	All participants were agreed to provide unconditional support to the proposed project as the project is going to solve the electricity problem faced by them and finally their life will be comfortable. Participants during the consultation mentioned that since power supply is very poor there are no small-scale industries in this area. Once there will be assured power supply it will help in better economic development of the area. People will start planning about establishing small scale industries in the area and as a result there will be more employment opportunities.
Support and participation during project implementation	All the participants during the consultation expressed that they will extend unconditional support to the project and participate during the implementation of the project as and when required.
Critical issue and concern by the local people for the project	The local people during the consultation pointed out various issues pertaining to the project. One major issue highlighted was safety to the nearest residential population due to the construction of substation. In some locations they pointed out the issue of timely construction of proposed substation as during the construction there are lot of dust and noise pollution for the nearby population.
Criteria to be considered during project design, operation stage and construction	Few of the participants during the consultation suggested that the proposed substation should be at least 2 to 3 kms away from the residential populated area. In some locations, people mentioned that for safety fencing around the project site is required and modern technique should be used to reduce the noise pollution. Some were suggested that for safety there should be a safety wall with guard facility. In a few substations, the people during the consultation pointed out that proper approach road with streetlight facility to the proposed substation is needed to deal with emergency situations.
Status of current electricity supply	Majority of the participants during the consultation reported that electricity is available for 12 to 14hrs only. There are regular power cuts due to load shading, and they experience voltage fluctuations. The electricity supply is very less when there is strong wind and rain. In some substation areas, the participants pointed out that electricity is available for 6 to 7hrs in a day and during the rainy season the electricity supply is even less.
Perceived benefits from project	Almost all participants during the consultation pointed out that the construction of new substations will ensure increased electricity supply to villages and will stabilize the voltage fluctuations. Some of the participants pointed out that the increased power supply will meet the power demand of small-scale industries in the future which in turn will create employment opportunities for people in the area. The availability of sufficient power would be beneficial for the students for studying and undertaking other learning activities especially in the evening time.
Perceived loss	Almost all the villagers felt that there are no such negative impacts from this proposed project. Though there are some perceived losses these are very minimal in nature as they feel that there could be disruption of agricultural activities during stringing of feeder line or loss of crops if not avoided
Safety issues	Almost all the villagers raised the issue of safety due to the construction of substation. The participants mentioned that there will be always fear in the mind near the substation. For safety fencing around the project site is required and modern technique should be used to reduce the noise pollution. Some participants suggested that safety wall should be constructed around the substation with guard facility. This has been clarified that the substation boundary will be permanently fenced and there will be no influx of people inside the s/s boundary. Necessary safety measures will be adopted for ensuring safety of local people.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Issues Discussed	People's Views and Perception[57]
Usefulness of consultation	All villagers admitted that the consultations are very useful and helpful as they got an opportunity to share their views and concerns about the proposed project. Most of them pointed out that regular information sharing regarding the proposed project is needed for information about project status among local people.
Involvement of people in implementation	All participants during the consultation mentioned that they will participate during the implementation of the project. As the proposed project is very important to address the problem of electricity in their area, the villagers extended their full support in the implementation of the project.

Source: SES survey, June 2024 and Resettlement Plan

802. Photographs are attached in Appendix VIII.

803. Table below list responses by PGCB regarding avoidance and safeguards issues raised by SCMs.

Table 10.5: Replies from PGCB for Avoidance and Safeguards

No	Issues and concerns raised	Response from the PGCB
1	We expect transmission lines to contribute to improved village and household power supply, reduce load shedding, stable supply of electricity to irrigate crop cultivations, uninterrupted power supply at night for children's studies, development of industries and commercial centres and employment for our unemployed people in civil works, and permanent employment for educated youth at substations specifically affected households.	Project will bring many positive benefits to the local communities. The project will improve and stabilize the power supply. Moreover, if the electricity supply increases, it will create more livelihood opportunities and employment for people. PGCB will negotiate with the construction contractors to place their priority in local labor in recruiting labor teams for civil works.
2	Transmission lines should avoid traversing public places like schools, mosques, graveyards, *madarasa*, markets etc. as well as residential dwellings of the people.	In the final engineering designs, PGCB will take maximum efforts to avoid primary residential dwellings, businesses related structures and community properties. Installation of transmission towers will avoid residential areas and other public spaces. If unavoidable, project will provide compensation at replacement cost and other rehabilitation and restoration assistance. PGCB ensures that transmission lines do not cause population displacements. People can live in the same places provided that distance between the roof of their structures and the transmission conductors are maintained at 7-8 meters.
3	Transmission lines and towers can cause possible electrocution, accidents, fires and damages to trees and crops particularly during natural disasters like heavy rains, lightening, storms and winds.	PGCB will ensure that all required safety measures are followed by contractors during substation construction and PGCB officers during its operations. Necessary safety measures such as erecting bamboo sheds over the built structures and fencing off the line stringing sites will be adopted by the contractor during conductor stringing. Civil works will be scheduled to avoid cultivation seasons, and peak periods for other livelihood activities. Contractors will be obliged to avoid traffic congestion and follow health and safety guidelines to control dust emissions and noise generation.
4	Construction and operations of substations should ensure the prevention of potential accidents, pollution and noise disturbances to local communities and the common property resources situated in the vicinity of the substations.	

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

No	Issues and concerns raised	Response from the PGCB
5	Transportation of construction material can cause traffic congestion, dust and noise emissions.	PGCB officers will monitor the performance of the contractor and his compliance with safeguards requirements.
6	Land-filling for substations can disturb the drainage systems and would adversely affect the rest of the lands, water logging, floods etc.	The final engineering designs will study the drainage systems and necessary measures would be incorporated to avoid environmental hazards.
7	Construction work of the transmission lines should not damage utility services and our water sources and pumps.	No utility services or water sources will be affected. If affected, project will restore them at its own cost within a reasonable time frame.
8	Civil works of the project will lead to influx of migrant labor teams; their possible misconduct and engagement in sexual harassment of women; drug peddling and abuse, human trafficking etc.	PGCB and the contractors will endeavor to minimize labor influx and place priority in local labor. Awareness raising programs will be conducted for labor teams. It will be a mandatory requirement for the contractors to enforce a code of conduct for the labor teams. PGCB will establish a grievance redress mechanism (GRM) to facilitate any affected/aggrieved parties to report their grievances/complaints and seek resolution within a reasonable time frame.

Action taken: [58]

804. During construction, the local people expressed that one major issue regarding safety to the nearest residential population due to the construction of substation and lines due to high dust, surface water and noise pollution. Secondly, they felt that only day time construction should be allowed at sites. Lastly, they had issue regarding perceived losses due to disruption of agricultural activities during stringing of lines or loss of crops if not avoided during season. During operations, almost all the villagers raised the issue of safety due to the construction of substation and lines in their vicinity mostly due to lightning and electrocution. Accordingly, the EMP contains stringent clauses for the contractor to follow which will be monitored closely by contractors EHS and labor officers as well oversight by SIC and PGCB site engineer.

10.8.1.2 Gender consultations (key EHS issues)

805. Total 377 female joined in 32 gender consultations meetings/focus group discussions. However, during census most of the female household members are consulted one to one. The summary of discussions is presented in the below table.

Table 10.6: Summary on Key Gender Consultations related to Environment during census

Issues Discussed	Women's views and perception	PGCB response
General Perception about the project	Around 75% of the women have heard about this project and they felt that successful implementation of this project will ensure regular power supply at home. Un interrupted power supply also increases the local business.	More consultations will be undertaken during the updating and implementation of EMP involving women to make them aware about the project

[58] These actions taken represent issues that have been incorporated into the project EMP/EMoP attached to this IEE. Any final list of actions taken will be incorporated by the contractor in the CSEMP to be approved by PGCB and ADB after completion of design stage.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Issues Discussed	Women's views and perception	PGCB response
Primary occupation of women	Women are primarily engaged in the household work. Most of them are also engaged in cultivation as per the agriculture season including collection of harvested yields. Some women members also run small shops and make bamboo baskets, and pickles at the household.	Women's occupation will be continued and will not be hampered by the project.
Availability of public health facilities and quality of services	In majority of the villages there are sub-centre and Primary Healthcare Centre (PHC)facilities. Women generally visit these facilities to seek first level of basic treatment for different ailments. However, in majority of the sub-centres there is poor infrastructure and in majority of PHCs no lady doctor is available. Due to these factors, home delivery is still practised. Civil hospitals are mainly located in towns and the villages near to the towns avail the good facilities of these hospitals.	PGCB clarified that this issue belongs to the health department and as power utility, it is not in their purview.
Commonly prevalent diseases among the community	During consultation, most of the women members reported that high blood pressure and diabetes are prevalent among the community. It was also mentioned that in some of the villages, malaria is prevalent in the area. The community generally seek allopathic treatment for the above ailments.	The project will not trigger large scale construction activities and will not affect the health of the people and community.
Overall observation	Women in the community are hard working. They are engaged in almost all the productive activities of the household. The society follows Islamic and government rules in which the right of property and inheritance passes to women members of the family. All these factors contribute to make the women members more empowered. Women members also have active interest to learn other skills for strengthening the income of the household.	PGCB clarified that the project will initiate some gender related intervention for which a gender action plan has been prepared.

Source: SES survey, June 2024 and Resettlement Plan

806. Photographs are attached in Appendix VIII.

Action Taken (related to Environmental issues):

807. There was a general request for ensuring local population specifically the women and children are not inconvenience due to construction activities and labor in vicinity of construction sites. Accordingly, the EMP contains stringent clauses for the contractor to follow which will be monitored closely by contractors EHS and labor officers as well oversight by SIC and PGCB site engineer.

10.8.2 Focus Group Discussions (FGDs)

808. Focus Group Discussions (FGDs) were held with the communities who live in close to the proposed substations and transmission lines. The participation of the women was less in the consultation and FGDs due to religious and cultural matters.

809. However, the overall discussions and outputs from the FGDs are:

- General perception about the project and the awareness about the proposed project;
- During construction stage all of the affected households will get proper compensation;
- During winter season transmission line wire make noise which is disturbing;
- Status of current environmental conditions in the area – air, dust, noise levels, status of soil in the area;
- Community Health and Safety;
- Labor availability in the Project area or requirement of outside labor involvement;
- Women development; etc.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Table 10.7: Focus Group Discussion (FGD) (Local Community/Officials/Occupational Groups) by ADB TA Consultant Team

	Meeting Place	SS/TL	Date	Number of Participants		
				Total	Male	Female
1	Chalakandi Monohardi, Narsingdi	230/132/33 kV New AIS Substation at Monohardi	31.05.2024	12	9	3
2	Jararpar, Lohajhuri, Kotiadi, Kishoreganj	2×132 kV AIS bay extension of Bajitpur Substation	02.06.2024	8	4	4
3	Bir Mizdia, Borochapa Union, Monohardi, Narsingdi	Monohardi-Bajitpur 132 kV transmission line	01.06.2024	8	0	8
4	Chandanpur, Monohardi, Narsingdi	Monohardi-Bajitpur 132 kV transmission line	01.06.2024	8	8	0
5	Jararpar, Lohajhuri, Kotiadi, Kishoreganj	Monohardi-Bajitpur 132 kV transmission line	02.06.2024	8	4	4
6	Hakimpur, Baljitpur, Kishoreganj	Monohardi-Bajitpur 132 kV transmission line	03.06.2024	8	8	0
7	South Purbachar, Lohajhuri, Kotiadi, Kishoreganj	Monohardi-Bajitpur 132 kV transmission line	02.06.2024	8	8	0
8	South Purbachar, Kotiadi, Kishoreganj	Monohardi-Bajitpur 132 kV transmission line	02.06.2024	8	5	3
9	Matikkata, Madhabpur, Habiganj	230/132/33 kV New AIS Substation at Madhabpur	07.06.2024	10	10	0
10	Mirpur, Chandura, Bijoynagar, Brahmanbaria	Reconductoring of Shahjibazar-Brahmanbaria-Ashuganj 132kV line: (58+17) = 75 km) (Proposed Conductor: CFCC type HTLS equivalent to ACSR Grosbeak)	07.06.2024	6	2	4
11	Malhita Brahmanbaria Sadar Upazila, Brahmanbaria	Reconductoring of Shahjibazar-Brahmanbaria-Ashuganj 132kV line: (58+17) = 75 km) (Proposed Conductor: CFCC type HTLS equivalent to ACSR Grosbeak)	07.06.2024	18	10	0
12	Putai, Brahmanbaria Sadar Upazila, Brahmanbaria	Reconductoring of Shahjibazar-Brahmanbaria-Ashuganj 132kV line: (58+17) = 75 km) (Proposed Conductor: CFCC type HTLS equivalent to ACSR Grosbeak)	08.06.2024	8	0	8
13	Kamawra, Talshor, Ashuganj, Brahmanbaria	Reconductoring of Shahjibazar-Brahmanbaria-Ashuganj 132kV line: (58+17) = 75 km) (Proposed Conductor: CFCC type HTLS equivalent to ACSR Grosbeak)	08.06.2024	8	3	5
14	Upazila More, Chatkhil, Noakhali	132/33 New AIS Substation at Chatkhil	11.06.2024	6	6	0
15	Dakhin Matlab, Chandpur	132/33 kV New AIS Substation at Matlab Uttar	11.06.2024	8	8	0
16	Dakkhin Ajgor, Matarbari, Cox's Bazar	400/230/132kV New AIS Substation at Pekua/Chakaria	12.06.2024	10	10	0
17	Gopalganj Pourashava, Gopalganj	2×132kV AIS bay extension Gopalganj (Old) Substation	23.06.2024	6	6	0
18	Baladanga, Patgati, Tungipara, Gopalganj	Gopalganj – Tungipara 132kV double circuit line: 19.00 km	23.06.2024	4	4	0

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

	Meeting Place	SS/TL	Date	Number of Participants		
				Total	Male	Female
		(Proposed Conductor: ACSR Grosbeak)				
19	Karalgati, Durgapur, Gopalganj	Gopalganj – Tungipara 132kV double circuit line: 19.00 km (Proposed Conductor: ACSR Grosbeak)	23.06.2024	7	7	0
20	Barokania, Bhandaria, Pirojpur	Bhandaria-Mathbaria 132kV double circuit transmission line: 32.00 km (Proposed Conductor: ACSR Grosbeak)	24.06.2024	11	7	4
21	Kalikapur, Tala, Satkhira	2×132kV AIS bay extension of Satkhira Substation	28.06.2024	8	6	2
22	Shahji Bazar Tala, Satkhira	2×132kV AIS bay extension of Satkhira Substation	25.06.2024	8	8	0
23	Paikgacha, Khulna	132/33 New AIS Substation at Paikgacha	25.06.2024	8	8	0
24	Charikul, Kumarklhali, Kusthia	132/33 New AIS Substation at Kumarkhali	02.06.2024	7	7	0
25	Islampura, Dhupchanchia, Bagura	132/33 kV New AIS Substation at Dupchanchia	26.06.2024	8	6	2
26	Dolichar, Hakimpur, Bajitpur, Kishoreganj	2×132 kV AIS bay extension of Bajitpur Substation	03.06.2024	8	8	0
27	Brahmanbaria Sadar Upazila, Brahmanbaria	Recondutoring of Shahjibazar-Brahmanbaria-Ashuganj 132 kV line	08.06.2024	8	1	7

Table 10.8: Summary of Focus Group Discussion (FGD)

Sl	Date	Location	No of Participants	Type of Participants	Participant's Opinion
1.	31.05.2024	Chalarkandi Monohardi, Narsingdi	12	Businessmen, job, farmer, housewife, student	• The participants lack awareness and understanding of the project. • The rice mills and market in the project area may be impacted. • The current environmental status is good, but it may be affected by the project. • Crops such as potatoes, paddy, and mustard may be disrupted. • Some date and banana trees will also be affected.
2.	31.05.2024	Jararpur, kotikdi, Kishoreganj	08	Farmer, Autodriver, shopkeeper, Housewife, student	• Both men and women expressed concerns about the inadequate electricity supply, citing frequent outages and voltage fluctuations as significant challenges impacting daily life and economic activities. • Female participants highlighted specific hardships in managing household chores and small businesses due to unreliable power.
3.	01.06.2024	Bir Maizddia, Monohardi, Narsingdi	08	Housewife, student	• Male participants emphasized the impact on larger industries and agricultural productivity. • The discussion underscored the urgent need for infrastructure improvements and community involvement to address these issues effectively.
4.	01.06.2024	Chandanpur, Monohardi, Narsingdi	08	Farmer, student, remittance fighter	• The main environmental concern in the area is the poor sanitary conditions, primarily caused by open defecation and inadequate sewage management.
5.	02.06.2024	Jararpur, kotiadi, Kishoreganj	08	Farmer, Shopkeepr, Driver, housewife, student	• **Challenges for Women:** Female participants noted difficulties in managing household chores and running small businesses due to unreliable power. • **Impact on Men:** Male participants highlighted how unreliable electricity affects larger industries and agricultural productivity.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Sl	Date	Location	No of Participants	Type of Participants	Participant's Opinion
					• **Need for Improvements:** The discussion stressed the urgent need for infrastructure improvements to address these electricity issues. • **Community Involvement:** Emphasis was placed on the importance of community involvement in finding effective solutions.
6.	02.06.2024	Hakimpur, Bajitpur, Kishoreganj	08	In charge, electrician, technician	• The participants are aware of and understand the project. • Agriculture will be affected, and soil fertility may decrease. • The project is located near the road, resulting in high levels of dust and vehicle emissions in the air.
7.	02.06.2024	South purbachar, kotiadi, kishorganj	08	Farmer, Shopkeeper, Driver, student	• Implementing proper environmental, health, and safety (EHS) practices can reduce the risks of hygienic contamination, public health hazards, surface and groundwater pollution, soil pollution, noise, air pollution, and health and safety risks to workers and local communities. • The project can collaborate with the municipality to improve w management and drainage systems.
8.	02.06.2024	Kotiadi, Kishoreganj	08	Student, Businessmen, housewife	• **Electricity Supply Issues:** Both men and women expressed con about inadequate electricity supply, citing frequent outages and vo fluctuations as major challenges affecting daily life and economic a • **Challenges for Women:** Female participants noted difficulties i household chores and running small businesses due to unreliable p • **Impact on Men:** Male participants highlighted how unreliable e affects larger industries and agricultural productivity. • **Need for Improvements:** The discussion stressed the urgent ne infrastructure improvements to address these electricity issues.
9.	07.06.2024	Matikata, Madhabpur, Habijanj	10	Farmer, Shopkeeper, Driver, student	• Implementing proper environmental, health, and safety (EHS) practices can reduce the risks of hygienic contamination, public health hazards, surface and groundwater pollution, soil pollution, noise, air pollution, and health and safety risks to workers and local communities. • The project can collaborate with the municipality to improve waste management and drainage systems.
10.	07.06.2024	Chandura, Bijoynagar, Brahmanbaria	06	Housewife, farmer, student	• There are many lands around Bijoynagar that could be destroyed, impacting homes, schools, medical facilities, mosques, and the environment. The area has a 100-meter river to the left and a 200-meter river to the right, with schools, medical facilities, and mosques all within 300 meters. • Many large trees, such as teak, mahogany, neem, mango, and jam, may be cut down, affecting wildlife and leading to problems for local people and animals.
11.	07.06.2024	Malihata, Sadar, Brahmanbaria	08	Farmer, Businessmen, Driver	• **Impact on Local Infrastructure:** Nearby schools, colleges, mosq madrasas could be affected by the changes, emphasizing the need plants and animals to preserve the environment. • **Sustainable Practices:** To safeguard the environment, it is cruci that development does not lead to the loss of plants, homes, or wi promoting practices that allow for coexistence and survival.
12.	08.06.2024	Putai, Sadar, Brahmanbaria	08	Housewife, driver	• **Deforestation Concerns:** Many large trees, including teak, mah neem, mango, and jam, will be cut down, potentially leading to pro both people and local wildlife. • **Environmental Challenges:** This area faces frequent floods, fire related issues, exacerbating the difficulty of maintaining livelihood • **Health Issues:** Residents are concerned about various health pr including asthma, fever, colds, coughs, and shortness of breath, wh aggravated by environmental changes.
13.	08.06.2024	Talshohor, Asuganj, Brahmanbaria	08	Farmer, student, housewife	• Male participants emphasized the impact on larger industries and agricultural productivity. • The discussion underscored the urgent need for infrastructure improvements and community involvement to address these

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Sl	Date	Location	No of Participants	Type of Participants	Participant's Opinion
					issues effectively.
14.	11.06.2024	Boro mosque, Chatkhil, Noakhali	06	Job keeper, business, unemployed	• The participants lack awareness and understanding of the project. • The rice mills and market in the project area may be impacted. • The current environmental status is good, but it may be affected by the project. • Crops such as potatoes, paddy, and mustard may be disrupted. • Some date and banana trees will also be affected.
15.	11.06.2024	Dakkhin Matlab, Chandpur	08	Farmer, NGO job, businessmen, student	• The people affected by the project corridor desire development in their area. • The landowners and business owners have expressed concerns about receiving fair compensation for their land from the project authorities.
16.	12.06.2024	Dakkhin ajgor, Matarbari, Cox's bazar	10	Farmer, mistry, business, student	• Environmental Monitoring: Calls for rigorous monitoring of air and water quality, biodiversity, and ecological health to assess and mitigate impacts. • Mitigation Measures: Advocates for implementing robust mitigation strategies, including green infrastructure and ecological restoration, to offset biodiversity losses. • Community Engagement: Stresses the need for transparent communication and active community participation in decision-making processes related to the power plant and environmental management.
17.	23.06.2024	Gopalganj Pourosova, Gopalganj	06	Farmer, student, shopkeeper	• Gopalganj frequently experiences natural disasters like floods, fires, and storms, which already make life challenging for residents. People are concerned that using these lands for development will further complicate their livelihoods.
18.	23.06.2024	Patghati, Tungipara, Gopalganj	04	Fishpond, Gher workers, farmer	• There are several important structures within 1 km of the project area, such as the Filling Station, a road, a gas line, primary school, fish Gher and a market, which could be affected. • There are no protected areas.
19.	23.06.2024	Kararghati, Durgapur, Gopalganj	07	Farmer, student, shopkeeper	• The people affected by the project corridor desire development in their area. • The landowners and business owners have expressed concerns about receiving fair compensation for their land from the project authorities.
20.	24.06.2024	Barokania, Bhandaria, Pirojpur	11	Job keeper, housewife, student, teacher, businessmen, engineer	• The livelihood of the local populace primarily depends on agriculture, with the area mainly supporting two crops, Amon and Boro rice, during the monsoon season. Agriculture in this region is heavily reliant on groundwater. In addition to Aman and Aush rice, some farmers also produce small-scale crops such as vegetables, mustard, and lentils. • There are no protected areas.
21.	25.06.2024	Kailkapur, tala, Satkhira	08	Farmer, businessmen, student, housewife	• The community is worried about various health issues, including asthma, fever, and respiratory problems. They emphasize the importance of protecting plants, animals, and homes to preserve the environment and ensure the safety of people and wildlife. Schools, colleges, mosques, and madrasas are nearby and could be impacted as well
22.	25.06.2024	Shahji bazar, tala, Satkhira	08	Businessmen, job keeper, farmer, mistry	• There are no protected areas. • Tare several important structures within 1 km of the project area, such as the Filling Station, a road, a gas line, primary school, fish gher and a market, which could be affected.
23.	25.06.2024	Paikgacha, khulna	08	Businessmen, farmer, shopkeeper, student	• Unsustainable land use practices and climate change threaten this fragile environment. • These areas serve as a sanctuary for migratory species, emphasizing their global ecological significance. • Socioeconomic challenges in these areas include poverty and

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Sl	Date	Location	No of Participants	Type of Participants	Participant's Opinion
					limited access to education and healthcare. • Sustainable development strategies are needed to balance conservation efforts with community well-being.
24.	26.06.2024	Charikul, Kumarkhali, Kushtia	07	Farmer, student, shopkeeper, businessmen	• The region supports migratory species, increasing its ecological significance. • Rapid urbanization and industrialization are challenging the natural environment and impacting human health. • Socioeconomic conditions show both progress and disparities. • There is a need for sustainable development practices to preserve biodiversity and improve livelihoods equitably.
25.	26.06.2024	Islampur, Dhupchanchia, Bogra	08	Businessmen, contractor, farmer, remittance, housewife	• The participants are aware of and understand the project. • Agriculture will be affected, and soil fertility may decrease. • The project is located near the road, resulting in high levels of dust and vehicle emissions in the air.

Action Taken:

810. Contractor's EMP and EMoP will ensure rigorous monitoring of air and water quality, biodiversity, and ecological health to assess and mitigate any negative impact. Sensitive Receptor mapping has been conducted within 1 km of the project area to record filling station, gas line, primary school, residential and commercial areas etc. GRM and public consultation will be conducted in on-going mode by the SIC and contractor. The GRM procedure layouts the transparent communication and active community participation in decision-making processes related to the power plant and environmental management.

10.8.3 Key Informant Interviews (KII)

811. The secondary stakeholders identified included the public representatives, local government administration, the executing agency, financing institutions etc. The secondary stakeholder for the project includes PGCB, Deputy Commissioners of the respective districts, DAE, DF, DAE, RHD, BR, BWDB, Department of Fisheries, public representatives and Upazila level administration.

812. A total of 21 KII interviews were held. KIIs were held with concerned stakeholders such as NGOs, Upazilla elected persons, government officers etc. in relevant areas. The key informant interviews (KIIs) were conducted along with the following persons regarding the construction of substations and transmission lines at respective areas. Some consultations were personal communications with the experts and so some may not represent the official or institutional views of the organizations that they represent. A number of additional detailed clarification exchanges took place, often by email.

813. TA consultant visited the Pekua site to meet stakeholders, NGOs, forest officials, ornithologists, and etc., to determine the type of migratory birds and aquatic fauna that could be affected at the site in the absence of any primary data of the area.

Table 10.9 : List of Key Informant interviews

	Meeting Place	Date	Number of Participants		
			Total	Male	Female
	Key Informant Interviews (KIIs) by ADB TA Consultant Team				
	Chakaria Upazila, Cox's Bazar	22-23.05.2024	6	6	0
	Dhaka	23-25.05.2024	3	3	0
	Satkhira Sadar Upazila, Satkhira	15.7.2024	4	4	0
	Tungipara Upazila, Gopalganj	16.7.2024	3	3	0
	Bhandaria Upazila, Pirojpur	19.7.2024	2	2	0
	Chatkhil Upazila, Noakhali	16.7.2024	3	2	1

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Table 10.10 : Details of Key Informant interviews

Sl. No.	Name and Designation	Date	Medium	District	Summary of Discussion
1	SM Sanaul Kafi Environmental Specialist Matarbari Ultra Super Critical Coal-Fired Power Project Contact No. +8801712580146	22-05-2024	Meeting	Cox's Bazar	The Cox's Bazar district is very important in terms of ecological resources. As I am staying at this area from last eight years therefore, I had a privilege to see the ecosystem of this area closely. The selected site for the proposed substation does not have any major concern in terms of ecological impacts. I am traveling through this road every day and I never noticed the migratory birds around this salt pans. There might have very few numbers of migratory birds on the salt pans, but I can see some domestic birds like stork and cormorants. However, the further coastal areas have significant number of migratory birds. In every year we do a survey as part of the monitoring of this project, and we can see several species of migratory and local birds near the mangrove areas along the coast as well as in the waterbodies. Regarding the other wildlife, I can say that the coastal area near the coal power plant is very important for sea turtles. This coast is designated area for turtles breeding. Since, the substation site is very far from here so there is no chance to find any sea turtle at that site but the freshwater turtles only. For other wildlife, I do not have much information but I can say that since there is no forest near the proposed substation site so it would be very rare to see any wildlife at that site.
2	Md. Sirajul Islam Chowdhury Chairman Paschim Boro Bheola Union Parishad Contact No. +8801715879000	22-05-2024	Meeting	Cox's Bazar	In my opinion the selected site is suitable for this kind of development. This is a low land therefore it is required to do sand filling which will have minor impact on the hydrology. However, there is a canal just beside the area which is sufficient to carry the water. Therefore, the project may need to consider this issue very carefully, I can ensure that this place does not have any problem with the migratory birds. We can see very few numbers of local birds only around the salt pans. However, in our area we can see several numbers of birds but those are traveling to other sites than the salt pans. In terms of other wildlife, this area does not have any significance, but sometimes we can see the small turtles and snakes around the area.
3	Md. Redwan House Owner Ilishia Bazar (Near Substation Site) Contact No. +8801760483546	22-05-2024	Meeting	Cox's Bazar	I am living this area for several years and this is the only one house located near the proposed site. Therefore, I know about this place than any other persons of this area. During the summer we do salt farming in this area until the rainy season starts. When this area is inundated, the farmers cultivate different kinds of fishes. Birds rarely visit the salt pans during salt cultivation, but few numbers of domestic birds visit the area when we do fish farming. The most visited birds are stork and cormorants. If there are some other birds also visiting the salt pans that I never

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Sl. No.	Name and Designation	Date	Medium	District	Summary of Discussion
					noticed. However, I have noticed the small turtles are coming this area. Also, the snake is very common and few months ago we killed an Indian Cobra near my house. Other wild animals are very rare in this area. Approximately 4 or 5 years ago we saw a leopard in this area only.
4	Md. Farhan Tazim Senior Upazila Fisheries Officer Chakaria, Cox's Bazar Contact No. +8801718927656	23-05-2024	Meeting	Cox's Bazar	The fisheries department only deals with the fish production when the salt pans are being used for fish cultivations. As a fisheries officer I never noticed the birds on the salt pans. Since I do visit the area occasionally, so it is hard to say that migratory birds or other local birds are not coming to the salt pans. The salt pans have food source for the birds therefore they might visit the area. My farmers also never shared this kind of information with me that lot of birds are visiting their fisheries areas. The required land for this project is very small. Around the proposed site we have several fisheries projects which are being used for salt cultivation during summer time.
5	S.M Nasim Hossain Upazilla Agriculture Officer Chakaria, Cox's Bazar Contact No. +8801855582166	23-05-2024	Meeting	Cox's Bazar	The agriculture department does not work with the salt farmers, so we do have very little knowledge on that area. I can say that the salt pan area for the proposed substation is very big, but you are considering only a minor part for development. There are very few numbers of trees within the salt pan area where the birds can stay. Additionally, the forests are also far away from the considered location; so, wildlife movement within the area is rare. I am working in this upazila for last three years and during this period I never heard or noticed any wildlife in this area. However, I have heard that previously the leopard was found in this area. Turtles are sometimes found in the agricultural land but those are not sea turtles. Being an agriculturist, I can say that those salt pans have very limited source of foods for the birds. Therefore, both the migratory and domestic birds are not visiting the salt pans regularly.
6	Alok Das Gupta Asst. Agriculture Extension Officer Chakaria, Cox's Bazar Contact No. +8801914512448	23-05-2024	Meeting	Cox's Bazar	I am newly posted to this upazila and therefore I have very little knowledge about this area. Agricultural department does not work on the salt production, and we do not visit the area frequently. However, my previous workstation was Moheskhali upazila which is close to the sea and have salt pans also. During my stay at that upazila I did not see any migratory birds are visiting the salt pans frequently. However, some domestic birds always visit the salt pans. Since those salt pans are located further inland area and does not have the tidal influence therefore birds may visit the location with fewer numbers that I saw at Moheskhali upazila area.
7	Delip K Das Member, Bangladesh Bird Club PhD Candidate at University of Groningen Assistant Professor	23-05-2024	Phone Call	Cox's Bazar, Khulna, Pirojpur	The salt pan areas near the coast are important place for the shorebirds. During our research work we noticed significant numbers of migratory birds are choosing salt pans for their regular food source. Since the selected salt pan for substation development is far away from the coast therefore it is hard to draw a conclusion with their availability without having a proper survey. In Bangladesh there is not a full survey or research on the migratory birds

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Sl. No.	Name and Designation	Date	Medium	District	Summary of Discussion
	Jagannath University, Dhaka Contact No. +8801913154961				for the salt pans located in the further inland side. Migratory birds in the coastal salt pans are very common and we counted significant numbers of birds around those areas. As the considered salt pans are away from the coast therefore the number should be lesser. However, we noticed the migratory birds along with the threatened or vulnerable species in the forest areas which are located further inland from the coast. So, we can say those birds are travelling thorough the salt pans to reach the inland forests and waterbodies. As there is no specific information on those inland salt pans therefore, I could not talk about the presence of any threatened or vulnerable species around the area. However, I would also recommend considering not only the migratory species but also the domestic species found in the area in your project design. There are few species of our domestic birds which are decreasing with numbers due to loss of its habitat. Finally, I would say that this place is very important for both the migratory and domestic birds. The project should conduct a survey for the birds before finalization of its design. Though it is not correct time to do the survey for migratory birds but survey for the local birds can be conducted now. We should take all reasonable measures to protect all kind of birds so that in future no bird will become threatened which is abundant now because of our activities.
8	Samiul Mohsanin Vice President, Bangladesh Bird Club Coordinator (CWT) Terrestrial Conservation Program Wildlife Conservation Society (WCS), Bangladesh Contact No. +8801711964456	25-05-2024	Meeting	Cox's Bazar, Khulna, Pirojpur	Salt pans are very important for birds. A lot of migratory birds are visiting the salt pans not only in Bangladesh but also the other countries. For example, Laem Pak Bia and Pak Thale in Thailand is a well-known place for migratory birds. This place is using for salt production as well as a conservation place for the migratory birds. So, we cannot ignore any salt pans however it is located further inland area during our development project design. In Cox's Bazar and other coastal areas, we can see both the waterbirds and the shorebirds. Some of those species are breeding residents. I have noticed several threatened and vulnerable species of shorebirds around the coastal salt pans, such as Black-tailed godwit (NT), Bar-tailed godwit (NT), Great knot (EN), and Spoon-billed Sandpiper (CR). However, those kinds of species are rarely found in the inland salt pans. This area is not only important for the migratory birds but also the resident birds. Several resident birds are becoming vulnerable due to loss of habitats. So, I would recommend conducting a survey to identify the birds in the project area. From March to July is the suitable period for doing survey on the resident birds but some shorebirds could be identified also.
9	Mohammad Foysal Member, Bangladesh Bird Club	25-05-2024	Meeting	Cox's Bazar, Khulna, Pirojpur	First of all, we have very little information on the inland salt pans areas as almost all the surveys and research conducted along the coastal areas. However, the salt pans are very important as the roosting grounds for the migratory and resident birds.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Sl. No.	Name and Designation	Date	Medium	District	Summary of Discussion
	Avian Researcher & Senior Research Officer Bangladesh Spoon-Billed Sandpiper Conservation Project Contact No. +8801717100508				I have noticed all kinds of birds in the salt pans near the coast and the numbers are significant. So, salt pans can be used for the threatened and endangered species also. For example, Spoon-billed sandpipers are found in salt pans in Thailand. We have found NT, T, VU, CR, EN species in Matarbaria area which is very near your project site. Also, those species are found in the hills and forest areas of further inland from the coastline. From the analysis of their travel route, I can say that birds usually take the route along the coastline to migrate from one place to another place. I have found some important species within the forest areas near the proposed substation site, such as the Fasiakhali Reserved Forest and other forests in Cox's Bazar. So, if we do more analysis then the selected site could be the travel route for the birds to visit the hills and forest near the substation location.
11	Ashrafuzzaman Ashu Member of Parliament, Satkhira-2	15-07-2024	Meeting	Satkhira	This project will definitely have a positive impact to reduce the scarcity of electricity in this area. Due to the installation of transmission line several tall trees will be impacted. Therefore, I would request to select the line in such a way that may have less impact to the taller trees. Furthermore, people in this area mostly depend on prawn culture. So, I would also request to consider this matter in your project design. If possible, avoid the transmission line route through any fish culture land.
12	Md Mashiur Rahman Chairman, Satkhira Sadar Upazila 01764637876		Meeting	Satkhira	We do face frequent power shortage in this area; particularly in the urban area. This project will definitely have a positive impact to reduce the scarcity of electricity in this area. Though people in this area will loss land due to this project but eventually it will have positive impact in the future. Approximately 70-80% shrimp culture of the total country is practicing here. Therefore, the line route should consider that it may not affect the livelihood. Moreover, there is a Beel around 2km far from the line where migratory birds visit during winter but do not stay for longer period.
13	Md Shafiqul Islam Senior Upazila Fisheries Officer, Satkhira Sadar 01769459465		Meeting	Satkhira	This project will definitely have a positive impact to reduce the scarcity of electricity in this area. This area produces both freshwater and saltwater fish. Approximately 3000 shrimp *Gher* around this area. Moreover, using saline water people cultivate several domestic and introduced species. In my opinion, this project will have negative impact in fish culture if the transmission line will go through the fish farming area.
14	Protab Kumar Barman Sub Assistant Agricultural Officer, Satkhira sadar 01703720261		Meeting	Satkhira	This project will bring good impact to this area. There are both 2 and 3 cropping agricultural land. Therefore, both *Boro* and *Aman* are cultivated here. Usually during the winter period migratory birds visit the agricultural land from nearby areas.
15	Debashis Bachar Senior Upazila Fisheries Officer, Tungipara 01737085667		Meeting	Gopalganj	This project will bring good impact to this area but will have negative impact in fish production. The Baghiar River is located 2 km far from here and there is also Baghiar *Beel* nearby this area. A lot of fish species are found in both the waterbodies. In winter season migratory birds visit in this area. People are self-dependent in this area and may not have significant

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Sl. No.	Name and Designation	Date	Medium	District	Summary of Discussion
					economic impact.
16	Md Rakibul Islam Upazila Agricultural Officer, Tungipara 01700715747		Meeting	Gopalganj	There is only single cropping agricultural land where *Boro* is cultivated during *October-March* in a year. Therefore, select the transmission line carefully so that minimum amount of agricultural land will be impacted. In this area there are few taller species trees but mostly are short to medium.
17	Md Rabiul Islam Field Assistant Fisheries Officer, Tungipara		Meeting	Gopalganj	This project will bring good impact to this area but will have negative impact in fish production. The Baghiar River is located 2km far from here and there is also Baghiar *Beel* nearby this area. A lot of fish species are found in both the waterbodies. In winter season migratory birds visit in this area. People are self-dependent in this area and may not have significant economic impact.
18	Sayed Nazrul Islam Senior Upazila Fisheries Officer, Bhandaria		Meeting	Pirojpur	This project will definitely have a positive impact to reduce the scarcity of electricity in this area. There are two cropping agricultural land in this area. There is no *Haor* or *Beel* but people do fish culture only in ponds. Since the saline water is far away therefore no shrimp culture in this area. Cotton Pygmy Goose and other few kinds of birds are common here.
19	Md Rezaul Karim Additional Upazila Agricultural Officer, Bhandaria		Meeting	Pirojpur	This project will bring good news to this area and it will reduce the power shortage also. Continuous electricity supply will ensure the farmers for irrigation in dry season. Among the available trees coconut and betelnut is the dominant species. Farming of betel leaf is also common here. I do not see any major impact due to this project.
20	Mst. Fatematuz Zohura Information Officer, Sunaimuri Upazila 01844276638		Meeting	Noakhali	Existing facilities is not adequate to supply continuous electricity in this area. Therefore, this new substation and lines will improve the situation. Due to power shortage our regular activities are hampered even we do not get support at hospital in emergency time. There is no archeological site in this area but an old mosque at 6km far from here. In this area significant numbers of migratory birds visit every year. There is a bill in this area where several species of birds and fishes are found. If the line will avoid this waterbody, then there is no problem.
21	Md. Anowar Hossain Agriculture Assistant Officer, Sunaimuri Upazila 01730170777		Meeting	Noakhali	In this area agricultural land is 3 cropping but agricultural practice is very limited. Try to avoid the area where trees are located. It will have negative impact on fruits production as well as the habitat of birds. In the winter several migratory birds visit the agricultural land.
22	Md. Monir Hossain Sub- Assistant Fisheries Officer Sunaimuri Upazila 01740-644879		Meeting	Noakhali	Existing facilities is not adequate to supply continuous electricity in this area. Therefore, this new substation and lines will improve the situation. Fish farming is common at here and produce a lot of amounts round the year. If the line will go through the fish ponds, khal, beel and gher area then it will have
23	Mr. Tris Allison, Birdlife International	11/3/25	Email by ADB	n/a	Recommended to contact Dr. Sayam U. Chowdhury as the local Birdlife contact for Bangladesh
24	Dr. Sayam U. Chowdhury, Coordinator EAAFP Spoon-billed Sandpiper Task Force	11/3/25	Email by ADB	n/a	Not worried too much about the transmission line north of Sonadia but the existing wind power park may inspire other power companies in that region. This site used to be a regular roosting site for a few thousand shorebirds including many species of global concern. After the installation of the wind power plant, shorebirds stopped roosting there during

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Sl. No.	Name and Designation	Date	Medium	District	Summary of Discussion
					high tide and moved elsewhere. Note that a critical shorebird site called Tajiakata is only 5km west to this power plant where species like Nordmann's Greenshank, Spoon-billed Sandpiper and Great Knot winter -- attached a paper that summarises some results of our recent work. EAAFP can be consulted about some mitigation measures for future power park. Below is the list of globally threatened and threatened species that occur in the area: Grey Plover *Pluvialis squatarola* VU Eurasian Curlew *Numenius arquata* NT Bar-tailed Godwit *Limosa lapponica* NT Ruddy Turnstone *Arenaria interpres* NT Great Knot *Calidris tenuirostris* EN Red Knot *Calidris canutus* NT Broad-billed Sandpiper *Limicola falcinellus* VU Curlew Sandpiper *Calidris ferruginea* VU Spoon-billed Sandpiper *Calidris pygmaea* CR Red-necked Stint *Calidris ruficollis* NT Nordmann's Greenshank *Tringa guttifer* EN

Source: ADB TA consultant Meeting in May 2024

814. Photographs from the meeting are attached in Appendix VIII.

Key Follow-up Actions from KII at Pekua

815. NGOs, forest officials, ornithologists, etc. in South Chattogram and specifically Pekua still need to be consulted to understand the type of migratory birds and aquatic fauna that could be affected at the site in the absence of any primary data. Currently, the risk to birds is anticipated to be low-medium, but due to the nearby coastal habitats, it is recommended that overwintering bird surveys be conducted to confirm this.

816. Due to the timing of the overwintering season versus the project processing schedule, these should be completed by PGCB either prior to the award of contract or, if included in the contractor's scope, prior to the approval of detailed designs.

Action Taken:

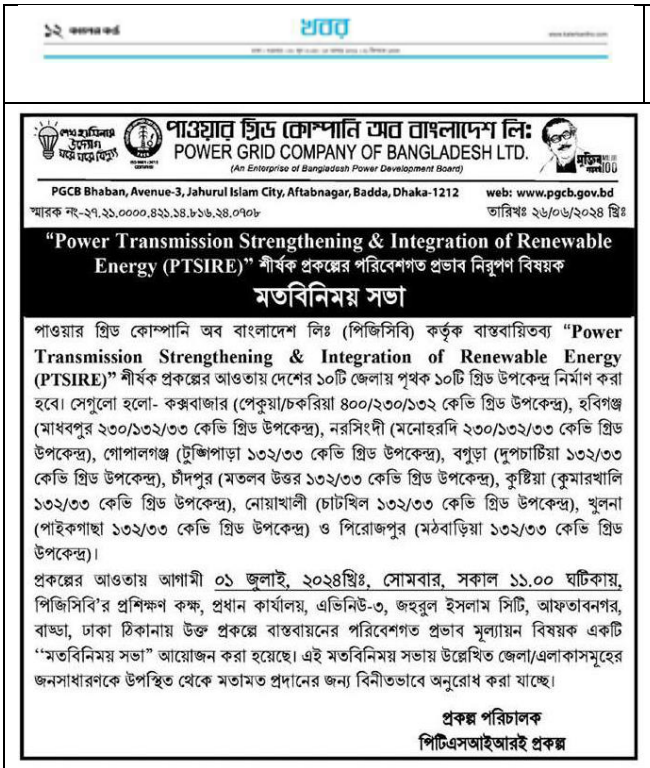
817. Prior to preparation of the BMP, the contractor will complete the pre-construction ecology surveys required in the mitigation and monitoring plans and have prepared a report for submission to PMU/SIC to confirm no unanticipated impacts; this includes bird surveys during appropriate periods round the year for the migratory and local birds in the project area of influence for the works in proximity to waterbodies (salt pans) at Pekua.

818. Secondly, the biodiversity mitigation measures will include avoidance of avian electrocution collision with transmission lines through bird sensitive design and the installation of "Bird Divertors" at suitable intervals in locations where birds are determined to be at risk. The EAAFP can be consulted by Government of Bangladesh in developing guidelines for the mitigation measures required for solar and wind parks at the VRE hub.

10.8.4 Public Consultation Meeting (PCM)

819. Considering the environmental impact, the project is included in the red category, Rule 16 of the Environmental Protection Rules 2023, Sub-rule (1) of public opinion verification for environmental impact assessment, on behalf of PGCB as the entrepreneur, as part of the environmental impact assessment, in the presence of the stakeholders concerned with the project and presence of the officials of the concerned office of the Department of Environment on 1 July 2024 at 11 o'clock the public opinion initiative has been taken.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.



পাওয়ার গ্রিড কোম্পানি অব বাংলাদেশ লিঃ
POWER GRID COMPANY OF BANGLADESH LTD.
(An Enterprise of Bangladesh Power Development Board)

PGCB Bhaban, Avenue-3, Jahurul Islam City, Aftabnagar, Badda, Dhaka-1212 web: www.pgcb.gov.bd

স্মারক নং-২৭.২১.০০০০.৪২১.১৪.৮১৬.২৪.০৭০৮ তারিখঃ ২৬/০৬/২০২৪ খ্রিঃ

"Power Transmission Strengthening & Integration of Renewable Energy (PTSIRE)" শীর্ষক প্রকল্পের পরিবেশগত প্রভাব নিরূপণ বিষয়ক

মতবিনিময় সভা

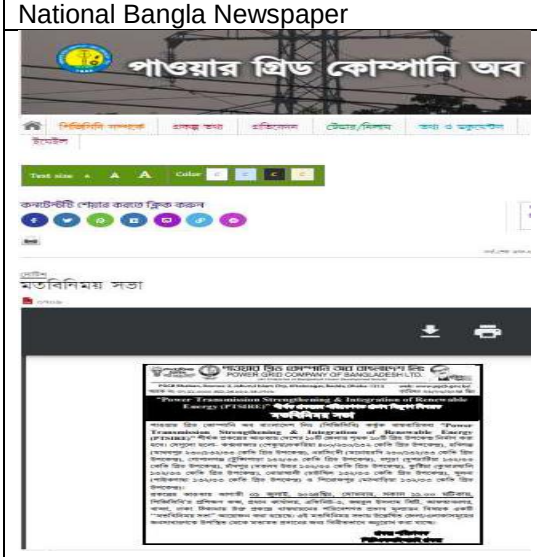
পাওয়ার গ্রিড কোম্পানি অব বাংলাদেশ লিঃ (পিজিসিবি) কর্তৃক বাস্তবায়িতব্য **"Power Transmission Strengthening & Integration of Renewable Energy (PTSIRE)"** শীর্ষক প্রকল্পের আওতায় দেশের ১০টি জেলায় পৃথক ১০টি গ্রিড উপকেন্দ্র নির্মাণ করা হবে। সেগুলো হলো- কক্সবাজার (পেকুয়া/চকরিয়া ৪০০/২৩০/১৩২ কেভি গ্রিড উপকেন্দ্র), হবিগঞ্জ (মাধবপুর ২৩০/১৩২/৩৩ কেভি গ্রিড উপকেন্দ্র), নরসিংদী (মনোহরদি ২৩০/১৩২/৩৩ কেভি গ্রিড উপকেন্দ্র), গোপালগঞ্জ (টুঙ্গিপাড়া ১৩২/৩৩ কেভি গ্রিড উপকেন্দ্র), বগুড়া (দুপচাচিঁয়া ১৩২/৩৩ কেভি গ্রিড উপকেন্দ্র), চাঁদপুর (মতলব উত্তর ১৩২/৩৩ কেভি গ্রিড উপকেন্দ্র), কুষ্টিয়া (কুমারখালি ১৩২/৩৩ কেভি গ্রিড উপকেন্দ্র), নোয়াখালী (চাটখিল ১৩২/৩৩ কেভি গ্রিড উপকেন্দ্র), খুলনা (পাইকগাছা ১৩২/৩৩ কেভি গ্রিড উপকেন্দ্র) ও পিরোজপুর (মঠবাড়িয়া ১৩২/৩৩ কেভি গ্রিড উপকেন্দ্র)।

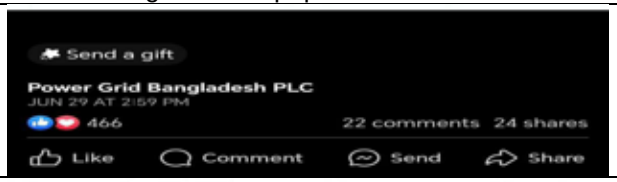
প্রকল্পের আওতায় আগামী ০১ জুলাই, ২০২৪খ্রিঃ, সোমবার, সকাল ১১.০০ ঘটিকায়, পিজিসিবি'র প্রশিক্ষণ কক্ষ, প্রধান কার্যালয়, এভিনিউ-৩, জহুরুল ইসলাম সিটি, আফতাবনগর, বাড্ডা, ঢাকা ঠিকানায় উক্ত প্রকল্পে বাস্তবায়নের পরিবেশগত প্রভাব মূল্যায়ন বিষয়ক একটি ''মতবিনিময় সভা'' আয়োজন করা হয়েছে। এই মতবিনিময় সভায় উল্লেখিত জেলা/এলাকাসমূহের জনসাধারণকে উপস্থিত থেকে মতামত প্রদানের জন্য বিনীতভাবে অনুরোধ করা যাচ্ছে।

প্রকল্প পরিচালক
পিটিএসআইআরই প্রকল্প

Advertisement in 'Daily Kaler Kantha' a Popular National Bangla Newspaper

Advertisement in 'Daily My District' a Popular National English Newspaper





Advertisement in PGCB Website

Advertisement in PGCB Facebook Page

Figure 10.2: Advertisement of Public Consultation Meeting

820. PCM was conducted at PGCB headquarters with 12 participants on July 8, 2024 to disseminate the IEE/EMP as well disclose the documents.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Table 10.11: Questions and comments of Participants

Sl. No.	Name and Address	Questions/Observations from Participants	PGCB Response
1	Abdur Rahim (Madhabpur, Habiganj)	He requested to ensure that work in the project area should be done only during daytime i.e. no work should be done at night	Tecvy Energy Ltd.'s consultant agrees to work only during daytime
2	Golam Mostafa (Chatkhil, Noakhali)	He wants to know how to determine Mauza rate and type of land	The consultant of Tecvy Energy Ltd. said that the office of the concerned Deputy Commissioner has determined the mauza rate and type of land according to The Acquisition and Requisition of Immovable Property Act 2017 and Electricity Act 2018 and Electricity Rules 2022.
3	Abdullah (Dupchanchia, Bogra)	The affected people who have given land for the construction of the substation want to know how they will get the money for the land	Md. Humayun Kabir Abbasi (Superintending Engineer, Contract) said the District Commissioner's office will provide compensation through rigorous verification. Only the person who has the proper document will get the compensation. Compensation for land acquired for construction of grid substations will be given as per the Acquisition and Requisition of Immovable Property Act 2017 (ARIPA).
4	Md. Ziaur Rahman (Paikgacha, Khulna)	He asked who would own the land after the transmission lines were built	Md. Emdad Haque (Executive Engineer, Design and quality Control (Transmission Line)) said the compensation for the land used for the tower foundation will be paid as per the Electricity Rules 2022 framed under the Electricity Act 2018. The land ownership shall remain unchanged in case of use of privately owned land during construction of electric tower.
5	Md. Omar Farooq Chakoria, Cox's Bazar)	He wants to know what action will be taken due to crop damage because of the construction of tower foundation	Sohail Rana (Executive Engineer Project Office) said compensation for damaged crops will be provided for Tower Foundation based on prevailing market value.
6	Anisur (Mathbaria, Pirojpur)	He wants to know whether compensation will be given in case of felling of tree in case of transmission line	Md. Humayun Kobir Abbasi (Superintending Engineer Contract) said that in case of tree felling along the transmission line,

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Sl. No.	Name and Address	Questions/Observations from Participants	PGCB Response
			compensation for loss of trees and crops will be paid as per Electricity Act 2018 and Electricity Rules 2022.
7	Saiful Islam (Monohardi, Narsingdi)	The contractors are seen to commit various irregularities while working within the specified period. In that case, he wants to know how it will be controlled	The project director said that there are various types of monitoring systems to prevent the irregularities of the contractor
8	Md. Mostafizur Rahman (Matlab North, Chandpur)	He expressed satisfaction that if this project is implemented as uninterrupted power supply will be available	The project director agreed
9	Md. Rifat Sharif (Tungipara, Gopalganj)	He expressed satisfaction that if this project is implemented as uninterrupted power supply will be available	The project director agreed
10	Raisin Akhter Feroz (TA Consultant, ADB)	As ADB is associated with this project, they will directly monitor and maintain reports. There are opportunities to give feedback throughout the duration of the project. It is ADB's own policy that it takes step holders' views very seriously. Any kind of complaint or suggestion shall be subject to suspension of project site and if necessary to the regional office and head office.	Nafisa Sher (Manager, Environment and Social Unit) added that a three-level grievance redressal committee will be constituted by PGCB, the implementing organization of the project, to redress various grievances during the project. First step will be site level second step will be project level and third step will be executive director level EIA and rap report are mentioned in detail.
11	Md. Shamsuzzaman Sarkar (Deputy Director EIA, DoE)	Ask whether there is any river crossing, KPI, ECA in the RoW of the proposed transmission line, whether any trees will be felled, if the trees are cut, what is the rate of planting against them etc. Finally, he explained the purpose of this public consultation and informed that, Minutes of the meeting should be submitted to the Department of Environment (DoE) within 7 working days which is a part of the EIA approval.	• Mohammad Emdadul Haque (Executive Engineer Design & Quality Control Transmission Line) said there is no KPI, ECA in RoW and if there is a river crossing there is no tower footing in the river. • Tareque Ahmed Bhuiyan (Deputy Manager Environment and Social Unit) said that against every tree cut, 3 trees will be planted and in this case the tree plantation plan prepared by the contractor will be followed. • Sohel Rana (Executive Engineer Project Office) said that necessary measures will be taken for approval from the Department of Environment within seven working days.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Sl. No.	Name and Address	Questions/Observations from Participants	PGCB Response
12	Mohammad Zubair Alvi (Divisional Engineer, System Planning)	He wants to know whether the Department of Environment monitors whether adverse environmental impacts are being properly dealt with during the implementation of any project.	A representative of the Department of Environment said that regular monitoring is done by the Department of Environment and clearance is not renewed if problems are found.

Source: ADB TA consultant in July 2024

821. Photographs are attached in Appendix VIII.

822. Key topics raised by the participants that relate to the IEE area:

- Work in the project area should be done only during daytime i.e. no work should be done at night
- PGCB will be responsible for dealing with adverse environmental impacts with during the implementation of any project
- The implementation of this project will result in uninterrupted and reliable power supply
- Any violation of EMP by the contractor working within the specified period should be controlled and mitigated by the contractor under direction of PGCB.

Action Taken:

823. The main concern regarding contractor's accountability as they commit various irregularities while working and how it could be controlled. Accordingly, the EMP contains stringent clauses for the contractor to follow which will be monitored closely by contractors EHS and labor officers as well oversight by SIC and PGCB site engineer.

10.9 Positive Perceptions

824. All participants were agreed to provide unconditional support to the proposed project as the project is going to solve the electricity problem faced by them and finally their life will be comfortable. Participants during the consultation mentioned that since power supply is very poor there are no small-scale industries in this area. Once there will be assured power supply it will help in better economic development of the area. People will start planning about establishing small scale industries in the area and as a result there will be more employment opportunities.

825. All participants during the consultation mentioned that they will participate during the implementation of the project. As the proposed project is very important to address the problem of electricity in their area, the villagers extended their full support in the implementation of the project.

826. From KIIs conducted for Pekua substation that has biodiversity related issues, the respondents feels that the area is important for both the migratory and domestic birds. The project should conduct a survey for the birds before finalization of its design. Though it is not correct time to do the survey for migratory birds but survey for the local birds can be conducted now. The project should take all reasonable measures to protect all kind of birds so that in future no bird will become threatened which is abundant now because of project activities.

10.10 Consultation Outcomes and Policy Issues

827. The outcomes of the consultation meetings were very helpful in minimizing the impacts of the Project. The probable harmful/beneficial effects that may be caused due to the implementation of the project have been identified and documented in the meeting minutes. Suggestions received regard to change of transmission route considering avoidance policy, minimizing or no alternative options to the

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

proposed project.

10.11 Consultation and Participation during Project Implementation

828. A consultation and participation mechanism will be developed by engaging the primary stakeholders in local committees. Process of engagement of primary stakeholders has been described in chapter 9. The Implementing NGO will be appointed by the Project for the implementation of RP, who will continue the processes of consultation and participation by involving the affected households and the beneficiaries as well. Thus, consultation will remain as an integral part of Project management and implementation.

829. **Summary of Consultation meetings output:** Based on the discussion at the consultation meetings the project stakeholders have identified potential impacts for the affected people (APs). The following summary findings of the consultation meetings/discussions would help the project proponent in carrying out the EMP properly:

- ✓ Minimise loss of trees and crops during construction works;
- ✓ Homestead should be avoided during stringing cables;
- ✓ Local people should be engaged in the construction activities, by employing them;
- ✓ Ensuring smooth electricity supply;
- ✓ Reducing the load shedding during irrigation period at village level,
- ✓ Limit vegetation loss during cleaning sites for stockpiling for tower construction;
- ✓ Ensure community health safety issues during stringing and tower construction in the area.

10.12 Information Disclosure

830. The draft and final IEE report will need to be disclosed in an accessible place (e.g., local government offices, libraries, community centers, etc.), and the executive summary translated into local language (Bengali) for the project-affected people and other stakeholders. The translated summary of IEE report will be disclosed in DC offices, Upazila and Union Parishad of respective project areas. The PGCB and ADB will also post the final IEE document, Closing Date (Streamlined Procedure), or management approval date (delegated authority) as part of their disclosure policy (e.g., on its website), and the same will be submitted to the Department of Environment (DoE) for approval and disclosure at local (DC offices, Upazila Parishad) and national level, so affected people, contractors, other stakeholders, and the general public can provide meaningful inputs into the project design and implementation. The effectiveness of the IEE is directly linked to the degree of continuing involvement of those affected people directly or indirectly by the project. During the preparatory stage, consultations were held at local, sub-district and district level. Several additional rounds of consultations with stakeholders will be planned in IEE finalization, and during construction as well as operation phases of the Project.

831. Free printed copies of the SEP in Bangla and English will be made accessible for the general public at the following locations:

- o PGCB headquarter and local offices
- o Affected District Administration office
- o The local Project offices;
- o Affected Upazila Headquarters
- o Affected Union Parisad Offices
- o Local NGO offices;

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

- Other designated public locations to ensure wide dissemination of the materials.
- Newspapers, posters, radio, television (where relevant);
- Information centers and exhibitions or other visual displays;
- Brochures, leaflets, posters, nontechnical summary documents and reports; and
- Official correspondence, meetings

10.12.1 Role of ESU and SIC in Disclosure of Project Information

832. The ESU and safeguard implementation consultant (SIC) firm will continue their communications with the affected persons and other stakeholders and disclose information such as the dates of final surveys and census of affected households, valuation procedures, project related impacts, specific entitlements of the affected persons, compensation procedures, grievance redress procedures and dates of the commencement of civil works. The project will follow below steps for continued consultation and participation of PAPs throughout the project cycle.

- ✓ The ESU and safeguard implementation firm will engage in continuous consultations with the affected persons to minimize/avoid adverse impacts of the project emanating from final engineering designs.
- ✓ The ESU and safeguard implementation firm will organize and conduct periodic meetings with affected persons and other stakeholders to inform them the status of final engineering designs, land acquisition process and entitlements and payment of compensation to affected persons.
- ✓ The ESU and safeguard implementation firm will engage the affected persons and other stakeholders to review the entitlements and other benefits to affected persons.
- ✓ The ESU and safeguard implementation firm will maintain liaison with the office of the Deputy Commissioner to verify the status of land acquisitions and communicate the same information to the affected persons.
- ✓ The ESU and safeguard implementation firm will conduct consultations with affected persons and other stakeholders to elicit their views and suggestions to revise and to update the environment management plan.
- ✓ The ESU and safeguard implementation firm will hold periodic meetings with the affected persons and other stakeholders to review any unanticipated or indirect consequences of the implementation of safeguard plans.
- ✓ The ESU and safeguard implementation firm will assist the affected persons to access necessary information, prepare documentation related to CSEMP implementation, land acquisitions and receive compensation and other resettlement assistance and other project related benefits.
- ✓ The ESU and safeguard implementation firm will conduct information dissemination sessions at major locations and solicits the help of the local community leaders to encourage the participation of the affected persons in CSEMP implementation.
- ✓ Through consultation meeting, the ESU and safeguard implementation firm will take special attention to assist the vulnerable groups to understand the process and to help them in getting any assistance if they are facing any issues with contractor.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

11 Grievance Redress Mechanism

11.1 Introduction

833. PGCB, the Project Proponent will establish a procedure to deal with and resolve any queries as well as address complaints and grievances about any issues or irregularities during project implementation. In this regard, a grievance redress mechanism (GRM) following ADB's Safeguard Policy Statement 2009 requirements will be established. It requires the establishment of a responsive, readily accessible, and culturally appropriate GRM capable of re-ceiving and facilitating the resolution of affected persons' concerns and grievances about the physical, social and economic impacts of the project. The GRM aims to: (i) reduce conflict, risk of undue delay and complication in project implementation; (ii) improve the quality of project activities and outputs; (iii) ensure that the rights of affected parties are respected; (iv) identify and respond to unintended impacts of the project on individuals; and (v) maximize participation, support, and benefit to local communities. The GRM will deal with complaints and grievances related to both social safeguards/resettlement and environmental issues of the Project.

834. Grievance Redress Committees (GRC) will be formed at three tiers to receive and resolve complaints as well as grievances from aggrieved persons and local stakeholders including the Project-affected persons and construction workers. Based on consensus, the procedure will help resolving issues/conflicts amicably and quickly, saving the aggrieved persons from having to resort to expensive, time-consuming legal actions. The procedure will, however, not prevent a person's right to go to the courts of law. The aggrieved party/affected persons can approach the country's judicial system any time during the project cycle independent of the GRM proposed for the Project. An aggrieved party can directly contact ADB's resident mission in Dhaka regarding a grievance or problem that the GRM has failed to resolve. The affected party can use the ADB's Accountability Mechanism by writing to the Complaint Receiving Officer at the ADB Headquarters in Manila as a last resort if they are not satisfied with decision and/or actions of the project GRM and resolution by the ADB.

835. The project will establish a three-tier Grievance Redress Mechanism (GRM). The GRM will be established by loan effectiveness and function throughout the life cycle of the project implementation. By implementing this structured GRM, PGCB aims to address grievances promptly, transparently, and efficiently, ensuring the project's smooth progression and fostering trust with the affected communities.

11.2 Grievance Redress Mechanism

11.2.1 Background:

836. A grievance redress mechanism (GRM) will be established to address community concerns, complaints, and grievances, reduce risks, and assist the project to maximize environmental and social benefits. In addition to serving as a platform to resolve grievances, the GRM has been designed to help achieving the following objectives: (i) open channels for effective communication, including the identification of new environmental/social issues of concern arising from the project; (ii) to understand concerns about community members and their environmental well- being; and (iii) prevent or mitigate any adverse environmental/social impacts on communities and workers caused by project implementation and operations.

837. The GRM is accessible to diverse members of the community, collectively called the "project affected persons" (PAPs), including more vulnerable groups such as women and the elderly. It will also be open to construction workers. Requests for confidentiality and privacy for complainants are to be honored. The project level GRM can be an effective tool for early identification, assessment, and resolution of complaints on projects. Understanding when and how a GRM may improve project

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

outcomes can help both the project team and beneficiaries improve results when issues arise on the project.

11.2.2 Project Proponent's Role

838. Unforeseen problems and issues may arise due to construction and operational impacts. The impacts of the project may raise numerous grievances and complaints on the part of affected persons. These may be land related or other non-land acquisition-based or environmental grievances and complaints. Therefore, to resolve these issues, PGCB will establish a GRM to receive and facilitate resolution of affected peoples' concerns, complaints, and grievances about the project's environmental and social performance. The clearance of standing trees and way-leaves within the RoW of the transmission lines can adversely affect the livelihoods and incomes of households; civil construction works can cause destruction of standing crops; stringing of transmission lines over private properties can lead to property devaluation and raise people's concerns over their personal safety; and construction work of the project could also result in various inconveniences to the general public such as access difficulties, restrictions to public places, damages to privately owned built structures and common property resources, disturbances causing from noise and dust, and issues related to labour influx, worker health and safety etc. However, the legal framework of the country may not have all-inclusive provisions nor the institutional mechanisms to effectively address all the potential grievances mentioned. The Deputy Commissioner in a district may not have the legal provisions to resolve all the issues arising from land acquisitions. On the other hand, not all the project affected parties or workers will be able to resort to legal action which is costly, time consuming and non-affordable to the poor segments of the population. Therefore, the project will establish a project-based grievance redress mechanism (GRM) which is easily accessible to the aggrieved parties, transparent and accountable in grievance handling and responding both effectively and efficiently to the grievances reported by the affected parties while winning the confidence of the complainants. A well-established and well-functioning GRM would be able to resolve the grievances locally, and avoid lengthy court procedures which on the other hand could generate adverse implications on the timely implementation of the project together with reputational risks to key stakeholders.

839. PGCB will ensure that local people and workers can express their legitimate grievance or file a complaint about the project by establishing a process to address issues raised. This can be achieved by careful implementation of the EMP, continuing consultation and communication with stakeholders during implementation by PGCB, through the project management unit (PMU) of PGCB, various contractor(s), and local government authorities. Contact details of the PMU for filing complaints will be posted in each village in the project area.

11.3 Objectives of Grievance Redress Mechanism

840. The GRM is a locally based, project-specific extra-legal way to deal with and resolve complaints and grievances faster and thus enhance project performance standards in terms of environmental and social safeguards management. The fundamental objectives of the GRM, implemented through a Grievance Redress Committee (GRC) serving as a para-legal body, are to resolve any environmental and resettlement related grievances in consultation with the aggrieved party to facilitate smooth implementation of environmental and resettlement plans and establish accountability of the affected people.

11.3.1 Guidelines to Redress Grievances

841. PGCB will establish a procedure to deal with and resolve queries as well as address complaints and grievances. The GRM is to promptly record and address any informal and formal grievance received however minor and to keep adequate records and documentation of timely grievance resolution. Each safeguard-related grievance received is to be reported in the environment monitoring reports from the reporting period of receipt until the reporting period of closure. Records to include but are not limited

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

to, name of the complainant and contact details, date the complaint was received, details of the complaint and status, minutes of meetings held, decisions made, and agreements reached up to the resolution of the complaint.

842. A GRC will be formed at each tier to receive and resolve complaints as well as grievances from aggrieved persons and local stakeholders including the Project-affected persons and workers. Based on consensus, the procedure will help to resolve issues/conflicts amicably and quickly, saving the aggrieved persons from having to resort to expensive, time-consuming legal actions. The procedure will, however, not prevent a person's right to go to the courts of law. The GRCs will be established through a gazette notification from the Ministry of Power, Energy and Mineral Resources; therefore, the GRCs will be a legally constituted body.

11.4 Grievances Redress Committees

843. Affected persons may appeal any disagreeable decision, practice or activity arising from project related activities to the GRCs. Affected persons will be fully informed of their rights and of the procedures for addressing complaints, either verbally or in writing during consultation, survey, and time of compensation.

844. The Grievance Redress Committees (GRCs) will be established locally at the Project sites and centrally at the Project level to receive and settle grievances from the affected persons and other local stakeholders. The project will establish a three-tier GRM as follows, before the first tier there will be an informal tier where affected persons may raise a grievance to the contractor which will be resolved by the contractor and PGCB field team on the ground - all environment, health and safety issues that pose a risk of pollution or to life must be immediately resolved. The informal tier grievances and their resolution will still be recorded under the GRM. If contractor and PGCB cannot informally resolve it within 3 days it will be passed to the first tier:

- the first tier of GRM will be PGCB field teams for each project component with local (Upazila) level GRC,
- the second tier of GRM will be at Project Level with the PMU team, and
- the third tier of the GRM will be at central level of PGCB.

845. Most of the grievances will be resolved informally or at the local-level GRC, but those cases that cannot be resolved at the local level will be forwarded to PGCB PMU. The first-tier local level GRC will be constituted with representation of the local Upzilla Chairman and affected people ensuring women's representation, if available. The second tier Project-level GRC will be constituted by the PMU with representation from the contract package project manager, PMU Project Director, environment and social safeguards SIC representative, and one independent person from the DC or civil society having knowledge about land acquisition law of Bangladesh and involuntary resettlement. The third tier GRC will comprise of the Executive Director (P&D) PGCB, Dhaka – Convener, and, Chief Engineer, PGCB-Member Secretary for final determination.

11.4.1 Local-level GRC

846. Level 1 of GRC will be at the upazila level of the project site. The appointed field GRM coordinator of PGCB will record the complaint, the name of the complainant, and the date of the complaint etc. The field GRM coordinator will communicate with the relevant persons and agencies implicated in the complaint and will try to reach an amicable settlement within two weeks. The members of GRC of level 1 comprise of (i) Executive Engineer/Contract Package Project Manager-Convener, (ii) Field GRM Coordinator of PMU–Member Secretary, (iii) representative of contractor, (iv) Upazila Chairman or his representative-Member, (v) Agriculture Extension Officer at Upazila level – Member, (vi) One representative from PAPs male or female (female in case of female aggrieved person)– Member.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Level	Members of the GRC at different levels
Level 1 Local (Upazila) level GRC	Executive Engineer/Contract Package Project Manager-Convener Field Coordinator of PMU–Member Secretary Representative from EPC contractor Upazila Chairman or his representative-Member Agriculture Extension Officer at Upazila level -Member One representative from PAPs male or female (female in case of female aggrieved person) –Member

847. One (1) representative of PAPs or workers (based on the recommendation of the PMU Project Director and approved by the Convener) will be a member of the LGRC. The Member-Secretary of LGRC will be available and accessible to PAPs and workers to address concerns and grievances. Post evaluation of some past projects indicate that GRCs have worked well and were successful in resolving disputes in a participatory manner ensuring fairness in the decision-making process. Unresolved cases will be forwarded to the Project-level GRC (PMU). The LGRC is empowered to take a decision, which is bound upon the Project Proponent. But it requires the approval of the Project Director for implementation of the decisions.

Terms of Reference for Local GRC (LGRC)

848. The scopes of work and the Terms of Reference (ToR) for LGRC are:

- ✓ The LGRC shall review, consider, and resolve grievances related to social safeguards and environment during implementation of the Project.
- ✓ Any grievances presented to the LGRC, including all environment grievances, should ideally be resolved on the first day of hearing to be held within 7 days or for social safeguards within a period of two to four weeks, except for complicated issues requiring additional investigations. Grievances of indirectly affected persons and/or persons affected during project implementation due to social or environmental problems will also be reviewed by LGRC.
- ✓ The LGRC will not engage in any review of the legal standing of an “awardee” other than in the distribution of shares of acquired property among the legal owners and associated compensation or entitlement issues.
- ✓ LGRC decisions should ideally be arrived at through consensus, failing which resolution will be based on majority vote. Any decision made by the LGRC must be within the purview of ADB’s SPS 2009 policy requirements and RP entitlements.
- ✓ The LGRC will not deal with any matters pending in the court of law.
- ✓ A minimum three (3) members (in addition to the Member Secretary) shall form the quorum for the meeting of the LGRC to proceed.
- ✓ LGRC meetings will be held in the convener’s office in the Project area or other location(s) as agreed by the aggrieved persons. If needed, LGRC members may undertake field visits to verify and review the issues at dispute, including titles/shares, left-out cases during Joint Verification Survey (JVS) or other relevant matters. Other than disputes relating to ownership right under the court of law, GRC will review grievances involving all resettlement benefits, relocation and other assistance. However, the major grievances that might require mitigation include:
    - APs not enlisted;
    - Losses not identified correctly;

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

- Compensation/assistance not as per entitlement matrix;
- Dispute about ownership;
- Delay in disbursement of compensation/assistance;
- Improper distribution of compensation/assistance in case of joint ownership;
- Incorrect name in the award book of DC.

11.4.2 Project-level GRC

849. Level 2 of GRC will be the Project Management Unit of PGCB chaired by the Project Director. The rest of the members of the GRC will include (i) Safeguards Team Leader SIC-Member Secretary (ii) Executive Engineer of the project component, PGCB-Member (iii) a representative of the DC or civil society. The Grievances that cannot be resolved at GRM-Level 1 or else if the affected persons were dissatisfied with the Level 1 resolution can submit their grievances to project level GRC which will be located at the project office of the PGCB.

850. The composition of the PGRC will be as follows:

Level	Members of the GRC at different levels
Level 2 Project Level (PMU)	Project Director –Convener Safeguards Team Leader SIC-Member Secretary Executive Engineer of the project component, PGCB-Member DC or civil society-Member

851. The Member-Secretary in the PGRC will provide necessary knowledge and information regarding relevant national standards or policies and international good practice requirements. He/she will also set examples of resolving such grievances from other development projects in Bangladesh. The PGRC should establish fairness and transparency in the resolution of grievances by project-affected persons. In case of technical or environmental issues as well as any legal matters, the Safeguards Team Leader of the SIC will advise the PGRC. In specific cases, Environment and Social Unit (ESU) or external legal advisors may be consulted, if required.

ToR for Project Level GRC (PGRC)

852. The scope of work and the Terms of Reference (ToR) for PGRC are:

- ✓ Review, consider and settle unresolved grievances forwarded by LGRCs related to social safeguards and environmental issues.
- ✓ Any grievances presented to the PGRC should be resolved within 15 days, maximum 4 (four) weeks from the date of receiving the complaints from LGRC.
- ✓ In case of complicated cases, the PGRC Members can request additional information or carry out field level verifications.
- ✓ Resolutions should be based on consensus among Members, failing which the decision may be taken on majority vote.
- ✓ Any decision made by the PGRC must be within the purview of ADB's SPS 2009 policy requirements and RP entitlements.
- ✓ The PGRC will not deal with any matters pending in the court of law.
- ✓ All Members are required to form the quorum for the meeting of the PGRC.

11.4.3 Central-level GRC

853. Level 3 of GRC will be the central level of PGCB and will comprise (i) Executive Director (P&D) PGCB, Dhaka –Convener, and (ii) Chief Engineer, PGCB-Member Secretary. The complainant and/or his/her representative will be called to appear before the Level 3 GRC and explain his/her grievance. The

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

GRC located at PGCB Headquarters will conclude its proceedings within one month from the submission of the grievance to them.

Level	Members of the GRC at different levels
Level 3 ED Level (Central level of PGCB)	Executive Director (P&D) PGCB, Dhaka –Convener Chief Engineer, PGCB-Member Secretary

Terms of Reference for Central Level GRC

854. The scope of work and the Terms of Reference (ToR) for CGRC are:

i. Review, consider and settle unresolved grievances forwarded by PGRC related to social safeguards and environmental issues.
ii. Any grievances presented to the CGRC should be resolved within 30 days, maximum 4 (four) weeks from the date of receiving the complaints from PGRC.
iii. In case of complicated cases, the CGRC Members can request additional information or carry out field level verifications.
iv. Resolutions should be based on consensus among Members, failing which the decision may be taken on majority vote.
v. Any decision made by the CGRC must be within the purview of ADB's SPS 2009 policy requirements and RP entitlements.
vi. The CGRC will not deal with any matters pending in the court of law.
vii. Both Members are required to form the quorum for the meeting of the CGRC.

11.5 Grievances Resolution Process

855. The PMU, ESU and Safeguards Implementing Consultant (SIC) will keep a close liaison with the affected people and discuss any type of issues, observations, and complaints at regular focus group discussion (FGD) meetings on a weekly or fortnightly basis. Most of the issues will hopefully be settled in the focus group meetings but some issues requiring formal hearing and resolution will be brought to the Grievance Redress Committee (GRC) for resolution in the form of a formal complaint. A sample Grievance Registration Form is attached in Appendix XVII.

856. All formal complaints will have to be received at the local (Union) level GRC (LGRC) and resolved within a certain period (maximum four weeks from the date of lodging the complaints) as per circular of the MoPEMR (gazette notification). The grievance resolution process will be facilitated by the field GRM coordinator being the Member Secretary of the committee. It will review and sort the cases in terms of nature of grievance, urgency of resolution and schedule hearings in consultation with the Convener. If any case is found beyond the purview of the LGRC (as per ToR) and related to land ownership, categorization of land, they are to be settled under arbitration. The LGRC will request the aggrieved person to apply to the Deputy Commissioner (DC) for resolution or the LGRC may refer such issues to the DC office for consideration. All cases will be heard at LGRC within four weeks from the date of receiving the complaints.

857. If the resolution attempt at the local level fails, the LGRC will refer the complaint with the minutes of the hearings to the PGRC. In case of failure at PGRC, the complaint with the minutes of the hearings of PGRC will be sent to the Executive Director (P&D) PGCB for further review. The Environment and Social Unit (ESU) may be assigned to review the grievance cases and to assist the PGRC and CGRC in making a decision. The ESU, headed by Superintending Engineer and Manager (ESU), will review the case records, pay field visits for cross-examination and consult the LGRC Members and aggrieved persons, if required. The cases are to be resolved at PGRC within four weeks from the date of receiving the file from the LGRC and similarly for CGRC within four weeks from the date or receiving the file from the PGRC. If a

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

decision at this level is found unacceptable by the aggrieved person(s), he/she may still go to court of law for verdict. Aggrieved persons are always allowed to go to court of law for settlement of any unresolved issues.

858. A decision agreed with the aggrieved person(s) at any level of hearing will need to be approved by the Project Director before making any payment based on the GRC's decision.

859. Environmental grievances, including those by workers, will be handled in accordance with the project's GRM. In case of SEAH case being raised a SEAH grievance specific procedure will be followed due to the sensitive nature of such cases. Open and transparent dialogue will be maintained with project affected persons and workers as and when needed, in compliance with ADB's Safeguard Policy Statement 2009. This GRM will provide an effective approach for resolution of complaints and issues of the affected person/community/worker and includes procedures of taking/recording complaints, handling on-the-spot resolution of minor problems, taking care of complainants and provisions of responses to distressed stakeholders, etc. paying particular attention to the impacts on vulnerable groups.

11.6 GRC's Scope of Operations and Decision Requirements

860. The scope of work and responsibility/ jurisdiction of the GRC is:

- Any grievances presented to the GRC should ideally be resolved on the first day of hearing to be held within 7 days or within one month of the case being filed for complicated cases that require additional investigations.
- Grievances of indirectly affected persons and/or persons affected during project implementation will also be reviewed by the GRC.
- The GRC will not engage in any review of the legal standing of an "awardees" other than in direct losses or distribution of shares of acquired property among the legal owners and associated compensation or entitlement issues.
- GRC decisions should ideally be arrived at through consensus, or as a minimum, based on a majority vote. Any decision made by the GRC must be within the boundaries established by the ADB's Safeguard Policy Statement 2009.
- The GRC will not deal with any matters pending in the court of law. But if the parties agree on through a written appeal, GRC can mediate. The parties will withdraw the litigation.
- A minimum three (03) members shall form the quorum for the meeting of the LGRC.
- The disputed person may proceed to legal trial in parallel to GRC. GRC do not have the right to hold back the disputed person from seeking legal support in national system.

11.7 Processes for Filing Grievance Cases

861. PAPs and workers will be able to file their grievances (sample grievance registration form attached in Appendix XVII) without any fear and intimidation. Where required, PGCB will assist the PAPs and workers with drafting any grievance notifications. All formal grievances must be submitted in writing to the LGRC convener. The complainant may be represented by the PAP or worker him/herself or appointed agent such as locally elected officials/legal advisors. The judgment made by GRC will be communicated to the concerned PAP or worker in writing. If dissatisfied, and with the agreement of the GRC, the PAP or worker may request a further review of the judgment of LGRC by the Project-level GRC. In such cases, the case will be forwarded to the Convener of the project-level GRC with all documentations by the LGRC convener. If the disputant still remains unsatisfied, he/she can approach to the third tier through the LGRC and Project level GRC for final resolution. They will enjoy the opportunity to go to the formal court of law if still remain dissatisfied with the decision of any level of the GRM, or raise the issue to ADB resident mission.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

11.8 Grievance Redress Documentation and Monitoring

862. The affected persons and their communities as well as workers will be informed of the project's GRM in open meetings at important locations and in PAP group meetings and worker inductions. Bangla translations of the IEE executive summary, RP and the GRM chapter/procedure in the form of information brochures will be distributed among the PAPs and workers. The PAPs and workers will also be briefed on the scope of the GRC, the procedure for lodging grievances cases and the procedure of grievance resolution at the project level.

863. To ensure impartiality and transparency, hearings on complaints will remain open to the public. The LGRCs will record the details of the complaints and their resolution in a register, including intake details, resolution process and the closing procedures. All grievances raised no matter if received at the informal or formal tier, and no matter how minor and readily resolved by the contractor or PGCB on the ground will be recorded and reported in monitoring reports. The field GRM coordinator (for informal and tier 1) and SIC/ESU (tier 2 and 3) will maintain the following three Grievance Registers at each level (informal, tier 1, tier 2 and tier 3):

- **Intake Register:** (1) Case number, (2) Date of receipt, (3) Name of complainant, (4) Gender, (5) Father or husband, (6) Complete address, (7) Main grievance regarding social (loss of land/property or entitlements) or environmental, (8) Complainants‟ story and expectation with evidence, and (8) Previous records of similar grievances.
- **Resolution Register:** (1) Serial no., (2) Case no., (3) Name of complainant, (4) Complainant's story and expectation, (5) Date of hearing, (6) Date of field investigation (if any), (7) Results of hearing and field investigation, (8) Decision of GRC, (9) Progress (pending, solved), and (10) Agreements or commitments.
- **Closing Register:** (1) Serial no., (2) Case no., (3) Name of complainant, (4) Decisions and response to complainants, (5) Mode and medium of communication, (6) Date of closing, (7) Confirmation of complainants‟ satisfaction, and (8) Management actions to avoid recurrence.

864. Grievance resolution will be a continuous process in IEE/EMP and RP implementation. The PMU will keep records of all resolved and unresolved complaints and grievances (one file for each case record) and make them available for review as and when asked for by ADB and any other interested persons/entities. The PMU will also prepare periodic reports on the grievance resolution process in time for inclusion in the quarterly progress reports and safeguard monitoring reports. The process of grievance resoltuation and timeline is presented in the following Table 11.1 and

865. Figure **11.1**.

Table 11.1: Process for Resolving the Grievance Issues

Step 1	I. PGCB, SIC and contractors inform PAPs and workers of GRM and counsel them on the environmental impacts and environmental management plan, land acquisition and resettlement policy, compensation and entitlement modalities, entitlement packages, and eligibility and process to obtain the entitlements. II. PAPs with clear understanding approach DC and/or PGCB and/or contractors for corrective action, compensation or assistance under the EMP/RP as applicable. III. PAPs with confusion and valid complaints on environment, land acquisition and resettlement process and entitlements approach GRC for resolution.
Step 2	I. PGCB PMU, ESU and SIC assist the aggrieved PAPs to produce a written complaint to the convener of local level GRC (LGRC) at Upazila Level with stories, expectations and any parties. PGCB, ESU and SIC counsels the aggrieved persons on the mandate and procedure of grievance resolution. II. GRC scrutinize the case records and sort out cases to be referred to the DC or the court of law and those to be resolved in GRC. III. Hearing is organized on cases with merit at the LGRC secretariat (field office of PMU contract package) or at the Office of Upazila Chairman at local level and resolution is given by the GRC in **7**

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

	days of receiving the complaints. IV. Aggrieved PAPs and workers satisfied with the resolution approach PGCB for corrective action or resettlement assistance under the provision of the EMP/RP. The agreed resolution is forwarded to PMU for approval by the PGCB PD before processing entitlements for the entitled person. V. In case the resolution is not acceptable to the aggrieved person, he/she approaches the PMU through the LGRC convener with assistance from PGCB for further review.
Step 3	I. Cases with all proceedings are placed with the PMU, where the PD reviews them with assistance from the Executive Engineer (Contract Package Project Manager). If found necessary, field investigation is carried out and the resolutions are given within **15 days** of receiving the complaints. II. Aggrieved PAPs satisfied with the resolution approach PGCB for corrective action or resettlement assistance under the provision of the EMP/RP. The resolution will be sent to the Conveners office of LGRC to communicate to the aggrieved persons for acceptance. The PD then approves the resolution accepted by the aggrieved person. III. In case the resolution is not acceptable to the aggrieved person, he/she approaches the Director General, PGCB through the PD PMU with assistance from the convener of LGRC.
Step 4	I. Cases with all proceedings from GRC and from PMU are placed with the ED, PGCB where the ED appoints a reviewer to resolve the grievance in view of the merits and redirects the case records to the PD, PMU with written resolutions within **30 days** of receiving the complaints at ED office. II. Aggrieved PAPs satisfied with the resolution approach PGCB for corrective action or resettlement assistance under the provision of the EMP/RP. The resolution will be sent to the Conveners office of LGRC to communicate to the aggrieved persons for acceptance. The PD then approves the resolution accepted by the aggrieved person. III. Aggrieved PAPs may opt to approach to the Court of Law or ADB, if the resolution at DG level is not acceptable to him/her.
Step 5	I. The resolution accepted by the aggrieved persons at any level (LGRC, PMU, ED) is approved/nodded by the PD and forwarded back to the Conveners office of LGRC keeping records at his/her office. II. Based on the approved resolution, PGCB take corrective action or processes his/her entitlements and assist in arranging payment.
Note	The aggrieved party can approach the country's judicial system any time during the project cycle independent of the GRM proposed for the Project

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

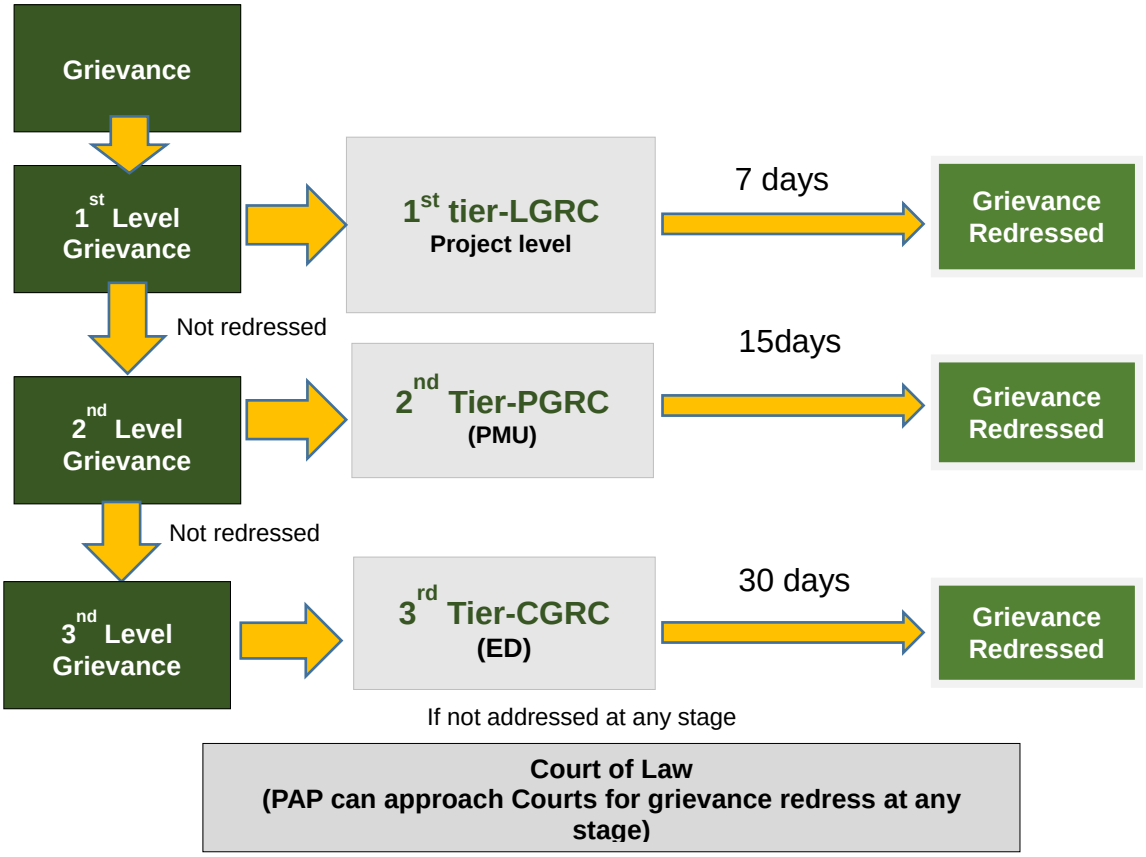


Figure 11.1: Grievance Resolving Process (Formal Tiers)

11.9 Approval of GRCs and Entitlements of GRC Members

866. All the decisions and proceedings of GRC meetings at any level will be finally approved by the Project Director, PMU. According to the agenda of the EMP/RP, the approved GRC decisions will be implemented in a particular location. PAPs and workers will be exempted from all administrative and legal fees. Complainants to the court will also have the right of free legal representation. The detailed procedures for redress of grievances and the appeals process will be widely publicized among the parties involved.

867. All GRC members will attend a training and orientation meeting before commencing of their work. SIC will conduct the training with ESU staff. Before starting construction work the EMP pre-construction requirements/resettlement process has to be completed.

868. Grievances will be heard once a month by GRC. The GRC may meet more than once in every 30 days depending upon the number of such cases. Within 15 days of the hearing of the grievances the GRC will inform the concerned aggrieved persons of their decision.

869. **ADB and Accountability Mechanism**: SIC and GRC will also inform the PAP's and worker's of the ability to submit complaints to ADB's resident mission and ADB's Accountability Mechanism and its access mechanism. An aggrieved party can directly contact ADB's resident mission in Dhaka regarding a grievance or problem that GRM has failed to resolve. The party in writing informs the resident mission and initiates a good faith negotiation to solve the problem by working with the concerned resident mission's specialists and, if necessary, with ADB's Energy Sector Group, South Asia. The aggrieved party can use English or any local language to send the complaint to the resident mission or to the sector group, energy, and the arbitration can be done in the preferred language of the aggrieved party. The

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

affected party whose grievances were not addressed by the GRM and/or are not satisfied by the good faith efforts of ADB to resolve, can use the ADB's Accountability Mechanism by writing to the Complaint Receiving Officer at the ADB Headquarters in Manila. The Accountability Mechanism has two arms: the first is the Office of the Special Project Facilitator. The facilitator deals with the complaints with the help the project personnel and the aggrieved party through a consultative process; the second arm of the Accountability Mechanism deals with the complaints against ADB regarding its failure to abide by its own safeguard policy requirements. Information on the ADB Accountability Mechanism will be included in the project information kit to be distributed among the affected communities as a part of the project GRM.

11.10 Grievance Redress Monitoring

870. The PMU field GRM coordinators will keep records of all the grievances and their redress in monthly cumulative formats, which will be provided by the SIC and to be signed by the convener of the Grievance Redress Committee. The format will contain information on the number of grievances received with nature, resolved, and the number of unresolved grievances. Monitoring of grievance redress will also be incorporated in the EMR.

871. **Budget for GR and Disclosure:** The budget for EMP includes budget for grievance redress administration and disclosure and SIC budget for its oversight.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

12 Environmental Management Plan

12.1 Introduction

872. ADB's Safeguard Policy Statement (SPS) 2009 requires that an Environmental Management Plan (EMP) be prepared to ensure construction and operation of the Power Transmission Strengthening and Integration of Renewable Energy Project (PTSIREP) (the Project) will be undertaken in accordance with its safeguard requirements. This Chapter describes the EMP of the Project. It defines the roles and responsibilities for implementation, supervision and monitoring by PGCB and their Contractors; lists the mitigation measures which are to be implemented to reduce potential impacts and risks to a level acceptable to ADB and national regulatory authorities; gives guidance to the Contractors for preparation of their Contractors Site-specific Environmental Management Plans (CSEMP) and Health and Safety (H&S) Plans under the contract; gives an outline of the monitoring requirements to ensure that the mitigation measures are effective, the capacity development requirements to ensure all parties understand what is required, and, the corresponding cost of the mitigation, supervision and monitoring activities.

873. The primary aim of the EMP is to avoid, minimize, mitigate or compensate for potential negative environmental impacts and risks of the Project by identifying general and site-specific mitigation measures to be followed, and to support positive impacts where possible by enhancement measures. In doing so, it seeks to ensure compliance with (i) ADB's Safeguard Policy Statement 2009 requirements and international good practice as set out in the related International Finance Corporation (IFC) Environment, Health and Safety (EHS), General and Electric Power Transmission and Distribution guidelines, and (ii) applicable national environmental, health and safety requirements, including the international agreements which the Government of Bangladesh (GoB) is a signatory to, as well as having cognizance of the sensitivity of local ecological and human receptors in the project area of influence around each project site.

874. The specific objectives of the EMP are to:

- Summarize the potential negative environmental impacts and risks arising from the various activities associated with the construction, and operation and maintenance phases of the Project;
- Facilitate the implementation of mitigation measures to avoid, minimize, mitigate or compensate all negative impacts and risks from the design phase, through the pre-construction, construction, and the operation and maintenance phases of the Project;
- Define the roles, responsibilities, and obligations of PGCB's Project Management Unit (PMU) supported by a Safeguards Implementation Consultant (SIC) and the environmental and social unit (ESU) of PGCB;
- Set out the roles, responsibilities, and obligations of PGCB's Contractors and other third parties; and
- Define a supervision and monitoring mechanism, plus environmental reporting requirements to check if mitigation measures are effective and ensure the environmental compliance of the Project.

875. The EMP reflects the legal requirements of the Bangladesh government on environment, health and safety and ADB's Safeguard Policy Statement (2009) including international good practice related to the negative environmental impacts and risks predicted during implementation. It requires adherence to guideline levels and national standards; prohibits the use of PCBs in new transformers and the use of asbestos containing materials in new construction; and requires PGCB and their contractors to undertake community awareness raising activities on the health and safety risks of construction and utility electrical equipment.

876. This EMP provides the overall Project-level EMP for contract packages involving works:

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Table 12.1: List of Packages

Package	Items
Package: 1 Pekua	Proposed 400/230/132 kV New AIS Substation at Pekua/Chakaria
	LILO of Matarbari PP – Banskhali PP 400kV line at Matarbari (Quad ACSR Finch)
	LILO of Anwara-Cox's Bazar 230kV line at Matarbari (Twin ACSR Mallard)
	LILO of Existing Matarbari – Chakaria 132kV line at Matarbari (ACSR Grosbeak)
Package: 2 Madhabpur Monohardi	Proposed 230/132/33 kV New AIS Substation at Madhabpur, Habiganj
	Proposed 230/132/33 New AIS Substation at Monohardi, Narsingdi
	2x132 kV AIS Bay Extension at Bajitpur Substation
	LILO of Sripur-Ashuganj 230kV double circuit line at Monohardi (Twin ACSR Mallard)
	LILO of Cumilla(N) – Shahjibazar PP 230kV double circuit line at Madhabpur (Twin ACSR Mallard)
	Monohardi-Bajitpur 132kV double circuit line (Single ACSR Grosbeak)
Package: 3 Tungipara Mathbaria Paikgacha	Proposed 132/33 New AIS Substation at Mathbaria, Pirojpur
	Proposed 132/33 New AIS Substation at Paikgacha, Khulna
	2x132 kV AIS Bay Extension at Satkhira Substation
	2x132 kV AIS Bay Extension at Bhandaria Substation
Package: 4 Kumarkhali Dupchanchia Matlab Uttar Chatkhil	Proposed 132/33 New AIS Substation at Kumarkhali, Kushtia
	Proposed 132/33 New AIS Substation at Dupchanchia, Bagura
	Proposed 132/33 New AIS Substation at Matlab Uttar, Chandpur
	Proposed 132/33 New AIS Substation at Chatkhil, Noakhali
	2x132 kV AIS Bay Extension at Kachua 230/132/33 kV Substation
Package: 5	Satkhira-Paikgacha 132kV double circuit line (Single ACSR Grosbeak)
	Kachua- Matlab North 132kV double circuit line (Single ACSR Grosbeak)
	Bhandaria-Mathbaria 132kV double circuit line (Single ACSR Grosbeak)
	LILO of Chowmuhani-Ramganj 132kV double circuit line at Chatkhil (Single ACSR Grosbeak)
	LILO of Shahjibazar – Brahmanbaria 132kV double circuit line at Madhabpur (Single ACCC Grosbeak)
	LILO of Bogura(S)-Naogaon 132kV line at Dupchanchia (Single ACCC Grosbeak)
	LILO of Bheramara – Rajbari 132kV line at Kumarkhali (Single ACCC Grosbeak)
	Reconductoring of Shahjibazar-Brahmanbaria-Ashuganj 132kV line (Single ACCC Grosbeak)
Package: 6	Proposed 132/33 New AIS Substation at Tungipara, Gopalganj
	2x132 kV AIS Bay Extension at Gopalganj Substation
	Gopalganj-Tungipara 132kV double circuit line (Single ACSR Grosbeak)

877. The generic parts of the EMP are applicable to all contract packages regardless they will follow ADB or PGCB procurement requirements. In addition, works-specific measures are provided for the five different types of contract package. Site-specific measures have also been developed for the 10 number new substations, the 10 number of bay extension at five existing grid substations and the major transmission lines as shown in Table 12.2. Pertinent requirements related to equipment specifications will also need to be incorporated into the contract packages for the supply of different equipment and other items under the Project.

Table 12.2: List of New Substations and Substation Bay Extensions under the Project

Sl	Substation Name	Type	Remarks		
			Capacity (MVA)	Land Requirement	Future Required Bay
1	Pekua	400/230/132 kV New AIS Substation	• 3x520 MVA (400/230	32 Acres	400 kV: 4 230 kV: 4

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Sl	Substation Name	Type	Remarks		
			Capacity (MVA)	Land Requirement	Future Required Bay
			kV) & 2x225/300 MVA (230/132 kV)		132 kV: 4
2	Madhabpur	230/132/33 kV New AIS Substation	• 3x225/300 (230/132 kV) & 2x80/120 (132/33 kV)	10 Acres	230 kV: 3 132 kV: 3
3	Monohardi	230/132/33 New AIS Substation	• 2x225/300 (230/132 kV) & 2x80/120 (132/33 kV)	10 Acres	230 kV: 3 132 kV: 3
4	Tungipara	132/33 New AIS Substation	• 2x80/120	4 Acres	132 kV: 3
5	Mathbaria	132/33 New AIS Substation	• 2x50/75 MVA	4 Acres	132 kV: 3
6	Paikgacha	132/33 New AIS Substation	• 2x50/75 MVA	5 Acres (Existing Land)	132 kV: 3
7	Kumarkhali	132/33 New AIS Substation	2x50/75 MVA	4 Acres	132 kV: 3
8	Dupchanchia	132/33 New AIS Substation	2x50/75 MVA	3 Acres	132 kV: 3
9	Matlab Uttar	132/33 New AIS Substation	2x50/75 MVA	3 Acres	132 kV: 3
10	Chatkhil	132/33 New AIS Substation	2x80/120 MVA	3 Acres	132 kV: 3
Sl	**Bay Extension***	**Type**	**Remarks**		
1	Baljitpur	132/33 AIS Substation 2 bays	2x250/350 (230/132 kV) & 2x80/120 (132/33 kV)	N/A	230 kV: 3 132 kV: 3
2	Gopalgunj (old)	132/33 AIS Substation 2 bays	2x80/120	N/A	132 kV: 3
3	Satkhira	132/33 AIS Substation 2 bays	2x50/75 MVA	• N/A	132 kV: 3
4	Bhandaria	132/33 AIS Substation 2 bays	2x50/75 MVA	• N/A	132 kV: 3
5	Kachua	132/33 AIS Substation 2 bays	2x50/75 MVA	• N/A	132 kV: 3

** No additional land will be required for the bay extensions for the existing substations.*

12.2 EMP Structure

878. The definitive version of the EMP cleared by ADB is the most recent version disclosed on its website and it is against this that environment safeguards performance will be monitored by ADB. The EMP is a living document and may be updated as appropriate during project implementation, including

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

in the event of any unanticipated impacts including design changes. However, any updated EMP will have to be cleared by ADB and disclosed on the ADB website.

Prior to the approval of detailed designs, PGCB will identify and review the implications of any design changes to the Project as assessed in the IEE and consult ADB regarding the need to update the IEE and thus EMP considering any variations put forward by their Contractors. If required, the IEE will be updated by PGCB for review, clearance, and disclosure by ADB before PGCB supported by the Safeguards Implementation Consultants (SIC) approve the Contractors designs and the start of any related works by their Contractors including site establishment and vegetation clearance. If different route alignments are put forward by the contractors the IEE will certainly need to be updated before approval of the Contractors designs, PGCB supported by the SIC will prepare the update but the contractor will be required to support them with preparation.

879. PGCB will award six (6) contract packages following ADB procurement requirements. The Contractors for all civil works packages will be contractually bound to implement the EMP. PGCB will ensure the EMP forms part of all bidding and contract documents for all works contract packages. During design and pre-construction, and construction, the Contractors will be responsible for implementing all relevant measures for the works in their contract package under the supervision of PGCB supported by their SIC up until handover of the infrastructure to PGCB. Any updates to it will be incorporated through a contract variation into the contract document. The Contractors must always follow the current version of the EMP which is the version disclosed on ADB's website. This includes any updates in response to unanticipated impacts.

880. To ensure the mitigation and monitoring measures are implemented, the environmental monitoring plan (EMoP) will be followed by PGCB supported by their SIC. Some quantitative monitoring in the EMoP will be delegated to the Contractors to undertake. In addition, in case of any requirement for corrective action due to noncompliance with the EMP during project implementation, these must be identified and immediately reported to ADB. Appropriate corrective action/s will be agreed between ADB and PGCB to bring the project implementation back on track. Corrective actions must be time-bound, budgeted and agreed between ADB and PGCB. The Contractors will cover the costs where corrective action is required due to noncompliance on behalf of the Contractor, its subcontractors or third parties it engages with the EMP.

881. This EMP covers the following:

- the proposed Corrective Action Plan for existing facilities (existing substations) to be implemented by PGCB prior to construction of the transmission lines;
- the Mitigation Plan, covering the mitigation of impacts and risks (during detailed design and pre-construction; construction, and operation and maintenance), including activity-specific and site-specific mitigation for the 10 no. new substation sites, 5 no. bay extension substations and major transmission lines. Part of this plan is the requirement for Contractors to develop Contractors Site-specific Environmental Management Plans (CSEMPs) and H&S Plans, both with several sub-plans, incorporating general measures described in the Environmental Codes of Practice (ECPs) and the chance find procedures in Appendix XVIII;
- a quantitative EMoP including monitoring parameters and performance indicators;
- implementation arrangements, including (a) the organizational roles and responsibilities for mitigation, supervision, monitoring and reporting; (b) capacity building needs; and (c) an initial cost estimate/EMP budget (see also Appendix XX on budget clarifications) subject to competitive bidding by contractors and SIC.
- In addition, PGCB and their Contractors have a role in implementing the grievance redress mechanism (GRM) (Chapter 11) for the facilitation of complaints or queries on project-related activities.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

12.3 Potential Impacts and Risks

882. The principal purpose of formulating the EMP is to ensure commitments made are translated into implementation. Potentially significant impacts relate to construction, no significant impacts are anticipated during operation subject to confirmation following migratory bird surveys. Impacts and risks are summarized as follows:

- Dust generation affecting the public and occupants of properties in immediately adjacent buildings due to land filling and levelling works, earthworks for construction, and transportation of materials.
- Noise and vibration causing disruption and disturbance to the public and occupants of properties in immediately adjacent buildings especially from piling work.
- Use of hazardous materials, including transformer oils and batteries, and the generation of solid and hazardous wastes including e-wastes for disposal during both construction and operation.
- Loss of trees and vegetation at substation sites and beneath the RoW of transmission lines including potential disturbance to nesting birds during site clearance and requiring 1:3 compensatory plantation, details to be set out in a tree protection/plantation plan which is to be developed for PGCB approval by the contractor as per Bid Document.
- Electrocution and collision of avifauna on the transmission lines especially where they cross waterbodies or run in proximity to the coast where habitat supports migratory and local bird populations including threatened species.
- No protected area, forest land or natural habitat is impacted. There are waterlogged areas (salt pans) around the Pekua and Paikgacha (naturally low-lying land inundated round the year) substations and transmission lines. These habitats are of local importance to non-threatened bird species and fish and provide various ecosystem services to the local community – they also have the potential to support migratory birds based on consultations and must be subject to further study prior to detailed design. Most of the project components do not impact on critical habitat, however, the Pekua substation and VRE Hub area of analysis covering South Chattogram support critical habitat with spotted greenshank (endangered species) recorded in the coastal habitat near to the existing power plant. Additionally, there are some low-lying areas on and around the substations which are inundated year around. Height of these lands will be raised up to the standard height of main access road during the construction stage according to the design.
- Occupational health and safety risks to workers including from working at height, lightening hazard, fall of materials from height and with electrical equipment.
- Community health and safety due to the presence of workers, electrical works in the public domain and crossing roads, due to construction traffic, structural safety of immediately adjacent buildings due to vibrations from piling work etc.
- Construction impacts that will adversely affect the baseline environment parameters (listed in Section 5.3) already above national standards and/or international guidelines such as the WHO guidelines must be minimized through targeted mitigation measures and regular monitoring of impacts.
- Concerns of the community and other key stakeholders regarding potential contractors' violations of the EMP that may affect them adversely as noted by the consultees (listed in Section 10.7 related to noise, dust, health and safety etc.) need to be incorporated into the detailed design and construction methods with supervision and monitoring to ensure compliance by the contractor.

12.4 Existing Facility Corrective Action Plan

883. Site inspections of 5 no. existing substations related to the bay extension components were undertaken during April-May 2024. An environmental audit was conducted by the ADB TA consultants,

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

and a corrective action plan (CAP) for the five existing substations where the ten additional bays will be constructed has been prepared. This identified lapses in pollution, health and safety activities at all of the substations. The risk of PCBs and asbestos being present needs due attention. This environmental audit of the existing substations culminated in a Corrective Action Plan (CAP) to amend any noncompliance. The findings of the audit are included in the CAP contained in Table 6.4.

884. PGCB will implement the CAP prior to access being given to Contractors unless actions have been included in the contractor's scope of works.

885. PGCB will be responsible for undertaking the CAP activities at these existing substations before access is given to the contractor or reflecting them in the bidding and contract documents, so they are the responsibility of the contractor.

886. CAP is not applicable to the proposed 10 new substations.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Table 12.3: Corrective Action Plan of Existing Substations

No	Issues	Corrective Action	By whom/ budget source	By when
1	**Ensuring Health and Safety of Substation Staff** Staff need to use personal protective equipment (PPE) at all times Standardized medical kits need to be supplied and be kept supplied with in-date supplies on regular basis Safety sign boards must be installed at substation boundaries Drinking water supply meeting GOB standards with purifiers where required must be supplied to the staff Non-WC wastewater (bathing, basin, urinals) to be connected to the sewerage system or septic tank, it should not be allowed to discharge to open drains Dedicated area needed in all control buildings for accommodation/rest room/cooking if this is permitted on site	**Corporate Level** • Ensure existing EHS guidance is issued to all SS Managers/incharges, • Source first aid kits and PPE for distribution to SS Managers/incharges -- PPE (footwear, masks, protective clothing, and goggles in appropriate areas) to be provided to the staff in accordance with GOB requirements and with reference to EMP • Periodic checks of first aid kits and PPE at substations should be carried out by corporate office, recorded and information on the same should be monitored • Develop as part of health and safety system/procedure a checklist for SS managers/incharges on correct content of first aid kit, PPE to be provided at SS, need for renewal if out of date etc. • Develop as part of health and safety system/procedure an incentive/disciplinary system to ensure use of PPE by workers at SS, such as use of written warnings etc. • Provide training to all SS managers/incharges on use of the checklist and incentive/disciplinary system, as well as on (i) use of PPEs - the importance of safety needs to be stressed to effect behavioral/attitudinal change, (ii) general health and safety aspects, and (iii) emergency procedures in event of accident, fire or natural hazard to be given on a train-the-trainer basis (document training and attendance by SS managers) • Provide training to all SS managers/incharges on the development and implementation of emergency preparedness and response plans for (i) environmental incident, (ii) health and safety incident in accordance with the General EHS Guidelines **Substation Level** **Short term:** • Ensure existing EHS guidance, pollution prevention and hazardous waste management manuals are kept on site. • Ensure fully equipped first aid kits available at first aid stations in each working area and building to be signed and easily accessible; to include list of equipment and use by dates as well as poster of the first aid procedures and emergency contact details/local hospital. • Safety mats must be installed at all substations.	PGCB corporate office and substation managers/incharges, O&M budget Costs to be borne by PGCB for repairing broken slabs, providing safety sign boards, drinking water purifiers, complete PPE and standardized medical first aid kits etc. Corporate office to provide guidance, training and oversee implementation by SS managers/incharges	Immediately for short term actions with compliance to be confirmed prior to access by EPC Contractor Long term actions; for compliance before handover of bay extension for operation and maintenance is undertaken

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

No	Issues	Corrective Action	By whom/ budget source	By when
		• Ensure appropriate PPE is available at the substation and is actively used by staff by implementing the incentive/disciplinary system. • SS manager to provide training to all SS staff (including housekeeping staff) on (i) use of PPEs the importance of safety needs to be stressed to effect behavioral/attitudinal change, (ii) general health and safety aspects, and (iii) emergency procedures in event of accident (document training and attendance by SS managers) • Ensure that a trained first aider is always provided on-site; this can be a member of staff trained in emergency procedures to follow in event of accident. • Broken slabs at SS need immediate replacement to avoid any slip, trip or fall related accidents. • Safety sign boards must be installed within the substation and at substation boundaries including visual warning of electrocution • Mark emergency exist signage and ensure emergency exit routes are kept clear of debris at all times • Conduct fire drills and alarm tests on a monthly basis with records kept • Place posters on medical revival, prevention / fire safety • Drinking water purifiers where required must be supplied to the staff and supply of drinking water from borewells to be tested to confirm that it meets GOB requirements • Ensure all toilets are lockable given no separate toilets for women are provided • Lighting to standard LUX levels to be installed • Provide emergency eye wash and shower • Provide dedicated shelter for security guards on duty Long term: • Undertake repair works to and maintain all control buildings with structural repair of Bhandaria SS to ensure safety of workers • Connect the non-WC wastewater (bathing, basin, urinals) to the sewerage system or septic tank, it should not be allowed to discharge to open drains • Improve capacity of the storm drainage at Satkhira SS to prevent waterlogging of switchyard (this needs to be done in parallel with drainage design for the project) • Provide a dedicated area in all control buildings for accommodation/rest room which meets the ILO worker accommodation guidelines and if cooking is permitted ensure that a separate cooking area is set up that does not pose a fire hazard		

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

No	Issues	Corrective Action	By whom/ budget source	By when
2	**Improvement of Waste Management** No proper arrangements for waste management Scrap material is currently scattered across the substation sites in open areas	**Corporate Level** • Ensure proper implementation of standardized waste management system/procedure in accordance with national laws and regulations and the EHS Guidelines on Waste Management for all substations. • System/procedure to include avoiding or minimizing the generation of waste materials, as far as practicable. Where waste generation cannot be avoided but has been minimized, the preference should be recovery and reuse. Where waste cannot be recovered or reused, reputable, legitimate, licensed contractors must be appointed to treat, destroy, and dispose of it in an environmentally sound manner. • Develop as part of system/procedure a checklist for SS managers on correct storage and disposal of transformer oils, other fuel, oil, and chemicals, old transformers, scrap metals, electronic wastes, municipal solid wastes, and wastewater etc. • Provide training to all SS managers on implementation of the waste management system/procedure and use of the checklist (document training and attendance by SS managers) • Source covered, enclosed garbage bins and drip trays for distribution to SS to enable improved solid waste management. **Substation Level** In short-term: • Removal of all currently stored/dumped waste from the substation premises including end of life equipment. • Identify and demark in the SS compound an appropriate area for waste storage yard. Ensure labelled, covered, enclosed garbage bins and drop trays are available. All liquid-related wastes should be stored on an impermeable bunded surface to 110% capacity of the volume to be stored, or on drip trays if not available in the short term. • SS manager to provide training to all SS staff (including housekeeping staff) on waste management system/procedure • Implement waste management system/procedure to include the (i) segregation of all solid and hazardous waste generated; and (ii) environmentally sound storage of all solid and hazardous waste in dedicated, labelled areas within the premises of substations using covered, enclosed garbage bins and placing liquid wastes on drip trays if no impermeable bunded storage area.	PGCB corporate office and substation managers, O&M budget Costs to be borne by PGCB for development of area for storage of waste and subsequent environmentally safe and sound disposal etc. Corporate office to provide guidance, training and oversee implementation by SS managers	Immediately for short term actions with compliance to be confirmed prior to access by EPC Contractor Long term actions; for compliance before handover of bay extension for operation and maintenance is undertaken

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

No	Issues	Corrective Action	By whom/ budget source	By when
		In long-term: • Ensure the waste storage yard is undercover with impermeable bunded surface to 110% capacity of the volume to be stored.		
3	**Preventing Oil Leakages from Transformers and Oil Drums** Seals of older transformer and drums can leak No impermeable, bunded storage areas for drums to be kept Compliance with Bangladesh commitment under the Stockholm Convention[59]	**Corporate Level** In short-term: • Develop and cascade to all SS for implementation a strengthened, standardized waste oil and oil spill plan/procedure in accordance with national laws and regulations and the EHS Guidelines on Hazardous Materials Management. • Provide training to all SS managers on implementation of the waste oil and spill plan/procedure and use of the checklist (document training and attendance by SS managers) • Source drip trays and absorbent materials (e.g. sorbents, dry sand, sandbags) to soak up spills for supply to SS. In long-term: • Transformers at existing substations are mixed in age i.e. ranging between 1980-2020. Status of PCB presence can be checked and confirmed by PGCB for all transformers manufactured before 2016 as they are being tested under a DOE initiative for PCBs with other transformers screened against DOE/UNIDO guidelines and tested if they are at risk. PGCB will work with DOE to detect and clean any transformers containing PCB before 31.12.2025 per the Stockholm Convention obligations. • PGCB has to submit to ADB proof of all substation transformers being free from PCB before the loan is completed. **Substation Level** In short-term: • Carry out preventive maintenance of transformers and ensure values, nuts and bolts are fully functional and tightly secured, ensure rubber seals of radiators are intact, continue to do so on a regular basis such that there is no oil leakage.	PGCB corporate office and substation managers, O&M budget Costs to be borne by PGCB for management of transformer oil leakage etc. Testing for PCB is to be done by PGCB staff. Corporate office to provide guidance, training and oversee implementation by SS managers	Immediately for short term actions with compliance to be confirmed prior to access by EPC Contractor Long term actions; for compliance before handover of bay extension for operation and maintenance is undertaken, by 31.12. 2025 for proof of PCB free transformers and results of soil and groundwater investigations to be available

[59] The Department of Environment, which operates under the Ministry of Environment, Forest and Climate Change, has initiated a project called "Environmentally Sound Development of the Power Sector with Final Disposal of Poly Chlorinated Bi-phenyls (PCB)". The aim of the project is to identify transformers of Power Division's Companies (BPDB, DESCO, DPDC, NESCO, BREB, PGCB & WZPDCL) in Bangladesh that have been contaminated by PCBs and dispose of them in safe locations. The United Nations Industrial Development Organization (UNIDO) is providing technical assistance for the project, which is being funded by the Global Environment Facilities (GEF). In summary, the project is focused on identifying and safely disposing of PCB-contaminated transformers in PGCB.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

No	Issues	Corrective Action	By whom/ budget source	By when
		• Monitor and maintain account of the oil usage and spills/leaks at SS and have a site-based plan/procedure for dealing with any oil spillage. • Provide in a signed, accessible location on-site sufficient absorbent materials (e.g. sorbents, dry sand, sandbags) for soaking up oil spills. • Soak up existing oil spills and, as required, remove soil to approximately a depth of 30cm for 1m beyond footprint of visible spillage for disposal to hazardous landfill site by reputable, legitimate, licensed contractor keeping photographic records and waste transfer notes. Extra gravel is to be placed to intercept and prevent any further oil percolation into the ground. • SS manager to provide training to all SS staff (including housekeeping staff) on waste oil and spill plan/procedure. In long-term: • All transformers to have containment bund / tanks for oil spillage management of 110% capacity for oil spillage during operations in order that any oil spill will be contained. • Soil and groundwater investigation to be undertaken by suitably qualified consultant to confirm extent of any contamination across/beneath SS from oil leaks and spills and additional remedial measures required. • Implement any additional remedial measures identified following the testing of soil and groundwater.		
4	**Ensuring Safe Storage of Hazardous Materials** Transformer oil being stored haphazardly without any bunding to prevent leakage to ground Storage areas for SF6 gas cylinders and lined facility for transformer oil, and non-hazardous material needs to be improved	**Corporate Level** • Develop and cascade to all SS for implementation a standardized hazardous materials management system/procedure in accordance with national laws and regulations and the EHS Guidelines on Hazardous Materials Management. • Develop as part of system/procedure a checklist for SS managers on correct storage and disposal of transformer oils, other fuel, oil, and chemicals, old transformers, SF6, scrap metals, electronic wastes, municipal solid wastes, and wastewater etc. • Provide training to all SS managers on implementation of the hazardous materials management system/procedure and use of the checklist (document training and attendance by SS managers) • SF6 detection handheld unit must be purchased and made available at each substation. • Drip trays must be purchased and made available at each substation without adequate capacity impermeable bunded storage area.	PGCB corporate office and substation managers, O&M budget Costs of construction of bunded area to be borne by PGCB. PGCB to purchase SF6 detection handheld unit to be made available at each substation etc. Corporate office to provide guidance, training and	Immediately for short term actions with compliance to be confirmed prior to access by EPC Contractor Long term actions; for compliance before handover of bay extension for operation and maintenance is undertaken

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

No	Issues	Corrective Action	By whom/ budget source	By when
		Substation Level In short-term: • Identify and demark in the SS compound an appropriate area for hazardous materials storage yard and for storage of oil barrels, fuel, SF6 etc. • SS manager to provide training to all SS staff (including housekeeping staff) on hazardous materials management system/procedure • Implement housekeeping and hazardous materials management system/procedure to include the (i) segregation of all solid and hazardous waste generated; and (ii) environmentally sound storage of all solid and hazardous materials and waste in dedicated, labelled areas within the premises of substations e.g. proper stacking of SF6 cylinders. • All oil drums and waste oil or empty drums and SF6 cylinders should be moved to the dedicated, labelled storage area. If covered, impermeable 110% bunded area is not currently available on site immediately store all barrels of transformer oil, other fuel, oils, and chemicals temporarily on the drip trays; ideally to be undercover. • Post Material Safety Data Sheets at the storage area. • Ensure all SF6 cylinders have been serviced and remain within the service validity date. • Maintain record of SF6 leakage checks being undertaken, leakage volumes recorded and any SF6 maintenance works etc. In long-term: • Construct a dedicated, covered, bunded, impermeable area to 110% for storage of barrels of transformer oil, other fuel, oils, and chemicals as well as liquid-related waste such as empty oil drums to prevent leakage into the ground and causing pollution.	oversee implementation by SS managers	
5	**Improvement of Fire Safety** Non-availability of and insufficient capacity of foam-based extinguishers for transformer fire Lack of automatic alarm and	**Corporate Level** • Fire extinguishers and other manual firefighting equipment must be purchased for distribution to SS that are requiring them. **Substation Level** **Short term:** • In each working area and building and at any oil storage site provide fire extinguishers and other manual firefighting equipment maintained in good working order and readily accessible – number to be adequate for size of premises,	PGCB corporate office and substation managers, O&M budget Costs to be borne by PGCB for purchase of fire extinguishers, installation/repair of water	Immediately for short term actions with compliance to be confirmed prior to access by EPC Contractor Long term actions; for compliance before handover of bay extension

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

No	Issues	Corrective Action	By whom/ budget source	By when
	fire suppressions system, lack of the water spray/nitrogen-based system for transformer fire.	equipment installed, physical and chemical properties of substances present, and maximum number of people present, to avoid any fatal incident during O&M. • Ensure adequate quantity of foam-based extinguishers for the fire risk. • Erect/repair water spray mechanism for prevention of transformer fires at substations. Long term: • Install/erect/repair automatic alarm and fire suppressions system, water spray mechanism/nitrogen-based system for prevention of transformer fires at substations. • Three substations among the five were noticed without any firewall. Provisions should be made to ensure proper safety mechanisms are insta to isolate the two transformers from any fire risks. Install fire walls to transformers.	spray/nitrogen-based system for transformer fires etc. Corporate office to provide guidance, training and oversee implementation by SS managers	for operation and maintenance is undertaken

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

887. PGCB management and substation in-charge will be responsible for applying any corrective actions under the guidance of the PMU and the SIC unless PMU delegates them to the respective Contractor through the scope of the contract before access is granted for works located within existing substations. PGCB will be responsible for submitting a report confirming the completion of corrective actions to ADB for clearance prior to the Contractor being given access to the existing substation in question to undertake works including site establishment.

888. The Contractor for the contract packages involving existing substations will be responsible for implementing corrective actions that are delegated to them by PGCB as part of their contractual obligations, in addition to the requirements of the EMP mitigation plan which are to be followed whilst undertaking works in existing substations.

12.5 Contractors Site-specific Environmental Management Plans (CSEMPs)

889. The Contractor will be responsible for the development of Contractors Site-Specific Environmental Management Plans (CSEMPs) and H&S Plans, setting out in detail how it will implement the measures listed in the Mitigation Plan and other commitments PGCB has made in this Project EMP. The general measures which will be included within them are described in the ECPs. Contractor will need to obtain PMU approval of its CSEMP and H&S Plan prior to the commencement of works which includes site establishment and vegetation clearance. SIC will support the PMU in reviewing and approving the CSEMPs and H&S including its subplans. PGCB will need to ensure the CSEMP and H&S Plan mirror and do not conflict with the Project EMP requirements and any requirement of national laws and regulations, including environmental clearance requirements. The CSEMP and H&S Plan will be a living document to be updated as required and reapproved by PGCB if construction methods or site conditions change or in response to an accident, near miss etc.

890. The key subplans of the CSEMP which will be prepared and implemented by Contractor will include the following – the H&S Plan is to be a stand-alone plan given its importance but is considered here as a sub-plan:

(a) **Demolition and Construction Method Statements** describing how each activity involved in demolition (as applicable) and construction works will be undertaken (schedule, access routes, anticipated traffic volumes, and working methods) with respect to ensuring compliance with the Project EMP requirements. Specific construction method statement is to be developed for the landfill works with particular attention to how this will be conducted in an environmentally sound manner.

(b) **Temporary Facilities Plan**, including details and the layout of the various temporary construction facilities required including any access roads, offices and workshops, material storage, laydown areas, refueling areas, waste storage areas, rest areas, sanitation and welfare facilities, construction labor camps or overnight accommodation.

(c) **Pollution Prevention Plan**, to be prepared with reference to the IFC EHS Guideline environmental requirements including those on Construction and Demolition.[60] This plan will detail the measures to control noise and vibration and, if required, include separate demolition (if any), piling and blasting management plans. Measures to control dust and air emissions will be included and details of how water resources will be protected, how water discharges including spills and leaks,

[60] https://www.ifc.org/wps/wcm/connect/topics_ext_content/ifc_external_corporate_site/sustainability-at-ifc/policies-standards/ehs-guidelines

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

surface water runoff, bentonite slurry and concrete wash water will be managed. The procedures and designated areas for the environmentally safe and sound storage, transportation and use of fuel, oil, and other hazardous substances, as applicable, will be described. Further, this plan will cover the issue of SF6 management.

(d) **Spoil Management Plan** on the management of excess spoils from various excavation, site levelling and cut and fill activities.

(e) **Piling Management Plan** specifically addressing noise and the management of piling mud and drainage management for all activities where piling is required. Management of drilling and piling muds.

(f) **Waste Management Plan**, detailing the measures required for the environmentally safe and sound collection, segregation, storage, transportation, and disposal of all solid and hazardous waste referring to the IFC EHS Guidelines on Waste Management and Construction and Demolition. The management of sanitary wastewater will be described. The plan will itemise how wastes can be reduced and recycled - disposal will be the last resort[61]. It will identify the suitably licensed reuse/recycling vendors and waste management facilities for the disposal of solid and hazardous wastes to be used by the Contactor. Use of open dump sites for disposal is not permitted and for this reason municipalities must not be relied upon by the Contractor for the disposal of wastes. Note: a separate Asbestos Management Plan will need to be prepared if asbestos is to be expected in the buildings that are to be demolished (no risk is identified to date, but for confirmation by contractor).

(g) **Drinking Water Supply and Sanitation and Welfare Plan**. This Plan will detail measures to ensure adequate water supply and sanitation and welfare provisions for the temporary construction facilities, including offices, rest areas, washrooms, and construction labor camps or overnight accommodation in order not to cause shortages and/ or contamination of existing drinking water sources and to ensure the safe and healthy working conditions for the laborers.

(h) **Occupational and Community Health and Safety (H&S) Plan**. This plan will be informed by a facilitated health and safety risk assessment participated in by PGCB/SIC and the Contractors and detail out workplace and community health and safety measures following the mitigation hierarchy referring to the IFC EHS Guidelines related to H&S and the ILO guidelines/code of practice.[62] Risks of communicable vector borne and viral diseases to also be addressed, including adequate sanitation.[63]

Health and Safety (H&S) Plan will include:

[61] For example, food waste can be composted, Plastic waste – can be reused and recycled, Other domestic waste e.g., cans, paper etc. much of this will be able to be recycled, Demolition waste e.g., bricks, concrete etc. a lot of which can be reused during construction or by others for their construction, Metals – can be recycled, Wood – can be recycled, and Hazardous used oil can be reused providing that it is taken by suitably licensed vendors to do so.

[62] https://www.ilo.org/resource/other/safety-and-health-construction-revised-edition
https://www.ilo.org/sector/Resources/codes-of-practice-and-guidelines/WCMS_861584/lang--en/index.htm

[63] Contractors will provide adequate sanitation and welfare facilities including hand washing and PPE in sufficient quantity on-site and at labor camps/overnight accommodation so workers can follow healthy hygiene practices as well as avoiding conditions for vectors to breed; contractors will also consider local health care facilities' capacity to deal with any infections agreeing with the nearest Health Center and/or Hospital for emergency cares of workers. Medical insurance will be provided by contractors for all workers with sick leave allowance to ensure symptomatic workers do not attend site; avoid no-work-no-pay policies, whereby by fear of not getting paid workers would be tempted to report to work and hide any symptoms.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

a. Safety Training Program – to provide general and specialized training courses for all workers on the site and at all levels of supervision and management. General courses will consist of (i) an initial Safety Induction which all workers will be required to attend prior to being allowed to work on site, all visitors and project workers who have not attended the safety induction course must be always accompanied by inducted workers when within the working area and (ii) periodic safety training refreshers covering similar topics to induction, conducted not less than once every six months. All subcontractor workers will be required to participate in relevant training courses appropriate to the nature, scale, and duration of the subcontract. Since they have heightened risk only trained workers must undertake certain activities e.g., working at height, working in confined spaces, working with electricity etc. Workers must have attended such training before they are involved in relevant works and the contractor must either offer an internal training course or organize for attendance at an external specialist training course. Workers must have a training record of attending a suitable training course. Untrained workers will not be permitted to work at height, enter confined spaces, work with live electricity etc.

b. Medical Check-Up/Health Surveillance – of workers fitness, eyesight, hearing, respiratory health, and communicable and noncommunicable diseases before works commence; and then repeated every six months by the contractor during construction. Only workers who have passed their fitness test and have the requisite medical clearance must undertake certain activities e.g., working with electricity etc.

c. Safety Meetings – to be conducted monthly during construction phase by PGCB. During construction the meetings will require attendance by the safety representatives of all contractors and subcontractors on-site. The minutes of all safety meetings including actions agreed will be taken and sent to PGCB within seven days of the meeting.

d. Safety Inspections – the contractor will regularly inspect, test, and maintain all safety equipment, scaffolds, guardrails, working platforms, hoists and other lifting equipment, ladders and other means of access, lighting and signage, firefighting equipment, first aid kit, stock take and condition of PPE etc. Signs will be graphic and in the languages of workers, kept clear of obstructions and legible to read. Lighting will meet illumination guidelines for the working area as per IFC EHS Guidelines on OHS. Equipment, which is damaged, dirty, incorrectly positioned or not in working order, will be immediately repaired, or replaced, by the contractor.

e. H&S Audit - during construction the contractor's H&S officer and PGCB will undertake monthly audits of compliance with the H&S plan.

f. Personal Protective Equipment (PPE) as a last resort where risks cannot be avoided – workers will be provided (before they start work) with appropriate PPE at no cost to the workers. PPE provided to workers (regardless formal and informal, directly contracted or subcontracted) in accordance with Table 2.7.1. Summary of Recommended Personal Protective Equipment according to Hazard in IFC EHS Guidelines on OHS including safety shoes, helmets, goggles, earmuffs, and face masks and ensure that this is always worn by them with a strict disciplinary system (no work condition if not compliant) being enforced for any non-compliance.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

g. Work Zone Noise Levels: during construction protective measures need to be provided and as per the IFC EHS Guidelines on OHS, Table 2.3.1. sets the level at 85 dB (A) for 8 hours exposure and will be adopted, as well as 140 dB(C) peak/instantaneous noise exposure for workers working near the high noise generating machinery. High noise work areas must be adequately signposted. In these high noise work areas PPE in the form of sound reducing earmuffs/ear plugs to the workers are to be provided. In the first instance however, reduction in noise levels to the lowest practical level must be achieved by adoption of suitable preventive measures, such as, use of enclosures with suitable absorption material, etc. Workers operating in the high noise work areas will be given auditory tests as part of health surveillance.

h. EMF levels at the construction site to be kept within international good practice levels as per ICNRP (reference and peak values) for the occupational exposure.

i. Electricity: IFC EHS Guideline on Electric Power Transmission and Distribution requirements for working with electricity will be observed with only licensed electricians that meet the requirements set out in them allowed to work on live electricity with strict adherence to safety standards including those listed in said guidelines. Live lines will be deactivated and properly grounded before work is performed on, or in proximity, to the lines and this will be checked and certified in writing by the contractor's H&S Officer in advance. While working at heights personal safety measures such as harnesses, tool bags, ropes etc. will need to be provided.

(i) **Traffic Management Plan**. This plan (a subplan of the H&S plan) will be prepared in consultation with the respective authorities responsible for roads and traffic. It will identify the off-site routes to be used, entrances and exits off the public road, procedures for the safety of the local community, particularly pedestrians and vulnerable groups, and mechanisms to avoid traffic congestion because of construction traffic movements and where transmission and distribution line works interfere with the highway. A designated person as the traffic controller, wearing colored vest will be engaged for traffic management.

(j) **Biodiversity Management Plan** setting out procedures for site clearance, tree cutting and earthworks with pre-checks and supervision undertaken by the Contractor's Ecologist plus (i) construction worker prohibitions on fishing, hunting, poaching, etc. (ii) an emergency fauna rescue and handling procedure, including contacts of forest department, nearest veterinary etc. and (iii) measures to avoid the spread of invasive species including the installation of washing stations for the pressure washing of vehicles at construction site entrances. Prior to preparation of the BMP the contractor will have completed the pre-construction ecology surveys required in the mitigation and monitoring plans and prepare a report for submission to PMU/SIC to confirm no unanticipated impacts; this includes bird surveys during appropriate periods round the year for the migratory and local birds in the project area of influence for the works in proximity to waterlogged areas at Pekua (salt pans) and Pakigacha. If required, due to the survey outcomes, the contractor will prepare a Tree Plantation Plan[64] where trees are to be cut confirming details of compensatory plantation. If trees or other notable flora and fauna are present, the biodiversity management plan will confirm

[64] the Contractor shall appoint a part-time ecologist to monitor EMP implementation full-time on-site for the duration of all "Physical Works" involving tree and vegetation clearance activities and prepare tree plantation plan.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

how no net loss of biodiversity will be achieved. The biodiversity mitigation measures will include avoidance of avian electrocution collision with transmission lines through bird sensitive design and the installation of "Bird Divertors" at suitable intervals in locations where birds are determined to be at risk.

Tree Plantation Plan: setting out details of trees to be lost and how the requirement for 1:3 compensatory plantation will be achieved. The plan will be prepared and finalized by the Contractor after the final route selection for the transmission lines. The objective of the tree plantation and replacement programme is to compensate for the loss of trees due to the proposed implementation of transmission lines. The species for the proposed tree plantation have been selected based on the statistics of the lost vegetation and in consultations with the concerned officials of the Forest Department (FD) of respective divisional office. The Contractor will be responsible for planting trees at the selected places as agreed by the PMU and SIC. The Contractor will need to procure and raise saplings until they survive.

(j) **Chance Find Procedure** setting out how damage to existing physical cultural resources will be avoided and the procedure to be followed in the event of a chance find incident. Sample Chance find procedure is described in Appendix XVIII.

(k) **Labor Management Plan** addressing the recruitment and management of the workforce including details of sanitation and welfare facilities, construction labor camps or overnight accommodation per ILO guidelines[65] and a worker code of conduct[66] to ensure workers have appropriate conduct whilst working and living in the local community. It will ensure compliance with the national labor law including that all workers whether formally or informally employed by the Contractor or their subcontractor(s) have a contract, identification card, the right to stop work, and do not work more than the legal working hours; it will discourage the use of daily workers by subcontractors and ensure adequate keeping of wage records. It will address the encouragement of local and women employment as well as measures needed to protect vulnerable worker groups including gender-based violence/sexual exploitation, abuse, and harassment prevention.

(l) **Emergency Preparedness Plan** will be prepared by the Contractor after assessing all potential hazards and emergency scenarios that could be encountered in relation to pollution, floods, health and safety, and security during construction to detail out how they will be quickly and effectively responded to.[67] This includes a sub-plan on flooding management.

[65] https://www.ilo.org/wcmsp5/groups/public/---ed_emp/---emp_ent/---multi/documents/publication/wcms_116344.pdf with particular attention to providing one bed per worker and lockable storage

[66] Code must be informed by the CSEMP and address the following aspects: Zero tolerance in respect of health and safety; Requirement on always wearing PPE on site; Zero tolerance of bribery or corruption; Respect for local community and customs, avoiding community conflict situations; Zero tolerance of illegal and unacceptable activities/behavior, including but not limited to engagement in: prostitution; gender-based violence/sexual exploitation, abuse, and harassment; illegal sale or purchase of alcohol; sale, purchase, or consumption of drugs; gambling; fighting etc.; Alcohol and drugs policy and testing regime; Role of workers in good housekeeping; Role of workers in maintaining good hygiene; Respect of wildlife and the environment; Description of disciplinary measures for infringement of the code of conduct and other employer rules (e.g., immediate removal from site, fine etc.)

[67] Including communication systems and protocols to report an emergency e.g., spills and leaks, health emergency, work-related accident including electrocution, traffic accident, accident involving the community, natural disaster including flooding or cyclones, fire, virus outbreak etc. It will need to be developed in consultation with local emergency services with adequate fire and first aid first-responders based on the construction site to facilitate immediate response. Provide readily available first-aid for workers as well as an ambulance for more serious cases. Make arrangements for a doctor on call and nearest Health Center and/or Hospital for emergency care of workers whether formally or informally employed by the Contractor or their subcontractors. Regular drills will be required involving all workers to prepare for any incident.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

(m) **Stakeholder Engagement Plan** to set out how the Contractor will interact with the local community and other stakeholders, issue advance notice of construction works, and disseminate the GRM, and manage site complaints in line with the GRM for the Project.

(n) **Training Plan** to set out how the Contractor will provide EHS training to its sub-contractors and all formally and informally employed workers on the construction site including daily tool box talks flagging their right to stop work if H&S risks are present, as well as awareness raising activities for the local community.

12.6 Environmental Codes of Practice (ECPs)

891. The following ECPs (Appendix IX) contain general, non-activity- or site-specific measures which need to be integrated into the Contractor's Site Specific EMP (CSEMPs) for implementation during the construction.

- ECP 1: Waste Management
- ECP 2: Fuels, Oils and Other Hazardous Substances Management
- ECP 3: Water Resources Management
- ECP 4: Drainage Management
- ECP 5: Soil Quality Management
- ECP 6: Erosion and Sediment Control
- ECP 7: Top Soil Management
- ECP 8: Topography and Landscaping
- ECP 9: Borrow Areas Management (note that borrow areas and dredging not permitted, only existing licensed sources are to be used)
- ECP 10: Air Quality Management
- ECP 11: Noise and Vibration Management
- ECP 12: Protection of Flora
- ECP 13: Protection of Fauna
- ECP 14: Protection of Fisheries
- ECP 15: Road Transport and Road Traffic Management
- ECP 16: Construction Camp Management
- ECP 17: Cultural and Religious Issues
- ECP 18: Workers Health and Safety (H&S)
- ECP 19: Sulfur Hexafluoride (SF6) Management
- ECP 20: Construction Management in Ecologically Sensitive, Salt Plan, Fish Ponds and Waterlogged Areas

892. Measures in the IFC EHS General and Electric Power Transmission and Distribution guidelines, ADB's Good Practice Guidance for the Management and Control of Asbestos: Protecting Workplaces and Communities from Asbestos Exposure Risks, the ILO Code of Practice on Safety and Health in Construction and worker accommodation are to also be taken on board by the contractor preparing the CSEMPs and the H&S Plans.

12.7 Environmental Mitigation Plan

893. The Mitigation Plan sets out the plan for the avoidance, minimization, mitigation and compensation of impacts and risks during the following three phases:

(1) detailed design and pre-construction;
(2) construction (including demolition of existing small structures);
(3) operation and maintenance.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

894. There are five parts to the Mitigation Plan, as follows, with Parts 2-3 applicable to the respective contract packages:

(1) Part 1: General Mitigation (applicable to all civil works components)
(2) Part 2: New Substations / Bay Extensions
(3) Part 3: Transmission Lines

895. The Mitigation Plan describes the general, activity- and site-specific mitigation measures to address the impacts and risks, which have been identified during the impact assessment, and ensure compliance with applicable national standards and international guidelines (Chapter 2). Performance indicators to check that the measures are being implemented effectively are listed, along with the responsible entities for implementing them and supervising and monitoring their effectiveness (either PGCB, the SIC and/or the Contractors). The Contractors will be contractually bound to implement these measures plus the more general ECPs by incorporating both into site-specific CSEMPs and H&S Plans, as described in the following sections. Measures that must be commenced during the design and pre-construction phase will continue to be implemented by the Contractor during the construction phase. Within the defects liability period of 1.5 years the Contractor will also be responsible for maintenance. Following that, PGCB will take over the responsibilities for both operation and maintenance.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Table 12.4: Environment Management Plan

12.7.1 Part 1 – General Mitigation

General Mitigation								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB[68]	**SIC[69]**	**Contractor[70]**	
Detailed Design and Pre-Construction Phase								
Compliance with national laws and regulations and SPS 2009 requirements	Environmental and social impacts/risks of construction and O&M phase -- lack of management of detailed design, construction and O&M leading to environmental degradation, H&S risks for construction and O&M workers as well the local community	– PGCB and contractor to comply with national laws and regulations including those set out in the EIA/IEE in addition to international good practice e.g., IFC EHS General Guidelines (April 2007), the EHS Guidelines for Electric Power Transmission and Distribution (April 2007), the ILO guidelines on safety and health in construction and the mitigation set out within this table. – Any conditions of the national SCC and ECC[71] and all other permissions or permits required to be complied with by PGCB and contractor throughout the project duration. – The IEE will be finalized to reflect the final selected substation site/routes prior to approval of detailed design, and prior to procurement if substation sites assessed in the draft IEE are changed before bid stage. – PGCB and contractor to comply with the definite version of the EMP which is the version disclosed on	– No breaches of national regulations and/or international good practice guidelines. – No breaches of EMP by PGCB, contractor, subcontractors or other third parties with prompt corrective action taken if required. – Status of EMP compliance documented in EMRs	Upon loan effectiveness for PGCB (prior to contract award in case of advance contracting or third-party works) and contract award for contractor then throughout project implementation	√	√	√	PGCB and Contract Cost

[68] PGCB to implement EMP requirements as well as supervising and monitoring the contractor's implementation of measures delegated to them, including reviewing and approving detailed designs, CSEMPs/H&S Plans and subplans, and other documentation, reporting compliance in EMRs for submission to ADB.
[69] SIC to support PGCB in EMP implementation, supervision, and monitoring of the contractors, the reviewing and approving of documentation, and reporting.
[70] Contractor to implement the measures delegated to them for the duration of their contract period, pre-construction measures are to be completed before the commencement of works and then to implement requirements throughout construction works reporting to PGCB monthly on the status of EMP implementation
[71] Environment Clearance Certificate from DOE

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

General Mitigation								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB[68]	**SIC[69]**	**Contractor[70]**	
		ADB's website. This includes any measures in an updated EIA/IEE following design or any updates in response to unanticipated impacts. Contractors will be responsible for implementing and budgeting for all measures required. – Environmental Quality (including laboratory based tests of Air, Ground Water, Surface Water, Soil, Noise, Vibration, EMF) quarterly monitoring report should be submitted by the contractor upto defect liability period. – Environmental Quality Monitoring will be conducted again by the EPC Contractor at the final selected substation site/routes along with detailed design per the EMoP for all SS and TL, to inform the final IEE. – If there is any conflict between the measures set out in this EMP and the national ECC the most stringent provision is precedent. – Contractors will have in place corporate environment, health and safety policies and corporate environment, health, and safety management system certifications, such as, ISO 14001 for environment, ISO 45001 for health and safety, or equivalent. – Contractors will not engage in any activities described on the ADB Prohibited Investment Activities List in Appendix 5 of ADB's SPS (2009)						
Securing national environmental clearance and other		– PGCB to annually renew ECC informing DOE of any changes in scope and design (submitting copy of updates to EIA/IEE) since it was issued and ensure that all other required national permissions are	All ECC and other permits, licenses, and clearances are obtained prior to commencement of related	Upon loan effectiveness for PGCB (prior to contract award in	√	√	√	PGCB (Contract cost if requested

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

General Mitigation								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB[68]	**SIC[69]**	**Contractor[70]**	
permissions		secured and renewed as needed before the commencement of related works. – Contractor at request of PGCB to obtain permissions as part of their scope of works; and to obtain those permissions which by default the Contractor is responsible to obtain. – Contractor to report to PGCB any tree cutting required that was not originally planned in the EIA/IEE and PGCB/contractor to obtain any tree cutting permit required from Forest Department prior to cutting of trees. A tree plantation plan will be prepared by the contractor for undertaking 1:3 compensatory plantation with the timeline for completion prior to commissioning of substations and transmission lines. – For tree plantation, Quarterly Monitoring Report must be submitted upto the defect liability period, Monitoring and Reporting must be done for 2 years for tree plantation management status and viability assessment by the Contractor after the completion of the work. – Avoidance of tree cutting in the bird nesting season.	work. Copies of these will be included in the EMR for the period in which they were obtained.	case of advance contracting or third-party works) and contract award for contractor then throughout project implementation				by PGCB or to be obtained by default by the contractor)
Procurement of contractors for demolition and construction work and goods supply		– PGCB to ensure the EMP is incorporated in the bidding documents and the final (definitive) EMP cleared by ADB is incorporated into the contract documents for construction works prior to contract award, any updates to it will be incorporated as a contract variation. This includes any site-specific EMP included in an updated EIA/IEE following detailed design or any updates in response to	– Final EMP to be included in bidding and contract documents for construction works. – Relevant clauses in the contract document for works and goods supply contracts.	Prior to issue of bidding documents and contract award	√	√	NA	PGCB

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

General Mitigation								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB[68]	**SIC[69]**	**Contractor[70]**	
		unanticipated impacts. – PGCB to ensure that the requirement to comply with the final (definitive) EMP as well as pertinent EHS requirements form an integral and binding part of the contract, including appropriate incentives and/or penalties for (non-) compliance related to EHS management. – PGCB to ensure that contractors for construction have Bangladesh experience in handling hazardous waste (such as Asbestos if found or contaminated soil) and aware of local guidelines for disposal of demolition or construction muck from sites.	– Copy of EMP related contract extracts will be attached to EMR for the period in which the contract was awarded.					
Detailed design and updates to IEE		– Contractors to ensure that detailed designs reflect the requirements of the EIA/IEE/EMP and international engineering best practice/good EHS practice including site-specific measures where these are required with regards to biodiversity and physical cultural resources as well as other sensitive receptors. – During detailed design contractors to ensure national seismic design requirements are followed especially for buildings and tower foundations; building and structural designs are to be checked for seismic safety by design team and an independent expert separate to design team, to confirm international good practice seismic design standards	– Detailed Design cleared and approved reflects EMP requirements. – ADB informed of any unanticipated impacts identified at any point during project implementation. – IEE updated as required to reflect detailed design and any unanticipated impacts and reviewed and cleared by ADB prior to the start of related works.	Prior to detailed design approval and for implementation during construction	√	√	√	PGCB and Contract Cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

General Mitigation								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB[68]	**SIC[69]**	**Contractor[70]**	
		are met. – During detailed design climate change adaptation measures per ADB's CRA 2024[72] need to be incorporated by the contractors. – Contractor's detailed designs will be reviewed by PGCB's PMU with support of SIC to confirm that all measures required by this EMP have been adequately incorporated in them and that they reflect international engineering best practice/good EHS practice before they are approved. – Prior to the approval of detailed designs PGCB will consult ADB regarding the need to update the EIA/IEE. If required, the EIA/IEE will be updated for clearance and disclosure by ADB before approval of the detailed designs and the start of related works including site establishment. Contractor to support PGCB in respect of any update to the EIA/IEE following detailed design. Update will be required if the contractor adjusts the route alignments that were assessed within the IEE and where bird surveys have been required to be conducted. – If other changes in project scope or design occur during project implementation, or if any unanticipated impacts are identified, contractor to						

[72] For this project a climate risk assessment (CRA) will be carried out that sets out adaptation measures which need to be considered in detail design to improve resilience to heavy rainfall, cyclones, temperature, and floods. Measures incorporated include using temperature devises on transformers, etc. Full details of measures required are detailed in the CRA, 2024 will be disclosed on ADB website as part of RRP supplementary documents.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

General Mitigation								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB[68]	**SIC[69]**	**Contractor[70]**	
		inform PGCB who are to immediately inform ADB of change to determine the need to update the EIA/IEE. – Use of any asbestos containing materials is prohibited. – Use of PCB based oil for transformers/transformer oil is prohibited. – Use of chlorofluorocarbons (CFCs) and halon-based substances are prohibited.						
Construction EHS management planning during pre-construction and location of temporary construction facilities		– Contractor to develop Contractors site-specific Environmental Management Plans (CSEMPs) and H&S Plans including all subplans as required by the EMP to be approved by PGCB with support of SIC incorporating the requirements of (i) this Environmental Mitigation Plan, (ii) the ECPs (Appendix IX), (iii) the conditions of National Environmental Clearance (iv) international engineering best practice/good EHS practices e.g., IFC EHS guidelines including the Construction and Demolition section and ILO Code of Practice, and (v) site-specific measures where these are required with regards to biodiversity and physical cultural resources as well as other sensitive receptors. These will be living documents, to be updated as required and re-approved by PGCB as construction proceeds, if construction methods or site conditions change, in response to an accident, incident, near miss etc. – CSEMPs will include a biodiversity management plan with tree plantation plan, as required. Prior to	– CSEMPs/H&S Plans and all subplans cleared and approved before work are reflective of Project EMP requirements to minimize impacts and risks on EHS during subsequent stages of the project. Copies and any updates to these plans are to be attached to EMR during the period in which PGCB approved them. – Ecological surveys conducted and survey report submitted for PGCB approval prior to preparation of the biodiversity management plan including tree plantation plan, as	Prior to mobilization and site establishment and for implementation during construction	√	√	√	Contract cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

General Mitigation								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB[68]	**SIC[69]**	**Contractor[70]**	
		their preparation the contractor will conduct pre-construction ecological surveys required to inform them (applicable to all components including existing substations) and submit the survey report. – Construction is to only be undertaken on PGCB-owned land and no temporary or permanent relocation to be undertaken unless the resettlement plan is followed. – Contractor to seek to locate all temporary construction facilities required including laydown and storage areas within the boundaries of PGCB land (new or existing substations) except for overnight accommodation for workers that could be provided in existing properties off-site. If other public or private land is required for temporary construction facilities due to lack of space within PGCB land, land use to be negotiated with private landowner, submit land ownership papers and copy of agreement for temporary land use with a photographic record of pre-project condition. Sites that are waterlogged or supporting natural habitat must not be used. Drainage must be installed at all temporary facility locations to avoid waterlogging – the drainage must not exacerbate waterlogging on the adjacent land. – Noisy and dusty facilities or those that may generate sediment laden runoff or wastewater (e.g., concrete batching plant, asphalt plant, refueling areas, labor camps, maintenance yards, storage areas) must be sited at least 500m from residential property and outside biodiversity sites and away from any	required .					

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

General Mitigation								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB[68]	**SIC[69]**	**Contractor[70]**	
		physical cultural resources; pollution prevention equipment must be installed on such facilities. Laydown and storage areas that are not potential pollution sources may be located a minimum of 50m distant, but these must be outside dense habitation, not block accesses or road users. No land requiring extensive landfill or levelling will be used, there will be no clearance of trees/vegetation on land to be used by the contractor. Photographic record of land condition to be undertaken before any works to establish temporary facilities. – Design of sanitation and welfare facilities at construction sites and labor camps/overnight accommodation to conform to IFC EHS general guidelines, ILO's guidance on worker accommodation and national regulations and to be approved by PGCB.[73] Contractors to provide all basic requirements; individual beds and beddings, individual lockers, mosquito nets, artificial lights, natural lights, windows and ventilation, fans, emergency exits, firefighting equipment, kitchen and dining halls, mobile charging points, toilets and washing facilities, potable drinking water, recreational space etc.						

[73] Indoor toilets (one per six staff) with hand washing facilities and if overnight accommodation private bathing area, showers or baths, all connected to existing sewage system or septic tank with soak away; Shaded rest area that is accessible and can accommodate the number of workers on site; Indoor food preparation and separate clean eating area, provision of sufficient fuel supply for cooking other than wood; Enclosed garbage bins for disposal of waste, as burning of waste will be prohibited, and; Potability testing before work commencement, a drinking water supply that meets drinking water standards to be provided etc.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

General Mitigation								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB[68]	**SIC[69]**	**Contractor[70]**	
		– Contractors will determine if they source canned drinking water from an existing commercial supplier (as the preferred option) or provide their own source of treated water for workers; all drinking water provided is to be regularly tested and confirmed to meet drinking water standards. – For sources other than canned drinking water undertake baseline water quality sampling per EMoP to confirm source suitability and, if necessary, provide additional water treatment facilities during construction to facilitate safe drinking water supplies. If contractors use existing or install their own borewell for construction water supply permissions will be obtained from authorities together with agreement of local communities before abstraction. – Contractors will use locally sourced materials as far as practical to reduce transportation, but all raw materials will be sourced only from existing licensed sources e.g., sand and aggregates from quarries or borrow areas which hold ECC with submission to PGCB of all necessary documents such as records of materials used and source with copies of ECC. Contractors will not open any borrow areas or quarries under the project, and will not undertake dredging for river sediment unless approved by PGCB and the EIA/IEE/EMP has been updated. – Contractors to provide adequate facilities for the collection, separation, and storage of construction waste (including from labor camps/overnight						

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

General Mitigation								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB[68]	**SIC[69]**	**Contractor[70]**	
		accommodation) on-site and safe transportation for composting or recycling or disposal through reputable, legitimate, licensed third parties with all waste transfer records retained. Leaving or disposing of construction waste by burying it on-site or disposing of it at unlicensed waste management facilities is strictly prohibited. Unsanitary open dumps are not to be used by the contractor or their third parties for this reason. Respective municipalities must not be relied upon by the Contractor for the disposal of waste since this is likely to result in it being open dumped due to lack of sanitary waste management facilities in Bangladesh requiring long-distance transport for disposal. – Burning of waste is also to be strictly prohibited.						
Consideration of H&S thorough detailed design and construction H&S management planning during pre-construction		– Contractors to undertake facilitated H&S risk assessment with PGCB through a workshop attended by PMU/SIC during the detailed design (and at other key stages) so it can inform both the detailed design and pre-construction preparations, considering both occupational and community H&S risks resulting from subsequent stages of the project. Facilitated workshop will involve the design and construction team of the contractors and PGCB O&M staff. – Informed by the outcome develop a H&S Plan to avoid, minimize and mitigate occupational H&S risks. PGCB will be required to approve the H&S Plan and then ensure their own staff on-site follow it when on site.	CSEMPs/H&S Plans and all subplans cleared and approved before work are reflective of EMP requirements to minimize impacts and risks on EHS during subsequent stages of the project. Copies and any updates to be attached to EMR during the period in which they are approved by PGCB.	Prior to mobilization and site establishment and for implementation during construction	√	√	√	Contract cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

General Mitigation								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB[68]	**SIC[69]**	**Contractor[70]**	
		– Contractors will set up an accident reporting system for any health and safety incidents (near miss, minor, lost time, fatal) involving workers or community to be reported to PGCB within 24 hours of occurrence with a response plan detailing the incident and how its reoccurrence will be avoided. PGCB to then report any lost time or fatal incidents to ADB within 48 hours. Record of all incidents and response taken should include date, time, details of incident, treatment given and outcome, and lessons learnt for the future. Contractors will ensure all workers are covered by medical/accident insurance to pay out in the event of a disability or fatality. Contractor's insurance includes a community liability clause for payment of compensation in case of any accidents because of construction. – Emergency contact number and details for medical, fire, etc. are to be displayed in all construction sites.						
Environmental safeguards staffing and employment of construction workers; environment safeguards training and awareness raising activities	Environmental and social impacts of construction phase -- lack of EHS management capabilities on PGCB and Contractor's part, leading to environmental degradation, H&S risks for	– PGCB to assign ESU to the project and appoint SIC as set out in the EMP institutional arrangements. ESU staff will be delegated authority under the contract to be able to halt construction works if any EHS issues arise. – Contractor to recruit EHS team under an Environmental, Social and Health and Safety (ESHS) Manager and enough EHS Supervisors as set out in the EMP institutional arrangements for onsite supervision and monitoring of environment safeguards implementation daily for the duration of works.	– ESU assigned to the project with PMU supported by SIC. – Contractor equipped with approved EHS team prior to mobilization. – EHS staffing details for period to be included in EMR. – No breach of Bangladesh labor laws and labor management sub-plan	Upon loan effectiveness for PGCB (prior to contract award in case of advance contracting) and contract award for contractor and then throughout project implementation	√	√	√	PGCB and contract cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

General Mitigation								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB[68]	**SIC[69]**	**Contractor[70]**	
	construction workers as well the local community.	– Subcontractors to be required to appoint an EHS representative for each construction site – Use of day labor is to be discouraged, if day labor is used the contractor will have to ensure increased supervision on-site from their side due to increased risks from lack of health and safety awareness etc. – CVs of the contractors EHS team plus team structure to be submitted to PGCB in bid document or immediately on contract award for approval before mobilization. List of staff and copies of CVs to be reflected in the first monthly progress report to PGCB. Any updates to be reflected in the succeeding progress reports. – Maintain administrative procedures for recruitment. – No illegal forced or child labor to be employed in construction with the minimum age for employment on the construction site to be 18 given hazardous nature of works involved – no persons under 18 to be employed. – Working hours to be in accordance with Bangladesh labor laws to minimize H&S risks. – Contractors must not discriminate and must proactively encourage the employment of suitably skilled women on the project. – Contractors must proactively encourage local employment for unskilled roles whilst ensuring suitably qualified and experienced workers for skilled roles; local labor can be used for manual and office work, but precedence must be given to ensuring that all workers are appropriately skilled	under the CSEMPs. – Breakdown of construction worker profiles, plus verifiable proof of age and wage documentation for every worker, insurance certificates and labor related permissions are maintained by the contractor throughout the project. – No incidents/ community complaints related to impacts from influx of workers. – Detailed training plan reflecting EMP requirements developed. – Records of all training activities are retained. Training undertaken will be documented and reported in EMRs including photos and records of participants (including gender breakdown) – Trainings and awareness raising delivered in accordance with the					

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

General Mitigation								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB[68]	**SIC[69]**	**Contractor[70]**	
		given the hazardous nature of construction works. Contractors are to provide construction skill enhancement training to local communities to enhance the skill of local people and help avoid conflict, if skilled workers not locally available. – Contractors to ensure the provision medical/accident insurance for all workers (formal and informal) for the duration of their contracts and 14 days sick leave for all construction workers. – PGCB to prepare a detailed training plan elaborating how training and awareness raising activities required by EMP will be conducted and with the support of SIC conduct required training sessions on EMP implementation and GRM operationalization for all those with management responsibilities to clarify requirements, roles and responsibilities, record keeping and reporting at each stage of the project. Contractor to ensure all members of contractor's EHS team, design team, and construction management team attend trainings. – Contractor to prepare a detailed training plan upon contract award elaborating how training and awareness raising activities required by EMP will be conducted. – Prior to the start of and then throughout construction contractor to conduct training for construction management and provide all workers and visitors onsite, irrespective of them being formally or informally employed by contractor, subcontractor or third-party with an EHS induction before being	training plan. – Contractors and construction workers fully aware of their responsibilities under the EMP through training					

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

General Mitigation								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB[68]	**SIC[69]**	**Contractor[70]**	
		allowed on-site including dos and don'ts in relation to construction site, temporary workers camps, local communities, forests, protected areas, etc. Contractor to ensure topics covered by training and induction will include but not be limited to good housekeeping at all times; environmentally sound waste management practices; hygiene and communicable disease prevention including STDs and HIV/AIDS; sexual exploitation, abuse and harassment prevention; culturally acceptable practices. – Contractor to prepare with guidance of health experts communicable diseases information video/brochures/leaflets for distribution to all workers during induction, covering factual health issues as well as behaviour change issues (e.g., good hygiene) around the transmission and infection vector borne and viral communicable diseases including STDs and HIV/AIDS. – Contractor to prepare with guidance of labor experts a worker Code of Conduct and information video/brochure/leaflet for distribution to all workers during induction addressing culturally acceptable practices etc.						
Establishment of a functioning Grievance Redress Mechanism	Unresolved community grievances and increased conflict due to lack of operational	– PGCB to set up and operationalize a three-layer GRM for local community and workers as set out in the IEE, identifying GRM focal persons and GRC and ensuring all the members are trained on the process. – Contractor's EHS team too operationalize the	– GRM as per IEE operationalized, affected persons aware of its existence and are actively using GRM to raise their grievances.	Upon loan effectiveness for PGCB (prior to contract award in case of advance contracting) and	√	√	√	PGCB and contract cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

General Mitigation								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB[68]	**SIC[69]**	**Contractor[70]**	
	Grievance Redress Mechanism (GRM)	informal site level GRM per the IEE, and support PGCB in resolving and addressing grievances entering the formal GRM, keep record of all grievances registered, status, time taken for redressal and outcomes, etc. Nominate a GRM Focal Point for each construction site who will keep affected persons and local communities informed of the status of work and be readily available onsite to receive, document and deal with grievances at site level. – PGCB and contractor to ensure GRM as well as the GRM process and means to submit a grievance is communicated verbally to the community (especially those within 50m of SS and 500m of power line works)[74] before commencement of works. Information on GRM to be disseminated through community meetings, one-on-one consultations, posters, leaflets, brochures, SMS, or sign boards in prominent areas. Contractor to provide notice boards at all substations, construction site offices and active work sites including highly visible details of the GRM including the name, designation, contact numbers including phone/SMS/What's App, address of both the PGCB and contractor's GRM focal persons plus the timeline and process of redressal together with a suggestion box that is regularly checked for any grievances received.	– 100% of grievances received are recorded and resolved in a timely manner as per GRM process; no unresolved grievances. – Records to be kept of all grievances received and their resolution for reporting per the IEE. – Details of GRM being operation, including photos of awareness raising activities to be submitted in EMR. – Details of all grievances received and resolved during the period to be reported in EMR.	contract award for contractor				

[74] 50m from substations and 500m of TL ROW is the project area of influence that was adopted for the IEE.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

General Mitigation								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB[68]	**SIC[69]**	**Contractor[70]**	
		– GRM will be available to all workers for receiving and handling complaints about unfair treatment or unsafe living or working conditions, ensuring no coercion nor reprisal. Construction workers will be given access to register any grievances with the contractors or direct access to the PGCB GRM Focal person. – Contractor to carry out awareness raising among workers on the GRM at the start of employment onsite, including details on how to submit a grievance, process, and timeframes including disseminating GRM contact details on noticeboards and placing suggestion boxes at construction site offices and at employer provided staff accommodation. – PGCB and contractor to encourage affected persons to use the GRM but also clarify that the GRM can run in parallel with legal redress. PGCB and Contractor to inform about ADB's Accountability Mechanism as the last resort.						
Meaningful consultations, information disclosure and community awareness raising activities	Unresolved community grievances regarding disruption and disturbance and increased conflict due to lack of communication with the local community	– PGCB to prepare a detailed stakeholder engagement plan for meaningful consultation with the local community (especially those in 50m of substations and 500m of power line works) before commencement of works. – No work will start on site until PGCB has locally disclosed the IEE on their website with executive summary translated into Bangla and placed hard copies at construction site offices. Copies of the executive summary in Bangla will be printed and	– Stakeholder engagement plan prepared, and IEE is locally disclosed and accessible to affected persons. – Details of all consultations and awareness raising activities undertaken by PGCB and contractor documented and reported	Upon loan effectiveness for PGCB (prior to contract award in case of advance contracting) and contract award for contractor and then throughout project implementation	√	√	√	PGCB and contract cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

General Mitigation								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB[68]	**SIC[69]**	**Contractor[70]**	
	regarding project impacts and risks	disseminated through community meetings, one-on-one consultations, or sign boards in prominent areas. Hard copies and translation to Bangla of the full IEE are to be provided by PGCB upon request by affected persons. If an IEE update is required, it will be similarly disclosed as will findings of EMRs. – Contractor to consult with and seek agreement of landowners and local communities within 500m on proposed locations for any temporary labor camps, site offices, storage areas, areas for waste management, etc. – Contractor to consult with and seek agreement of local communities to temporarily use any community resources (e.g., water supplies) during construction to identify any potential conflict, if additional demand may place stress on community resources plan for alternative sourcing for these resources for project needs. – Contractor to consult with local communities and other concerned stakeholders including local government officials and public utilities as well as the local police and municipalities during design in order that any concerns raised can be reflected in the choice of SS site layout, route alignment and construction method, contractor to continue liaising in construction. – Contractor to communicate at least four weeks (one month) prior to the commencement of works advance notice to local communities. This is to be done verbally through local government offices and	in EMRs including photos and records of participants (including gender breakdown). – Local communities and other concerned stakeholders kept informed throughout project implementation, and aware of construction, providing with awareness raising etc.					

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

General Mitigation								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB[68]	**SIC[69]**	**Contractor[70]**	
		community meetings, one-on-one consultations, posters, leaflets, brochures, SMS, or sign boards in prominent areas about the agreed schedule of and details of the planned construction works including its anticipated impacts, such as traffic disruption (road closures, diversions, including notices/signs on either end and marking of the diversion routes) to help manage any disruption and disturbance to and potential conflicts with local communities. Contractor to continue with consultations with affected persons who will be most impacted (in 50m of substations and 500m of power line ROWs) on at least a weekly basis to keep them fully informed of the nature of works and schedule. They will be specifically notified about the commencement of works and any high dust or noise activities (especially demolition, earthwork and piling work) – Contractor to undertake construction safety community awareness raising activities in local affected communities within 50m of new substations and 500m of power lines routes, especially with schools. – Contractor to undertake electrical safety community awareness raising activities in local affected communities within 50m of new substations and 500m of power lines routes, and especially with schools, awareness raising activities to be repeated on completion of construction; to include electrocution risks, EMF, corona noise, etc. The awareness sessions should provide information						

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

General Mitigation								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB[68]	**SIC[69]**	**Contractor[70]**	
		regarding the findings of the IEE on EMF and specifically discuss best practice reference limits for EMF and how they have been applied to the Project. – Community awareness by PGCB will use distribution of posters, leaflets, and safety booklets to all households in Bangla within 50m of the substations and 500m from power line routes in addition to face-to-face awareness raising by the contractor. These posters and safety booklets will also be available to pick up within substations, local PGCB offices etc. – Contractors to distribute leaflets/pamphlets/posters to the local community covering (i) health awareness including STDs and HIV/AIDS and other vector borne and viral communicable diseases, and (ii) the conduct of construction workers that can be expected.						
Construction Phase								
Onsite construction activities in general including works for temporary facilities	Environmental and social impacts of construction phase -- lack of management of construction leading to environmental degradation, H&S risks for construction workers as well the local community.	– Contractor to comply with EMP including EMoP and the approved CSEMP/H&S Plans (including all subplans) along with the IFC EHS Guidelines and ILO Code of Practice during construction. – PGCB to undertake at least weekly checks of EHS activities on active construction sites ensuring at least monthly supervision visits as well as periodic "spot check" site visits to all contract packages whilst directing supervision efforts towards the most environmentally sensitive components of the project. – Contractor to ensure each active construction site has an EHS Supervisor on site full time with responsibility for ensuring EMP implementation on	– No breaches of national regulations and/or international good practice guidelines. – No breaches of EMP by PGCB, contractor, subcontractors or other third parties with prompt corrective action taken if required – Compliance with EMP documented in Contractor's monthly	Throughout construction	√	√	√	PGCB and contract cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

General Mitigation								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB[68]	**SIC[69]**	**Contractor[70]**	
		their site with enough H&S supervision capacity as per the EMP institutional arrangements. – Contractor's EHS team will oversee EMP implementation and provide guidance on corrective actions. The contractor through the EHS team will document activities and compliance with EHS and conditions onsite through photos and written records. – The contractor will comply with any corrective action plan required and cover the costs where corrective action is required due to noncompliance on behalf of the contractor, its subcontractors or third parties. – Contractors will ensure all their subcontractors and third parties, irrespective of being formally or informally employed by them, also comply with the EMP and any updates to it, as well as their own CSEMP/H&S Plan and that this responsibility is cascaded down any chain involved. Provisions will be incorporated into all sub-contracts to ensure compliance with the EMP and CSEMP/H&S Plan and all other subplans at all tiers; all will be given a copy of the IEE/EMP and CSEMP/H&S and all other subplans. – Contractors will put in place appropriate incentives and/or penalties for (non-) compliance by subcontractors and workers related to the use of PPE, prohibition on firewood, fishing by workers or poaching birds etc. – Land filling activities should receive increased environmental supervision from the contractor and	progress reports – Status of EMP compliance documented in EMRs					

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

General Mitigation								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB[68]	**SIC[69]**	**Contractor[70]**	
		PGCB to ensure environmentally sound construction methods are being used at all times especially if sucontractors are used. – Piling activities should also receive increased EHS supervision attention from the contractor and PGCB to ensure safe and environmentally sound construction methods are being used at all times especially if sucontractors are used. – All equipment and machinery used during construction to be of modern design, maintained in good condition, and with secure and strong health and safety guards installed around moving parts and kept in use at all times. – Fuel, oils and lubricants for operating equipment and machinery must be kept on the drip trays whilst in use on site. – Stack emissions of any temporary diesel generator set (including back up suppliy at substations) or hot mix to comply with national emission standards with the stack height design according to both GoB requirements and international good industry practice (as per IFC EHS General Guidelines).						
Environment safeguards training and awareness raising activities	Environmental and social impacts of construction phase -- lack of EHS management capabilities on PGCB and Contractor's part,	– Contractors to ensure workers with a specific role have, before been allocated the task, attended specialized health and safety trainings related that role e.g., health and safety stewards, first aiders, fire safety officers, as well as ensuring workers have received task-specific trainings for working at height, demolition, working with electricity, etc. – Only allow suitably trained and qualified workers to	– Records of all training activities are retained. Training undertaken will be documented and reported in EMRs including photos and records of participants (including gender	Throughout construction at least weekly basis	√	√	√	Contract cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

General Mitigation								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB[68]	**SIC[69]**	**Contractor[70]**	
	leading to environmental degradation, H&S risks for construction workers as well the local community	work on electrical equipment and at height, these workers must have training record of attending suitable training course on electrical safety and working at height and be provided with and wear the appropriate PPE for their role. Untrained workers must not be permitted to work with either live electricity or at height. – During construction site and activity specific risk assessments to be undertaken prior to the commencement of related work to identify the hazards present and applicable measures to be followed. – Contractor to undertake regular, compulsory awareness raising activities for all workers related to the EMP, including short monthly EHS refresher sessions, daily toolbox talks and posting of information at construction site offices, labor camps, and all work sites etc. – Contractors to conduct regular emergency preparedness and response drills involving all workers irrespective of them being formally or informally employed by contractor, subcontractor or third-party to prepare them in case of an environmental or health and safety incident including fire, spillage, natural disaster, disease outbreak, etc. – Emergency preparedness and response training for construction management will include modules on first aid and fire safety including training on how to use first aid and firefighting equipment provided on-site.	breakdown) – Trainings and awareness raising delivered in accordance with the training plan. – Contractors and construction workers fully aware of their responsibilities under the EMP through training					

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

General Mitigation								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB[68]	**SIC[69]**	**Contractor[70]**	
		– All construction workers to be made aware of the chance-find procedure and types of finds to be reported. – Driver training to include advice on behaviour to reduce the potential for disturbance, including use of horn, loud radios with windows open, switching engines off when not in use, strictly observing speed limits and not accelerating or braking aggressively.						
Construction workers	Upholding of the labour rights of construction workers to maintain H&S	– Contractor to allow collective bargaining and ensure that national labor law and ILO core labor standards are upheld. All workers receive at least the minimum wage as defined by national legislation and additional work hours are adequately compensated. Workers operate within legal working hours; no more than 60 hours per week. All overtime hours are voluntary; coercion, threats or penalties are not used to pressure the workers into overtime.	No breach of Bangladesh labor law or labor management sub-plan under the CSEMPs.	Throughout construction	√	√	√	Contract cost
Site clearance and earthworks including works for temporary facilities	Impacts to soil and vegetation cover, loss of biodiversity habitat and disturbance to flora and fauna	– Ensure clear demarcation of the working area and avoid encroachment outside the agreed impact area. Implement careful construction practices to avoid damage to trees. Vehicle movements to be restricted to demarcated working areas to reduce unnecessary impacts to adjacent land. – Demarcation of trees to be avoided and retained as per the Tree Plantation Plan. – Only marked trees are to be felled after joint verification with PMU and approval of tree list. In case tree cutting is required, PGCB to secure the necessary permit from the Forest Department and schedule tree cutting/trimming outside the bird	– EMP/CSEMP requirements successfully implemented as determined through regular site checks, photographic record etc. – No outstanding grievances related to impacts on biodiversity etc.	Throughout construction	√	√	√	Contract cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

General Mitigation								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB[68]	**SIC[69]**	**Contractor[70]**	
		breeding season with all trees checked by an ecologist for nesting birds and other fauna prior to being cut. Similarly, any burrows will be checked for fauna by an ecologist before any earthworks commence. – Record all trees removed during construction, compensation paid, and replacements at 1:3 planted (including location, species, size, and economic value) in accordance with the Tree Plantation Plan and monitor their current health and survival status, trees to be planted as early as possible but latest before commissioning to ensure maintenance for 1.5 years following plantation. – Use of herbicides or burning to clear vegetation is strictly prohibited. Cut/trimmed trees and other vegetation trimmings will be immediately removed from the site. No dumping of cut vegetation onto agricultural fields. – Minimize removal of existing vegetation and topsoil. Excavated spoil to be reused as a landscaping material. Topsoil disturbed will be separately stored and used to restore exposed surfaces which will be promptly revegetated with native species including areas used for temporary construction facilities. If topsoil is stored for more than six months, the stacks will be monitored for anaerobic conditions and manual aeration will be undertaken if they develop. Topsoil storage areas will be protected from vehicle movements to avoid soil compaction. – Carry out works during the dry season to minimize						

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

General Mitigation								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB[68]	**SIC[69]**	**Contractor[70]**	
		soil erosion and sedimentation and in wet conditions minimize the use of heavy machinery. Consideration of the temporary use of removable steel plates to protect soil and its vegetation cover especially in locations that are subject to being waterlogged. – Construction lighting to be directional avoiding spill outside the working area at all construction sites and noise attenuating screens to be erected to avoid disturbance to wildlife in areas flagged in the IEE. – Strict prohibition of cutting of fuelwood or timber for cooking and heating by the construction workers. Contractor to provide alternative fuel source (e.g., kerosene/LPG) which will be stored safely. – Trainings will be provided to workers on identification of threatened species, dos and don'ts in relation to disturbance to local and migratory birds, prohibition on illegal activities including poaching, and regarding chance encounter with wild animals (especially those species that can be dangerous to human like snakes, etc.) at site or in the labor camp and wildlife rescue protocols; contacts for any wildlife rescue will be displayed in the construction office and labor camp – Construction activities to be scheduled to avoid high rainfall periods when drainage may become congested and result in flood, drainage connectivity and the natural flow of waterbodies must not be obstructed or diverted to another direction.						
Transportation, use of	Impacts due to dust and vehicle	– Construction equipment and vehicles to meet national emission standards including for air and	– EMP/CSEMP requirements successfully	Throughout construction	√	√	√	Contract cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

General Mitigation								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB[68]	**SIC[69]**	**Contractor[70]**	
construction plant, demolition and earthworks including works for temporary facilities	emissions on air quality Impacts due to construction noise	noise. – A provision for a daily log sheet to document dust suppression activities, which will be shared with PMU/ADB through periodic monitoring reports. – Avoid the use of diesel- or petrol-powered and use mains electricity or battery-powered equipment where practicable. – Belching of black smoke prohibited, use diesel fuel that has a low sulfur content, less than 0.1%. – Use low noise generating equipment e.g., less than 55dBA sound pressure level at 1m. – The use of horns in areas where sensitive receptors are located (houses, schools, clinics, mosques, etc.) will be prohibited. – Regularly check and maintain construction equipment and vehicles to keep them in good working condition as per the manufacturer's specifications to meet emission standards. Record all maintenance works undertaken. – Vehicles shall not be left running idle for more than 5 minutes. – Regular sprinkling of water to be undertaken for dust suppression at the construction site (excavations, earthen or otherwise dusty access roads, and material stockpiles). (i.e. 3 times per day but more often if needed during traffic movements, earthwork, dry or windy conditions) but avoid overwatering as it can make for muddy conditions. – A designated person, traffic controller, wearing colored vest will be engaged for traffic management.	implemented as determined through regular site checks, photographic record etc. – No exceedance of air quality or noise levels (Appendix X, and ECP 11) or increase in baseline air or noise pollution levels where they are already exceeded. – No outstanding grievances related to impacts from dust, air and noise pollution.					

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

General Mitigation								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB[68]	**SIC[69]**	**Contractor[70]**	
		– Stockpiles of spoils and other dust generating materials to be kept to a minimum. Cover stockpiles with tarpaulin. Locate stockpiles as far away as possible from residential property to avoid inconvenience from fugitive dust and from waterbodies to minimize pollution. Ensure they are enclosed by a solid fence or equivalent to avoid windblown dust and sediment laden runoff entering waterbodies. Minimize double handling and drop loads. – Remove materials that have the potential to produce dust from site as soon as possible, unless being re-used on site. If they are being re-used on-site cover, seed or fence stockpiles to prevent wind whipping. – Trucks transporting any loose materials or loose spoil from construction sites to local approved disposal sites will be covered with tarpaulin to reduce dust. – Position any stationary emission sources (e.g. diesel generators, compressors, etc.) as far as practical from sensitive receptors (houses, schools, clinics, mosques, etc.) – Only use cutting, grinding, or sawing equipment fitted or in conjunction with suitable dust suppression techniques such as water sprays. – Impose speed limits on construction vehicles to minimize exhaust and dust emissions along areas where sensitive receptors are located (houses, schools, clinics, mosques, etc.) – 10km/hr on site and 30km/hr on unpaved roads otherwise per the						

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

General Mitigation								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB[68]	**SIC[69]**	**Contractor[70]**	
		national limits. – Clean dust from access roads daily and then once after all construction work is completed. – Strictly prohibit the burning of waste generated by project-related activities. – Ensure workers working near or having long exposure to vehicle exhausts and earthworks are provided with clean N95 dust masks to avoid inhalation or particulate matter and other pollutants.						
Use of materials in construction works including works for temporary facilities especially fuel, oil and chemicals	Generation of construction wastes and use of hazardous materials	– In locations where waste is dumped (existing site conditions) the contractor will clean the site and collect the waste for onward disposal before they commence their works. – Contractor to provide adequate facilities for handling and storage of construction materials to reduce the amount of waste that is caused by damage or exposure to the elements and a system for the collection/storage of wastes generated. Provide a central covered warehouse for storage of construction materials etc. Only volumes of material required for the day's work will be stored on-site – Fuel, oil, and chemicals used to be kept under lock and key and stored in labelled, sealed containers on drip trays to provide secondary containment. Waste oil to be stored in drums and similarly stored. In designated storage areas, these will be located on an impermeable 110% bunded surface and be under cover. – Mount construction plant and equipment containing oil and diesel on drip trays to catch leaks – all diesel	– No deterioration in soil and water quality from baseline levels – EMP/CSEMP requirements successfully implemented as determined through regular site checks, photographic record etc. – No outstanding pollution or waste related grievances from local communities or other interested stakeholders	Throughout construction	√	√	√	Contract cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

General Mitigation								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB[68]	**SIC[69]**	**Contractor[70]**	
		operated equipment to have self-contained fuel tank. – Provide spill prevention kits (sorbent pads, loose sorbent material, etc.) at storage areas and other at-risk locations within clearly labelled containers to immediately confine any spills or leaks that occur. – Provision of designated hard standing areas for equipment servicing, refueling and wash down at least 50 m from surface water and groundwater wells, with drainage directed through oil and grease interceptors before being discharged into a settling pond prior to discharge offsite. – No wastewater will be discharged direct to surface waterbodies or groundwater without adequate treatment. Use of pit latrines is prohibited as is open defecation and urination. Provision of adequate on-site sanitation facilities including connection to existing sewerage system linked to a wastewater treatment plant, septic tanks with soak-aways or alternative temporary sanitary facilities that do not allow untreated disposal of sewage to adjacent water bodies e.g., portable toilets where the wastewater generated is enclosed in a container and will later be taken offsite for wastewater treatment and disposal. – Minimize waste generation, restrict use of plastics and polyethene and use recyclable/biodegradable materials during construction to the extent possible. Ensure that the waste hierarchy is followed including prevention, minimization, reuse and recycling -- maximum reuse and recycling of waste.						

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

General Mitigation								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB[68]	**SIC[69]**	**Contractor[70]**	
		– Any plant or equipment that is rejected during the installation and commissioning due to damage or failure to immediately be removed from the site and returned to the supplier. – Constructions wastes, rejects, parts, etc. are not to be dumped outside substation boundaries or in drains/khals/beels/rivers or on agricultural land but stored for disposal in a temporary designated storage area. – It must be ensured that spoil reused on site is not contaminated with solid and hazardous waste (including oil spills) by maintaining good housekeeping and waste segregation/storage/transport/disposal. If spoil is contaminated it will need to be taken off site by a licensed waste management operator for disposal at a licensed waste management facility suitable for accepting hazardous waste. – Records of excavated spoil, generated waste, and transfer records will be kept by the contractors. Contractors will keep copies of the waste management company's licenses on file at the site office. Document all volumes and types of wastes generated and removed off site (inert, solid, hazardous) using transfer notes, to be taken by licensed waste contractors who should reuse/recycle or dispose of the waste according to type to suitably licensed and engineered waste management facilities. Spoil that is not required on site can be used by local communities if not						

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

General Mitigation								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB[68]	**SIC[69]**	**Contractor[70]**	
		contaminated. – Collect and transport construction waste to appropriately engineered and licensed solid/hazardous waste management facilities. Unsanitary open dumps and are not to be used by the contractor. Municipal waste collection systems must not be used as this is likely to mean that the waste is open dumped. Hazardous waste will need to be safely and soundly separately stored for disposal to suitably licensed hazardous waste management facilities. Contractor will identify the suitable vendors/facilities to take the waste generated for approval by the PMU.						
Onsite construction activities in general including works for temporary facilities	Health and safety risks to workers and the community	– Contractor is responsible for ensuring H&S of everyone on construction site including visitors and sub-contractor workers regardless they have been formally or informally employed. – Ensure adequate health and safety supervision is always on site (if staff temporarily off sick or on short term leave of less than a fortnight contractor to provide a named alternate in advance; if safeguard staff are on longer term leave, are posted elsewhere, or resign, contractor to ensure replacement CV is submitted to PGCB in 7 days of the contractor becoming aware with the staff joining the site within one month) – Require workers to confirm they have seen and understood the requirements of the health and safety plan before proceeding with the work. – Construction plant and equipment used on or	– EMP/CSEMP requirements successfully implemented as determined through regular site checks, photographic record etc. – No outstanding health and safety grievances from workers, local communities or other interested stakeholders	Throughout construction	√	√	√	Contract cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

General Mitigation								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB[68]	**SIC[69]**	**Contractor[70]**	
		around the site will be modern and fitted with appropriate safety devices. – Ensure adequate health and safety signage is provided – using graphics and in Bangla and other languages of the workers found on site. – Ensure shaded rest area with 4 liters of drinking water per worker and toilets that are easily accessible and can accommodate the number of workers on site. – MSDS or equivalent data/information in Bangla and other languages of the construction workers are to be readily available to any exposed workers and the first-aid personnel. – Ensure good housekeeping at construction site, storage areas, staff accommodation, etc. -- to be kept neat and tidy, e.g., no materials, equipment, trash laying around, cleanup worksites so that they are free of debris on daily basis. – If works are not completed within the day the contractor must not leave any hazardous conditions (e.g., unsigned, unfenced, and unlit open excavations without means of escape and emergency contacts in case an accident occurs) overnight unless absolutely no access by public can be ensured. – In the dense areas transport equipment only during non-rush hours i.e., avoid the hours of 6am to 8am and 4pm to 6 pm to minimize traffic congestion. – Road safety standards and norms to be strictly implemented by contractor, construction vehicles to						

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

General Mitigation								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB[68]	**SIC[69]**	**Contractor[70]**	
		strictly follow road regulations – During construction works, ensure qualified first aider and trained fire marshal is always available on-site with an appropriately equipped first aid kit and appropriate fire extinguisher and other firefighting equipment immediately available for use. – Provide an ambulance for more serious cases to transport the patient to the hospital for treatment – Emergency contact number and details for medical, fire, etc. are to be displayed in all construction sites. – Construction workers to be given medical checkup per statutory requirements before being allowed on site; medical records are to be maintained by the contractor's labor officer.						
Site reinstatement including of temporary facilities	Unanticipated damage to existing public and private property	– A photographic record will have been made of the pre-construction condition of land used for temporary facilities before construction to inform the reinstatement works. After completion of the construction work any temporary structures will be completely removed and the temporary land will be restored to its earlier condition with all waste being removed. – All spoil and construction waste and scrap material must be removed on the completion of works and temporarily disturbed sites restored back to their earlier condition. Roads and footpaths utilized to be cleaned and restored back to their previous condition satisfactorily to the community which is using them. – All planned and unanticipated damage to existing	– Land reinstated to its former condition as compared to photographic record. – No grievances regarding reinstatement of land and property to its former condition.	On the completion of construction works prior to handover to PGCB	√	√	√	Contract cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

General Mitigation								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB[68]	**SIC[69]**	**Contractor[70]**	
		public and private property will be restored to pre-project condition and/or compensated at the cost of the contractor.						

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

12.7.2 Part 2 – New Substations and Bay Extensions

New Substations and Bay Extensions								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
Detailed Design and Pre-Construction Phase								
Connection to Existing Substations	Environmental audit has identified gaps in EHS management at existing substations for bay extensions resulting in pollution, health and safety risks	– PGCB to undertake the corrective actions set out in the Corrective Action Plan (CAP) for existing substations to which lines will have bay extensions prior to allowing the contractor access to them to start work. Contractor at request of PGCB to address corrective actions as part of their scope of works. – If asbestos is identified but does not need to be disrupted and is not weathered and appears in good condition, consider leaving it where it is, as main health risks occur when asbestos is moved. If any asbestos will be disturbed by construction works, it must be removed following national requirements and international good practice per EHS General Guidelines on OHS and ADB Good Practice Guidance for the Management and Control of Asbestos and disposed of as hazardous waste material. – SIC to submit a report, including photos for each existing substation, on the status of corrective action implementation, compliance with national laws and regulations, and consistency with SPS 2009 requirements to validate PGCB's compliance with the CAP and submit to ADB for clearance. CAP must be fully implemented and PGCB must receive ADB clearance of this report before the	Implementation of the corrective action plan, all existing facilities (substations) meet national laws and regulations and are consistent with SPS 2009 requirements prior to the contractor being allowed access to them	Prior to access being granted to the contractor	√	√	TBC	PGCB

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

New Substations and Bay Extensions								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		contractor is given access to an existing substation to start work. – Once the contractor has taken access then any non-compliance at the existing substation will become their responsibility so they must ensure they are satisfied CAP is completed by PGCB.						
Substation detailed design and construction EHS management planning during pre-construction	Environmental and social impacts of construction and O&M phase -- lack of management of detailed design, construction and O&M leading to environmental degradation, H&S risks for construction and O&M workers as well the local community	– Designs to reflect the requirements of the EMP and international engineering best practice/good EHS practices – Detailed design to ensure works will only take place on modified habitat found within the boundaries of the allocated substation land. – Detailed design to minimize the need to cut mature trees that are present at the substation sites – Detailed design to minimize visual impact and clutter with buildings in keeping with the local vernacular. Landscaping to be included as part of the detailed design to enhance ecology and visual appearance of the substation. – Take a life-cycle approach to detailed design, considering the use of construction materials and the energy and water efficiency of the building during operation adopting the “green building” concept e.g., using natural ventilation for reducing the need for air conditioners. Detailed design is to include rainwater harvesting. – Detailed design to ensure all lighting is of energy efficient LED type with solar powered LED lighting	Detailed Design cleared and approved reflects EMP requirements to minimize impacts and risks on EHS during subsequent stages of the project	Prior to detailed design approval and for implementation during construction	√	√	√	PGCB and Contract Cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

New Substations and Bay Extensions								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		where practical Use of fluorescent/HPSV lamps will be avoided since they are less energy efficient/classed as hazardous waste for purposes of disposal. – Outdoor lighting to be installed must be of low intensity with little or no blue wavelength and operated using passive infrared (PIR) technology movement sensors set at person height so as not to be kept permanently on overnight, it must be directional and shielded, so light does not fall outside the site boundary. Outdoor yard lighting must be placed in a manner that does not project light into adjoining areas as this could disturb biodiversity or occupants of houses near the vicinity of the substation. – Ensure that all substation equipment is raised on foundations located above the flood level including an allowance for climate change plus freeboard. – Construction method statements for landfilling activities must ensure a robust containment wall or bund is installed and that the excess water from sand fill is evaporated or infiltrates to ground, there must be no drainage to or waterlogging of adjacent land and no drainage to or sedimentation of adjacent waterbodies. – Drilling and piling mud must be managed to avoid it being discharged to adjacent land and untreated to waterbodies.						

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

New Substations and Bay Extensions								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		– Substations that are in proximity to waterbodies, including salt pans, or waterlogged areas, and residential or other sensitive properties need to ensure drilling or piling noise and mud is managed to avoid adverse effects on water quality, ecology and the adjacent land and local community.						
	Emissions of SF6, a potent greenhouse gas, to the atmosphere	– Use of alternative insulation medium (such as Hydrophobic Cycloaliphatic Epoxy) to be considered as the preferred option. – The leakage of SF6 in gas insulated equipment must be minimized. – Detailed design of SF6 insulated equipment (e.g., switchgear) and AIS substations will comply with international norms and standards for handling, storage, and management of SF6. – SF6 insulated equipment and AIS will be hermetically pressure sealed “sealed for life” units, tested and guaranteed by the supplier at less than 0.1% leakage rate. – Equipment purchased by PGCB or the contractor for use on the project is to be accompanied by letter from the manufacturer stating that it meets these requirements. – Substations with SF6 insulated equipment to be equipped with a Leak Detection System (LDS) for SF6. This will be designed such that any leakage of SF6 will trigger an alarm to the nearest concerned O&M location so that staff may	Detailed Design cleared and approved reflects EMP requirements including leak detection system with copies of equipment purchase letters included in EMRs, all SF6 project equipment must have <0.1% leakage rate etc.	Prior to detailed design approval and for implementation during construction	√	√	√	Contract Cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

New Substations and Bay Extensions								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		immediately rectify any leak. – Provision of SF6 leakage detection kit at each substation is mandatory. – SF6 emergency response plan to be prepared by contractor for construction. PGCB in relation to operation to deal with event of an accidental leak.						
	Pollution of soils and water due to discharge of transformer oil or other fuel, oil or chemicals into the environment due to spills or leaks or discharge of wastewater from substation washrooms	– Use of PCBs will be prohibited in all new transformers and other substation equipment. Equipment purchased by PGCB or the contractor for use on the project is to be accompanied by letter from the manufacturer stating that it is guaranteed PCB free and to be labelled as PCB free before its installation. – Contractor to provide PGCB with Material Data Sheets for insulating oil meeting technical specifications for use in new transformers. – Toilets/washrooms to be connected to either existing sewerage system (connected to a sewage treatment plant) or to septic tank with soakaway sufficient distance from waterbodies – any discharge to surface water must meet the project effluent quality standards (Appendix X, and ECP 1 & 16). – Detailed design of substations to locate new transformers, storage areas and septic tanks/soakaway as far away as possible from any surface waterbodies and groundwater sources to reduce pollution risk. If within 500m of surface	Detailed Design cleared and approved reflects EMP requirements with copies of equipment purchase letters and MDS included in EMRs.	Prior to detailed design approval and for implementation during construction	√	√	√	PGCB and Contract Cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

New Substations and Bay Extensions								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		water or groundwater well further assessment to be carried out by contractor to demonstrate using a source-pathway-receptor model there will be no adverse impact on aquatic ecology or human health. – Detailed design of transformers and fuel, oil chemical, and waste storage areas to incorporate impermeable concrete surface bunded to 110% volume which is not connected to the drainage system to collect spills and leaks. – Detailed design of fuel, oil chemical, and materials and waste storage areas to provide for a covered storage area of sufficient size to accommodate all anticipated storage requirements with segregation of wastes, ensure storage areas can be locked, are well-ventilated and will not reach extreme temperatures. Ensure space also provided in the storage area for solid and hazardous waste garbage bins to be stored. – Provide spill prevention kits (sorbent pads, loose sorbent material, etc.) at storage areas and other at-risk locations within clearly labelled containers. – Conduct a flood and drainage risk assessment and incorporate effective drainage design (allowing for climate change) to prevent possible flooding or waterlogging of the substation during the wet season, whilst ensuring that surface runoff from the project site is no more than the existing site runoff						

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

New Substations and Bay Extensions								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		rate. – Substation design must ensure that existing drainage flows/drains/culverts are not blocked and avoid exacerbating flooding and waterlogging of adjacent land due to raising of land above the flood level and removing the storage capacity – If the substation selected by PGCB is inundated or waterlogged landfill will be required to create the development platform, the flood and drainage risk assessment must include modelling of the impact of the detailed design on the surrounding 500m to ensure that inundation or waterlogging on adjacent land will not be beyond the current greenfield level as a result of the presence of the raised substation land. – No drainage water will be permitted to discharge direct to surface water, oil interceptors are to be fitted on all drainage to catch oil spill.						
	Health and safety risks related to fire safety and emergency response	– Identify presence of any unstable land/steep slopes and avoid these during the detailed design. – Identify presence of floodplain or depressions that get waterlogged in the rainy season and avoid these during detailed design. – If the substation selected by PGCB is inundated or waterlogged landfill will be required to create the development platform. – Detailed design of control buildings to follow national building and fire safety standards as well	Detailed Design cleared and approved reflects EMP requirements	Prior to detailed design approval and for implementation during construction	√	√	√	PGCB and Contract Cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

New Substations and Bay Extensions								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		as international good practice – Provide fire walls on all transformers. – Detailed design of building to include emergency exits with emergency exit signage – Provide fully stocked, in-date first aid kit installed in a prominent, signed position, first aid posters and emergency contacts to also be displayed – Provide eye wash station and water supply to shower located near the storage areas for fuel/oil/chemicals – Detailed design of substations to include fire safety measures including detector, alarm, and firefighting equipment in accordance with national regulations and IFC EHS Guidelines on OHS. – Provide sand buckets, full of sand, placed in a prominent, signed location near to fire-risk locations such as transformers and oil storage areas. – Provide fire extinguishers (including for oil and electric fires) in a prominent, signed location near to fire-risk locations such as transformers and oil storage areas with service and expiration dates clearly labelled. – Provide automatic fire alarm and fire suppression system in the control buildings along with posters on fire safety. – All electrical hazards will feature written and visual warning signs that meet the IEEE standards to						

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

New Substations and Bay Extensions								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		include the ISO 7010 "Hazard Type: Electrical Symbol" warning of the risk of electrocution.						
	Impacts to health and safety of O&M workers and the public	– Use of any asbestos containing materials is prohibited. – Include in the design of all substations (if not already present or in poor condition) and around transformers a secure wall or fence sufficiently high it cannot be climbed over with lockable entry featuring written and visual warning signs to include the ISO 7010 “Hazard Type: Electrical Symbol” warning of the risk of electrocution. – Indoor work areas at substations to be well ventilated and naturally or artificially well-lit in accordance with national regulations and the IFC EHS Guidelines on OHS. – Detailed design of substations to ensure EMF levels within the substation boundary are within international good practice levels as per International Commission on Non-Ionizing Radiation Protection (ICNIRP) (reference and peak values) for occupational exposure;75 in areas where EMF levels could be exceeded posting of written and visual warning signs. Use of shielding equipment/materials to decrease EMF exposure as required.	– Detailed Design cleared and approved reflects EMP requirements – Compliance with ICNRP occupational/community EMF exposure levels (reference and peak values)	Prior to detailed design approval and for implementation during construction	√	√	√	PGCB and Contract Cost

[75] https://www.icnirp.org/cms/upload/publicatio ns/ICNI RPemfgdl.pdf

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

New Substations and Bay Extensions								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		– Detailed design of substations to ensure EMF levels at the boundary is within international good practice levels as per International Commission on Non-Ionizing Radiation Protection (ICNIRP) (reference and peak values) applicable to the public exposure. – For control buildings provide adequate natural and/or artificial lighting levels to meet the IFC EHS Guidelines on Occupational H&S (Table 2.3.3. Minimum Limits for Workplace Illumination Intensity) – Pit latrines and disposal of untreated sanitary wastewater to surface or groundwater is prohibited. – Staff will reside off site but detailed design of substations to include adequate sanitation and welfare facilities for all workers to be posted at or visiting the substations including separate indoor kitchen, eating and rest areas (with day bed facilities for rest periods) to the control room and adequate number of indoor toilets/washrooms (one per six staff and separate for men/women with hot and cold running water hand washing facilities) which are connected to either existing sewerage system or to septic tank with soakaway. Drainage from all sinks and urinals to be connected to the septic tank as well as the WC. Provide a dedicated shelter and rest area for the 24-hour security guards, shielding them from rain, wind, and						

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

New Substations and Bay Extensions								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		extreme (hot and cold) temperatures. – Disposal of worker generated waste (e.g., plastic bottles) on-site is prohibited and adequate waste storage areas to be incorporated into the detailed design. Composting of food waste may be permitted on-site if detailed design incorporates enclosed composting facilities (enclosed to avoid attraction of vermin etc.) located away from accommodation and any properties outside the site boundary. – Source of drinking water that meets GOB and WHO drinking water standards to be provided to substations. If any surface or groundwater sources are proposed for use in substations, Contractor is to undertake a baseline water quality sampling per EMoP to confirm its suitability for use. If drinking water standards are not met, detailed design to consider alternative source or include water treatment facilities (RO) at the substation to facilitate safe drinking water supply. Detailed design to include water meters for monitoring of water abstracted. – Provide gated, safe vehicular access for entry/exit off the public highway having adequate sight lines for all drivers and warning signs of entrance as well as adequate parking for cars. Entrance ways over bridges or culverts must have safety rails on either side.						

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

New Substations and Bay Extensions								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		– Final surface level of substation equipment will be at least 0.5 m above the existing ground level or highest flood level including an allowance for climate change (whichever is higher) – Foundations to be constructed in such a way as to be adequately drained to prevent washouts and flooding impacts to adjacent land. – Junctions between new access roads and existing roads will not impede or damage the latter nor any associated drainage channels, irrigation infrastructure, etc. – If crossing of drainage channels is required for substation entrance creation, a bridge or culvert is to be used to maintain the natural flow of the drain. These should be designed to 1:100 years return period with the invert level of culverts below the bed level to enable the natural substrate to return.						
	Impacts from dust generated by earthworks	– Detailed design of substations to minimize cut and fill and land raising to reduce the extent of earthworks and thus dust generation during construction, also maximize reuse of spoil to minimize the need for disposal off site. – During detailed design, contractors will quantify extent of earthworks required, amount of spoil to be generated and location for disposal of excavated spoil through landscaping within the site boundary – generation of excess spoil to be avoided.	– Detailed Design cleared and approved reflects EMP requirements – Compliance with air quality levels applicable to the substation location as per (Appendix X, and ECP 10).	Prior to detailed design approval and for implementation during construction	√	√	√	PGCB and Contract Cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

New Substations and Bay Extensions								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
	Impacts due to substation noise	– Detailed design to ensure maximum sound power level of equipment at 1 m is 85 dBA through use of sound attenuation, in areas where these noise levels will be exceeded OHS noise warning signage identifying that ear protection to be worn must be installed as part of detailed design. – Detailed design of transformers and other noise sources to be located as far as practical from the substation site boundary since noise diminishes with distance. – Contractors will be required to measure and confirm the distance from their detailed design and construction works to sensitive receptors to confirm if the noise standards can be met. If any properties are within 100m of the substation site boundary[76] then baseline measurements must be carried out during detailed design (refer to EMoP) by the contractor who will also undertake quantitative noise assessment using internationally recognized noise modelling software of (i) the detailed design considering low frequencies associated with transformer hum and (ii) construction methods to confirm that noise standards per Appendix X, and ECP 11 can be achieved for the substation alone	– Detailed Design cleared and approved reflects EMP requirements – Compliance with noise levels applicable to the substation location as per (Appendix X, and ECP 11).	Prior to detailed design approval and for implementation during construction	√	√	√	PGCB and Contract Cost

[76] Per the EIA/IEE general construction impacts and operational noise exceedance in silent zone might be possible up to 100m. However, if the louder types of piling (impact or vibratory hammers) that generate over 85 dBA are intended to be used by the contractor baseline measurements must be carried out at substation sites with any properties present in 50m due to the increased impact area that will result.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

New Substations and Bay Extensions								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		without additional noise mitigation – industrial levels must be achieved at the site boundary with residential levels at the nearest properties with silent levels achieved when schools or other silent zone receptors are present. If residential properties or other sensitive receptors are near the substation boundary, then measurements must be carried out during detailed design and baseline noise calculations (modelling) considering low frequencies associated with transformer hum will be undertaken by the Contractor to demonstrate that the noise standards/guidelines can be met. If background noise levels already exceed the standards/guidelines the design must ensure that noise levels result in a <3dBA increase in background. – Given transformers are generally in the range 60-80 dBA at 1m if outdoors they are to be located at least 5 m inside the substation site boundary but this distance will need to be increase to between 20m – 100m depending on the land use adjacent to the substation for noise limits to be met without additional attenuation. The quietest available equipment with manufacturer-supplied noise mitigation will be installed. If noise levels cannot be met through siting and design alone detailed design to incorporate acoustic barrier designed to international good practice around either the noise						

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

New Substations and Bay Extensions								
Project Activity	Impact or Risk	Mitigation/ Compensation/ Contingency/ Enhancement Measures	Performance Indicator	Timing	Responsibilities (implementation, supervision and monitoring)			Budget Source
					PGCB	SIC	Contractor	
		source and/or substation site boundary to attenuate noise to level such that noise levels at the receptors will be met. As operational noise is permanent the acoustic noise barrier will need to be a permanent installation as part of the detailed design – Contractor to avoid soil compaction, piling, blasting and other vibration inducing activities as much as possible. If needed a management plan will be prepared for approval. The quietest equipment available will be used, noise attenuation measures will include, (i) fitting of high efficiency mufflers to the noise generating equipment; and (ii) keeping acoustic enclosures around piling/drilling equipment. For piling it will not be possible to use the louder types of piling (impact or vibratory hammers) that generate over 85 dBA without resulting in a significant impact because noise from piling equipment of 120 dBA at 1m would exceed 85dBA, the level at which hearing damage is caused at adjacent properties if found within 100m. If noise levels are still exceeded a temporary acoustic noise barrier will be provided or alternatively temporary relocation of occupants during works to a rented property. In locations where soil compaction, piling, blasting and other vibration inducing activities are unavoidable Contractor to identify properties within the zone of						

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

New Substations and Bay Extensions								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		influence and undertake pre-construction structural surveys to identify level of risk with reference to the guideline vibration levels per Appendix X, ECP 11. If there is a risk of structural damage to properties due to their current condition, consider alternative construction methods or temporary relocation of occupants during works if at risk to a rented property. Consider the need to install monitors to monitor structural movement. Structural or cosmetic damage to be repaired by Contractor to at least pre-project condition at their own cost.						
	Impacts to surface and groundwater resources	– Construction activities must be planned not to limit the availability of or restrict access to water sources (e.g., groundwater wells) used by local communities; natural flow of any surface water or drains must not be obstructed or if not possible diverted through a drainage system to another direction. – Any piling or excavation works within 500m of groundwater wells used as a drinking water source by local communities will require pre-construction and post construction water quality monitoring against drinking water standards to ensure there is no contamination of the water supply. – Construction water to be sourced from an existing licensed commercial supplier (preferred option especially for potable water supplies), where available, or rainwater harvesting. If using an	– Monitoring data demonstrates compliance with national standards – No unresolved grievances regarding water resources	Prior to mobilization and site establishment and for implementation during construction	√	√	√	Contract cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

New Substations and Bay Extensions								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		existing surface water or an existing borewell for construction water, permissions to be obtained from the relevant authorities together with the agreement of local communities. – Prior agreement is required from local community users to use any existing surface water/borewell or local piped water either temporarily during construction or permanently for substations; in cases where use of local water source is not agreed, contractor to import tanked water to the project area. – No groundwater will be used in locations without additional groundwater capacity – in other locations groundwater will only be used after it has been confirmed through assessment that there will be no additional stress on groundwater resources as a result. – Permissions for any new borewell installation (for construction of permanent supply to substation) to be obtained together with agreement of local communities before abstraction, include water meter for monitoring of water abstracted. – Contractor to avoid piling activities as much as possible. If needed a management plan will be prepared for approval. Oil will not be used for drilling or piling fluid. The piling management plan will include measures to avoid water pollution from the use of any bentonite clay slurry - adequate						

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

New Substations and Bay Extensions								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		bunding must be provided around piling activities to contain piling mud and decanting ponds will need to be fully enclosed to avoid spills or leaks to adjacent land. Piling fluid must not be intentionally or unintentionally disposed of to surface water untreated or be allowed to damage adjacent land. Sediment laden surface water runoff and discharges must be disposed of to open ground for percolation or passed through a sedimentation tank having adequate settlement tank, to obtain at least 50 mg/l TSS, before being allowed to enter surface water. Use of piling mud treatment equipment to be considered where space constraints exist preventing adequate settlement.						
	Impacts of temporary access roads	– All substations will be accessed via the existing road network and no new access road will be constructed, although new entranceways of up to 35m length will need to be created onto main roads. Entrances ways will be asphalt or concrete surfaced. Junctions between new entrances and existing roads will not impede or damage the latter nor any associated drainage channels, public utilities, etc. Adequate sight lines will be provided for safe entrance and exit of vehicles during both construction and O&M. – A photographic record will be made of the pre-construction condition of access roads to inform the reinstatement works. After completion of the	– Access roads reinstated to their former condition as compared to photographic record. – No grievances regarding reinstatement of access roads to their former condition.	Prior to mobilization and site establishment and for implementation during construction	√	√	√	Contract cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

New Substations and Bay Extensions								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		construction work access roads will be restored to their original condition. – The entranceways to the SS off the main roads and internal service roads will need to be adequately lit, the lighting of the access was raised during consultation.						
	For terrestrial ecology new and existing SS sites For aquatic ecology Pekua, Madhabpu, Tungipara, Chatkhil, Paikachia, Gupulganj and Satkhira substation sites e.g., all sites supporting ponds, low lying permanently inundated land, or waterbodies that will be infilled For birds Pekua and Paikgacha substation sites	– Baseline ecological surveys per EMoP to inform the detailed design and prior to the start of any activity onsite; results of ecology suverys included in final IEE report – Ecology surveys on commissioning and prior to handover of subsation to PGCB with comparison made to baseline survey in terms of biodiversity loss	– Ecology survey including terrestrial and aquatic (especially to confirm absence of threatened species) – For birds, ornithology survey including point counts on a monthly basis from October to March of the substation site and surroundings	No net loss of biodiversity results following construction in comparison to the baseline reported in the final IEE	√	√	√	Contract cost
Construction Phase								
Onsite	Emissions of SF6, a	– Careful installation of SF6 insulated equipment	– EMP/CSEMP requirements	Throughout	√	√	√	Contract

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

New Substations and Bay Extensions								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
construction activities	potent greenhouse gas, to the atmosphere	(e.g., switchgear) at substations following international norms and standards for handling, storage, and management of SF6 to avoid damage/ruptures/leakages of SF6 gas. – Provision of SF6 awareness raising to construction workers and training of O&M staff on the operation of the SF6 LDS and emergency response procedures during the commissioning stages.	successfully implemented as determined through regular site checks, photographic record etc.	construction				cost
	Impacts due to dust from earthworks	– Plan the construction site layout so that machinery and dust-causing activities are located away from receptors, as far as is possible. – Erect solid screens or barriers around the dusty activities or the site boundary that are at least as high as any stockpiles on site to fully enclose operations. – Contractors to undertake quantitative air quality monitoring as per the EMoP. In addition to quantitative monitoring (as per EMoP) contractors will undertake weekly dust soiling checks of surfaces of adjacent properties during earthworks and help with cleaning of external surfaces of property if dust is evident. – If air quality levels are exceeded, an increase in existing background air pollution is recorded where they were already exceeded, or complaints are received contractor will be required to implement additional dust mitigation e.g., barricading/isolating sources of dust, use of wheel wash, adjusting	– EMP/CSEMP requirements successfully implemented as determined through regular site checks, photographic record etc. – No exceedance of air quality levels (Appendix X, and ECP 10) or increase in baseline air pollution levels where they are already exceeded. – No outstanding grievances related to impacts from dust and air pollution.	Throughout construction	√	√	√	Contract cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

New Substations and Bay Extensions								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		working methods, to ensure the levels are met.						
	Impacts due to construction noise	– During night (6am to 10pm) no works will be permitted at substations. – Contractor's maximum working hours (including the movement of heavy vehicles for construction on off-site access roads) will be 7 am – 7 pm. – Residents within 500m will be informed well in advance of the construction schedule for noisy activities taking place on-site. Noisy construction activity at substations (especially demolition and piling works) will only take place between the hours of 10 am - 4 pm. No noisy work and heavy vehicle movements will take place on Saturdays and during school/college/university exam periods. No work on holidays and festival days. Sensitive receptors to be consulted with any other special days when they would wish noise levels to be minimized. – For substations with properties in 50m, loud construction noise must be limited to only very short periods of activity to minimize disturbance, or by installations of temporary acoustically designed noise barriers. – Layout substations to keep nosiest construction works the furthest distance possible from adjacent receptors and adopt construction methods that ensure noise generated from construction is minimized. If the noise levels at the site boundary	– EMP/CSEMP requirements successfully implemented as determined through regular site checks, photographic record etc. – No exceedance of noise levels (Appendix X, and ECP 11) or increase in baseline noise levels where they are already exceeded. – No outstanding grievances related to impacts from noise and vibration.	Throughout construction	√	√	√	Contract cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

New Substations and Bay Extensions								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		or receptors will exceed the required noise levels, are more than 3dBA above background when already exceeded, or there are complaints then a temporary acoustically designed noise barrier will need to be installed around the substation perimeter to be able to meet required noise level. – Sound levels received by workers must not be over 85 dB(A) during continuation of 8 working hours without wearing PPE. – Contractors to undertake quantitative noise monitoring as per the EMoP. If noise levels are exceeded, an increase in existing or noise levels >3dBA recorded where they were already exceeded, or complaints are received contractor will be required to implement additional noise mitigation e.g., adjusting working methods, or placing of temporary acoustically designed noise barriers to ensure met.						
	Impacts due to infilling works.	– No borrow area or quarry will be opened by the contractor to obtain land fill material. No dredging will be undertaken by the contractor. Ensure sand and gravel for substation land filling is from an existing government licensed sand and gravel supplier operating legally permitted sites i.e. ensure no illegally extracted sand and gravel is used for the project. Copies of licenses of the supplier to be obtained by contractor prior to the commencement	– EMP/CSEMP requirements successfully implemented as determined through regular site checks, photographic record etc. No outstanding grievances related to impacts from landfilling activities.	Prior to and during infilling of the low-laying land	√	√	√	Contract cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

New Substations and Bay Extensions								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		– The adjacent properties to be informed at least one month prior that the infill work is to be commenced. – Conduct infilling during the dry season when the site is not waterlogged to minimize the risk of sediment laden runoff. – Ensure land fill works are commenced at the start of the dry season – To avoid cumulative impact on the road network since a large number of trucks will be needed to import material, plan the import of material in a staggered manner to reduce the number of daily traffic movements ensuring no congestion is allowed to build up at the site entrance; parking area for trucks is to be provided off the access road. – Consider the option for sand[77] to be pumped to site from existing licensed sources using a pipeline. Since the route will be determined by the contractor an environmental assessment will need to be submitted to demonstrate that this will not have adverse impact, and the IEE will need to be updated. – Removal of all dumped waste from the site for disposal to a suitably licensed waste management						

[77] There are low-lying areas around some substations, which might get waterlogged during the monsoon period. Height of these lands will be raised up to the standard height of the main access road during the construction.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

New Substations and Bay Extensions								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		facility prior to infilling – no waste must be buried under the infill. – Erection of a robust bund or wall (e.g. sheet pile or earthen bund) to contain the mud sand whilst the water evaporates or discharges to ground. – Given the adjacent waterbodies the condition of the bund or wall must be checked daily to ensure no leak. – There should be no discharge of water to the adjacent land or drainage channels; no waterlogging of adjacent land and no sedimentation of waterbodies adjacent. – Photographic record of the access road and adjacent land and properties to be taken before the start of infill works. – Water quality baseline monitoring data to be taken from the adjacent waterbodies before the start of infill works. – If any damage occurs to the adjacent land or waterbodies due to the infill activity, then this must be rectified or compensated by the contractor. – The water quality (pH, turbidity, TDS, TSS, DO) of the adjacent waterbodies will be monitored daily during the infill activity and works must halt immediately upon any deterioration with corrective action taken to bring the water quality back to baseline before continuing works. No exceedance of the water quality standards as are mentioned in						

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

New Substations and Bay Extensions								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		Appendix X. – Following infill, the dry raised land must be seeded, and the slopes planted with native grass species, short water tolerant plants and reeds at the base to prevent soil erosion whilst the landfill settles for construction. – PGCB to ensure their environmental specialist or SIC supervises and monitors infilling activities on a daily basis and in doing so ensures works are undertaken following national laws and regulations and the EMP requirements.						
	Site restoration	– Rehabilitate any disturbed areas beyond the substation infrastructure footprint to through revegetation and landscaping using native species. – All spoils, construction waste and material scrap after erection of substation/terminal gantries must be removed. The substation boundaries to be cleared of construction waste, footpaths and surrounding to be cleared and restored satisfactorily to the community staying near the substation.	– EMP/CSEMP requirements successfully implemented as determined through regular site checks, photographic record etc.	On the completion of construction works prior to handover to PGCB	√	√	√	Contract cost
O&M Phase (Measures to be Implemented by PGCB)								
Operation and maintenance activities	EHS impacts and risks in general; biodiversity impacts	– Update operational SOP for substations covering pollution control, solid and hazardous waste management, health and safety risk assessments and management plans addressing both occupational and community risks and including permit to work system of critical activities such as	– Compliance with GOB regulations – No fatalities or lost time incidents 100% of H&S incidents including near miss recorded, immediately	Throughout the O&M Phase	√			PGCB

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

New Substations and Bay Extensions								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		electrical or work at height and emergency preparedness and response provisions (content will be similar to those of construction phase but tailored to reflect operational aspects) – Substation workers will need to be trained in update SOP/OR (Appendix X, and ECP 16 & 18) and good housekeeping practices including how to clean up oil/fuel spills and dispose of contaminated sorbent material which would be treated as hazardous waste etc. – During maintenance activities mitigation measures applicable to the construction phase are also applicable to PGCB maintenance workers or contractors and are to be followed – Material Safety Data Sheets for all fuel/oil/chemical kept on site to be posted – Records volumes of all type of wastes generated and keep transfer records at the substation with copies of the waste management company's licenses on file. – Defunct solar PV (if any) and also batteries (e.g., lead acid) installed at the substations at their end-of-life will need to be disposed of as hazardous waste. – During O&M, internal audits will be undertaken by the PGCB ESU Environment Officer, and Health and Safety Officer – Record any mortality of wildlife, local or migratory	investigated, and corrective action taken to prevent repeat. – Compliance with noise levels: 1- hour LAeq 70 dB(A) at the site boundary, 60dB(A) within mixed zones, 55 dB(A) at the nearest residential properties including those in commercial zones and 50dB(A) within 100m of silent zones – Compliance with ICNRP occupational/community EMF exposure levels (reference and peak values) at substations – EMP/CSEMP requirements successfully implemented as determined through regular site checks, photographic record etc. – No outstanding grievances from local communities or other interested stakeholders					

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

New Substations and Bay Extensions								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		birds within and near the substation boundary.						
	Gas insulated equipment– release of SF6 as GHG	– Inventory to be maintained of all SF6 containing equipment at SS, their make and model, volume of SF6 contained, details of repair works undertaken, dates of SF6 replenishment, leakage incidents etc. – Inventory to be used to monitor SF6 leakage from SS. If trend of lowering gas pressure is observed investigate the cause and rectify any leak per the manufacturer's instruction. – If SF6 used on site carry out regular inspections and periodic preventative maintenance to minimize SF6 leakages; monitor SF6 leakage rates using leak detection equipment – SOP to define a safe SF6 retrieval arrangement with appropriate handling, storage, disposal process for end-of-life circuit breakers by a certified industrial waste management company who will need to remove SF6 and treat the equipment prior to disposal in accordance international good practice International Electrotechnical Commission (IEC) standard 61634 to ensure SF6 not released to atmosphere.						
	Occupational health safety of maintenance staff - accident risk	– Maintain incident logbook and medical tests / health check-up of staff – Provide everyone who enters the SS with an OHS induction – Keep vents/windows unblocked and replace defunct bulbs/lights immediately						

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

New Substations and Bay Extensions								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		– Ensure all SS workers receive basic first aid and firefighting training with annual refreshers – Ensure that at least one staff at SS is fully trained as a first aider and fire marshal – Maintain fully stocked, in-date first aid kit, keep first aid posters and emergency contact lists that are posted up to date – Maintain firefighting systems including in-date fire extinguishers and full sand buckets and keep fire safety posters up Carry out regular inspections and periodic maintenance to ensure electrical standards are being upheld – Keep emergency exits clear at all times and maintain emergency exit signs Maintain written warning signages including the ISO 7010 Hazard Type: Electrical Symbol warning of the risk of electrocution. – Collect, segregate, and store in the designated and labelled storage areas all wastes including food wastes for onward disposal as per construction. – Undertake regular pest control using integrated pest management approach Maintain vegetation at the SS that poses a health and safety hazard Prohibit the use of herbicides, pesticides or burning to control any vegetation growth or to manage vegetation waste. – O&M to be performed only by suitably qualified and experienced workers who are regularly trained staff						

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

New Substations and Bay Extensions								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		of PGCB or a contactor under supervision of a Health and Safety Officer following the SOP for H&S. – O&M workers to be given required PPE and other requisite safety equipment, provide sufficient PPE spares available on site for visitors etc. – Sanitation and welfare facilities as per construction will also be required for O&M workers. – Continue to provide potable drinking water supply meeting GoB and WHO drinking water standards (regular testing of drinking water is included in EMoP scope). – Cleaning of toilets on daily basis, use of disinfectant and floor cleaners; keep toilets/septic tank/soakaway maintained periodic spot monitoring using mobile phone app of noise levels and ambient EMF for substations at the boundary fence/near transformers to ensure they are below the occupational/community noise levels and ICNRP occupational/community EMF exposure levels						
	Community H&S risks – impact on surrounding community, noise, EMF, accidents etc.	– Maintain security and prevent entry by the local community by maintaining adequate boundary fencing or wall, always keeping control room doors and gates shut, and having security persons present 24x7 to prevent unauthorized public access and trespass. – The entranceways to the SS off the main roads						

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

New Substations and Bay Extensions								
Project Activity	Impact or Risk	Mitigation/ Compensation/ Contingency/ Enhancement Measures	Performance Indicator	Timing	Responsibilities (implementation, supervision and monitoring)			Budget Source
					PGCB	SIC	Contractor	
		and internal service roads will need to be adequately lit, the lighting of the access was raised during consultation – Maintain written warning signages including the ISO 7010 Hazard Type: Electrical Symbol warning of the risk of electrocution. – Regular checks and periodic maintenance of equipment like transformers and capacitors to minimize corona noise emissions. – PGCB in conjunction with local municipalities and the media with the support of CSOs to continue to organize health and safety campaigns on electrical safety community awareness raising activities in local communities and schools within 500 m of the substations						
	Use of mineral oil for transformers – accidental spillage contaminating both land and water	– Maintain inventory of transformers on site, make, model, risk of PCBs and other details including transformer test report, details any maintenance works undertaken, dates oil changes, leakage incidents etc. – Carry out regular inspections and periodic preventive maintenance to minimize oil leakages; ensure values, nuts and bolts are fully functional and tightly secured, ensure rubber seals of radiators are intact – The acceptance of mineral oil at substation to be accompanied with Material Safety Data Sheet and certification that it is PCB free.						

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

New Substations and Bay Extensions								
Project Activity	Impact or Risk	Mitigation/ Compensation/ Contingency/ Enhancement Measures	Performance Indicator	Timing	Responsibilities (implementation, supervision and monitoring)			Budget Source
					PGCB	SIC	Contractor	
		– Waste oil to be disposed as hazardous waste using appropriately licensed waste management company with environmentally safe and sound storage, transport, and disposal – Maintain spill management materials (sorbent pads, loose sorbent material, sand, etc.) next to storage areas for immediately soaking up any leaks or spills that do accidentally occur.						

12.7.2.1 Site-specific Mitigation at Substation (SS) Sites

CESMP to include the following measures at the SS as well reflecting the ECPs and all general and SS specific EMP measures.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	Impact or Risk	Mitigation/ Compensation/ Contingency/ Enhancement Measures	Performance Indicator	Timing	Responsibilities (implementation, supervision and monitoring)			Budget Source
					PGCB	SIC	Contractor	
400/230/132kV AIS: Pekua/Chakaria, Cox's Bazar								
Detailed Design and Preconstruction Phase								
Infilling of low-lying land within salt pan area	Environmental and social impacts due to infilling works including on salt pan waterbodies and	– Contractor to employ field ecologist to undertake pre-construction ecology surveys including potential for threatened fish and vegetation species and ornithological survey of the substation site per the EMoP including point counts surveys	EMP/SCEMP requirements successfully implemented as determined through regular site checks, photographic record etc.	Prior to infilling of the low-laying land	√	√	√	Contract Cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
	ecology – no threatened species anticipated, impacts on ecology of the salt pan and 8-10 salt farmers directly or indirectly relying on the salt pan for production of salt.	to identify movement of birds across the substation site and transmission line; submit survey report alongside detailed design – Due to loss of saltpan habitat the substation design is to have the input of a landscape architect/biodiversity expert and to follow the recommendations of the pre-construction aquatic ecology and bird survey to provide biodiversity enhancement. – Before land filling any salt pan canal that will be diverted is to be blocked off, then the water pumped out and fish trapped translocated by the contractor's ecologist to the remaining canalincluding point counts surveys to identify movement of birds across the substation site and transmission line; submit survey report alongside detailed design. – EIA/IEE/EMP to be updated to reflect the results of ecology and bird surveys before detailed design approval and the commencement of construction works. – Site allocated to the substation lies within an area which is used for salt production during summer during monsoon period, land acquisition to be undertaken in accordance with the Resettlement Plan before access is given to the contractor for works providing sufficient time for salt production to cease.						

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		– Site allocated to the substation lies within an area which may also be used for fish and shrimp cultivation, this will be confirmed in finalizing the IEE and Resettlement Plan. Land acquisition to be undertaken in accordance with the Resettlement Plan before access is given to the contractor for works providing sufficient time for fish and shrimp to be harvested. – Ensure salt pan canal around the edge of the site is retained as an open channel to enable salt pan activities on the adjacent land to be continued. It is preferable to retain the salt pan canals crossing the site as open channel. If required to accommodate the site layout, salt pan canal that crosses through the site is to be diverted around the edge of the substation site (outside the boundary walls) in a salt pan canal of the same dimensions to enable continuous flow of water.						
Detailed design	Low lying land inundated during the monsoon and at risk of waterlogging during heavy rain, waterbody (salt pan canal) is present immediately adjacent to the proposed	– Detailed design to retain the salt pan canal around the edge of the site as an open channel except for the creation of a site access; in this location bridge or culvert of 1:100-year capacity to be installed with any culvert inverted below bed level to allow natural substrate to reform. – SS site is situated in low-lying areas, necessitating the elevation of the ground level and the construction of a 2m access entrance from the	Substation design is climate resilient.	Prior to approval of detailed design	√	√	√	Contract cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
	location	adjacent road. To avoid altering the local hydrology maintain natural water flow, the entrance design needs to incorporate cross-drainage structures with adequate openings. – Contractor to conduct a flood risk and drainage assessment including modelling of the site layout and drainage design with particular attention to loss of flood storage capacity due to the infill – Detailed design to ensure adjacent flood and salt pan canal levels do not increase due to loss of floodwater storage as a result of the infill e.g., by providing diverted salt pan canal or a shallow attenuation pond that can also provide a wildlife benefit to mitigate the loss of seasonal salt pan.						
	Residential properties are located within 100m – per the IEE operational noise exceedance in silent zone might be possible up to 100m and residential zone around 50m distant	– Presence of houses near the substation means that the applicable noise limit at this site is of "Residential Area" – Due to proximity of properties to substation site contractor to appropriately locate transformers if possible so they are screened by the control building and undertake quantitative noise assessment using internationally recognized noise modelling software of the detailed design to confirm that noise standards per Appendix X can be achieved for the substation alone without additional noise mitigation.	– No breaches of compliance with noise standards during O&M. – No outstanding noise grievances from local communities or other interested stakeholders.	Prior to approval of detailed design	√	√	√	Contract cost
	Local and potential migratory bird	– Substation lighting to be designed to avoid any nighttime lighting spilling outside of the substation	– Substation adopts recommendations of the bird	Prior to approval of detailed design	√	√	√	Contract cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
	interaction with substation and connecting LILO	compound on the adjacent saltpan habitat using movement detection sensors. – Ensure the substation and any connecting OHL adopt a bird friendly design in accordance with GIIP[78] with adequate separation or insultation between live and ground	survey and a bird friendly design per GIIP					
	Loss of mature trees	– Detailed design is to avoid the loss of mature trees along the existing highway adjacent to the substation site; permission to be obtained by the contractor for any trees to be cut and replacement planting at 1:3 ratio to be undertaken. – No loss of nationally or IUCN threatened (VU/EN/CR) vegetation species. – Tree cutting is to be avoided during the bird nesting season.	Trees cut are compensated for at 1:3 (no net loss of biodiversity) as per Biodiversity Management Plan and Tree Protection Plan	Prior to approval of detailed design	√	√	√	Contract cost
Substation construction activities	Disturbance to residential properties immediately adjacent, public utilities along highway, local and potential migratory birds, and pollution of salt pan canals from the construction	– Construction to be conducted only during the dry season – Schedule works to avoid the monsoon in Bangladesh when the water level in the saltpan is at its highest – No works to be undertaken from 1 hour before sunset to 1 hour after sunrise to minimize impacts on wildlife. – Before land filling any salt pan canal that will be diverted is to be blocked off, then the water	– CSEMP and H&S Plan including BMP approved before commencement of construction works minimizes EHS impacts and risks and is subsequently complied with during construction works as determined through regular site checks, photographic record etc.	Prior to and then for implementation during construction	√	√	√	Contract cost

[78] Avian Power Line Interaction Committee (APLIC) 2006 and 2012

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
	traffic and works	pumped out. – Presence of houses near the substation means that the applicable noise limit at this site is of "Residential Area" – Ensure water suppression is used during construction works and do not conduct dusty work on windy days; dust levels not to exceed ambient air quality standards per Appendix Xat adjacent properties. – Provide adjacent properties with cleaning service for external surfaces and windows on a weekly basis during the construction due to buildup of dust. – Construction to be conducted only during the daytime between 10am-4pm with noisy activity such as piling only between 10am-12pm and 2-4pm to minimize disturbance and is not to be conducted on weekends or on festivals or holidays; noise limits per Appendix X are to be achieved at the adjacent properties. – To inform CSEMP and any piling management sub-plan due to proximity of properties to substation site contractor to undertake quantitative noise assessment of construction works using internationally recognized noise modelling software to confirm that noise standards per Appendix X can be achieved for the substation alone without additional noise mitigation. If	– No breaches of compliance with regulatory requirements or GIIP including ambient air quality and noise standards. – No outstanding dust, noise and general disturbance and disruption grievances from local communities or other interested stakeholders.					

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		required to meet noise standards contractor to install noise barrier etc. – Properties adjacent are to be consulted one-to-one and subject to structural survey and photographic record in case of vibration impact during construction. – No fuel, oil or chemicals are to be stored at this site and stockpiles to be kept to materials required during the day's work due to immediately adjacent to any waterbody. – Land filling and piling is required at the site and a method statement for the landfilling and management of piling mud is to be prepared to ensure the immediate adjacent waterbodies are protected, there must be no discharge of sediment laden water or untreated piling mud to the surface water. – Sensitive waterbodies adjacent to be avoided during construction will be flagged for protection. As there may be a risk of workers accidentally straying into these areas then worker training and the code of conduct will cover measures to ensure that wildlife will be protected. – Noise and vibration from piling will be contained to stipulated levels using quietest available piling methods and attenuating screens around piling equipment and site. – Site-specific traffic management plan to be						

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		developed and implemented given the large number of vehicles required to import infill material as well as to transport equipment, materials and construction waste which is likely to result in congestion due to narrow road. Provision of flag men at entry points and along the access road to control the traffic flow and ensure pedestrian and vehicular safety. – Overhead distribution lines x2 run parallel to the highway and will need to be relocated or sufficiently raised in consultation with the distribution utility before works commence on site. – H&S risk assessment and management plan to address risk from presence of distribution lines; safety clearances must be maintained at all time and safety protection installed to avoid workers or machinery coming into accidental contact with them.						
Associated Facility VRE Hub	Loss of natural habitat and avifauna, area of analysis for VRE hub is critical habitat for migratory birds on the East Asian–Australasian Flyway	– PGCB will work with MPEMR, BPDB and DOE on ecological constraints mapping and to develop guidelines on avifauna assessment and management for solar and wind energy in the VRE Hub so their IEE or EIA studies consider potential impacts on migratory birds (especially spoon billed sandpiper, spotted greenshank, and great knot) in line with GIIP including IFC EHS Guidelines on Wind Energy and its Good Practice Handbook on Post-construction Bird and Bat Fatality Monitoring	– VRE Hub as associated facility achieve the same outcome as the project facilities e.g., natural and critical habitat requirements met with no net loss of biodiversity	Prior to O&M of Pekua Substation	√			PGCB

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		in consultation with flyway stakeholders; and undertake a series of awareness raising sessions for the IPP so that they understand the critical habitat and the ecological constraints of South Chattogram – Before connecting any project with the Pekua substation and transmission network in South Chattogram, PGCB will need to ensure the private sector has obtained ECC and addressed impacts on migratory birds						
230/132/33 kV AIS: Madhabpur, Habiganj								
Detailed Design and Preconstruction Phase								
Infilling of low-lying land	Environmental and social impacts due to infilling works– no threatened species anticipated	– Contractor to employ field ecologist (after mobilization) to undertake pre-construction ecology survey of the substation site per the EMoP - as naturally low-lying land inundated round the year any aquatic ecological value will be confirmed - submit survey report alongside detailed design. – EIA/IEE/EMP to be updated to reflect the results of ecology surveys before detailed design approval and the commencement of construction works. – Survey recommendations to be followed by the contractor, to ensure no net loss of biodiversity and to provide biodiversity enhancement, this will include local translocation of fish before infilling if small fish would be found present. – After awarding the contract, contractor will conduct ecological and associated other surveys prior to	– EMP/CSEMP requirements successfully implemented as determined through regular site checks, photographic record etc.	Prior to and during infilling of the low-laying land	√	√	√	Contract Cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		construction work.						
Detailed design	Low lying land at risk of waterlogging during heavy rain	– Detailed design to retain the ditch along the highway as an open channel except for the creation of a site access; in this location bridge or culvert of 1:100-year capacity to be installed with any culvert inverted below bed level to allow natural substrate to reform. – SS site is situated in low-lying areas, necessitating the elevation of the ground level and the construction of a 7m access entrance from the adjacent road. To avoid altering the local hydrology to maintain natural water flow, the entrance design needs to incorporate cross-drainage structures with adequate openings. – Contractor to conduct a flood risk and drainage assessment including modelling of the site layout and drainage design with particular attention to loss of flood storage capacity due to the infill – Detailed design to ensure adjacent flood levels do not increase due to loss of floodwater storage as a result of the infill	– Substation design is climate resilient.	Prior to approval of detailed design	√	√	√	Contract Cost
	Highway Inn and residential properties are located within 100m – per the IEE operational noise exceedance in silent zone might be	– Due to proximity of properties to substation site contractor to appropriately locate transformers so they are screened by the control building and undertake quantitative noise assessment using internationally recognized noise modelling software of the detailed design to confirm that noise standards per Appendix X can be achieved	– No breaches of compliance with noise standards during O&M. – No outstanding noise grievances from local communities or other interested stakeholders.	Prior to approval of detailed design	√	√	√	Contract cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
	possible up to 100m and residential zone around 50m distant	for the substation alone without additional noise mitigation.						
	Loss of mature trees	– Detailed design is to avoid the loss of mature trees along the existing highway adjacent to the substation site; permission to be obtained by the contractor for any trees to be cut and replacement planting at 1:3 ratio to be undertaken. – Tree cutting is to be avoided during the bird nesting season.	– Trees cut are compensated for at 1:3 (no net loss of biodiversity) as per Biodiversity Management Plan and Tree Protection Plan	Prior to approval of detailed design	√	√	√	Contract cost
Substation construction activities	Disturbance to residential/semi-commercial properties immediately adjacent from the construction traffic and works	– Presence of receptors means that the applicable noise limit at this site is of "residential zone" – Ensure water suppression is used during construction works and do not conduct dusty work on windy days; dust levels not to exceed ambient air quality standards per Appendix X at adjacent properties. – Provide adjacent properties with cleaning service for external surfaces and windows on a weekly basis during the construction due to buildup of dust. – Construction to be conducted only during the daytime between 10am-4pm with noisy activity such as piling only between 10am-12pm and 2-4pm to minimize disturbance and is not to be conducted on weekends or on festivals or holidays; noise limits per Appendix Xare to be	– CSEMP and H&S Plan approved before commencement of construction works minimizes EHS impacts and risks and is subsequently complied with during construction works as determined through regular site checks, photographic record etc. – No breaches of compliance with regulatory requirements or GIIP including ambient air quality and noise standards. – No outstanding dust, noise and general disturbance and disruption grievances from local communities or other interested	Prior to and then for implementation during construction	√	√	√	Contract cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		achieved at the adjacent properties. – To inform CSEMP and any piling management sub-plan due to proximity of properties to substation site contractor to undertake quantitative noise assessment of construction works using internationally recognized noise modelling software to confirm that noise standards per Appendix X can be achieved for the substation alone without additional noise mitigation. If required to meet noise standards contractor to install noise barrier etc. – Properties adjacent are to be consulted one-to-one and subject to structural survey and photographic record in case of vibration impact during construction. – No fuel, oil or chemicals are to be stored within 100 m of neighboring ponds and stockpiles to be kept to materials required during the day's work due to immediately adjacent waterbody. – Landfilling and piling is required at the site and a method statement for the landfilling and management of piling mud is to be prepared to ensure the immediate adjacent waterbodies are protected, there must be no discharge of sediment laden water or piling mud to surface water. – Noise from piling will be contained to stipulated levels using quietest available piling methods and attenuating screens around piling equipment and	stakeholders.					

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		site. – Site-specific traffic management plan to be developed and implemented given the large number of vehicles required to import infill material as well as to transport equipment, materials and construction waste which is likely to result in congestion due to narrow road. Provision of flag men at entry points and along the access road to control the traffic flow and ensure pedestrian and vehicular safety. – Overhead distribution line runs parallel to the highway and will need to be relocated or sufficiently raised in consultation with the distribution utility before works commence on site. – H&S risk assessment and management plan to address risk from presence of distribution lines; safety clearances must be maintained at all time and safety protection installed to avoid workers or machinery coming into accidental contact with them.						
230/132/33kV AIS: Monohardi, Narshingdi								
Detailed Design and Preconstruction Phase								
Detail Design	Low lying land at risk of waterlogging during heavy rain, culverts are present at both the sides immediately adjacent	– SS site is situated in low-lying areas, necessitating the elevation of the ground level and the construction of a 7m access entrance from the adjacent road. To avoid altering the local hydrology to maintain natural water flow, the entrance design needs to incorporate cross-drainage structures	Substation design is climate resilient.	Prior to approval of detailed design	√	√	√	Contract cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
	to the substation land	with adequate openings. – Contractor to conduct a flood risk and drainage assessment, attention to be paid to ensure the flow from existing culverts can be maintained						
	Loss of mature trees	– Detailed design is to avoid the loss of mature trees along the existing highway adjacent to the substation site; permission to be obtained by the contractor for any trees to be cut and replacement planting at 1:3 ratio to be undertaken. – Tree cutting is to be avoided during the bird nesting season.	Trees cut are compensated for at 1:3 (no net loss of biodiversity) as per Biodiversity Management Plan and Tree Protection Plan	Prior to approval of detailed design	√	√	√	Contract cost
Substation construction activities	• Disturbance from the construction traffic and solid and hazardous waste management	– No receptors present in 100m of the substation means that the applicable noise limit at this site is of "residential zone" – On the opposite side of the road to the substation is an open dumping site – under no circumstances shall the contractor deposit or allow workers to deposit any waste in this open dumping area. Signage to be installed instructing that the open dumping area is not to be used, training to cover correct procedures for waste management and disposal. – Site-specific traffic management plan to be developed and implemented given the large number of vehicles required to import infill material as well as to transport equipment, materials and construction waste which is likely to result in	– CSEMP and H&S Plan approved before commencement of construction works minimizes EHS impacts and risks and is subsequently complied with during construction works as determined through regular site checks, photographic record etc.	• Prior to and then for implementation during construction	• √	• √	• √	Contract cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		congestion due to narrow road. Provision of flag men at entry points and along the access road to control the traffic flow and ensure pedestrian and vehicular safety. – Overhead distribution line runs parallel to the highway and will need to be relocated or sufficiently raised in consultation with the distribution utility before works commence on site. – H&S risk assessment and management plan to address risk from presence of distribution lines; safety clearances must be maintained at all time and safety protection installed to avoid workers or machinery coming into accidental contact with them.						
132/33kV AIS: Tungipara, Gopalganj								
Detailed Design and Preconstruction Phase								
Infilling of low-lying land	Environmental and social impacts due to infilling works – no threatened species anticipated	– Contractor to employ field ecologist (after mobilization) to undertake pre-construction ecology survey of the substation site per the EMoP - as naturally low-lying land inundated round the year any aquatic ecological value will be confirmed - submit survey report alongside detailed design. – EIA/IEE/EMP to be updated to reflect the results of ecology surveys before detailed design approval and the commencement of construction works. – Survey recommendations to be followed by the contractor, to ensure no net loss of biodiversity and to provide biodiversity enhancement, this will	EMP/SCEMP requirements successfully implemented as determined through regular site checks, photographic record etc.	Prior to and during infilling of the low-laying land	√	√	√	Contract Cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		include local translocation of fish before infilling if small fish would be found present. – After awarding the contract, contractor will conduct ecological and associated other surveys prior to construction work.						
Detail Design	Low lying land at risk of waterlogging during heavy rain, river is present immediately adjacent to the substation site	– SS site is situated in low-lying areas, necessitating the elevation of the ground level and the construction of an access entrance from the adjacent road. – Layout to account for presence of groundwater wells to avoid pollution from septic tanks etc. – Contractor to conduct a flood risk and drainage assessment including modelling of the site layout and drainage design with particular attention to loss of flood storage capacity due to the infill, attention to be paid to ensure the flow from existing culverts can be maintained – Detailed design to ensure adjacent flood levels do not increase due to loss of floodwater storage as a result of the infill	Substation design is climate resilient.	Prior to approval of detailed design	√	√	√	Contract cost
	Loss of mature trees with 114 trees to be cut	– 114 trees are supported by the site as well as mature trees along the access road; detailed design is to avoid the loss of mature trees on the site and along the existing highway adjacent to the substation site; permission to be obtained by the contractor for any trees to be cut and replacement planting at 1:3 ratio to be undertaken. – Tree cutting is to be avoided during the bird	Trees cut are compensated for at 1:3 (no net loss of biodiversity) as per Biodiversity Management Plan and Tree Protection Plan	Prior to approval of detailed design	√	√	√	Contract cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		nesting season.						
Substation construction activities	Disturbance from the construction traffic and works	– No receptors present in 100m of the substation means that the applicable noise limit at this site is of "residential zone" – No fuel, oil or chemicals are to be stored at this site and stockpiles to be kept to materials required during the day's work due to immediately adjacent waterbody – risk of surface water pollution and groundwater wells present. – Landfilling and piling is required at the site and a method statement for the landfilling and management of piling mud is to be prepared to ensure the immediate adjacent waterbodies are protected, there must be no discharge of sediment laden water or piling mud to surface water. – Site-specific traffic management plan to be developed and implemented given the large number of vehicles required to import infill material as well as to transport equipment, materials and construction waste which is likely to result in congestion due to narrow road. Provision of flag men at entry points and along the access road to control the traffic flow and ensure pedestrian and vehicular safety. – Overhead distribution lines run along the highway and through the site and will need to be relocated or sufficiently raised in consultation with the distribution utility before works commence on site.	– CSEMP and H&S Plan approved before commencement of construction works minimizes EHS impacts and risks and is subsequently complied with during construction works as determined through regular site checks, photographic record etc. .	Prior to and then for implementation during construction	√	√	√	Contract cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		– H&S risk assessment and management plan to address risk from presence of distribution lines; safety clearances must be maintained at all time and safety protection installed to avoid workers or machinery coming into accidental contact with them.						
132/33kV AIS: Dupchanchia, Bogura								
Detailed Design and Preconstruction Phase								
Detail Design	Low lying land at risk of waterlogging during heavy rain, waterbody is present immediately adjacent to the boundary wall	– Contractor to conduct a flood risk and drainage assessment – SS site is situated in low-lying areas, necessitating the elevation of the ground level and the construction of access road from the adjacent highway.	– Substation design is climate resilient.	Prior to approval of detailed design	√	√	√	Contract cost
	Properties are located within 100m – per the IEE operational noise exceedance in silent zone might be possible up to 100m and residential zone around 50m distant	– Presence of buildings within 100m of substation means that the applicable noise limit at this site is of "residential zone" – Due to proximity of properties to substation site contractor to appropriately locate transformers so they are screened by the control building and undertake quantitative noise assessment using internationally recognized noise modelling software of the detailed design to confirm that noise standards per Appendix Xcan be achieved for the substation alone without additional noise mitigation.	– No breaches of compliance with noise standards during O&M. – No outstanding noise grievances from local communities or other interested stakeholders.	Prior to approval of detailed design	√	√	√	Contract cost
	Loss of mature trees	– Detailed design is to avoid the loss of mature trees	– Trees cut are compensated for	Prior to approval of	√	√	√	Contract

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		along the existing highway adjacent to the substation site; permission to be obtained by the contractor for any trees to be cut and replacement planting at 1:3 ratio to be undertaken. – Tree cutting is to be avoided during the bird nesting season.	at 1:3 (no net loss of biodiversity) as per Biodiversity Management Plan and Tree Protection Plan	detailed design				cost
Substation construction activities	Disturbance to ponds, residential properties immediately adjacent from the construction traffic and works	– Presence of buildings within 100m of substation means that the applicable noise limit at this site is of "residential zone" – Ensure water suppression is used during construction works and do not conduct dusty work on windy days; dust levels not to exceed ambient air quality standards per Appendix X at adjacent properties. – Provide adjacent properties with cleaning service for external surfaces and windows on a weekly basis during the construction due to buildup of dust. – Construction to be conducted only during the daytime between 10am-4pm with noisy activity such as piling only between 10am-12pm and 2-4pm to minimize disturbance and is not to be conducted on weekends or on festivals or holidays; noise limits per Appendix Xare to be achieved at the adjacent properties. – To inform CSEMP and any piling management sub-plan due to proximity of properties to substation site contractor to undertake quantitative	– CSEMP and H&S Plan approved before commencement of construction works minimizes EHS impacts and risks and is subsequently complied with during construction works as determined through regular site checks, photographic record etc. – No breaches of compliance with regulatory requirements or GIIP including ambient air quality and noise standards. – No outstanding dust, noise and general disturbance and disruption grievances from local communities or other interested stakeholders.	Prior to and then for implementation during construction	√	√	√	Contract cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		noise assessment of construction works using internationally recognized noise modelling software to confirm that noise standards per Appendix X can be achieved for the substation alone without additional noise mitigation. If required to meet noise standards contractor to install noise barrier etc. – Properties adjacent are to be consulted one-to-one and subject to structural survey and photographic record in case of vibration impact during construction. – No fuel, oil or chemicals are to be stored within 100m of the adjacent pond at this site and stockpiles to be kept to materials required during the day's work due to immediately adjacent to any waterbody. – Landfilling and piling is required at the site and a method statement for the landfilling and management of piling mud is to be prepared to ensure the immediate adjacent waterbodies are protected, there must be no discharge of sediment laden water or piling mud to surface water. – Noise from piling will be contained to stipulated levels using quietest available piling methods and attenuating screens around piling equipment and site. – Site-specific traffic management plan to be developed and implemented given the large						

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		number of vehicles required to import infill material as well as to transport equipment, materials and construction waste which is likely to result in congestion due to narrow road.. Provision of flag men at entry points and along the access road to control the traffic flow and ensure pedestrian and vehicular safety. – Overhead distribution line runs parallel to the highway and if disturbed by works will need to be relocated or sufficiently raised in consultation with the distribution utility before works commence on site. – H&S risk assessment and management plan to address risk from presence of distribution lines; safety clearances must be maintained at all time and safety protection installed to avoid workers or machinery coming into accidental contact with them.						
132/33kV AIS: Matlab (N), Chandpur								
Detailed Design and Preconstruction Phase								
Detail Design	• LGED's Narrow access route is to be used for construction traffic to avoid temporary relocation	– No temporary access is to be formed from the nearest main road; access must be through the narrow LGED road through residential to avoid temporary relocation impact. – The main road is 3 m in width to substation from the nearest village and LGED is in the process of undertaking road improvement works, as a	– No temporary relocation is required for construction – No damage to local or community infrastructure. – LGED to be approached for permissions for approach road as well as transportation of	• Prior to access of the substation location	• √	• √	• √	• Contract Cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		separate activity to the project. These must be completed prior to construction, to facilitate heavy construction material/equipment traversing on inadequate surface and because turning corners are currently very narrow for long trailers to traverse the stretch. – PGCB will need to consult with LGED regarding the road improvements prior to finalization of detailed design. – If the road improvements by LGED do not push through but are still required for substation construction then the impacts of road works including any impacts on the adjacent irrigation canal will need to be addressed in an update of the IEE and EMP before the detailed design approval.	heavy machinery					
	Low lying land at risk of waterlogging during heavy rain	– Detailed design to retain the drainage canal along the highway as an open channel except for the creation of a site access; in this location bridge or culvert of 1:100-year capacity to be installed with any culvert inverted below bed level to allow natural substrate to reform. – SS site is situated in low-lying areas, necessitating the elevation of the ground level and the construction of a 6m access entrance from the adjacent road. To avoid altering the local hydrology to maintain natural water flow, the entrance design needs to incorporate cross-drainage structures with adequate openings.	– Substation design is climate resilient.	Prior to approval of detailed design	√	√	√	Contract Cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		– Contractor to conduct a flood risk and drainage assessment						
	Residential properties are located within 100m – per the IEE operational noise exceedance in silent zone might be possible up to 100m and residential zone around 50m distant	– Presence of several houses at the opposite side of the substation means that the applicable noise limit at this site is of "residential zone" – Due to proximity of properties to substation site contractor to appropriately locate transformers if possible so they are screened by the control building and undertake quantitative noise assessment using internationally recognized noise modelling software of the detailed design to confirm that noise standards per Appendix X can be achieved for the substation alone without additional noise mitigation.	– No breaches of compliance with noise standards during O&M. – No outstanding noise grievances from local communities or other interested stakeholders.	Prior to approval of detailed design	√	√	√	Contract cost
	Loss of mature trees	– Detailed design is to avoid the loss of mature trees along the existing highway adjacent to the substation site; permission to be obtained by the contractor for any trees to be cut and replacement planting at 1:3 ratio to be undertaken. – Tree cutting is to be avoided during the bird nesting season.	– Trees cut are compensated for at 1:3 (no net loss of biodiversity) as per Biodiversity Management Plan and Tree Protection Plan	Prior to approval of detailed design	√	√	√	Contract cost
Substation construction activities	Disturbance to residential properties immediately adjacent from the construction traffic and works	– Presence of several houses at the opposite side of the substation means that the applicable noise limit at this site is of "Residential Area" – CSEMP to include the following measures as well reflecting the ECPs and all the general EMP measures:	– CSEMP and H&S Plan approved before commencement of construction works minimizes EHS impacts and risks and is subsequently complied with during	Prior to and then for implementation during construction	√	√	√	Contract cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		– Ensure water suppression is used during construction works and do not conduct dusty work on windy days; dust levels not to exceed ambient air quality standards per Appendix X at adjacent properties. – Provide adjacent properties with cleaning service for external surfaces and windows on a weekly basis during the construction due to buildup of dust. – Construction to be conducted only during the daytime between 10am-4pm with noisy activity such as piling only between 10am-12pm and 2-4pm to minimize disturbance and is not to be conducted on weekends or on festivals or holidays; noise limits per Appendix X to be achieved at the adjacent properties. – To inform CSEMP and any piling management sub-plan due to proximity of properties to substation site contractor to undertake quantitative noise assessment of construction works using internationally recognized noise modelling software to confirm that noise standards per Appendix X can be achieved for the substation alone without additional noise mitigation. If required to meet noise standards contractor to install noise barrier etc. – Properties adjacent are to be consulted one-to-one	construction works as determined through regular site checks, photographic record etc. – No breaches of compliance with regulatory requirements or GIIP including ambient air quality and noise standards. – No outstanding dust, noise and general disturbance and disruption grievances from local communities or other interested stakeholders.					

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		and subject to structural survey and photographic record in case of vibration impact during construction. – No fuel, oil or chemicals are to be stored within 100m of the drainage canal at this site and stockpiles to be kept to materials required during the day's work due to immediately adjacent to any waterbody. – Landfilling and piling is required at the site and a method statement for the landfilling and management of piling mud is to be prepared to ensure the immediate adjacent waterbodies are protected, there must be no discharge of sediment laden water or piling mud to surface water. – Noise from piling will be contained to stipulated levels using quietest available piling methods and attenuating screens around piling equipment and site. – Site-specific traffic management plan to be developed and implemented given the large number of vehicles required to import infill material as well as to transport equipment, materials and construction waste which is likely to result in congestion due to narrow road. – Contrctor will remove any waste prior to any works and disposed of it at a suitable licensed waste management facility with transfer notes kept. – Flag men to be used at entry points and along						

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		access road to control the construction traffic flow and ensure pedestrian and vehicular safety						
132/33kV AIS: Kumarkhali, Kushtia								
Detailed Design and Preconstruction Phase								
Land supporting pump house	Environmental and social impacts due to loss of small pump house for irrigation	– Land supports pump house with land acquisition to be undertaken in accordance with the Resettlement Plan before access is given to the contractor for works providing sufficient time for alternative irrigation water supply to be installed – Pump house will need to be demolished, contractor to confirm no asbestos present (e.g., roofing material) prior to demolition	– EMP/SCAMP requirements successfully implemented as determined through regular site checks, photographic record etc.	Prior to and during infilling of the low-laying land	√	√	√	Contract Cost
Detailed design	Low lying land at risk of waterlogging during heavy rain, ponds are supported	– SS site is situated in low-lying areas, necessitating the elevation of the ground level and the construction of an access entrance from the adjacent road. – Contractor to conduct a flood risk and drainage assessment.	– Substation design is climate resilient.	Prior to approval of detailed design	√	√	√	Contract Cost
	Residential properties are located within 100m – per the IEE operational noise exceedance in silent zone might be possible up to 100m and residential zone	– Presence of residential property at the side of the substation means that the applicable noise limit at this site is of “residential zone” – Due to proximity of properties to substation site contractor to appropriately locate transformers so they are screened by the control building and undertake quantitative noise assessment using internationally recognized noise modelling software of the detailed design to confirm that	– No breaches of compliance with noise standards during O&M. – No outstanding noise grievances from local communities or other interested stakeholders.	Prior to approval of detailed design	√	√	√	Contract cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
	around 50m distant	noise standards per Appendix X can be achieved for the substation alone without additional noise mitigation. – Property is to be consulted one-on-one regarding the layout of the substation and their views to be accommodated – Design is to include vegetation screening of the substation between the residential property and the boundary fence; including planting of trees to screen views.						
	Loss of mature trees	– Detailed design is to avoid the loss of mature trees along the existing highway adjacent to the substation site; permission to be obtained by the contractor for any trees to be cut and replacement planting at 1:3 ratio to be undertaken. – Tree cutting is to be avoided during the bird nesting season.	– Trees cut are compensated for at 1:3 (no net loss of biodiversity) as per Biodiversity Management Plan and Tree Protection Plan	Prior to approval of detailed design	√	√	√	Contract cost
Substation construction activities	Disturbance to residential properties immediately adjacent from the construction traffic and works	– Presence of residential property at the side of the substation means that the applicable noise limit at this site is of “residential zone” – Ensure water suppression is used during construction works and do not conduct dusty work on windy days; dust levels not to exceed ambient air quality standards per Appendix X at adjacent properties. – Provide adjacent properties with cleaning service for external surfaces and windows on a weekly	– CSEMP and H&S Plan approved before commencement of construction works minimizes EHS impacts and risks and is subsequently complied with during construction works as determined through regular site checks, photographic record etc. – No breaches of compliance	Prior to and then for implementation during construction	√	√	√	Contract cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		basis during the construction due to buildup of dust. – Construction to be conducted only during the daytime between 10am-4pm with noisy activity such as piling only between 10am-12pm and 2-4pm to minimize disturbance and is not to be conducted on weekends or on festivals or holidays; noise limits per Appendix X to be achieved at the adjacent properties. – To inform CSEMP and any piling management sub-plan due to proximity of properties to substation site contractor to undertake quantitative noise assessment of construction works using internationally recognized noise modelling software to confirm that noise standards per Appendix X can be achieved for the substation alone without additional noise mitigation. If required to meet noise standards contractor to install noise barrier etc. – Properties adjacent are to be consulted one-to-one and subject to structural survey and photographic record in case of vibration impact during construction. – Landfilling and piling is required at the site and a method statement for landfilling and management of piling mud is to be prepared. Noise from piling will be contained to stipulated levels using quietest available piling methods and attenuating screens	with regulatory requirements or GIIP including ambient air quality and noise standards. – No outstanding dust, noise and general disturbance and disruption grievances from local communities or other interested stakeholders.					

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		around piling equipment and site. – No fuel, oil or chemicals are to be stored within 100 m of nearby ponds on adjacent land – Site-specific traffic management plan to be developed and implemented given the large number of vehicles required to import infill material as well as to transport equipment, materials and construction waste which is likely to result in congestion due to busy road. Provision of flag men at entry points and along the access road to control the traffic flow and ensure pedestrian and vehicular safety. – Overhead distribution lines run parallel to the highway and will need to be relocated or sufficiently raised in consultation with the distribution utility before works commence on site. – H&S risk assessment and management plan to address risk from presence of distribution lines; safety clearances must be maintained at all time and safety protection installed to avoid workers or machinery coming into accidental contact with them.						
132/33kV AIS: Chatkhil, Noakhali								
Detailed Design and Preconstruction Phase								
Infilling of low-lying land within ponds	Environmental and social impacts due to infilling works– no threatened species	– Contractor to employ field ecologist to undertake pre-construction ecology survey (after mobilization) of the substation site per the EMoP - as naturally low-lying land inundated round the	– EMP/SCEMP requirements successfully implemented as determined through regular site checks, photographic record	Prior to and during infilling of the low-laying land	√	√	√	Contract Cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
	anticipated	year any aquatic ecological value will be confirmed - submit survey report alongside detailed design. – EIA/IEE/EMP to be updated to reflect the results of aquatic ecology surveys before detailed design approval and the commencement of construction works. – Survey recommendations to be followed by the contractor, to ensure no net loss of biodiversity and to provide biodiversity enhancement, this will include local translocation of fish before infilling if small fish would be found present. – After awarding the contract, contractor will conduct ecological and associated other surveys prior to construction work.	etc.					
Detail Design	Residential properties are located within 100m – per the IEE operational noise exceedance in silent zone might be possible up to 100m and residential zone around 50m distant	– Presence of households near the substation means that the applicable noise limit at this site is of "residential zone" – Due to proximity of properties to substation site contractor to appropriately locate transformers if possible so they are screened by the control building and undertake quantitative noise assessment using internationally recognized noise modelling software of the detailed design to confirm that noise standards per Appendix X can be achieved for the substation alone without additional noise mitigation.	– No breaches of compliance with noise standards during O&M. – No outstanding noise grievances from local communities or other interested stakeholders.	Prior to approval of detailed design	√	√	√	Contract cost
	Low lying land at risk of waterlogging	– Detailed design to retain the drainage canal along the highway as an open channel except for the	– Substation design is climate resilient.	Prior to approval of detailed design	√	√	√	Contract cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
	during heavy rain, ponds are supported	creation of a site access; in this location bridge or culvert(s) of 1:100-year capacity to be installed with any culvert inverted below bed level to allow natural substrate to reform. – SS site is situated in low-lying areas, necessitating the elevation of the ground level and the construction of a 35m access entrance from the adjacent road. To avoid altering the local hydrology to maintain natural water flow, the entrance design needs to incorporate cross-drainage structures with adequate openings. – Contractor to conduct a flood risk and drainage assessment including modelling of the site layout and drainage design with particular attention to loss of flood storage capacity due to the infill – Detailed design to ensure adjacent flood levels do not increase due to loss of floodwater storage as a result of the infill						
	Residential properties are located within 100m – per the IEE operational noise exceedance in silent zone might be possible up to 100m	– Presence of residential properties by the substation means that the applicable noise limit at this site is of "residential zone" – Due to proximity of properties to substation site contractor to appropriately locate transformers so they are screened by the control building and undertake quantitative noise assessment using internationally recognized noise modelling software of the detailed design to confirm that noise standards per Appendix X can be achieved	– No breaches of compliance with noise standards during O&M. – No outstanding noise grievances from local communities or other interested stakeholders.	Prior to approval of detailed design	√	√	√	Contract cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		for the substation alone without additional noise mitigation.						
	Loss of mature trees	– Detailed design is to avoid the loss of mature trees along the existing highway adjacent to the substation site; permission to be obtained by the contractor for any trees to be cut and replacement planting at 1:3 ratio to be undertaken. – Tree cutting is to be avoided during the bird nesting season.	– Trees cut are compensated for at 1:3 (no net loss of biodiversity) as per Biodiversity Management Plan and Tree Protection Plan	Prior to approval of detailed design	√	√	√	Contract cost
Substation construction activities	Disturbance to ponds and residential properties immediately adjacent from the construction traffic and works	– Before land filling ponds that will be lost are to have the water pumped out and fish trapped translocated by the contractor's ecologist to nearby ponds. – Presence of households near the substation means that the applicable noise limit at this site is of "residential zone" – Ensure water suppression is used during construction works and do not conduct dusty work on windy days; dust levels not to exceed ambient air quality standards per Appendix X at adjacent properties. – Provide adjacent properties with cleaning service for external surfaces and windows on a weekly basis during the construction due to buildup of dust. – Construction to be conducted only during the daytime between 10am-4pm with noisy activity such as piling only between 10am-12pm and 2-	– CSEMP and H&S Plan approved before commencement of construction works minimizes EHS impacts and risks and is subsequently complied with during construction works as determined through regular site checks, photographic record etc. – No breaches of compliance with regulatory requirements or GIIP including ambient air quality and noise standards. – No outstanding dust, noise and general disturbance and disruption grievances from local communities or other interested stakeholders.	Prior to and then for implementation during construction	√	√	√	Contract cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		4pm to minimize disturbance and is not to be conducted on weekends or on festivals or holidays; noise limits per Appendix X to be achieved at the adjacent properties. – To inform CSEMP and any piling management sub-plan due to proximity of properties to substation site contractor to undertake quantitative noise assessment of construction works using internationally recognized noise modelling software to confirm that noise standards per Appendix X can be achieved for the substation alone without additional noise mitigation. If required to meet noise standards contractor to install noise barrier etc. – Properties adjacent are to be consulted one-to-one and subject to structural survey and photographic record in case of vibration impact during construction. – No fuel, oil or chemicals are to be stored at this site and stockpiles to be kept to materials required during the day's work due to immediately adjacent waterbody. – Landfilling and piling is required at the site and a method statement for the landfilling and management of piling mud is to be prepared to ensure the immediate adjacent waterbodies are protected, there must be no discharge of sediment laden water or piling mud to surface water.						

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		– Noise from piling will be contained to stipulated levels using quietest available piling methods and attenuating screens around piling equipment and site. – Site-specific traffic management plan to be developed and implemented given the large number of vehicles required to import infill material as well as to transport equipment, materials and construction waste which is likely to result in congestion due to narrow road. Provision of flag men at entry points and along the access road to control the traffic flow and ensure pedestrian and vehicular safety. – Overhead distribution line runs parallel to the highway and will need to be relocated or sufficiently raised in consultation with the distribution utility before works commence on site. – H&S risk assessment and management plan to address risk from presence of distribution lines; safety clearances must be maintained at all time and safety protection installed to avoid workers or machinery coming into accidental contact with them.						
132/33kV AIS: Paikgacha, Khulna								
Detailed Design and Preconstruction Phase								
Infilling of low-lying land (inundated low	Environmental and social impacts due to infilling works	– Properties will need to be demolished, the contractor to confirm no asbestos present (e.g., roofing material) prior to demolition	– EMP/SCAMP requirements successfully implemented as determined through regular site	Prior to infilling of the low-laying land	√	√	√	Contract Cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
land area)	including impacts on ecology – no threatened species anticipated.	– Existing tube well to be decommissioned, disinfected and plugged with grout prior to landfilling - this in order to prevent surface water ingress and prevent water from different levels in the subsurface from mixing since an unsealed well can be a potential pathway for land contamination reaching the groundwater – Contractor to employ field ecologist to undertake pre-construction ecology survey including potential for threatened vegetation species to be supported and migratory ornithological survey of the substation site as per the EMoP including point counts surveys to identify movement of birds across the substation site and transmission line - as naturally low-lying land inundated round the year any aquatic ecological value will be confirmed - submit survey report alongside detailed design. – EIA/IEE/EMP to be updated to reflect the results of ecology and bird surveys before detailed design approval and the commencement of construction works. Ecological survey recommendations must be taken by the contractor to protect any ecology in the substation site and ensure no net loss of biodiversity. – In developing recommendations social experts to be consulted to ensure the livelihoods of communities using the adjacent inundated low-lying land for fisheries are also not adversely	checks, photographic record etc.					

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		impacted by dewatering or changes in water levels due to loss of flood storage etc. – Site allocated to the substation is owned by PGCB but whilst substation construction is awaited fish cultivation may still be taking place, this will be confirmed in finalizing the IEE and Resettlement Plan. Contractor to provide sufficient time for fish to be harvested before commencing construction						
Detail Design	Low lying land at risk of waterlogging during heavy rain	– Detailed design to retain a drainage canal around the edge of the site as an open channel except for the creation of a site access; in this location bridge or culvert of 1:100-year capacity to be installed with any culvert inverted below bed level to allow natural substrate to reform. – Layout to account for presence of groundwater wells to avoid pollution from septic tanks etc. – SS site is situated in low-lying areas, necessitating the elevation of the ground level. To avoid altering the local hydrology maintain natural water flow, the entrance design needs to incorporate cross-drainage structures with adequate openings. – Contractor to conduct a flood risk and drainage assessment including modelling of the site layout and drainage design with particular attention to loss of flood storage capacity due to the infill – During detailed design social experts to be consulted to ensure the livelihoods of communities using the adjacent inundated low lying land for	– Substation design is climate resilient.	Prior to approval of detailed design	√	√	√	Contract cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		fisheries are also not adversely impacted by dewatering or changes in water levels etc. – Paikgacha faces challenges with groundwater containing high levels of iron and salinity. Residents depend on bottled water for drinking and surface water for bathing and washing. The salinity issue regarding drinking water quality will be taken care of by installing more extensive drinking water treatment facilities at substations like Paikgacha to ensure GOB drinking water standards are met.						
	Loss of mature trees with 7 to be cut	– 7 trees are supported by the site (around the pond perimeter) as well as mature trees along the access road; detailed design is to avoid the loss of mature trees on the site and along the existing highway adjacent to the substation site; permission to be obtained by the contractor for any trees to be cut and replacement planting at 1:3 ratio to be undertaken. – No loss of any nationally or IUCN threatened species (VU, EN and CR) of vegetation – Tree cutting is to be avoided during the bird nesting season.	– Trees cut are compensated for at 1:3 (no net loss of biodiversity) as per Biodiversity Management Plan and Tree Protection Plan	Prior to approval of detailed design	√	√	√	Contract cost
	School and Residential properties are located within 100m – per the IEE	– Presence of school beside the substation means that the applicable noise limit at this site is of "silent zone" – Due to proximity of properties to substation site contractor to appropriately locate transformers if	– No breaches of compliance with noise standards during O&M. – No outstanding noise grievances from local	Prior to approval of detailed design	√	√	√	Contract cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
	operational noise exceedance in silent zone might be possible up to 100m and residential zone around 50m distant	possible so they are screened by the control building and undertake quantitative noise assessment using internationally recognized noise modelling software of the detailed design to confirm that noise standards per Appendix X can be achieved for the substation alone without additional noise mitigation. – Site entrance must be sited off the main road and be located at least 50m from the school entrance – Zebra crossing and solid safety barriers to be provided outside of the school to prevent children running into the road in front of construction traffic	communities or other interested stakeholders.					
	Local and potential migratory bird interaction with substation and connecting TL	– Substation lighting to be designed to avoid any nighttime lighting spilling outside of the substation compound on the adjacent fish pond habitat using movement detection sensors. – -Adopt a bird-friendly design in accordance with GIIP[79] with adequate separation of insulation between live and ground	– Substation adopts recommendations of the bird survey and a bird friendly design per GIIP	Prior to approval of detailed design	√	√	√	Contract cost
Demolition and substation construction activities	Disturbance to school and residential properties immediately adjacent, local and potential migratory	– Construction to be conducted only during the dry season – Schedule works to avoid the monsoon in Bangladesh when the water level in the fish ponds is at its highest – No works to be undertaken from 1 hour before	– CSEMP and H&S Plan approved before commencement of construction works minimizes EHS impacts and risks and is subsequently complied with during	Prior to and then for implementation during construction	√	√	√	Contract cost

[79] Avian Power Line Interaction Committee (APLIC) 2006 and 2012

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
	birds, and pollution from the construction traffic and works	sunset to 1 hour after sunrise to minimize impacts on wildlife. – Presence of school beside the substation means that the applicable noise limit at this site is of "silent zone" – Ensure water suppression is used during construction works and do not conduct dusty work on windy days; dust levels not to exceed ambient air quality standards per Appendix X at adjacent properties. – Provide adjacent properties with cleaning service for external surfaces and windows on a weekly basis during the construction due to buildup of dust. – Construction to be conducted only during the daytime between 10am-4pm with noisy activity such as piling only between 10am-12pm and 2-4pm to minimize disturbance and is not to be conducted on weekends or on festivals or holidays; noise limits per Appendix X to be achieved at the adjacent properties. – School to be consulted regarding other periods to avoid the noisy activity to be undertaken e.g. exam periods and their requests accommodated by the contractor – Daily one-hour "spot check" of noise levels at the school boundary during noisy activities to confirm compliance and the results (min, 1hr LAeq, max)	construction works as determined through regular site checks, photographic record etc. – No breaches of compliance with regulatory requirements or GIIP including ambient air quality and noise standards. – No outstanding dust, noise and general disturbance and disruption grievances from local communities or other interested stakeholders.					

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		shared with the head teacher – additional monitoring will be undertaken if head teacher raises concerns about the noise levels – To inform CSEMP and any piling management sub-plan due to proximity of properties to substation site contractor to undertake quantitative noise assessment of construction works using internationally recognized noise modelling software to confirm that noise standards per Appendix X can be achieved for the substation alone without additional noise mitigation. If required to meet noise standards contractor to install noise barrier etc. – Properties adjacent are to be consulted one-to-one and subject to structural survey and photographic record in case of vibration impact during construction. – No fuel, oil or chemicals are to be stored at this site and stockpiles to be kept to materials required during the day's work due to immediately adjacent waterbody and groundwater wells also present. – Land filling and piling required at the site and a method statement for the landfilling and management of piling mud is to be prepared to ensure the immediate adjacent waterbody is protected, there must be no discharge of sediment laden water or untreated piling mud to surface water.						

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		– Sensitive waterbodies adjacent to be avoided during construction will be flagged for protection. As there may be a risk of workers accidentally straying into these areas then worker training and the code of conduct will cover measures to ensure that wildlife will be protected. – Noise and vibration from piling will be contained to stipulated levels using quietest available piling methods and attenuating screens around piling equipment and site. – Site-specific traffic management plan to be developed and implemented given the large number of vehicles required to import infill material as well as to transport equipment, materials and construction waste which is likely to result in congestion due to narrow road. Provision of flag men at entry points and along the access road to control the traffic flow and ensure pedestrian and vehicular safety. – Trucks must be routed from the east and no trucks must use the section of road passing in front of the school premises – No truck movements will be permitted 1 hour before school starting and 1 hour after school ending times; contractor must provide a school crossing patrol during these times for the duration – Contractor must provide road and construction safety awareness sessions to the school children						

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		before the start of construction and then on a regular basis – Overhead distribution lines run parallel to the highway and will need to be relocated or sufficiently raised in consultation with the distribution utility before works commence on site. – H&S risk assessment and management plan to address risk from presence of distribution lines; safety clearances must be maintained at all time and safety protection installed to avoid workers or machinery coming into accidental contact with them.						
132/33kV AIS: Mathbaria, Pirojpur								
Detailed Design and Preconstruction Phase								
Detail Design	Residential properties are located within 100m – per the IEE operational noise exceedance in silent zone might be possible up to 100m and residential zone around 50m distant	– Presence of households near the substation means that the applicable noise limit at this site is of "residential zone" – Due to proximity of properties to substation site contractor to appropriately locate transformers if possible so they are screened by the control building and undertake quantitative noise assessment using internationally recognized noise modelling software of the detailed design to confirm that noise standards per Appendix X can be achieved for the substation alone without additional noise mitigation.	– No breaches of compliance with noise standards during O&M. – No outstanding noise grievances from local communities or other interested stakeholders.	Prior to approval of detailed design	√	√	√	Contract cost
	Low lying land at risk of waterlogging	– Detailed design to retain the drainage canal along the highway as an open channel except for the	–					

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
	during heavy rain	creation of a site access; in this location bridge or culvert(s) of 1:100-year capacity to be installed with any culvert inverted below bed level to allow natural substrate to reform. – SS site is situated in low-lying areas, necessitating the elevation of the ground level and the construction of an access entrance from the adjacent road. To avoid altering the local hydrology to maintain natural water flow, the entrance design needs to incorporate cross-drainage structures with adequate openings. – Contractor to conduct a flood risk and drainage assessment						
	Loss of mature trees	– Detailed design is to avoid the loss of mature trees along the existing highway adjacent to the substation site; permission to be obtained by the contractor for any trees to be cut and replacement planting at 1:3 ratio to be undertaken. – No loss of nationally or IUCN threatened (VU/EN/CR) vegetation species. – Tree cutting is to be avoided during the bird nesting season.	– Trees cut are compensated for at 1:3 (no net loss of biodiversity) as per Biodiversity Management Plan and Tree Protection Plan	Prior to approval of detailed design	√	√	√	Contract cost
Substation construction activities	Disturbance to residential properties immediately adjacent from the construction traffic and works	– Presence of households near the substation means that the applicable noise limit at this site is of “residential zone” – Ensure water suppression is used during construction works and do not conduct dusty work on windy days; dust levels not to exceed ambient	– CSEMP and H&S Plan approved before commencement of construction works minimizes EHS impacts and risks and is subsequently complied with during	Prior to and then for implementation during construction	√	√	√	Contract cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		air quality standards per Appendix X at adjacent properties. – Provide adjacent properties with cleaning service for external surfaces and windows on a weekly basis during the construction due to buildup of dust. – Construction to be conducted only during the daytime between 10am-4pm with noisy activity such as piling only between 10am-12pm and 2-4pm to minimize disturbance and is not to be conducted on weekends or on festivals or holidays; noise limits per Appendix X to be achieved at the adjacent properties. – To inform CSEMP and any piling management sub-plan due to proximity of properties to substation site contractor to undertake quantitative noise assessment of construction works using internationally recognized noise modelling software to confirm that noise standards per Appendix X can be achieved for the substation alone without additional noise mitigation. If required to meet noise standards contractor to install noise barrier etc. – Properties adjacent are to be consulted one-to-one and subject to structural survey and photographic record in case of vibration impact during construction. – No fuel, oil or chemicals are to be stored within	construction works as determined through regular site checks, photographic record etc. – No breaches of compliance with regulatory requirements or GIIP including ambient air quality and noise standards. – No outstanding dust, noise and general disturbance and disruption grievances from local communities or other interested stakeholders.					

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		100m of the drainage canal and stockpiles to be kept to materials required during the day's work due to immediately adjacent waterbody. – Landfilling and piling is required at the site and a method statement for the landfilling and management of piling mud is to be prepared to ensure the immediate adjacent waterbody is protected, there must be no discharge of sediment laden water or piling mud to surface water. – Noise from piling will be contained to stipulated levels using quietest available piling methods and attenuating screens around piling equipment and site. – Site-specific traffic management plan to be developed and implemented given the large number of vehicles required to import infill material as well as to transport equipment, materials and construction waste which is likely to result in congestion due to busy road. Provision of flag men at entry points and along the access road to control the traffic flow and ensure pedestrian and vehicular safety. – Overhead distribution line runs parallel to the highway and will need to be relocated or sufficiently raised in consultation with the distribution utility before works commence on site. – H&S risk assessment and management plan to address risk from presence of distribution lines;						

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		safety clearances must be maintained at all time and safety protection installed to avoid workers or machinery coming into accidental contact with them.						
Bay Extensions								
2× 132 kV AIS Bay Extension at Bajitpur Substation								
Detailed design	Residential properties are located within 100m – per the IEE operational noise exceedance in silent zone might be possible up to 100m and residential zone around 50m distant	– Obtain confirmation no PCB are present at the existing substation – No works will be undertaken outside the existing boundary wall of the substation and no landfilling conducted – If demolition of existing equipment or buildings is required asbestos survey to be conducted by comptentent asbestos surveyor and asbestos management plan following GIIP developed and implemented. – Presence of houses near the substation means that the applicable noise limit at this site is of "Residential Area" – Due to proximity of properties to substation site contractor to appropriately locate transformers if possible so they are screened by the control building and undertake quantitative noise assessment using internationally recognized noise modelling software of the detailed design to confirm that noise standards per Appendix X can be achieved for the substation alone and cumulatively with the existing SS without additional	– No breaches of compliance with noise standards during O&M. – No outstanding noise grievances from local communities or other interested stakeholders.	Prior to approval of detailed design	√	√	√	Contract cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		noise mitigation. – Soil testing including SS related contamination tests will be undertaken in the construction area given current status of housekeeping at the SS – Layout to account for presence of groundwater wells to avoid pollution.						
Substation construction activities	Impacts from interaction with existing substation	– PGCB to ensure no other construction contractor is working on the site before giving access to the contractor, that all boundary walls are complete and security gates and guards are in operation – Contractor will clearly demarcate an access route to and their working area within the existing substation, in that area they will be fully responsible for the H&S of all persons including PGCB staff – In the remainder of the substation PGCB will have primary responsibility for the H&S of all persons; contractor will ensure that their workers do not enter areas outside of the demarked area unless under PGCB supervision	– CSEMP and H&S Plan approved before commencement of construction works minimizes EHS impacts and risks and is subsequently complied with during construction works as determined through regular site checks, photographic record etc.	Prior to and then for implementation during construction	√	√	√	Contract cost
	Disturbance to residential properties immediately adjacent from the construction traffic and works	– Presence of houses near the substation means that the applicable noise limit at this site is of "Residential Area" – Ensure water suppression is used during construction works and do not conduct dusty work on windy days; dust levels not to exceed ambient air quality standards per Appendix X at adjacent properties.	– CSEMP and H&S Plan approved before commencement of construction works minimizes EHS impacts and risks and is subsequently complied with during construction works as determined through regular site	Prior to and then for implementation during construction	√	√	√	Contract cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		– Provide adjacent properties with cleaning service for external surfaces and windows on a weekly basis during the construction due to buildup of dust. – Construction to be conducted only during the daytime between 10am-4pm with noisy activity such as piling only between 10am-12pm and 2-4pm to minimize disturbance and is not to be conducted on weekends or on festivals or holidays; noise limits per Appendix X to be achieved at the adjacent properties. – To inform CSEMP and any piling management sub-plan due to proximity of properties to substation site contractor to undertake quantitative noise assessment of construction works using internationally recognized noise modelling software to confirm that noise standards per Appendix X can be achieved for the bay extension alone and cumulatively with existing SS noise without additional noise mitigation. If required to meet noise standards contractor to install noise barrier etc. – Properties adjacent are to be consulted one-to-one and subject to structural survey and photographic record in case of vibration impact during construction. – If piling is required, method statement for management of piling mud is to be prepared to	checks, photographic record etc. – No breaches of compliance with regulatory requirements or GIIP including ambient air quality and noise standards. No outstanding dust, noise and general disturbance and disruption grievances from local communities or other interested stakeholders.					

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		ensure the immediate adjacent waterbody is protected, there must be no discharge of piling mud to surface water. – Noise from piling will be contained to stipulated levels using quietest available piling methods and attenuating screens around piling equipment and site. – No fuel, oil or chemicals are to be stored within 100 m of the adjacent pond – Site-specific traffic management plan to be developed and implemented, provision of flag men at entry points and along the access road to control the traffic flow and ensure pedestrian and vehicular safety. – H&S risk assessment and management plan to address risk from presence of existing SS electrical infrastructure and distribution lines across the SS entrance; safety clearances must be maintained at all time and safety protection installed beneath distribution lines to avoid workers or machinery coming into accidental contact with them.						
2× 132kV AIS Bay Extension at Gopalganj (Old) Substation								
Detailed design	Residential properties are located within 100m – per the IEE operational noise	– No works will be undertaken outside the existing boundary wall of the substation and no landfilling conducted – Obtain confirmation no PCB are present at the	– No breaches of compliance with noise standards during O&M. – No outstanding noise grievances from local	Prior to approval of detailed design	√	√	√	Contract cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
	exceedance in silent zone might be possible up to 100m and residential zone around 50m distant	existing substation – Presence of houses near the substation means that the applicable noise limit at this site is of "Residential Area" – Due to proximity of properties to substation site contractor to appropriately locate transformers if possible so they are screened by the control building and undertake quantitative noise assessment using internationally recognized noise modelling software of the detailed design to confirm that noise standards per Appendix X can be achieved for the substation alone and cumulatively with the existing SS without additional noise mitigation. – Contractor to conduct a flood risk and drainage assessment including modelling of the site layout and drainage design – Soil testing including SS related contamination tests will be undertaken in the construction area given current status of housekeeping at the SS	communities or other interested stakeholders.					
	Loss of mature trees	– Detailed design is to avoid the loss of mature trees within the substation site; demarcation of the construction access route and area in the SS to avoid accidental damage	– No loss of mature trees from inside the existing substation site	Prior to approval of detailed design	√	√	√	Contract cost
Substation construction activities	Impacts from interaction with existing substation	– PGCB to ensure no other construction contractor is working on the site before giving access to the contractor, that all boundary walls are complete	– CSEMP and H&S Plan approved before commencement of construction	Prior to and then for implementation during construction	√	√	√	Contract cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		and security gates and guards are in operation – Contractor will clearly demarcate an access route to and their working area within the existing substation, in that area they will be fully responsible for the H&S of all persons including PGCB staff – In the remainder of the substation PGCB will have primary responsibility for the H&S of all persons; contractor will ensure that their workers do not enter areas outside of the demarked area unless under PGCB supervision	works minimizes EHS impacts and risks and is subsequently complied with during construction works as determined through regular site checks, photographic record etc.					
	Disturbance to residential properties immediately adjacent from the construction traffic and works	– Presence of houses near the substation means that the applicable noise limit at this site is of "Residential Area" – Ensure water suppression is used during construction works and do not conduct dusty work on windy days; dust levels not to exceed ambient air quality standards per Appendix X at adjacent properties. – Provide adjacent properties with cleaning service for external surfaces and windows on a weekly basis during the construction due to buildup of dust. – Construction to be conducted only during the daytime between 10am-4pm with noisy activity such as piling only between 10am-12pm and 2-4pm to minimize disturbance and is not to be conducted on weekends or on festivals or	– CSEMP and H&S Plan approved before commencement of construction works minimizes EHS impacts and risks and is subsequently complied with during construction works as determined through regular site checks, photographic record etc. – No breaches of compliance with regulatory requirements or GIIP including ambient air quality and noise standards. – No outstanding dust, noise and general disturbance and disruption grievances from local	Prior to and then for implementation during construction	√	√	√	Contract cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		holidays; noise limits per Appendix X to be achieved at the adjacent properties. – To inform CSEMP and any piling management sub-plan due to proximity of properties to substation site contractor to undertake quantitative noise assessment of construction works using internationally recognized noise modelling software to confirm that noise standards per Appendix X can be achieved for the substation alone and cumulatively with existing SS noise without additional noise mitigation. If required to meet noise standards contractor to install noise barrier etc. – If piling is required, method statement for the management of piling mud is to be prepared to ensure the immediate adjacent waterbody is protected, there must be no discharge of sediment laden water or piling mud to surface water. – Noise from piling will be contained to stipulated levels using quietest available piling methods and attenuating screens around piling equipment and site. – Properties adjacent are to be consulted one-to-one and subject to structural survey and photographic record in case of vibration impact during construction. – No fuel, oil or chemicals are to be stored within 100 m of the adjacent pond	communities or other interested stakeholders.					

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		– Site-specific traffic management plan to be developed and implemented, provision of flag men at entry points and along the access road to control the traffic flow and ensure pedestrian and vehicular safety. – H&S risk assessment and management plan to address risk from presence of existing SS electrical infrastructure and distribution lines across the SS entrance; safety clearances must be maintained at all time and safety protection installed beneath distribution lines to avoid						
2× 132kV AIS Bay Extension at Kachua 230/132kV Substation								
Detailed design	Mosque in 50m and residential properties are located within 100m – per the IEE operational noise exceedance in silent zone might be possible up to 100m and residential zone around 50m distant	– Obtain confirmation no PCB are present at the existing substation – Presence of collage and mosque in 0-50m of the substation means that the applicable noise limit at this site is of “Silent Area” – Due to proximity of properties to substation site contractor to appropriately locate transformers if possible so they are screened by the control building and undertake quantitative noise assessment using internationally recognized noise modelling software of the detailed design to confirm that noise standards per Appendix X can be achieved for the substation alone and cumulatively with the existing SS without additional noise mitigation. – Soil testing including SS related contamination	– No breaches of compliance with noise standards during O&M. – No outstanding noise grievances from local communities or other interested stakeholders.	Prior to approval of detailed design	√	√	√	Contract cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		tests will be undertaken in the construction area given current status of housekeeping at the SS – Layout to account for presence of groundwater wells to avoid pollution. – No works will be undertaken outside the existing boundary wall of the substation and no landfilling conducted						
	Loss of mature trees	– Detailed design is to avoid the loss of mature trees within the substation site; demarcation of the construction access route and area in the SS to avoid accidental damage	– No loss of mature trees from inside the existing substation site	Prior to approval of detailed design	√	√	√	Contract cost
Substation construction activities	Impacts from interaction with existing substation	– If demolition of existing equipment or buildings is required asbestos survey to be conducted by comptentent asbestos surveyor and asbestos management plan following GIIP developed and implemented. – PGCB to ensure no other construction contractor is working on the site before giving access to the contractor, that all boundary walls are complete and security gates and guards are in operation – Contractor will clearly demarcate an access route to and their working area within the existing substation, in that area they will be fully responsible for the H&S of all persons including PGCB staff – In the remainder of the substation PGCB will have primary responsibility for the H&S of all persons; contractor will ensure that their workers do not	– CSEMP and H&S Plan approved before commencement of construction works minimizes EHS impacts and risks and is subsequently complied with during construction works as determined through regular site checks, photographic record etc.	Prior to and then for implementation during construction	√	√	√	Contract cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		enter areas outside of the demarked area unless under PGCB supervision						
	Disturbance to residential properties immediately adjacent from the construction traffic and works	– Presence of collage and mosque in 50m of the substation means that the applicable noise limit at this site is of "Silent Area" – Ensure water suppression is used during construction works and do not conduct dusty work on windy days; dust levels not to exceed ambient air quality standards per Appendix X at adjacent properties. – Provide adjacent properties with cleaning service for external surfaces and windows on a weekly basis during the construction due to buildup of dust. – Construction to be conducted only during the daytime between 10am-4pm with noisy activity such as piling only between 10am-12pm and 2-4pm to minimize disturbance and is not to be conducted on weekends or on festivals or holidays; noise limits per Appendix X to be achieved at the adjacent properties. – No noisy activities will be permitted during prayer times; – Collage to be consulted regarding other periods to avoid the noisy activity to be undertaken e.g. exam periods and their requests accommodated by the contractor – Daily one-hour "spot check" of noise levels at the	– CSEMP/H&S/BMP Plan approved before commencement of construction works minimizes EHS impacts and risks and is subsequently complied with during construction works as determined through regular site checks, photographic record etc. – No breaches of compliance with regulatory requirements or GIIP including ambient air quality and noise standards. – No outstanding dust, noise and general disturbance and disruption grievances from local communities or other interested stakeholders.	Prior to and then for implementation during construction	√	√	√	Contract cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		collage boundary during noisy activities to confirm compliance and the results (min, 1hr LAeq, max) shared with the collage principal – additional monitoring will be undertaken if collage principal raises concerns about the noise levels – No truck movements will be permitted 1 hour before collage starting and 1 hour after collage ending times – Contractor must provide road and construction safety awareness sessions to the collage pupils before the start of construction and then on a regular basis – To inform CSEMP and any piling management sub-plan due to proximity of properties to substation site contractor to undertake quantitative noise assessment of construction works using internationally recognized noise modelling software to confirm that noise standards per Appendix X can be achieved for the substation alone and cumulatively with existing SS noise without additional noise mitigation. If required to meet noise standards contractor to install noise barrier etc. – Properties adjacent are to be consulted one-to-one and subject to structural survey and photographic record in case of vibration impact during construction. – If piling is required, method statement for						

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		management of piling mud is to be prepared to ensure the immediate adjacent waterbody is protected, there must be no discharge of piling mud to surface water. – Noise from Piling will be contained to stipulated levels using quietest available piling methods and attenuating screens around piling equipment and site. – No fuel, oil or chemicals are to be stored within 100 m of the adjacent canal and ponds and the groundwater wells – Site-specific traffic management plan to be developed and implemented, provision of flag men at entry points and along the access road to control the traffic flow and ensure pedestrian and vehicular safety. – H&S risk assessment and management plan to address risk from presence of existing SS electrical infrastructure and distribution lines across the SS entrance; safety clearances must be maintained at all time and safety protection installed beneath distribution lines to avoid						
2×132kV AIS Bay Extension at Satkhira Substation								
Detailed design	Poor drainage at the existing substation	– Improve capacity of the storm drainage at Satkhira SS to prevent waterlogging of switchyard (this needs to be done in parallel with drainage design for the project)	–					

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		– Contractor to conduct a flood risk and drainage assessment including modelling of the site layout and drainage design – Flood levels could be managed by providing a pond that can also provide wildlife benefit, there is no pond in the existing substation area.						
	Residential properties are located within 100m – per the IEE operational noise exceedance in silent zone might be possible up to 100m and residential zone around 50m distant	– No works will be undertaken outside the existing boundary wall of the substation and no landfilling conducted – Obtain confirmation that no PCB present in the existing substation – Presence of houses near the substation means that the applicable noise limit at this site is of "Residential Area" – Due to proximity of properties to substation site contractor to appropriately locate transformers if possible so they are screened by the control building and undertake quantitative noise assessment using internationally recognized noise modelling software of the detailed design to confirm that noise standards per Appendix X can be achieved for the substation alone and cumulatively with the existing SS without additional noise mitigation. – Soil testing including SS related contamination tests will be undertaken in the construction area given current status of housekeeping at the SS	– No breaches of compliance with noise standards during O&M. – No outstanding noise grievances from local communities or other interested stakeholders.	Prior to approval of detailed design	√	√	√	Contract cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		– Layout to account for presence of groundwater wells to avoid pollution.						
	Loss of mature trees with 37 to be cut	– Detailed design is to avoid the loss of mature trees – 37 trees are supported by the site; detailed design is to avoid the within the substation site; demarcation of the construction access route and area in the SS to avoid accidental damage; permission to be obtained by the contractor for any trees to be cut and replacement planting at 1:3 ratio to be undertaken. – Tree cutting is to be avoided during the bird nesting season.	– No more than 37 trees lost from inside the existing substation site – Trees cut are compensated for at 1:3 (no net loss of biodiversity) as per Biodiversity Management Plan and Tree Protection Plan	Prior to approval of detailed design	√	√	√	Contract cost
Substation construction activities	Impacts from interaction with existing substation	– If demolition of existing equipment or buildings is required asbestos survey to be conducted by comptentent asbestos surveyor and asbestos management plan following GIIP developed and implemented. – PGCB to ensure no other construction contractor is working on the site before giving access to the contractor, that all boundary walls are complete and security gates and guards are in operation – Contractor will clearly demarcate an access route to and their working area within the existing substation, in that area they will be fully responsible for the H&S of all persons including PGCB staff – In the remainder of the substation PGCB will have primary responsibility for the H&S of all persons;	– CSEMP and H&S Plan approved before commencement of construction works minimizes EHS impacts and risks and is subsequently complied with during construction works as determined through regular site checks, photographic record etc.	Prior to and then for implementation during construction	√	√	√	Contract cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		contractor will ensure that their workers do not enter areas outside of the demarked area unless under PGCB supervision						
	Disturbance to residential properties immediately adjacent from the construction traffic and works	– Presence of houses near the substation means that the applicable noise limit at this site is of "Residential Area" – Ensure water suppression is used during construction works and do not conduct dusty work on windy days; dust levels not to exceed ambient air quality standards per Appendix X at adjacent properties. – Provide adjacent properties with cleaning service for external surfaces and windows on a weekly basis during the construction due to buildup of dust. – Construction to be conducted only during the daytime between 10am-4pm with noisy activity such as piling only between 10am-12pm and 2-4pm to minimize disturbance and is not to be conducted on weekends or on festivals or holidays; noise limits per Appendix X to be achieved at the adjacent properties. – To inform CSEMP and any piling management sub-plan due to proximity of properties to substation site contractor to undertake quantitative noise assessment of construction works using internationally recognized noise modelling software to confirm that noise standards per	– CSEMP/H&S/BMP Plans approved before commencement of construction works minimizes EHS impacts and risks and is subsequently complied with during construction works as determined through regular site checks, photographic record etc. – No breaches of compliance with regulatory requirements or GIIP including ambient air quality and noise standards. – No outstanding dust, noise and general disturbance and disruption grievances from local communities or other interested stakeholders.	Prior to and then for implementation during construction	√	√	√	Contract cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		Appendix X can be achieved for the bay extension alone and cumulatively with existing SS noise without additional noise mitigation. If required to meet noise standards contractor to install noise barrier etc. – Properties adjacent are to be consulted one-to-one and subject to structural survey and photographic record in case of vibration impact during construction. – If piling is required, method statement for landfilling and the management of piling mud is to be prepared to ensure the immediate adjacent waterbody is protected, there must be no discharge of sediment laden water or piling mud to surface water. – Noise from piling will be contained to stipulated levels using quietest available piling methods and attenuating screens around piling equipment and site. – No fuel, oil or chemicals are to be stored within 100m of the adjacent waterbodies and groundwater wells – Site-specific traffic management plan to be developed and implemented, provision of flag men at entry points and along the access road to control the traffic flow and ensure pedestrian and vehicular safety. – H&S risk assessment and management plan to						

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		address risk from presence of existing SS electrical infrastructure and distribution lines across the SS entrance; safety clearances must be maintained at all time and safety protection installed beneath distribution lines to avoid workers or machinery coming into accidental contact with them.						
132kV AIS Bay Extension at Bhandaria								
Detailed design	Mosque in 50m and residential properties are located within 100m – per the IEE operational noise exceedance in silent zone might be possible up to 100m and residential zone around 50m distant	– Obtain confirmation no PCB is present at the existing substation – Presence of mosque in 25m of the substation means that the applicable noise limit at this site is of "Silent Area" – Due to proximity of properties to substation site contractor to appropriately locate transformers if possible so they are screened by the control building and undertake quantitative noise assessment using internationally recognized noise modelling software of the detailed design to confirm that noise standards per Appendix X can be achieved for the substation alone and cumulatively with the existing SS without additional noise mitigation. – Soil testing including SS related contamination tests will be undertaken in the construction area given current status of housekeeping at the SS	– No breaches of compliance with noise standards during O&M. – No outstanding noise grievances from local communities or other interested stakeholders.	Prior to approval of detailed design	√	√	√	Contract cost
	Loss of mature trees	– Detailed design is to avoid the loss of mature trees	– No more than 8 trees lost from	Prior to approval of	√	√	√	Contract

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
	with 8 to be cut	– 8 trees are supported by the site of which 7 may need to be cut due to lack of space to accommodate the bay extension; demarcation of the construction access route and area in the SS to avoid accidental damage; permission to be obtained by the contractor for any trees to be cut and replacement planting at 1:3 ratio to be undertaken. – Tree cutting is to be avoided during the bird nesting season.	inside the existing substation site – Trees cut are compensated for at 1:3 (no net loss of biodiversity) as per Biodiversity Management Plan and Tree Protection Plan	detailed design				cost
Substation construction activities	Impacts from interaction with existing substation	– PGCB to ensure no other construction contractor is working on the site before giving access to the contractor, that all boundary walls are complete and security gates and guards are in operation – No works will be undertaken outside the existing boundary wall of the substation and no landfilling conducted – Contractor will clearly demarcate an access route to and their working area within the existing substation, in that area they will be fully responsible for the H&S of all persons including PGCB staff – In the remainder of the substation PGCB will have primary responsibility for the H&S of all persons; contractor will ensure that their workers do not enter areas outside of the demarked area unless under PGCB supervision	– CSEMP and H&S Plan approved before commencement of construction works minimizes EHS impacts and risks and is subsequently complied with during construction works as determined through regular site checks, photographic record etc.	Prior to and then for implementation during construction	√	√	√	Contract cost
	Disturbance to	– Presence of mosque in 25m of the substation	– CSEMP and H&S Plan	Prior to and then for	√	√	√	Contract

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
	residential properties immediately adjacent from the construction traffic and works	means that the applicable noise limit at this site is of "Silent Area" – Ensure water suppression is used during construction works and do not conduct dusty work on windy days; dust levels not to exceed ambient air quality standards per Appendix X at adjacent properties. – Provide adjacent properties with cleaning service for external surfaces and windows on a weekly basis during the construction due to buildup of dust. – Construction to be conducted only during the daytime between 10am-4pm with noisy activity such as piling only between 10am-12pm and 2-4pm to minimize disturbance and is not to be conducted on weekends or on festivals or holidays; noise limits per Appendix X to be achieved at the adjacent properties. – To inform CSEMP and any piling management sub-plan due to proximity of properties to substation site contractor to undertake quantitative noise assessment of construction works using internationally recognized noise modelling software to confirm that noise standards per Appendix X can be achieved for the bay extension alone and cumulatively with existing SS noisewithout additional noise mitigation. If required to meet noise standards contractor to install noise	approved before commencement of construction works minimizes EHS impacts and risks and is subsequently complied with during construction works as determined through regular site checks, photographic record etc. – No breaches of compliance with regulatory requirements or GIIP including ambient air quality and noise standards. – No outstanding dust, noise and general disturbance and disruption grievances from local communities or other interested stakeholders.	implementation during construction				cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		barrier etc. – Properties adjacent are to be consulted one-to-one and subject to structural survey and photographic record in case of vibration impact during construction. – If piling is required, method statement for management of piling mud is to be prepared to ensure the immediate adjacent waterbody is protected, there must be no discharge of piling mud to surface water. – Noise from piling will be contained to stipulated levels using using quietest available piling methods and attenuating screens around piling equipment and site. – No fuel, oil or chemicals are to be stored within 100m of the adjacent waterbodies – Site-specific traffic management plan to be developed and implemented, provision of flag men at entry points and along the access road to control the traffic flow and ensure pedestrian and vehicular safety. – H&S risk assessment and management plan to address risk from presence of existing SS electrical infrastructure and distribution lines across the SS entrance; safety clearances must be maintained at all time and safety protection installed beneath distribution lines to avoid workers or machinery coming into accidental contact with						

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation at Substation (SS) Sites								
Project Activity	Impact or Risk	Mitigation/ Compensation/ Contingency/ Enhancement Measures	Performance Indicator	Timing	Responsibilities (implementation, supervision and monitoring)			Budget Source
					PGCB	SIC	Contractor	
		them.						

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

12.7.3 Part 3 – Transmission Lines

Transmission Lines								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
Detailed Design and Pre-Construction Phase								
Overhead Line detailed design and installation EHS management planning during pre-construction	Environmental and social impacts of construction and O&M phase -- lack of management of Detailed design, construction and O&M leading to environmental degradation, H&S risks for construction and O&M workers as well the local community from construction of the 400/230/132 kV lines	– Designs to reflect the requirements of the EMP and international engineering best practice/good EHS practices – Identify presence of any unstable land/steep slopes and avoid these during the detailed design. – Identify presence of floodplain or depressions that get waterlogged in the rainy season and avoid these during detailed design. – If the passing of waterlogged area is required in the first instance seek to avoid placement of towers within the area, if it is not possible then the foundation is to be installed only during the dry season when no water is present with the stub raised 0.5m above highest flood level accounting for climate change. – For all TL/LILO except reconductoring contractor to conduct a flood risk and drainage assessment for each tower location and ensure that all towers are raised on foundations located above the flood level including an allowance for climate change plus freeboard. – Detailed design to ensure works will only take place on modified habitat – Drilling and piling mud must be managed to avoid it being discharged to adjacent land.	– Disclosed IEE update reflects final line routes before detailed design is cleared – Detailed Design cleared and approved reflects EMP requirements to minimize impacts and risks on EHS during subsequent stages of the project	Prior to line routes being approved by PGCB	√	√	√	Contract and SIC Cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Transmission Lines								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contract or**	
		– Transmission towers to be set back from the banks of rivers ideally by 50m, this may require micro siting of towers along the indicative route – No towers will be located in ponds or drains; the micro siting towers along the indicative route will be required – Towers that are in proximity to waterbodies need to ensure drilling or piling noise and mud is managed to avoid adverse effects on water quality, ecology and the adjacent community. – Construction to be conducted only during the dry season – Construction activities must be planned not to limit the availability of or restrict access to water sources (e.g., groundwater wells) used by local communities; natural flow of any surface water or drains must not be obstructed or if not possible diverted through a drainage system to another direction. – Construction water to be sourced from an existing licensed commercial supplier (preferred option especially for potable water supplies), where available, or rainwater harvesting. If using an existing surface water or an existing borewell for construction water, permissions to be obtained from the relevant authorities together with the agreement of local communities. – Prior agreement is required from local community users to use any existing surface water/borewell or						

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Transmission Lines								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contract or**	
		local piped water temporarily during construction; in cases where use of local water source is not agreed, contractor to import tanked water to the project area. – No groundwater will be used in locations without additional groundwater capacity – in other locations groundwater will only be used after it has been confirmed through assessment that there will be no additional stress on groundwater resources as a result. – Any piling or excavation works within 500m of groundwater wells used as a drinking water source by local communities will require pre-construction and post construction water quality monitoring against drinking water standards to ensure there is no contamination of the water supply. – Contractor to avoid piling activities as much as possible. It is anticipated piling will however be needed in most cases so a management plan will be prepared for approval. Oil will not be used for drilling or piling fluid. The piling management plan will include measures to avoid water pollution from the use of any bentonite clay slurry - adequate bunding must be provided around piling activities to contain piling mud and decanting ponds will need to be fully enclosed to avoid spills or leaks to adjacent land. Piling fluid must not be intentionally or unintentionally disposed of to surface water untreated or be allowed to damage adjacent land.						

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Transmission Lines								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		Sediment laden surface water runoff and discharges must be disposed of to open ground for percolation or passed through a sedimentation tank having adequate settlement tank, to obtain at least 50 mg/l TSS, before being allowed to enter surface water. Use of piling mud treatment equipment to be considered where space constraints exist preventing adequate settlement. – Use manual construction to minimize soil compaction from vehicle movements. – All transmission lines will be accessed via the existing road network. – A photographic record will be made of the pre-construction condition of land and access roads to inform the reinstatement works. After completion of the construction work land and access roads will be restored to their original condition. – Transmission lines to be laid to avoid resettlement of structures as well as any forest land and natural wetland. – Contractor to employ field ecologist to undertake ROW walkover of all transmission line routes, map habitat and species encountered, and enumerate the number and species of trees requiring to be cut and lopped, submit survey report alongside detailed design. Adaptive management measures to be applied according to the findings of the surveys, e.g., realignment of routing to avoid tree roots, etc.						

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Transmission Lines								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		– Detailed design to minimize the need to cut mature trees. Towers to be placed in open land where tree cutting is not needed. Cutting or trimming of trees will only be planned when required to meet safety clearance requirements and no alternative route with less impact is available. Only trees >5m in height will be cut. – Towers to be placed so they do not block the road or footpath, and to avoid visual clutter. – Route alignments to be designed to have minimal impact on private land holdings and any informal settlements. – Careful selection of route alignments to avoid encroachment on socially, culturally, and archaeological sensitive areas (e.g., graveyards, religious worship place, monuments etc.) – No properties must be present within the safety clearance of overhead lines per GoB requirements and IFC EHS guidelines. – Any resettlement or temporary disturbance to be compensated per the resettlement plan and the 1:3 compensatory tree plantation by will be done as per the Tree Plantation Plan. – Alignment to avoid or minimize crop disturbance where lines cross private land by being undertaken outside the cropping season to the extent possible – Alignment to avoid impacting on rivers/ponds and groundwater sources especially water sources including springs/wells/pumps used by local						

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Transmission Lines								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contract or**	
		communities. – During route survey identify and inventory presence of any surface waterbodies including rivers/ponds and groundwater sources including springs/wells/pumps within and adjacent the ROW and confirm if any are used by local communities for drinking water or other purposes documenting distance to the center line. – Carefully select route alignments to avoid bisecting lakes, ponds and wetland areas – Given greater vulnerability of children to health and safety risk, the crossing of school compounds and playgrounds and any other similar community facilities will be avoided by overhead lines routes. – Detailed design to ensure EMF levels at the edge of the safety clearance are within international good practice levels as per International Commission on Non-Ionizing Radiation Protection (ICNIRP) (reference and peak values) for community exposure[80] – Photographic record of land condition to be undertaken before any work. – IEE to be updated to reflect the final route alignment. Contractor to provide plans (kmz of route and tower locations) for the Project Description and inventory of receptors and						

[80] https://www.icnirp.org/cms/upload/publicatio ns/ICNI RPemfgdl.pdf

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Transmission Lines								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contract or**	
		ecological survey results of the route alignment selected for the Baseline Setting/Environment Assessment sections of the IEE. Contractor to ensure has no greater impact than that assessed in the disclosed IEE and make adjustments to the route alignment as requested. PGCB and contractors to conduct consultations to inform the IEE (consulting with potentially affected persons and local communities within 500m of RoW and other stakeholders including local authorities and public utilities during design in order that any concerns raised during consultations can be reflected in the choice of route alignment, siting and construction method. Contractors' information including receptors and ecology findings to be verified by SIC in the field and submitted for inclusion by PGCB in IEE update to ensure line routes avoid sensitive receptors etc. Prior to PGCB approval of the detailed designs and commencement of construction PGCB will seek ADB clearance of the updated IEE, confirming no change from the impacts and risks described and assessed in the IEE, or undertaking site-specific assessment and developing a site-specific EMP if required, seeking ADB clearance of any updated IEE before works start.						
Overhead line installation	Impacts on sensitive receptors from the installation of	– Contractor to avoid soil compaction, piling, blasting and other vibration inducing activities as much as possible. If needed a management plan will be	– Detailed Design cleared and approved reflects EMP requirements and minimizes	Prior to line routes being approved by	√	√	√	Contract and SIC Cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Transmission Lines								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
	overhead lines	prepared for approval. The quietest equipment available will be used, noise attenuation measures will include, (i) fitting of high efficiency mufflers to the noise generating equipment; and (ii) keeping acoustic enclosures around piling/drilling equipment. For piling it will not be possible to use the louder types of piling (impact or vibratory hammers) that generate over 85 dBA without resulting in a significant impact because noise from piling equipment of 120 dBA at 1m would exceed 85dBA, the level at which hearing damage is caused at adjacent properties if found within 100m. If noise levels are still exceeded a temporary acoustic noise barrier will be provided or alternatively temporary relocation of occupants during works to a rented property. In locations where soil compaction, piling, blasting and other vibration inducing activities are unavoidable Contractor to identify properties within the zone of influence and undertake pre-construction structural surveys to identify level of risk with reference to the guideline vibration levels per Appendix X. If there is a risk of structural damage to properties due to their current condition, consider alternative construction methods or temporary relocation of occupants during works if at risk to a rented property. Consider the need to install monitors to monitor structural movement. Structural or cosmetic damage to be repaired by Contractor to	impacts and risks during subsequent stages of project implementation – Local communities and other concerned stakeholders kept informed throughout project implementation, and aware of construction etc. – No significant impacts to sensitive receptors – Any residual impacts in compliance with national regulations	PGCB				

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Transmission Lines								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contract or**	
		at least pre-project condition at their own cost. – H&S plan for line works to include a Traffic Management sub-plan considering both the safety of pedestrians and vehicles and need to avoid traffic congestion; it is to be developed in consultation with relevant local authorities to ensure proper execution of traffic controls including where temporary blockage of one lane of the road or footpath is needed for installation. – Contractors will dedicate enough health and safety supervision staff to overhead line section (at least one health and safety steward per overhead line section, each steward will supervise a maximum of 50 workers) and develop a work plan to ensure each stretch is completed and the road restored before moving onto the next. – Route alignment and location of tower line to avoid tree crowns especially mature trees. Root damage to trees is to be avoided so unstable trees do not present a public safety hazard. – Minimum horizontal clearance of 50 m from any river alignment will be maintained while traversing parallel to it. – Horizontal and vertical safety clearances will be maintained for all overhead lines to the nearest buildings etc. Contractor to undertake ROW walkover and enumerate any structures within the ROW and if safety clearances can be met, submit survey report alongside detailed design.						

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Transmission Lines								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		– To prevent live shock to person against conductor break incident of tower lines the system is designed to detect this and stop sending electricity immediately by automatically opening switchgear. – Final surface level of tower foundations will be at least 0.5 m above the existing ground level or highest flood level including an allowance for climate change (whichever is higher) – Foundations to be constructed in such a way as to be adequately drained to prevent washouts and flooding impacts to adjacent land. – Contractor to ensure structural safety of towers especially in the event of high winds/cyclones (allowing for climate change) or an earthquake by designing for maximum loadings and following GoB codes; select an appropriate foundation design considering both climatic and seismic risks present. Design to include adequate towers foundation in order that all towers remain vertical during operation, and that the lines are tensioned. Install on all towers a visual and written warning signages to the public to include the ISO 7010 Hazard Type: Electrical Symbol warning of the risk of electrocution. – Install lighting arrestors along all tower lines. Install anti-climbing deterrents on all the towers and suitable means of ensuring security of the conductor to avoid vandalism.						
	Impacts due to	– Contractor will check with relevant local authorities						

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Transmission Lines								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contract or**	
	damage to property and public utilities	(electric, water, telecoms) whether there are known pipes, cables, or other utility lines and carry out a scan using avoidance tool to identify any unknown underground utilities prior to excavation. – Contractors to identify in consultation with service providers appropriate measures to minimize period of disruption to utilities and reduce health and safety risks during installation. If services must be disrupted contractors (via service providers if appropriate) to notify affected communities well in advance of any power outage etc. – In relation to cumulative impact liaise with other developers and utilities regarding the timing and extent of other construction works in the same area and ensure plans for construction works are coordinated so emissions/disruption/ disturbance are minimized. – Contractors to conduct an inventory of property / ecology / water resources / physical cultural resources / utilities / street lighting fixtures in and adjacent to the RoW prior to the start of any works. For any at risk of damage during construction, including from potential breaking/drilling vibration damage (buildings, roads, drains etc.) photographic and/or structural pre-condition surveys are to be completed and agreed with PGCB prior to any works, including site establishment. To be documented in a pre-project condition report, which will serve as baseline in						

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Transmission Lines								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		case any inadvertent damage or vibration impact to property occurs. If risk of structural damage to adjacent properties from vibration identified due to current condition, consider alternative construction methods or temporary relocation of occupants during works if at risk. – Provide information to the public about the scope and schedule of construction activities and expected disruptions and access restrictions at least one week before the disruptions.						
	Health and safety risks related to overhead lines	– Designs to comply with the ICRNP limits of electromagnetic interference – All electrical hazards will feature written and visual warning signs that meet the IEEE standards to include the ISO 7010 "Hazard Type: Electrical Symbol" warning of the risk of electrocution. – Contractors will also ensure that ICNRP occupational/community EMF exposure levels (reference and peak values) will be achieved						
	Pekua transmission lines entire length, Paikgacha transmission line entire length	– Ornithology survey including point counts and vantage points (sufficient number to cover survey length, following Scottish Natural Heritage method[81] or similar to obtain flight line and height information) on a monthly basis from October to March of the transmission line route	Bird survey by qualified and experienced ornithologists during pre-construction with results reflected in final IEE	No net loss of biodiversity following construction.	√	√	√	Contract cost
Construction Phase								

[81] https://www.nature.scot/doc/recommended-bird-survey-methods-inform-impact-assessment-onshore-windfarms

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Transmission Lines								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
	Impacts due to dust and soil erosion	– Soil scattered on pavements and roads shall be immediately swept up to avoid windblown dust. – Vehicle movements will be restricted to defined access routes. – Erect solid screens or barriers around the dusty activities that are at least as high as any stockpiles on site to fully enclose operations. – Piling generates fine particles which require suitable dust suppression techniques such as water sprays etc. – Minimize removal of existing vegetation and topsoil. – Excavation of foundations will be conducted during the dry season to minimize soil erosion and sedimentation of watercourses although it has potential to exacerbate dust impact. – If air quality levels are exceeded, an increase in existing background air pollution is recorded where they were already exceeded, or complaints are received contractor will be required to implement additional dust mitigation e.g., barricading/isolating sources of dust, adjusting working methods, to ensure the levels are met.	– EMP/CSEMP requirements successfully implemented as determined through regular site checks, photographic record etc. – No exceedance of air quality levels (Appendix X, ECP 10) or increase in baseline air pollution levels where they are already exceeded. – No outstanding grievances related to impacts from dust and air pollution.	Throughout construction	√	√	√	Contract cost
	Impacts due to construction noise	– During night (6am to 10pm) no works will be permitted – Contractor's maximum working hours (including the movement of heavy vehicles for construction on off-site access roads) will be 7 am – 7 pm. – Residents within 500m will be informed well in	– EMP/CSEMP requirements successfully implemented as determined through regular site checks, photographic record etc. – No exceedance of noise levels (Appendix X,) or increase in	Throughout construction	√	√	√	Contract cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Transmission Lines								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contract or**	
		advance of the construction schedule for noisy activities taking place on-site. Noisy construction activity (especially piling works) will only take place between the hours of 10 am - 4 pm. No noisy work and heavy vehicle movements will take place on Saturdays and during school/college/university exam periods. No work on holidays and festival days. Sensitive receptors to be consulted with any other special days when they would wish noise levels to be minimized. – Noise generating construction-related activities will be avoided during evenings, school hours, exam periods, prayer times, religious or cultural events near the sensitive receptors in consultation with receptors on days they would wish noise levels to be minimized. – Where properties in 50m, loud construction noise must be limited to only very short periods of activity to minimize disturbance, or by installations of temporary acoustically designed noise barriers. – Sound levels received by workers must not be over 85 dB(A) during continuation of 8 working hours without wearing PPE. – If piling is required, method statement for management of piling mud is to be prepared to ensure the immediate adjacent waterbody is protected, there must be no discharge of piling mud to surface water. – Noise from piling will be contained to stipulated	baseline noise levels where they are already exceeded. – No outstanding grievances related to impacts from noise pollution.					

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Transmission Lines								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contract or**	
		levels – Loud construction noise, breaking and drilling activities in particular, must be limited to very short periods of activity adjacent to receptors to minimize disturbance. Contractor to use suitably designed mufflers or sound reduction equipment on breakers/drills and ensure all leaks in the air line are sealed on them. – Contractors to undertake quantitative noise monitoring as per the EMoP. If noise levels are exceeded, an increase in existing or noise levels >3dBA recorded where they were already exceeded, or complaints are received contractor will be required to implement additional noise mitigation e.g., adjusting working methods, or placing of temporary acoustically designed noise barriers to ensure met.						
	Piling fluid	– Contractor to avoid piling activities as much as possible. If needed a management plan will be prepared for approval. Oil will not be used for drilling or piling fluid. The piling management plan will include measures to avoid water pollution from the use of any bentonite clay slurry - adequate bunding must be provided around piling activities to contain piling mud and decanting ponds will need to be fully enclosed to avoid spills or leaks to adjacent land. Piling fluid must not be intentionally or unintentionally disposed of to surface water untreated or be allowed to damage adjacent land.	– EMP/CSEMP requirements successfully implemented as determined through regular site checks, photographic record etc. – No outstanding grievances related to impacts from soil or water pollution.	Throughout construction	√	√	√	Contract cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Transmission Lines								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		Sediment laden surface water runoff and discharges must be disposed of to open ground for percolation or passed through a sedimentation tank having adequate settlement tank, to obtain at least 50 mg/l TSS, before being allowed to enter surface water. Use of piling mud treatment equipment to be considered where space constraints exist preventing adequate settlement. – Water quality baseline monitoring data to be taken from the adjacent waterbodies before the start of tower foundation works as per Appendix X. – The water quality will be monitored daily during the foundation works (e.g., pH, TDS, TSS, DO in addition to quarterly analysis of full suite) and works must halt immediately upon any deterioration with corrective action taken to bring the water quality back to baseline before continuing works. – PGCB to ensure their environmental specialist or SIC supervises and monitors all foundation works adjacent to waterbodies on a daily basis (with photographic record) and in doing so ensures works are undertaken following national laws and regulations and the EMP requirements.						
	Impacts due to access and blocking of road	– Follow design drawings and implement careful construction practices to avoid damage to existing public and private property outside the working area. All unanticipated damage to existing public and private property shall be restored immediately to pre-project condition and/or compensated at the	– EMP/CSEMP requirements successfully implemented as determined through regular site checks, photographic record etc. – No outstanding grievances related to impacts from access	Throughout construction	√	√	√	Contract cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Transmission Lines								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contract or**	
		cost of the contractor. – In dense urban areas or on busy roads installation works affecting footpaths and roads to avoid rush hours e.g., 6am to 8am and 4pm to 6 pm; the construction period will be kept to the absolute minimum to reduce the period of road narrowing. – Stockpiling of spoil and any new equipment (conductor reels) shall be away from properties and only in designated areas where no access or road use will be blocked. – The construction site is to be cordoned off, clearly signposted and marked by warning lights. Additional nighttime warning lights are to be installed. – Pedestrian pathway to be clearly marked and signposted. In order to enable access to the roadside shops and other buildings, concrete or wooden bridges with side protection will be laid at regular intervals and in front of key locations for pedestrians to be able to cross over unimpeded. – Robustly fence with solid barrier and sign/light open foundations with security presence to prevent public access during construction works. Planks to be placed in the trenches to allow any animals to climb out of them. – Do not allow children to play in or adjacent to the construction site – Do not leave hazardous conditions (e.g., unsigned, unfenced, no unlit open excavations without means	restrictions.					

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Transmission Lines								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		of escape, emergency contacts posted in case of accident) overnight unless no access by public can be ensured. – Damage to roads must be immediately repaired to ensure that local communities can continue to safely use the public highways. – On completion of construction works any roads distbured must be left by the contractors in no poorer condition than when construction started.						
	Occupational and community health and safety	– Implement agreed traffic management plan. Traffic management will need to be done in consultation with the affected communities to ensure they are aware of likely disruption. – Wherever traffic diversions, warning signs, traffic control signals, barriers and the like are required, the contractor will install them to the satisfaction of the SIC and local authority prior to commencing the work. – A designated person, traffic controller, wearing colored vest will be engaged for traffic management. – Where the execution of the works requires single-lane operation/beside public road the contractor will provide and maintain all necessary barriers, warning signs and traffic control signals to the satisfaction of the SIC and local authority. – Safe access to property and roads should be maintained and safe alternative routes and access	– EMP/CSEMP requirements successfully implemented as determined through regular site checks, photographic record etc. – No outstanding grievances related to occupational or community health and safety	Throughout construction	√	√	√	Contract cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Transmission Lines								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contract or**	
		provided where there are temporary diversions or blockages, safe alternative routes to be clearly signed where there are temporary diversions or blockages. – Safety guides should be provided where works are on footpaths or in locations of pedestrian crossings to help guide pedestrians, especially vulnerable persons, safely around the working area. For congested and narrow roads flagmen should be utilized to warn road users of the situation. – Implement traffic management controls during construction works with advance warning signs or flag persons to ensure health and safety of construction workers and road users. Road safety and warning signs must be posted at 500m, 100m, and immediately in advance of the works at least one week prior to the works commencing to inform the public of the temporary blockage of one lane of the road. – Diversion works to be immediately dismantled on completion of works and the footpath and roads restored to their original condition. – For removal of any existing lines/conductor scaffolds and safety nets will be used to protect pedestrians and vehicles (and the conductor itself) from potential injury/damage – this will be used wherever stringing crosses over roads and securing a road closure is not possible, presenting a possible risk to traffic, waterbodies, or is in						

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Transmission Lines								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contract or**	
		settlement presenting a possible risk to local communities where access cannot be completely prevented, especially where buildings have encroached into the safety clearances and in the vicinity of schools. – Ensure proper grounding and deactivation of live power lines during construction /decommissioning work or before any work near the lines and this will be checked and certified by Health and Safety Officer in advance. – Require workers to observe WBG EHS Guideline on T&D requirements for working at height. Require workers to test the structural integrity of towers prior to proceeding with the work. Use fall protection measures when working on towers, i.e., mobile elevated working platform, all workers are required to wear body harness. – For the transient works provide workers with access to an existing functional toilet facility with hand washing facilities (e.g., public toilets) or provide a self-contained portable toilet with hand washing facilities (one toilet per six workers) that do not allow untreated disposal of sewage to adjacent water bodies e.g., sewage enclosed in a container and will later be taken offsite for wastewater treatment and disposal. Open defecation and use of pit latrines to be prohibited.						
	Site restoration	– Contractor to avoid damage to field boundaries and repair any damaged during the construction	– EMP/CSEMP requirements successfully implemented as	On the completion of	√	√	√	Contract cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Transmission Lines								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		works. – Rehabilitate any disturbed areas beyond the substation infrastructure footprint to through revegetation and landscaping using native species. – All spoils, construction waste and material scrap after erection of tower and line must be removed. Each erection site to be repaired back to its natural condition i.e. construction waste, footpaths and surrounding to be cleared and restored to the satisfaction of the community users.	determined through regular site checks, photographic record etc.	construction works prior to handover to PGCB				
O&M Phase (Measures to be Implemented by PGCB)								
Operation and maintenance activities	EHS impacts and risks of the project during O&M in general including occupational and community health and safety risks Community H&S risks due to presence of overhead lines – hazards of electrocution, lightning strike, strong winds snapping live conductor etc. People can climb towers and get	– During maintenance activities mitigation measures applicable to the construction phase are also applicable to PGCB maintenance workers or contractors and are to be followed – Carry out regular inspections (at least monthly) on lines and periodic maintenance to ensure that integrity of the towers and line is in good condition including possible conductor snapping and de-energizing of the line within three cycles to avoid the potential for electrocution from a breakage, the clearances are maintained, and electrical standards are being upheld. – Inspection protocol should confirm electrical safety warning signs and lighting arrestors in place and identify any missing or corroded parts for immediate replacement. – If property is found to be encroaching into the safety clearances notification is to be immediately	– No fatalities or lost time incidents 100% of H&S incidents including near miss recorded, immediately investigated, and corrective action taken to prevent repeat. – Compliance with safety clearances along transmission lines – Compliance with ICNRP occupational/community EMF exposure levels (reference and peak values) along transmission lines – EMP requirements successfully implemented as determined through regular site checks, photographic record etc.	Throughout the O&M Phase	√			PGCB

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Transmission Lines								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
	electrocuted	issued to the owner/occupier by PGCB along with awareness raising materials with respect to the importance of maintaining the horizontal and vertical clearance from buildings and the matter will be taken up further in consultation with the appropriate authorities. – Regular pruning or lopping of trees ensure the integrity and safety of the lines – Prohibit the use of herbicides, pesticides or burning to control any vegetation growth or to manage vegetation waste. – Maintain written warning signages including the ISO 7010 Hazard Type: Electrical Symbol warning of the risk of electrocution. – For all maintenance works undertake risk assessment and prepare H&S plan in accordance with EHS Guidelines, considering occupational and community H&S and including adherence to electrical safety standards and emergency preparedness and response plan with communication systems and protocols to report an emergency. – O&M to be performed only by suitably qualified and experienced workers who are regularly trained staff of PGCB or a contactor under supervision of a Health and Safety Officer with an appropriately equipped first aid kit and appropriate fire extinguishers immediately available for use – Restricting working at height and with electricity	– No outstanding grievances from local communities or other interested stakeholders					

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Transmission Lines								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contract or**	
		only by workers who are trained and certified to do so. – O&M workers to be given required PPE and other requisite safety equipment – Workers to observe guidelines to minimum approach distances for excavations, tools, vehicles, pruning, and other activities when working around power lines. – Testing of structural integrity prior to proceeding with the work and the use of fall protection measures such as harnesses, tool bags, ropes etc. – Proper grounding and deactivation of live power lines during maintenance work or when working near the lines. – In the event of an incident such as conductor break PGCB staff/community must immediately notify the nearest PGCB incident coordinator for handling measures: power cuts, technical O&M staffing to inspect and repair. – PGCB in conjunction with local municipalities and the media with the support of CSOs to continue to organize health and safety campaigns on electrical safety community awareness raising activities in local communities and schools within 500 m of the ROWs – In case of fire events and other related situations, given the PGCB may not be available immediately the community should be educated with respect to emergency response with 24/7 emergency contact						

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Transmission Lines								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contract or**	
		numbers for PGCB included on signs; PGCB will need to ensure this is manned 24/7 to ensure that it is effective reporting route. – During O&M, internal audits will be undertaken by the PGCB ESU Environment Officer, and Health and Safety Officer regarding corona noise near the lines, EMF under the tower lines and resolve any community grievances. – Record any mortality of wildlife, local or migratory birds on or under the transmission line during the maintenance walkovers.						
Health and safety: electromagnetic field (EMF)	Transmission line RoW	– Portable but professional, calibrated EMF detector, to be provided by the contractor one per substation along with personal EMF radiation exposure monitoring equipment for substation workers – EMF levels monitored semiannually or as may be required by DOE during O&M – Daily checks and record keeping during O&M for workers in close contact with EMF	– EMF levels to be monitored using professional, calibrated portable monitoring devices – Continuous checks for substation workers in close contact with EMF through use of personal EMF monitor carried by workers at all times while working on or near live electrical equipment	No exceedance of ICNIRP reference levels and records of EMF checking	√			Contract cost for equipment PGCB for implementation
Bird conservation	Pekua and transmission lines entire length, Paikgacha transmission line entire length	– Point count, vantage points and monthly carcass survey during the 1.5 year defects liability period of entire transmission line using internationally recognized survey methodology agreed with ADB during the defect liability period. Methodology to refer to IFC guidelines on carcass monitoring	– Bird and carcass survey by qualified and experienced ornithologists	No net loss of biodiversity following construction compared to baseline survey reported in the IEE	√	√	√	Contract Cost (DLP)

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

12.7.3.1 Site-specific Mitigation for Transmission Lines/LILO Lines

CSEMP to include the following measures for the TL as well reflecting the ECPs and all general and TL specific EMP measures;

Site-specific Mitigation for Transmission Lines/LILO Lines								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
Transmission Lines at Pekua/Chakaria, Cox's Bazar (3no. LILO) (LILO of Existing Matarbari PP- Bashkhali PP 400 kV Line, LILO of Anwara-Cox's Bazar 230kV Line & LILO of Existing Matarbari (132/33)-Chakaria 132kV line at Pekua)								
Detailed Design and Preconstruction Phase								
Towers on low-lying land within salt pan area	Environmental and social impacts due to towers on salt pan with waterbodies	– Contractor to employ field ecologist to undertake pre-construction overwintering season ornithological surveys of the entire transmission line route including point counts and vantage point surveys identifying flight lines and height per Scottish Natural Heritage or equivalent methods (sufficient number to cover the entire route) to identify movement of birds across the transmission line along the entire route classifying birds as to being resident/breeding/migratory/ congregatory/ threatened and pre-construction aquatic vegetation and fish surveys where towers will be located in inundated land (salt pan) with particular attention to potential for threatened species, submit survey report alongside detailed design. Adaptive management measures to be applied according to the findings of the surveys to ensure no net loss of biodiversity can result. – No loss of nationally or IUCN threatened (VU/EN/CR) vegetation species. – Ensure minimum number of towers in salt pan or permanently inundated land	EMP/CSEMP requirements successfully implemented as determined through regular site checks, photographic record etc.	Prior to and during tower foundation works	√	√	√	Contract Cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation for Transmission Lines/LILO Lines								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		– Transmission line towers to be set back from the banks of main drainage channels within the salt panarea by 50m – this will require micro siting of some towers on the indicative transmission line alignment – Maintain at least a 1.5 meter spacing between all energized components and grounded hardware or, where this spacing is not feasible, covering all energized parts and hardware to avoid birdlife electrocution. – Contractor to install bird divertors on the entire TL length – all three routes. Bird divertors to be installed on the earth wire; at a spacing of 10m. The bird divertors must be an internationally accepted, robust design of contrasting color, that reflects UV light, glows in the dark, and guaranteed for at least 5 years. However, the bird divertor to be installed will be approved as suitable by PGCB. Bird divertors are to be provided and installed by the contractor immediately following stringing and before commissioning/energizing of the transmission line – For towers in salt pan arrangement to be made with the owner to time and/or drain the installation area and adjacent plots during the dry season so that the tower can be constructed in dry conditions; no construction of tower foundations to take place in the water. – Conduct works during the dry season when the water level on the route through salt pan is at its lowest and request owners of salt pans in which towers will be						

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation for Transmission Lines/LILO Lines								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		constructed and the immediately adjacent salt pans to keep the land dry to minimize the risk of sediment laden runoff. – Water quality baseline monitoring data to be taken from the adjacent inundated land/nearest drainage channel before the start of tower foundation works as per Appendix X. – The water quality of the adjacent inundated land/nearest drainage channel will be monitored daily during the foundation works (e.g., pH, turbidity, TDS, TSS and DO in addition to quarterly monitoring of full suite) and works must halt immediately upon any deterioration with corrective action taken to bring the water quality back to baseline before continuing works. – PGCB to ensure their environmental specialist or SIC supervises and monitors foundation works in the salt pan on a daily basis and in doing so ensures works are undertaken following national laws and regulations and the EMP requirements.						
Construction Phase								
Transmission line construction activities	Disturbance to local and migratory birds and impacts on salt pan	– Piling is required at the site and an additional method statement for management of piling mud when working in salt pans area is to be prepared to ensure the immediate adjacent waterbodies are protected, there must be no discharge of untreated piling mud to surface water. – Sensitive waterbodies adjacent to be avoided during construction will be flagged for protection. As there may be a risk of workers accidentally straying into	– EMP/CSEMP/BMP requirements successfully implemented as determined through regular site checks, photographic record etc.	Prior to and then for implementation during construction	√	√	√	Contract cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation for Transmission Lines/LILO Lines								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		these areas then worker training and the code of conduct will cover measures to ensure that wildlife will be protected – No fuel, oil or chemicals are to be stored in the salt pan areas and stockpiles to be kept to materials required during the day's work due to risk of sediment entering immediately adjacent saltpan or drainage channel – Schedule works to avoid the monsoon season in Bangladesh when the water level in the saltpan is at its highest – No works to be undertaken from 1 hour before sunset to 1 hour after sunrise to minimize impacts on wildlife.						
Reconductoring of Shahjibazar-Brahmanbaria-Ashuganj								
Detailed Design and Preconstruction Phase								
Detailed design	Low lying land at risk of waterlogging during heavy rain, waterbodies are present, impacts on birdlife	– Contractor to employ field ecologist to undertake pre-construction ornithological survey of the transmission line route including point counts and vantage point surveys across the transmission line 500m either side of river crossings, large waterbodies and any other areas of interest identified following walkover/consultations to identify movement of birds across the transmission line, submit survey report alongside detailed design. – Contractor to install bird divertors on the TL for a length of 500m either side of river crossings or large waterbodies (including Meghna River at start point) and any additional locations recommended as a result of the surveys. The bird divertors must be an	EMP/CSEMP requirements successfully implemented as determined through regular site checks, photographic record etc.	Prior to approval of detailed design	√	√	√	Contract cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation for Transmission Lines/LILO Lines								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		internationally accepted, robust design of contrasting color, that reflects UV light, glows in the dark, and guaranteed for at least 5 years – the bird divertor to be installed must be approved as suitable by PGCB. Swan diverters may be appropriate depending on the survey results. Bird divertors are to be provided and installed by the contractor immediately following stringing and before commissioning/energizing of the transmission line						
	Community health and safety risks due to encroachment into safety clearances	– Contractor to ensure that there has been no encroachment of the safety clearances of the existing lines prior to reconducting proceeding – If there has been encroachment situation to be rectified in consultation with local government and in line with social safeguard requirements before commencement of restringing work	Safety clearances maintained for the reconductored transmission line.	Prior to approval of detailed design	√	√	√	Contract cost
Transmission Lines at Monohardi (2no.) **LILO of Sripur-Ashuganj 230kV double circuit line at Monohardi** **Monohardi-Bajitpur 132kV Double Circuit Line** **Gopalganj -Tungipara 132kV Double Circuit Line** **Kachua- Matlab(N) 132kV Double Circuit Line** **LILO of Chowmuhani-Ramganj 132kV double circuit line at Chatkhil**								
Detailed Design and Preconstruction Phase								
Towers on agricultural and low land area	Environmental and social impacts due to towers on agricultural and low land area, impacts on birdlife	– Contractor to avoid waterbodies in locating the towers – towers that based on the indicative route have been located in waterbodies are to be micro-sited in order to avoid impacts on the ponds. – Contractor to employ field ecologist to undertake pre-construction overwintering season ornithological surveys of the transmission line route including point	EMP/CSEMP requirements successfully implemented as determined through regular site checks, photographic record etc.	Prior to and during tower foundation works	√	√	√	Contract Cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation for Transmission Lines/LILO Lines									
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**				**Budget Source**
					PGCB		**SIC**	**Contractor**	
		counts and vantage point surveys to identify movement of birds across the transmission line 500m either side of river crossings, large waterbodies and other locations of interest identified following a walkover survey/consultations classifying birds as to being resident/breeding/migratory/ congregatory/ threatened, submit survey report alongside detailed design. Adaptive management measures to be applied according to the findings of the surveys to ensure no net loss of biodiversity can result. – Contractor to install bird divertors on the TL for a length of 500m either side of river crossings or large waterbodies and any additional locations recommended as a result of the surveys. Bird divertors to be installed on the earth wire; at a spacing of 10m. The bird divertors must be an internationally accepted, robust design of contrasting color, that reflects UV light, glows in the dark, and guaranteed for at least 5 years – the bird divertor to be installed must be approved as suitable by PGCB. Bird divertors are to be provided and installed by the contractor immediately following stringing and before commissioning/energizing of the transmission line							
Satkhira- Paikgacha 132kV Double Circuit Line									
Detailed Design and Preconstruction Phase									
Towers in agricultural and low land area	Environmental and social impacts due to towers on permanently inundated areas	– Contractor to employ field ecologist to undertake pre-construction ornithological survey of the transmission line route including point counts and vantage point surveys along the entire length but particularly where the TL crosses over permanently	EMP/CSEMP requirements successfully implemented as determined through regular site checks, photographic record etc.	Prior to and during tower foundation works	√		√	√	Contract Cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation for Transmission Lines/LILO Lines								
Project Activity	Impact or Risk	Mitigation/ Compensation/ Contingency/ Enhancement Measures	Performance Indicator	Timing	Responsibilities (implementation, supervision and monitoring)			Budget Source
					PGCB	SIC	Contractor	
		inundated areas and 500m either side of river crossings, large waterbodies and other locations of interest identified following a walkover survey/consultations to identify movement of birds across the transmission line and pre-construction vegetation with particular attention to potential for threatened species, submit survey report alongside detailed design. Adaptive management measures to be applied according to the findings of the surveys to ensure no net loss of biodiversity can result. – No loss of nationally or IUCN threatened (VU/EN/CR) vegetation species. – Ensure minimum number of towers in fish pond or permanently inundated land – There will be no tower footing on ponds (if any) under lying the TL RoW. – Maintain at least a 3-meter spacing between all energized components and grounded hardware or, where this spacing is not feasible, covering all energized parts and hardware to avoid birdlife electrocution. – Contractor to install bird divertors on the entire TL length with a focus on where it crosses permanently inundated areas plus 500m either side of river crossings and large waterbodies and any additional locations recommended as a result of the surveys. Bird divertors to be installed on the earth wire; at a spacing of 10m. The bird divertors must be an internationally accepted, robust design of contrasting color, that reflects UV light, glows in the dark, and guaranteed for at least 5 years – the bird divertor to be installed must be approved as suitable						

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation for Transmission Lines/LILO Lines								
Project Activity	Impact or Risk	Mitigation/ Compensation/ Contingency/ Enhancement Measures	Performance Indicator	Timing	Responsibilities (implementation, supervision and monitoring)			Budget Source
					PGCB	SIC	Contractor	
		by PGCB. Bird divertors are to be provided and installed by the contractor immediately following stringing and before commissioning/energizing of the transmission line – In permanently inundated areas contractor to make arrangements with the owner to time and/or drain the installation area and adjacent plots during the dry season so that the tower can be constructed in dry conditions; no construction of tower foundations to take place in the water. – Conduct works during the dry season when the water level on the route permanently inundated areas is at its lowest and request owners of fish ponds in which towers will be constructed and the immediately adjacent fish ponds to keep the land dry to minimize the risk of sediment laden runoff. – Water quality baseline monitoring data to be taken from the adjacent inundated land/nearest wet fish pond before the start of tower foundation works as per Appendix X. – The water quality of the adjacent inundated land/nearest wet fish pond (e.g., pH, turbidity, TDS, TSS, DO in addition to quarterly analysis) will be monitored daily during the foundation works and works must halt immediately upon any deterioration with corrective action taken to bring the water quality back to baseline before continuing works. – PGCB to ensure their environmental specialist or SIC supervises and monitors foundation works in fish ponds on a daily basis and in doing so ensures works are undertaken following national laws and regulations and the EMP requirements.						

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation for Transmission Lines/LILO Lines								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
Construction phase								
Transmission line construction activities	Disturbance to local and migratory birds	– Piling is required at the site and an additional method statement for management of piling mud when working in fish ponds is to be prepared to ensure the immediate adjacent waterbodies are protected, there must be no discharge of untreated piling mud to surface water. – Sensitive waterbodies adjacent to be avoided during construction will be flagged for protection. As there may be a risk of workers accidentally straying into these areas then worker training and the code of conduct will cover measures to ensure that wildlife will be protected – No fuel, oil or chemicals are to be stored in the stockpiles to be kept to materials required during the day's work due to risk of sediment entering immediately adjacent saltpan or drainage channel – Schedule works to avoid the monsoon season in Bangladesh when the water level in the fish ponds is at its highest – No works to be undertaken from 1 hour before sunset to 1 hour after sunrise to minimize impacts on wildlife.	– EMP/CSEMP/BMP requirements successfully implemented as determined through regular site checks, photographic record etc.	Prior to and then for implementation during construction	√	√	√	Contract cost
Bhandaria-Mathbaria 132kV Double Circuit Line								
Detailed Design and Preconstruction Phase								
Towers on agricultural and low land area	Environmental and social impacts due to towers on agricultural and low land area	– Contractor to employ field ecologist to undertake pre-construction ornithological survey of the transmission line route including point counts and vantage point surveys across the transmission line 500m either side of river crossings, large waterbodies and any other areas of interest	EMP/CSEMP requirements successfully implemented as determined through regular site checks, photographic record etc.	Prior to and during tower foundation works	√	√	√	Contract Cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation for Transmission Lines/LILO Lines								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
		identified following walkover/consultations to identify movement of birds across the transmission line, submit survey report alongside detailed design. Adaptive management measures to be applied according to the findings of the surveys to ensure no net loss of biodiversity can result. – Maintain at least a 3-meter spacing between all energized components and grounded hardware or, where this spacing is not feasible, covering all energized parts and hardware to avoid birdlife electrocution. – Contractor to install bird divertors on the TL 500m either side of river crossings or large waterbodies and any additional locations recommended as a result of the surveys. Bird divertors to be installed on the earth wire; at a spacing of 10m. The bird divertors must be an internationally accepted, robust design of contrasting color, that reflects UV light, glows in the dark, and guaranteed for at least 5 years – the bird divertor to be installed must be approved as suitable by PGCB. Swan diverters may be appropriate depending on the survey results. Bird divertors are to be provided and installed by the contractor immediately following stringing and before commissioning/energizing of the transmission line						
LILO of Cumilla(N) – Shahjibazar PP 230kV double circuit line at Madhabpur LILO of Shahjibazar – Brahmanbaria 132kV double circuit line at Madhabpur LILO of Bogura(S) -Naogaon 132kV line at Dupchanchia LILO of Bheramara-Rajbari, 132kv line at Kushtia								
Detailed Design and Preconstruction Phase								
Towers on	Environmental and	– Contractor to avoid waterbodies in locating the	EMP/CSEMP requirements	Prior to and	√	√	√	Contract

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Site-specific Mitigation for Transmission Lines/LILO Lines								
Project Activity	**Impact or Risk**	**Mitigation/ Compensation/ Contingency/ Enhancement Measures**	**Performance Indicator**	**Timing**	**Responsibilities (implementation, supervision and monitoring)**			**Budget Source**
					PGCB	**SIC**	**Contractor**	
agricultural and low land area	social impacts due to towers on agricultural and low land area	towers – towers that based on the indicative route have been located in waterbodies are to be micro-sited in order to avoid impacts on the ponds.	successfully implemented as determined through regular site checks, photographic record etc.	during tower foundation works				Cost

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

12.8 Environmental Monitoring Plan (EMoP)

896. The Environmental Monitoring Plan (EMoP) sets out the minimum requirements for quantitative monitoring and performance standards to be complied with during construction. The main purpose of this EMoP is to ensure that the various tasks detailed in the EMP, particularly the mitigation measures, are implemented in an effective manner and any unanticipated impacts on environment and social parameters can be promptly addressed.

897. Quantitative monitoring activities may be modified during project implementation, depending on the contractors' performance and analytical results obtained. If performance is worse than expected, corrective action/s will be identified, and environmental monitoring activities will be adjusted accordingly by PGCB and their Contractors during pre-construction, construction or the Operations and Maintenance (O&M) phase to help resolve any unsatisfactory performance.

898. In addition to quantitative monitoring there will also be supervision and monitoring of EMP implementation. Monitoring of this qualitative compliance with the EMP will be carried out with the help of checklists prepared based on the mitigation measures detailed in the Mitigation Plan.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Table 12.5: Environment Monitoring Plan (EMoP)

12.8.1 Part 1 – General (All Works)

General Works								
Environmental Parameters to be Monitored	**Location**	**Time/Frequency/ Duration**	**Method of Measurements**	**Performance Standard / Quantitative Targets**	**Responsibilities**			**Equipment and Monitoring Cost (Million BDT)**
					PMU	**SIC**	**Contractor**	
Construction Phase								
Water resources	All construction sites, including construction stores and labor camps	Ongoing throughout construction, monthly reporting of records kept by the contractor	- Water volume used and source (construction and drinking water).	- No grievance received during construction or operation regarding conflict with other water users	PMU to ensure record keeping by contractor and to report in EMR to ADB and DOE	SIC to supervise contractor and support PMU in checking compliance	Contractor to keep records and report to PMU in monthly progress reports	Part of contract cost, include costs of implementing EMoP as BOQ line
Water pollution	All construction sites, including construction stores and labor camps	Ongoing throughout construction, monthly reporting of records kept by the contractor	- Monitor all effluent discharges as per GoB effluent standards or the general IFC EHS effluent guidelines whichever is more stringent.	- No grievance received during construction or operation regarding water pollution	PMU to ensure record keeping by contractor and to report in EMR to ADB and DOE	SIC to supervise contractor and support PMU in checking compliance	Contractor to keep records and report to PMU in monthly progress reports	Part of contract cost, include costs of implementing EMoP as BOQ line
Air Pollution	All construction sites, including construction stores and labor camps	Ongoing throughout construction, monthly reporting of records kept by the contractor	- Air quality monitoring as per the SS/TL EMP and EMoP requirement	- No grievance received during construction or operation regarding air pollution	PMU to ensure record keeping by contractor and to report in EMR to ADB and DOE	SIC to supervise contractor and support PMU in checking compliance	Contractor to keep records and report to PMU in monthly progress reports	Part of contract cost, include costs of implementing EMoP as BOQ line
Noise Pollution	All construction sites, including construction stores and labor camps	Ongoing throughout construction, monthly reporting of records kept by the contractor	- Noise monitoring as per the SS/TL EMP and EMoP requirement	- No grievance received during construction or operation regarding noise pollution	PMU to ensure record keeping by contractor and to report in EMR to ADB and DOE	SIC to supervise contractor and support PMU in checking compliance	Contractor to keep records and report to PMU in monthly progress reports	Part of contract cost, include costs of implementing EMoP as BOQ line
Construction	All construction	Ongoing	- Keep records of all	Use of materials and transfer of	PMU to ensure	SIC to	Contractor to	Part of contract

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

General Works								
Environmental Parameters to be Monitored	**Location**	**Time/Frequency/ Duration**	**Method of Measurements**	**Performance Standard / Quantitative Targets**	**Responsibilities**			**Equipment and Monitoring Cost (Million BDT)**
					PMU	**SIC**	**Contractor**	
materials and waste management: record keeping	sites, including construction stores and labor camps	throughout construction, monthly reporting of records kept by the contractor	types of materials used and waste produced by type, volume/weight. Document waste handling full-cycle through transfer notes (including type, volume, source, transport, intermediaries if any, and final treatment or disposal facility with its license and capacity	all construction wastes documented with all wastes disposed of in an environmentally safe and sound manner.	record keeping by contractor and to report in EMR to ADB and DOE	supervise contractor and support PMU in checking compliance	keep records and report to PMU in monthly progress reports	cost, include costs of implementing EMoP as BOQ line
Soil (earthworks)	Construction sites involving earthworks/cut and fill activities	Ongoing throughout construction, monthly reporting of records kept by the contractor	- Volume of soil disturbed during construction - Keep records of earthworks involved, including total volume in m3 of soil excavated and reused (any disposed of as spoil off site to licensed waste disposal facilities recorded as per waste generation)	- Earthworks documented, and all excavated and cut and fill volumes accounted for, either reused on-site or disposed of off-site to licensed waste disposal facilities	- PMU to ensure record keeping by contractor and to report in EMR to ADB and DOE	SIC to supervise contractor and support PMU in checking compliance	- Contractor to keep records and report to PMU in monthly progress reports	Part of contract cost, include costs of implementing EMoP as BOQ line
Hazardous materials– incidents	All construction sites, including construction stores and labor camps	Ongoing throughout construction, monthly reporting of records kept by	- Records of pollution incidents (e.g., type of material spilled, amount in kg or m^3 and action taken to clean	- No pollution incident affecting soil of water quality - zero major incidents occurred. - Minor incidents responded to in accordance with EMP	- PMU to ensure record keeping by contractor and - to report in EMR to ADB and DOE	SIC to supervise contractor and support PMU in checking	- Contractor to keep records and report to PMU in monthly	Part of contract cost, include costs of implementing EMoP as BOQ line

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

General Works								
Environmental Parameters to be Monitored	**Location**	**Time/Frequency/ Duration**	**Method of Measurements**	**Performance Standard / Quantitative Targets**	**Responsibilities**			**Equipment and Monitoring Cost (Million BDT)**
					PMU	**SIC**	**Contractor**	
		the contractor	up) - Carry out visual inspection and interviews with workers and the community to identify if any unrecorded incidents occurred	response plan procedures with lessons learnt for future if they occur.	- Any pollution incident to be reported within 24 hours to ADB and DOE as per the EC requirements.	compliance	progress reports - Any pollution incident to be reported within 24 hours to PIU and SIC	
Occupational and community health and safety incidents: record keeping	All construction sites, including construction stores and labor camps	Ongoing throughout construction, monthly reporting of records kept by the contractor	- Keep records of near misses, minor, lost time, and fatal health and safety incidents related to the project, compile records from construction sites; carry out interviews with workers and the community to identify if any unrecorded incidents occurred. - During the COVID-19 pandemic, temperature checks to be carried out at entrance of the work site at start of shift, and records of all suspected and confirmed cases to be kept.	- Zero lost time incidents or fatalities (among workers and community) - All near miss, minor, lost time, and fatal incidents as well as suspected/confirmed COVID-19 instances having adequate response plan, with lessons learnt for future if they occur.	- PMU to ensure record keeping by contractor and to report in EMR to ADB and DOE - Any lost time incident or fatality to be reported within 24 hours to ADB and DOE as per the EC requirements	SIC to supervise contractor and support PMU in checking compliance	- Contractor to keep records and report to PMU in monthly progress reports - Any lost time incident or fatality to be reported within 24 hours to PMU and SIC	For COVID-temperature checks frontal thermometer. Part of contract cost, include costs of implementing EMoP as BOQ line
Health and Safety:	All construction sites, including	Ongoing throughout	- Water sample is to be taken in a clean, non-	Drinking water provided meets national drinking water standards	PMU to ensure monitoring	SIC to supervise	Contractor to undertake	- Water quality tests by accredited

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

General Works								
Environmental Parameters to be Monitored	**Location**	**Time/Frequency/ Duration**	**Method of Measurements**	**Performance Standard / Quantitative Targets**	**Responsibilities**			**Equipment and Monitoring Cost (Million BDT)**
					PMU	**SIC**	**Contractor**	
construction drinking water supplies	construction stores and labor camps	construction, monthly testing or reporting of records kept by the contractor	contaminated, well-sealed container and tested within the next 48 hours. Drinking water quality tests against Bangladesh drinking water standards by accredited laboratory (physical, chemical, and bacteriological tests including arsenic levels) where the contractor provides a surface or groundwater drinking water supply or sources where supplier is unable to provide water quality test results. - Alternatively, documentary evidence that drinking water meeting national standards is being imported for workers consumption.		undertaken by contractor and to report in EMR to ADB and DOE	measurements in the field and support PMU in checking compliance	measurements and report to PMU	laboratory. - Part of contract cost, include costs of implementing EMoP as BOQ line
Operation and Maintenance								
Hazardous materials– incidents	All substations, transmission and lines	Daily checks for pollution incidents and record	- Records of pollution incidents (e.g., type of material spilled,	- No pollution incident affecting soil of water quality - zero major incidents occurred.	- Substation In-charge to keep records and	NA	NA	PGCB O&M budget

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

General Works								
Environmental Parameters to be Monitored	**Location**	**Time/Frequency/ Duration**	**Method of Measurements**	**Performance Standard / Quantitative Targets**	**Responsibilities**			**Equipment and Monitoring Cost (Million BDT)**
					PMU	**SIC**	**Contractor**	
		keeping during O&M	amount in kg or m^3 and action taken to clean up) - Carry out visual inspection and interviews with workers and the community to identify if any unrecorded incidents occurred	- Minor incidents responded to in accordance with O&M response plan procedures with lessons learnt for future if they occur.	report to ESU in monthly progress reports - Any pollution incident to be reported within 24 hours to ESU by substation /line manager - PGCB ESU to report to ADB			
Health and safety: accident records	All substations, transmission and lines	Daily checks and record keeping during O&M	Keep records of health and safety incidents, compile records from substations and carry out interviews with workers and the community to identify if any unrecorded incidents occurred	- Zero lost time incidents or fatalities (among workers and community) - All near miss, minor, lost time, and fatal incidents as well as suspected/confirmed COVID-19 instances having adequate response plan, with lessons learnt for future if they occur.	- Substation In-charge to keep records and report to ESU in monthly progress reports - Any lost time incident or fatality to be reported within 24 hours to ESU by substation /line manager - PGCB ESU to report to ADB - Any lost time incident or fatality to be reported within 24 hours to ADB	NA	NA	PGCB O&M budget

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

12.8.2 Part 2 – New Substations and Bay Extensions at Existing Substations

New Substations and Bay Extensions at Existing Substations								
Environmental Parameters to be Monitored	**Location**	**Time/Frequency/ Duration**	**Method of Measurements**	**Performance Standard / Quantitative Targets**	**Responsibilities**			**Equipment and Monitoring Cost (Million BDT)**
					PMU	**SIC**	**Contractor**	
Detailed Design and Pre-Construction Phase								
Ecology	Substation sites and any temporary facility areas used	Once prior to construction – baseline monitoring prior to the start of any activity onsite	Ecological survey of substation site and any temporary facility areas used to include presence flora and fauna (including avifauna and aquatic ecology as applicable, especially to confirm importance of site for resident birds and absence of threatened species) and tree enumeration (numbers, species, size etc.)	No net loss of biodiversity following construction. Only types of habitats and number of trees documented in IEE are lost, any trees lost are compensated for, 1:3 replacement with native tree species in suitable alternative location as per Tree Plantation Plan, Target: 100% survival rate. No damage to other habitats/trees/vegetation outside the substation.	- Ensure survey undertaken by contractor - Report in EMR to ADB and DOE	SIC to supervise survey in the field and support PIU in checking compliance	Contractor to undertake survey and report to PIU	- Ecological survey by qualified and experienced ecologists - Part of contract cost, include costs if implementing EMP as BOQ line.
	Pekua and Paikgacha substation site	Once prior to construction – baseline monitoring prior to the start of any activity onsite (given that the Contractor is mobilized during land development)	Ornithology survey including point counts on a monthly basis from October to March of the substation site and surroundings	No net loss of biodiversity following construction.	- Ensure survey undertaken by contractor - Report in EMR to	SIC to supervise survey in the field and support PMU in checking compliance	Contractor to undertake survey and report to PMU	- Migratory Bird survey by qualified and experienced ornithologists

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

New Substations and Bay Extensions at Existing Substations								
Environmental Parameters to be Monitored	**Location**	**Time/Frequency/ Duration**	**Method of Measurements**	**Performance Standard / Quantitative Targets**	**Responsibilities**			**Equipment and Monitoring Cost (Million BDT)**
					PMU	**SIC**	**Contractor**	
					ADB and DOE			- Part of contract cost, include costs if implementing EMP as BOQ line.
Air Quality: PM10, PM2.5, SOX, NOX, CO & Pb	Nearest sensitive receptor within 500 m of substations on each boundary – all substations	Once prior to construction – baseline monitoring prior to the start of any activity onsite.	- To be measured as 1-hour and 24- hour averages along with meteorological data- temperature humidity, wind speed, and wind direction-during the dry season. - Record details as required by the EC.	Compliance with ambient air quality standards to be applied to the project (see Appendix X– Applicable Standards for EMP) or no increase above baseline if already exceeded	PMU to - ensure monitoring undertaken by contractor - report in EMR to ADB and DOE	SIC to support PMU in recruitment ensuring that ai quality monitoring is carried out	Contractor to undertake measurements and report to PMU	- Professional, calibrated, portable outdoor air quality monitoring sensors to be used. - Part of contract cost, include costs of implementing EMoP as BOQ line
Noise level: dB(A)	Site boundary and nearest sensitive receptor within 50m of substations on each boundary – all substations	Once prior to construction – baseline monitoring prior to the start of any activity onsite.	1hr LAeq over a 48-hour period including workday and weekend using professional, calibrated portable monitoring devices.	Compliance with ambient noise standards to be applied to the project (see Appendix X– Applicable	PMU to - ensure monitoring undertaken by	SIC to supervise measurements in the field and support	Contractor to undertake measurements and	Portable, professional, real-time calibrated Type 1 or 2 sound

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

New Substations and Bay Extensions at Existing Substations								
Environmental Parameters to be Monitored	**Location**	**Time/Frequency/ Duration**	**Method of Measurements**	**Performance Standard / Quantitative Targets**	**Responsibilities**			**Equipment and Monitoring Cost (Million BDT)**
					PMU	**SIC**	**Contractor**	
			Noise levels to be measured outdoors in free field conditions. Record details as required by the EC.	Standards for EMP) or <3dBA increase above baseline if already exceeded	contractor - report in EMR to ADB and DOE	PMU in checking compliance	report to PMU	level meter meeting all appropriate IEC standards to be used with a tripod. - Part of contract cost, include costs of implementing EMoP as BOQ line
Water quality Surface Water Quality: pH, BOD5, COD, TDS, TSS, DO, NH3-N, PO4, Turbidity, Odor, Chloride, Total Coliform (TC), Ammonia-Nitrogen, Oil & Grease, Polychlorinated Biphenyls (PCBs)	Nearest surface waterbodies (excluding those to be infilled or lost on the site) and groundwater sources (wells) unless >100m distant from the substation	Once prior to construction – baseline monitoring prior to the start of any activity onsite	- Water sample is to be taken in a clean, non-contaminated, well-sealed container and tested within the next 48h. Water quality tests by accredited laboratory (physical, chemical, and bacteriological tests) - Record details as required by the EC.	No pollution incident affecting surface or groundwater quality and compliance with ambient water quality standards to be applied to the project (see Appendix X– Applicable Standards for EMP) or no increase above baseline if already exceeded.	- ensure monitoring undertaken by contractor \ - report in EMR to ADB and DOE	SIC to supervise measurements in the field and support PMU in checking compliance	Contractor to undertake measurements and report to PMU	- Water quality tests by accredited laboratory. - Part of contract cost, include costs of implementing EMoP as BOQ line

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

New Substations and Bay Extensions at Existing Substations								
Environmental Parameters to be Monitored	**Location**	**Time/Frequency/ Duration**	**Method of Measurements**	**Performance Standard / Quantitative Targets**	**Responsibilities**			**Equipment and Monitoring Cost (Million BDT)**
					PMU	**SIC**	**Contractor**	
Ground Water/Drinking Water Quality: pH, Mn, Fe, As, Electrical Conductivity (EC), Chloride (Cl), Total Coliform (TC), Fecal Coliform (FC), Turbidity, Odor, Polychlorinated Biphenyls (PCBs) If used by local community as a source of drinking water to also test against GOB drinking water standards (full suite of parameters)								
Soil quality: pH, Texture Organic Contents, Lead (Pb), Copper (Cu), Chromium (Cr), Cadmium	For existing substation sites	One time for baseline establishment prior to the start of any activity onsite	Soil samples to be taken from across the substation area at various locations at surface and at depth in clean, non-contaminated, well-sealed containers and	- No soil contamination was present prior to construction work. If present this is to be treated as an unanticipated impact	- ensure monitoring undertaken by contractor - report in	SIC to supervise measurements in the field and support PMU in	Contractor to undertake measurements and report to	- Soil quality tests by accredited laboratory. - Part of

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

New Substations and Bay Extensions at Existing Substations								
Environmental Parameters to be Monitored	**Location**	**Time/Frequency/ Duration**	**Method of Measurements**	**Performance Standard / Quantitative Targets**	**Responsibilities**			**Equipment and Monitoring Cost (Million BDT)**
					PMU	**SIC**	**Contractor**	
(Cd), Polychlorinated Biphenyls (PCBs)			tested within the next 48h following international good practice for contaminated land investigation.[82] Soil quality tests by accredited laboratory to include pH, Texture Organic Contents, Lead (Pb), Copper (Cu), Chromium (Cr), Cadmium (Cd), Polychlorinated Biphenyls (PCBs)and any other contaminants indicated by contaminated land professional	and contaminated land remedial action plan developed and implemented by the contractor before the start of any other on-site activity. - No pollution incident affecting soil quality and compliance with soil quality standards to be applied to the project e.g., international good practice guidelines.[83]	EMR to ADB and DOE	checking compliance	PMU	contract cost, include costs if implementing EMP as BOQ line.
Health and Safety: operational drinking water supplies	All sources that will be developed by contractor for use as an operational drinking water supply	One time for baseline establishment prior to the start of any activity onsite	Water sample is to be taken in a clean, non-contaminated, well- sealed container and tested within the next 48h. Drinking water quality tests against	Drinking water provided for operational substations meets national drinking water standards or appropriate level of	PMU to - ensure monitoring undertaken by contractor	SIC to supervise measurements in the field and support PMU in	Contractor to undertake measurements and report to	- Water quality tests by accredited laboratory. - Part of

[82] There are various good practice guidelines that can be followed, such as: https://www.health.vic.gov.au/sites/default/files/migrated/files/collections/policies-and-guidelines/h/hs680_land_contam---pdf.pdf

[83] There are various soil quality guidelines that can be followed to determine if land is contaminated such as those from Australia: https://www.nepc.gov.au/nepms/assessment-site-contamination/toolbox

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

New Substations and Bay Extensions at Existing Substations								
Environmental Parameters to be Monitored	**Location**	**Time/Frequency/ Duration**	**Method of Measurements**	**Performance Standard / Quantitative Targets**	**Responsibilities**			**Equipment and Monitoring Cost (Million BDT)**
					PMU	**SIC**	**Contractor**	
			Bangladesh drinking water standards by accredited laboratory (physical, chemical, and bacteriological tests including arsenic levels) per Appendix X, and ECP 3.	water treatment is incorporated into the project design	and - to report in EMR to ADB	checking compliance	PMU	contract cost, include costs of implementing EMoP as BOQ line
Health and safety/physical cultural resources: condition surveys in relation to property damage from construction	All substations; include surveys of all properties located immediately adjacent all boundaries (including informal settlements) at substations for which piling works are being required, plus properties immediately adjacent to the access entrance to substation sites	One time for baseline establishment prior to the start of any activity onsite	- Photographic and/or structural precondition surveys of existing - property condition including utilities, structures, drains etc. Risk - assessment of potential damage to structures and additional - recommendations for structural and vibration monitoring condition where there is a risk of property damage	- Damages to property avoided but if caused, to be paid for by the contractor. - National Building Code to be referred to in relation to ensuring structural safety of property during works.	PMU to - ensure surveys undertaken by contractor and - to report in EMR to ADB and DOE	SIC to supervise surveys in the field and support PMU in checking compliance	Contractor to undertake surveys and report to PMU	Part of construction cost, include costs of implementing EMP as BOQ line.
Construction Phase								
Ecology Conservation	Substation sites and any temporary facility areas used	- Ongoing throughout construction, monthly reporting of records kept by the contractor. - Ecological survey once on commissioning and prior to	- Upon commissioning ecological survey of substation site and any temporary facility areas used to include presence flora and fauna and tree enumeration (numbers,	No net loss of biodiversity following construction. Only types of habitats and number of trees documented in IEE are lost, including minimum	PMU to - ensure record keeping by contractor and	SIC to supervise contractor and support PMU in checking compliance	Contractor to undertake surveys, keep records and report to	Ecological survey by qualified and experienced ecologists Part of contract

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

New Substations and Bay Extensions at Existing Substations								
Environmental Parameters to be Monitored	**Location**	**Time/Frequency/ Duration**	**Method of Measurements**	**Performance Standard / Quantitative Targets**	**Responsibilities**			**Equipment and Monitoring Cost (Million BDT)**
					PMU	**SIC**	**Contractor**	
		handover of substation to PGCB	species, size etc.) - Keep records of all compensatory tree plantation undertaken (numbers, species, size etc.) including survival and replacement of trees during defect liability period	number of trees, any trees lost are compensated for, 1:3 replacement with native tree species in suitable alternative location,[84] 100% survival rate. No damage to other habitats/trees/vegetation outside the substation.	- to report in EMR to ADB and DOE		PMU in monthly progress reports	cost, include costs of implementing EMoP as BOQ line
	Pekua and Paikgacha substation site	Once on commissioning and prior to handover of substation to PGCB	Overwintering bird survey of PAI of substation site following methodology used for baseline survey in the IEE.	No net loss of biodiversity following construction compared to baseline survey reported in the IEE.	PMU to - ensure record keeping by contractor and - to report in EMR to ADB and DOE	SIC to supervise contractor and support PMU in checking compliance	Contractor to undertake surveys, keep records and report to PMU in monthly progress reports	- Migratory Bird survey by qualified and experienced ornithologists - Part of contract cost, include costs of implementing EMoP as BOQ line

[84] Tree plantation to be done by contractor considering native plant species as appropriate for the substation site in the vacant spaces to be kept as per BNBC 2020 – if there is not space at the substation then a suitable site in the neighborhood is to be identified for this tree plantation to be completed.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

New Substations and Bay Extensions at Existing Substations								
Environmental Parameters to be Monitored	**Location**	**Time/Frequency/ Duration**	**Method of Measurements**	**Performance Standard / Quantitative Targets**	**Responsibilities**			**Equipment and Monitoring Cost (Million BDT)**
					PMU	**SIC**	**Contractor**	
Air Quality: PM10, PM2.5, SOX, NOX, CO & Pb	- Nearest sensitive receptor within 500 m of substations on each boundary - Additional locations at request of PMU/SIC in the event of visible dust pollution or grievance received during construction.	Quarterly during active construction involving demolition and earthworks, and then as requested by PMU/SIC in event of visible dust pollution or grievance received during construction.	- To be measured as 1-hour and 24- hour averages along with meteorological data- temperature humidity, wind speed, and wind direction-during the dry season. - Record details as required by the EC.	- No exceedance of ambient air quality standards (see Appendix X – Applicable Standards for EMP) or no worsening if already exceeded (as per the baseline)	PMU to - ensure monitoring undertaken by contractor and - to report in EMR to ADB and DOE	SIC to supervise measurements in the field and support PMU in checking compliance	Contractor to undertake measurements and report to PMU	- Professional, calibrated, portable outdoor air quality monitoring sensors to be used. - Part of contract cost, include costs of implementing EMoP as BOQ line
Noise level: dB(A)	1m from noisy equipment within substation in respect of commissioning Site boundary and nearest sensitive receptor within 500 m of substations on each boundary. Additional locations at request of PMU/SIC in the event of noise pollution concerns or grievance received during construction	- Monthly during active demolition and construction involving noisy activities such as piling, and then as requested by PMU/SIC in event of noise pollution concerns or grievance received during construction. - One time during commissioning (at substations)	- 1hr LAeq over a 48-hour period including workday and weekend using professional, calibrated portable monitoring devices. Noise levels to be measured outdoors in free field conditions. - Record details as required by the EC.	No exceedance of ambient noise standards (see Appendix X – Applicable Standards for EMP) or <3dBA increase if already exceeded (as per the baseline)	PMU to - ensure monitoring undertaken by contractor and - to report in EMR to ADB and DOE	SIC to supervise measurements in the field and support PMU in checking compliance	Contractor to undertake measurements and report to PMU	- Portable, professional, real-time calibrated Type 1 or 2 sound level meter meeting all appropriate IEC standards to be used with a tripod.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

New Substations and Bay Extensions at Existing Substations								
Environmental Parameters to be Monitored	**Location**	**Time/Frequency/ Duration**	**Method of Measurements**	**Performance Standard / Quantitative Targets**	**Responsibilities**			**Equipment and Monitoring Cost (Million BDT)**
					PMU	**SIC**	**Contractor**	
								- Part of contract cost, include costs of implementing EMoP as BOQ line
Water quality Surface Water Quality: pH, BOD5, COD, TDS, TSS, DO, NH3-N, PO4, Turbidity, Odor, Chloride, Total Coliform (TC), Ammonia-Nitrogen, Oil & Grease, Polychlorinated Biphenyls (PCBs) Ground Water/Drinking Water Quality: pH, Mn, Fe, As, Electrical Conductivity (EC),	Nearest surface waterbodies and groundwater sources (wells) unless > 100m distant from the substation. Additional locations at request of PMU/SIC in the event of water pollution concerns or grievance received during construction	Quarterly during active construction involving earthworks, and then only required if requested by PMU/SIC in event of water pollution concerns or grievance received during construction. Daily during infill and piling works adjacent to waterbodies using handheld meter for pH, turbidity, TDS, TSS and DO	Water sample is to be taken in a clean, non-contaminated, well- sealed container and tested within the next 48h. Water quality tests by accredited laboratory (physical, chemical, and bacteriological tests). Record details as required by the EC.	No pollution incident affecting surface or groundwater quality and compliance with ambient water quality standards to be applied to the project (see Appendix X – Applicable Standards for EMP) or no increase above baseline if already exceeded.	PMU to - ensure monitoring undertaken by contractor and - to report in EMR to ADB and DOE	SIC to supervise measurements in the field and support PMU in checking compliance	Contractor to undertake measurements and report to PMU	- Water quality tests by accredited laboratory. - Part of contract cost, include costs of implementing EMoP as BOQ line

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

New Substations and Bay Extensions at Existing Substations								
Environmental Parameters to be Monitored	**Location**	**Time/Frequency/ Duration**	**Method of Measurements**	**Performance Standard / Quantitative Targets**	**Responsibilities**			**Equipment and Monitoring Cost (Million BDT)**
					PMU	**SIC**	**Contractor**	
Chloride (Cl), Total Coliform (TC), Fecal Coliform (FC), Turbidity, Odor, Polychlorinated Biphenyls (PCBs) If used by local community as a source of drinking water to also test against GOB drinking water standards (full suite of parameters mentioned in Appendix X)								
Soil: pH, Texture Organic Contents, Lead (Pb), Copper (Cu), Chromium (Cr), Cadmium (Cd), Polychlorinated Biphenyls (PCBs)	All substation sites with earthworks/cut and fill, and piling works	Ongoing throughout construction, monthly reporting of records kept by the contractor Semi-Yearly laboratory test is required.	Keep records of earthworks involved, including total volume in m3 of soil excavated and reused (any disposed of as spoil off site to licensed waste disposal facilities recorded as per waste generation)	Earthworks documented, and all excavated and cut and fill volumes accounted for, either reused on-site or disposed of off-site to licensed waste disposal facilities	PMU to - ensure record keeping by contractor and - to report in EMR to ADB and DOE	SIC to supervise contractor and support PMU in checking compliance	Contractor to keep records and report to PMU in monthly progress reports	- Part of contract cost, include costs of implementing EMoP as BOQ line

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

New Substations and Bay Extensions at Existing Substations								
Environmental Parameters to be Monitored	**Location**	**Time/Frequency/ Duration**	**Method of Measurements**	**Performance Standard / Quantitative Targets**	**Responsibilities**			**Equipment and Monitoring Cost (Million BDT)**
					PMU	**SIC**	**Contractor**	
Health and Safety: operational drinking water supplies	All sources that will be developed for use as an operational drinking water supply as part of substation construction (pre- and post-treatment samples are to be taken)	Once on commissioning and prior to handover of substation to PGCB to confirm operational substation meets drinking water quality standards	Water sample is to be taken in a clean, non-contaminated, well- sealed container and tested within the next 48h. Drinking water quality tests against Bangladesh drinking water standards by accredited laboratory (physical, chemical, and bacteriological tests including arsenic levels) per (Appendix X). Record details as required by the EC.	Drinking water provided for operational substations meets national drinking water standards or appropriate level of water treatment is incorporated into the project design	PMU to - ensure monitoring undertaken by contractor and - to report in EMR to ADB and DOE	SIC to supervise measurements in the field and support PMU in checking compliance	Contractor to undertake measurements and report to PMU	- Water quality tests by accredited laboratory. - Part of contract cost, include costs of implementing EMoP as BOQ line
Health and safety: electromagnetic field (EMF)	Substation sites	- Substation boundary and adjacent to electrical equipment - Once on commissioning and prior to handover of substation to PGCB to confirm operational substation meets EMF reference levels	EMF levels to be monitored using professional, calibrated portable monitoring devices	No exceedance of ICNIRP reference levels	PMU to - ensure monitoring undertaken by contractor and - to report in EMR to ADB and DOE	SIC to supervise measurements in the field and support PMU in checking compliance	Contractor to undertake measurements and report to PMU	- Portable but professional, calibrated EMF detector - Part of contract cost, include costs of implementing EMoP as BOQ line
Health and safety/physical	Adjacent properties at risk (ongoing survey of properties	- Ongoing throughout construction, daily site	- Ongoing photographic and/or structural condition	- Damages to property avoided but if caused,	PMU to - ensure	SIC to supervise	Contractor to	Part of contract cost, include

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

New Substations and Bay Extensions at Existing Substations								
Environmental Parameters to be Monitored	**Location**	**Time/Frequency/ Duration**	**Method of Measurements**	**Performance Standard / Quantitative Targets**	**Responsibilities**			**Equipment and Monitoring Cost (Million BDT)**
					PMU	**SIC**	**Contractor**	
cultural resources: condition surveys in relation to property damage	flagged at risk during pre-construction)	checks and additional monitoring of condition as per the recommendation of the pre-construction surveys - Once on commissioning and prior to handover of substation to PGCB to confirm no residual damage occurred	surveys of existing property condition including utilities, structures, drains etc. - Structural condition monitoring of properties at risk as recommended during the pre-construction surveys	to be paid for by the contractor. - National Building Code to be referred to in relation to ensuring structural safety of property during works.	monitoring undertaken by contractor and - to report in EMR to ADB and DOE	measurements in the field and support PMU in checking compliance	undertake measurements and report to PMU	costs of implementing EMoP as BOQ line
Operation and Maintenance								
GHG emissions: SF6 leakage	All substations	Daily checks and record keeping during O&M	Record of all SF6 leakage and any SF-6 related maintenance activities in substations	Leakage <0.1% and records of undertaking a regular maintenance	- PGCB substation in-charge (supported by third party if needed) to undertake monitoring and report monthly to the ESU - PGCB ESU to report to ADB	NA	Contractor to supply monitoring equipment for use by PGCB SS in-charge during O&M	- Portable but professional, calibrated SF6 leakage detector, to be provided by the contractor one per substation / include for equipment provision as a BOQ line - PGCB O&M budget
Wastewater discharge:	All substations not connected to existing sewerage system,	Semiannually or as may be required by DOE during O&M	- Treated water sample is to be taken in a clean, non-	No pollution incident affecting surface or	PGCB ESU to appoint	NA	NA	- Water quality tests by

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

New Substations and Bay Extensions at Existing Substations								
Environmental Parameters to be Monitored	**Location**	**Time/Frequency/ Duration**	**Method of Measurements**	**Performance Standard / Quantitative Targets**	**Responsibilities**			**Equipment and Monitoring Cost (Million BDT)**
					PMU	**SIC**	**Contractor**	
pH, BOD5, COD, TDS, TSS, DO, NH3-N, PO4, Turbidity, Odor, Chloride, Total Coliform (TC), Ammonia-Nitrogen, Oil & Grease, Polychlorinated Biphenyls (PCBs)	substations having septic tank with soak away		contaminated, well- sealed container and tested within the next 48h. Water quality tests against Bangladesh drinking water standards by accredited laboratory (physical, chemical, and bacteriological tests) - Record details as required by the EC.	groundwater quality and compliance with effluent discharge standards to be applied to the project (see Appendix X, and ECP 3)– Applicable Standards for EMP) or no increase above baseline if already exceeded.	third-party laboratory to undertake monthly testing and report the results to ADB.			accredited laboratory. - PGCB O&M budget
Health and safety: drinking water supplies	All substations	Monthly testing or reporting of records kept	- Water sample is to be taken in a clean, non-contaminated, well- sealed container and tested within the next 48h. Drinking water quality tests against Bangladesh drinking water standards by accredited laboratory (physical, chemical, and bacteriological tests including arsenic levels) where a surface or groundwater drinking water supply was provided by the contractor or	Drinking water provided for operational substations meets national drinking water standards or appropriate level of water treatment is being maintained	Substation manager to keep records and report to ESU in monthly progress reports PGCB ESU to appoint third-party laboratory to undertake monthly	NA	NA	- Water quality tests by accredited laboratory. - PGCB O&M budget

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

New Substations and Bay Extensions at Existing Substations								
Environmental Parameters to be Monitored	**Location**	**Time/Frequency/ Duration**	**Method of Measurements**	**Performance Standard / Quantitative Targets**	**Responsibilities**			**Equipment and Monitoring Cost (Million BDT)**
					PMU	**SIC**	**Contractor**	
			sources where supplier is unable to provide water quality test results. - Alternatively, documentary evidence that drinking water meeting national standards is being imported for O&M workers consumption. - Record details as required by the EC.		testing and report the results to ADB.			
Health and safety: electromagnetic field (EMF)	All substations	Semiannually or as may be required by DOE during O&M Daily checks and record keeping during O&M for workers in close contact with EMF	- EMF levels to be monitored using professional, calibrated portable monitoring devices - Continuous checks for substation workers in close contact with EMF through use of personal EMF monitor carried by workers at all times while working on or near live electrical equipment	No exceedance of ICNIRP reference levels and records of EMF checking	- PGCB substation manager (supported by third party if needed) to undertake monitoring and report monthly to the ESU - PGCB ESU to report to ADB.	NA	Contractor to supply monitoring equipment for use by PGCB substation manager and staff during O&M	- Portable but professional, calibrated EMF detector, to be provided by the contractor one per substation along with personal EMF radiation exposure monitoring equipment for substation

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

New Substations and Bay Extensions at Existing Substations								
Environmental Parameters to be Monitored	Location	Time/Frequency/ Duration	Method of Measurements	Performance Standard / Quantitative Targets	Responsibilities			Equipment and Monitoring Cost (Million BDT)
					PMU	SIC	Contractor	
								workers / include for equipment provision as a BOQ line - PGCB O&M budget

12.8.3 Part 3- Transmission Lines/LILO Lines

Transmission Lines, LILO and Reconductoring of Existing Line								
Environmental Parameters to be Monitored	Location	Time/Frequency/ Duration	Method of Measurements	Performance Standard / Quantitative Targets	Responsibilities			Equipment and Monitoring Cost (Million BDT)
					PMU	SIC	Contractor	
Detailed Design and Pre-Construction Phase								
Ecology	ROW and any temporary facility areas used	Once prior to construction – baseline monitoring prior to the start of any activity onsite	Ecological survey along ROW and any temporary facility areas used to include presence flora and fauna (include avifauna) and tree enumeration (numbers, species, size etc.)	No net loss of biodiversity following construction. Only types of habitats and number of trees documented in IEE are lost, any trees lost are compensated for, 1:3 replacement with native tree species in suitable alternative location as per Tree Plantation Plan, Target: 100% survival rate. No damage to other habitats/trees/vegetation outside the ROW.	- Ensure survey undertaken by contractor - Report in EMR to ADB and DOE	SIC to supervise survey in the field and support PIU in checking compliance	Contractor to undertake survey and report to PIU	- Ecological survey by qualified and experienced ecologists - Part of contract cost, include costs if implementing EMP as BOQ line.
	Pekua transmission lines entire	Once prior to construction – baseline	- Seasonal ornithology survey including point counts and vantage	No net loss of biodiversity following construction.	- Ensure survey undertaken by contractor	SIC to supervise survey in the	Contractor to undertake survey and report to	- Bird survey by qualified and experienced

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Transmission Lines, LILO and Reconductoring of Existing Line								
Environmental Parameters to be Monitored	Location	Time/Frequency/ Duration	Method of Measurements	Performance Standard / Quantitative Targets	Responsibilities			Equipment and Monitoring Cost (Million BDT)
					PMU	SIC	Contractor	
	length, Paikgacha transmission line entire length, selected locations along with TLs as per site specific EMP requirements	monitoring prior to the start of any activity onsite (after the contractors are mobilized)	points (sufficient number to cover survey length, following Scottish Natural Heritage method[85] or similar to obtain flight line and height information) on a monthly basis from October to March (migration) and in the breeding season for the transmission line route		- Report in EMR to ADB and DOE	field and support PMU in checking compliance	PMU	ornithologists - Part of contract cost, include costs if implementing EMP as BOQ line.
Air Quality: PM10, PM2.5, SOX, NOX, CO & Pb	Nearest sensitive receptor within 500 m of towers	Once prior to construction – baseline monitoring prior to the start of any activity onsite.	- To be measured as 1-hour and 24- hour averages along with meteorological data-temperature humidity, wind speed, and wind direction-during the dry season. - Record details as required by the EC.	Compliance with ambient air quality standards to be applied to the project (see Appendix X, and ECP 10– Applicable Standards for EMP) or no increase above baseline if already exceeded	PMU to - ensure monitoring undertaken by contractor - report in EMR to ADB and DOE	SIC to support PMU in recruitment ensuring that ai quality monitoring is carried out	Contractor to undertake measurements and report to PMU	- Professional, calibrated, portable outdoor air quality monitoring sensors to be used. - Part of contract cost, include costs of implementing EMoP as BOQ line
Noise level: dB(A)	Nearest sensitive receptor within 500m of towers	Once prior to construction – baseline monitoring prior to the start of any activity onsite.	1hr LAeq over a 48-hour period including workday and weekend using professional, calibrated portable monitoring devices. Noise levels to be measured outdoors in free	Compliance with ambient noise standards to be applied to the project (see Appendix X, and ECP 11– Applicable Standards for EMP) or <3dBA increase above baseline if already exceeded	PMU to - ensure monitoring undertaken by contractor - report in EMR to ADB and DOE	SIC to supervise measurements in the field and support PMU in checking compliance	Contractor to undertake measurements and report to PMU	- Portable, professional, real-time calibrated Type 1 or 2 sound level meter meeting all appropriate IEC standards to be

[85] https://www.nature.scot/doc/recommended-bird-survey-methods-inform-impact-assessment-onshore-windfarms

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Transmission Lines, LILO and Reconductoring of Existing Line								
Environmental Parameters to be Monitored	Location	Time/Frequency/ Duration	Method of Measurements	Performance Standard / Quantitative Targets	Responsibilities			Equipment and Monitoring Cost (Million BDT)
					PMU	SIC	Contractor	
			field conditions. Record details as required by the EC.					used with a tripod. - Part of contract cost, include costs of implementing EMoP as BOQ line
Water quality Surface Water Quality: pH, BOD5, COD, TDS, TSS, DO, NH3-N, PO4, Turbidity, Odor, Chloride, Total Coliform (TC), Ammonia-Nitrogen, Oil & Grease, Polychlorinated Biphenyls (PCBs) Ground Water/Drinking Water Quality: pH, Mn, Fe, As, Electrical Conductivity (EC), Chloride (Cl), Total Coliform (TC), Fecal Coliform (FC),	Nearest surface waterbodies and groundwater sources (wells) unless >100m distant from the towers	Once prior to construction – baseline monitoring prior to the start of any activity onsite	- Water sample is to be taken in a clean, non-contaminated, well-sealed container and tested within the next 48h. Water quality tests by accredited laboratory (physical, chemical, and bacteriological tests) - Record details as required by the EC.	No pollution incident affecting surface or groundwater quality and compliance with ambient water quality standards to be applied to the project (see Appendix X, and ECP 3– Applicable Standards for EMP) or no increase above baseline if already exceeded.	- ensure monitoring undertaken by contractor and - to report in EMR to ADB and DOE	SIC to supervise measurements in the field and support PMU in checking compliance	Contractor to undertake measurements and report to PMU	- Water quality tests by accredited laboratory. - Part of contract cost, include costs of implementing EMoP as BOQ line

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Transmission Lines, LILO and Reconductoring of Existing Line								
Environmental Parameters to be Monitored	Location	Time/Frequency/ Duration	Method of Measurements	Performance Standard / Quantitative Targets	Responsibilities			Equipment and Monitoring Cost (Million BDT)
					PMU	SIC	Contractor	
Turbidity, Odor, Polychlorinated Biphenyls (PCBs) If used by local community as a source of drinking water to also test against GOB drinking water standards (full suite of parameters)								
Soilquality: pH, Texture Organic Contents, Lead (Pb), Copper (Cu), Chromium (Cr), Cadmium (Cd), Polychlorinated Biphenyls (PCBs)	For towers in existing substations	One time for baseline establishment prior to the start of any activity onsite	Soil samples to be taken from ROW at various locations at surface and at depth in clean, non-contaminated, well-sealed containers and tested within the next 48h following international good practice for contaminated land investigation.[86] Soil quality tests by accredited laboratory to include pH, Texture	- No soil contamination was present prior to construction work. If present this is to be treated as an unanticipated impact and contaminated land remedial action plan developed and implemented by the contractor before the start of any other on-site activity. - No pollution incident affecting soil quality and compliance with soil quality standards to be applied to the project e.g.,	- ensure monitoring undertaken by contractor and - to report in EMR to ADB and DOE	SIC to supervise measurements in the field and support PMU in checking compliance	Contractor to undertake measurements and report to PMU	- Soil quality tests by accredited laboratory. - Part of contract cost, include costs if implementing EMP as BOQ line.

[86] There are various good practice guidelines that can be followed, such as: https://www.health.vic.gov.au/sites/default/files/migrated/files/collections/policies-and-guidelines/h/hs680_land_contam---pdf.pdf

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Transmission Lines, LILO and Reconductoring of Existing Line								
Environmental Parameters to be Monitored	Location	Time/Frequency/ Duration	Method of Measurements	Performance Standard / Quantitative Targets	Responsibilities			Equipment and Monitoring Cost (Million BDT)
					PMU	SIC	Contractor	
			Organic Contents, Lead (Pb), Copper (Cu), Chromium (Cr), Cadmium (Cd), Polychlorinated Biphenyls (PCBs)and any other contaminants indicated by contaminated land professional	international good practice guidelines.[87]				
Health and Safety: operational drinking water supplies	All sources that will be developed by contractor for use as an operational drinking water supply	One time for baseline establishment prior to the start of any activity onsite	Water sample is to be taken in a clean, non-contaminated, well- sealed container and tested within the next 48h. Drinking water quality tests against Bangladesh drinking water standards by accredited laboratory (physical, chemical, and bacteriological tests including arsenic levels) per Appendix X, and ECP 3.	Drinking water provided for operational substations meets national drinking water standards or appropriate level of water treatment is incorporated into the project design	PMU to - ensure monitoring undertaken by contractor and - to report in EMR to ADB	SIC to supervise measurements in the field and support PMU in checking compliance	Contractor to undertake measurements and report to PMU	- Water quality tests by accredited laboratory. - Part of contract cost, include costs of implementing EMoP as BOQ line
Health and safety/physical cultural	Detailed ROW surveys of all properties	One time for baseline establishment	- Photographic and/or structural precondition surveys of existing	- Damages to property avoided but if caused, to be paid for by the contractor.	PMU to - ensure surveys undertaken by	SIC to supervise surveys in the	Contractor to undertake surveys and	Part of construction cost, include costs of implementing EMP as

[87] There are various soil quality guidelines that can be followed to determine if land is contaminated such as those from Australia: https://www.nepc.gov.au/nepms/assessment-site-contamination/toolbox

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Transmission Lines, LILO and Reconductoring of Existing Line								
Environmental Parameters to be Monitored	Location	Time/Frequency/ Duration	Method of Measurements	Performance Standard / Quantitative Targets	Responsibilities			Equipment and Monitoring Cost (Million BDT)
					PMU	SIC	Contractor	
resources: condition surveys in relation to property damage from construction	located immediately adjacent (including informal settlements) with condition surveys where required e.g., risk of damage from vibration due to piling works	prior to the start of any activity onsite	- property condition including utilities, structures, drains etc. Risk - assessment of potential damage to structures and additional - recommendations for structural and vibration monitoring condition where there is a risk of property damage	- National Building Code to be referred to in relation to ensuring structural safety of property during works.	contractor and - to report in EMR to ADB and DOE	field and support PMU in checking compliance	report to PMU	BOQ line.
Construction Phase								
Ecology Conservation	ROW and any temporary facility areas used	- Ongoing throughout construction, monthly reporting of records kept by the contractor. - Ecological survey once on commissioning and prior to handover of Line	- Upon commissioning ecological survey of substation site and any temporary facility areas used to include presence flora and fauna and tree enumeration (numbers, species, size etc.) - Keep records of all compensatory tree plantation undertaken (numbers, species, size	No net loss of biodiversity following construction. Only types of habitats and number of trees documented in IEE are lost, including minimum number of trees, any trees lost are compensated for, 1:3 replacement with native tree species in suitable alternative location,[88] 100% survival rate. No damage to other habitats/trees/vegetation outside the substation.	PMU to - ensure record keeping by contractor and - to report in EMR to ADB and DOE	SIC to supervise contractor and support PMU in checking compliance	Contractor to undertake surveys, keep records and report to PMU in monthly progress reports	Ecological survey by qualified and experienced ecologists Part of contract cost, include costs of implementing EMoP as BOQ line

[88] Tree plantation to be done by contractor considering native plant species as appropriate for the substation site in the vacant spaces to be kept as per BNBC 2020 – if there is not space at the substation then a suitable site in the neighborhood is to be identified for this tree plantation to be completed.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Transmission Lines, LILO and Reconductoring of Existing Line								
Environmental Parameters to be Monitored	**Location**	**Time/Frequency/ Duration**	**Method of Measurements**	**Performance Standard / Quantitative Targets**	**Responsibilities**			**Equipment and Monitoring Cost (Million BDT)**
					PMU	**SIC**	**Contractor**	
		to PGCB	etc.) including survival and replacement of trees during defect liability period					
	- Pekua and transmission lines entire length, Paikgacha transmission line entire length	Upon commissioning monthly during defects liability period and prior to handover of TL to PGCB	- Point count, vantage points and monthly carcass survey during the 1.5 year defects liability period of entire transmission line using internationally recognized survey methodology agreed with ADB during the defect liability period. Methodology to refer to IFC guidelines on carcass monitoring[89]	- No net loss of biodiversity following construction compared to baseline survey reported in the IEE.	PMU to - ensure record keeping by contractor and to report in EMR to ADB and DOE	SIC to supervise contractor and support PMU in checking compliance	Contractor to undertake surveys, keep records and report to PMU in monthly progress reports	- Bird and carcass survey by qualified and experienced ornithologists - Part of contract cost, include costs of implementing EMoP as BOQ line
Air Quality: PM10, PM2.5, SOX, NOX, CO & Pb	- Nearest sensitive receptor within 500 m of towers - Additional locations at request of PMU/SIC in the event of	Quarterly during active construction as requested by PMU/SIC in event of visible dust pollution or grievance received during construction.	- To be measured as 1-hour and 24- hour averages along with meteorological data-temperature humidity, wind speed, and wind direction-during the dry season. - Record details as required by the EC.	- No exceedance of ambient air quality standards (see Appendix X, and ECP 10) – Applicable Standards for EMP) or no worsening if already exceeded (as per the baseline)	PMU to - ensure monitoring undertaken by contractor and - to report in EMR to ADB and DOE	SIC to supervise measurements in the field and support PMU in checking compliance	Contractor to undertake measurements and report to PMU	- Professional, calibrated, portable outdoor air quality monitoring sensors to be used. - Part of contract cost, include costs of implementing EMoP as BOQ line

[89] https://www.ifc.org/en/insights-reports/2023/bird-bat-fatality-monitoring-onshore-wind-energy-facilities

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Transmission Lines, LILO and Reconductoring of Existing Line								
Environmental Parameters to be Monitored	**Location**	**Time/Frequency/ Duration**	**Method of Measurements**	**Performance Standard / Quantitative Targets**	**Responsibilities**			**Equipment and Monitoring Cost (Million BDT)**
					PMU	**SIC**	**Contractor**	
	visible dust pollution or grievance received during construction.							
Noise level: dB(A)	- Nearest sensitive receptor within 500 m of towers. Additional locations at request of PMU/SIC in the event of noise pollution concerns or grievance received during construction	- Monthly during active construction involving noisy activities such as piling, and then as requested by PMU/SIC in event of noise pollution concerns or grievance received during construction.	- 1hr LAeq over a 48-hour period including workday and weekend using professional, calibrated portable monitoring devices. Noise levels to be measured outdoors in free field conditions. - Record details as required by the EC.	No exceedance of ambient noise standards (see Appendix X, and ECP 11) – Applicable Standards for EMP) or <3dBA increase if already exceeded (as per the baseline)	PMU to - ensure monitoring undertaken by contractor and - to report in EMR to ADB and DOE	SIC to supervise measurements in the field and support PMU in checking compliance	Contractor to undertake measurements and report to PMU	- Portable, professional, real-time calibrated Type 1 or 2 sound level meter meeting all appropriate IEC standards to be used with a tripod. - Part of contract cost, include costs of implementing EMoP as BOQ line
Water quality Surface Water Quality: pH, BOD5, COD, TDS, TSS, DO, NH3-N, PO4, Turbidity, Odor, Chloride, Total	- Nearest surface waterbodies and groundwater sources (wells) unless > 100m	Quarterly during active construction involving earthworks, and then only required if requested by PMU/SIC in event of water pollution	Water sample is to be taken in a clean, non-contaminated, well- sealed container and tested within the next 48h. Water quality tests by accredited laboratory (physical, chemical, and	No pollution incident affecting surface or groundwater quality and compliance with ambient water quality standards to be applied to the project (see Appendix X, and ECP 3– Applicable Standards for EMP) or no increase above baseline if	PMU to - ensure monitoring undertaken by contractor and - to report in EMR to ADB and DOE	SIC to supervise measurements in the field and support PMU in checking compliance	Contractor to undertake measurements and report to PMU	- Water quality tests by accredited laboratory. - Part of contract cost, include costs of implementing EMoP as BOQ line

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Transmission Lines, LILO and Reconductoring of Existing Line								
Environmental Parameters to be Monitored	Location	Time/Frequency/ Duration	Method of Measurements	Performance Standard / Quantitative Targets	Responsibilities			Equipment and Monitoring Cost (Million BDT)
					PMU	SIC	Contractor	
Coliform (TC), Ammonia-Nitrogen, Oil & Grease, Polychlorinated Biphenyls (PCBs) Ground Water/Drinking Water Quality: pH, Mn, Fe, As, Electrical Conductivity (EC), Chloride (Cl), Total Coliform (TC), Fecal Coliform (FC), Turbidity, Odor, Polychlorinated Biphenyls (PCBs) If used by local community as a source of drinking water to also test against GOB drinking water standards (full suite of parameters mentioned in Appendix X)	distant from the towers. - Additional locations at request of PMU/SIC in the event of water pollution concerns or grievance received during construction	concerns or grievance received during construction. Daily during infill and piling works adjacent to waterbodies using handheld meter for turbidity etc.	bacteriological tests). Record details as required by the EC.	already exceeded.				

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Transmission Lines, LILO and Reconductoring of Existing Line								
Environmental Parameters to be Monitored	**Location**	**Time/Frequency/ Duration**	**Method of Measurements**	**Performance Standard / Quantitative Targets**	**Responsibilities**			**Equipment and Monitoring Cost (Million BDT)**
					PMU	**SIC**	**Contractor**	
Soil: pH, Texture Organic Contents, Lead (Pb), Copper (Cu), Chromium (Cr), Cadmium (Cd), Polychlorinated Biphenyls (PCBs)	All TL/LILO construction sites with earthworks/cut and fill, and piling works	Ongoing throughout construction, monthly reporting of records kept by the contractor Semi-Yearly laboratory test is required. All TL/LILO construction sites with earthworks/cut and fill, and piling works. Soil quality testing only needed for towers in the existing substations	Keep records of earthworks involved, including total volume in m3 of soil excavated and reused (any disposed of as spoil off site to licensed waste disposal facilities recorded as per waste generation)	Earthworks documented, and all excavated and cut and fill volumes accounted for, either reused on-site or disposed of off-site to licensed waste disposal facilities	PMU to - ensure record keeping by contractor and - to report in EMR to ADB and DOE	SIC to supervise contractor and support PMU in checking compliance	Contractor to keep records and report to PMU in monthly progress reports	Part of contract cost, include costs of implementing EMoP as BOQ line
Health and safety: electromagnetic field (EMF)	Transmission lines Once on commissioning and prior to handover of site to PGCB to confirm operational line	- Once on commissioning and prior to handover of site to PGCB to confirm operational line meets EMF reference levels	EMF levels to be monitored using professional, calibrated portable monitoring devices	No exceedance of ICNIRP reference levels	PMU to - ensure monitoring undertaken by contractor and - to report in EMR to ADB and DOE	SIC to supervise measurements in the field and support PMU in checking compliance	Contractor to undertake measurements and report to PMU	- Portable but professional, calibrated EMF detector - Part of contract cost, include costs of implementing EMoP as BOQ line
Health and safety/physical	Adjacent properties at	- Ongoing throughout	- Ongoing photographic and/or structural	- Damages to property avoided but if caused, to be paid for by	PMU to - ensure monitoring	SIC to supervise	Contractor to undertake	Part of contract cost, include costs of

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Transmission Lines, LILO and Reconductoring of Existing Line								
Environmental Parameters to be Monitored	**Location**	**Time/Frequency/ Duration**	**Method of Measurements**	**Performance Standard / Quantitative Targets**	**Responsibilities**			**Equipment and Monitoring Cost (Million BDT)**
					PMU	**SIC**	**Contractor**	
cultural resources: condition surveys in relation to property damage	risk (ongoing survey of properties flagged at risk during pre-construction)	construction, daily site checks and additional monitoring of condition as per the recommendation of the pre-construction surveys	condition surveys of existing property condition including utilities, structures, drains etc. - Structural condition monitoring of properties at risk as recommended during the pre-construction surveys	the contractor. - National Building Code to be referred to in relation to ensuring structural safety of property during works.	undertaken by contractor and - to report in EMR to ADB and DOE	measurements in the field and support PMU in checking compliance	measurements and report to PMU	implementing EMoP as BOQ line
Operation and Maintenance								
Health and safety: electromagnetic field (EMF	All through the ROW locations near highly populated areas	Semiannually or as may be required by DOE during O&M - Daily checks and record keeping during O&M for workers in close contact with EMF	- EMF levels to be monitored using professional, calibrated portable monitoring devices - Continuous checks for substation workers in close contact with EMF through use of personal EMF monitor carried by workers at all times while working on or near live electrical equipment	- No exceedance of ICNIRP reference levels and records of EMF checking	- PGCB substation manager (supported by third party if needed) to undertake monitoring and report monthly to the ESU - PGCB ESU to report to ADB.	NA	Contractor to supply monitoring equipment for use by PGCB substation manager and staff during O&M	- Portable but professional, calibrated EMF detector, to be provided by the contractor one per substation along with personal EMF radiation exposure monitoring equipment for substation workers / include for equipment provision as a BOQ line PGCB O&M budget
Ecology conservation	Pekua and Paikgacha transmission lines entire	During operation to confirm significant adverse impacts avoided	- Point count, vantage points and monthly carcass survey during the 1.5 year defects	- No net loss of biodiversity following construction compared to baseline survey reported in the IEE.	PMU to - Contract ornith ologist (as part of construction	N/A	Contractor to undertake monitoring during DLP and submit	Bird and carcass survey by qualified and experienced ornithologists

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Transmission Lines, LILO and Reconductoring of Existing Line								
Environmental Parameters to be Monitored	Location	Time/Frequency/ Duration	Method of Measurements	Performance Standard / Quantitative Targets	Responsibilities			Equipment and Monitoring Cost (Million BDT)
					PMU	SIC	Contractor	
	length, Paikgacha transmission line	upon project closure	liability period of entire transmission line using internationally recognized survey methodology agreed with ADB during the defect liability period. Methodology to refer to IFC guidelines on carcass monitoring		contract) and - report in EMR to ADB and DOE		results to PGCB PMU	Part of contract cost, include costs of implementing EMoP as BOQ line

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

12.9 Supervision, Monitoring and Reporting Arrangements

899. PGCB will submit environmental monitoring reports to ADB on a semi-annual basis up until the completion of construction and on an annual basis during operation, within 15 days from the end of each reporting period i.e., June and December. A template update of IEE report is included in Appendix XI. Submission of environmental monitoring reports will be required from loan effectivity. In between, PGCB will submit quarterly progress reports including an update on environment safeguards implementation following the template in the PAM.

900. The Contractor's EHS management team will establish their own internal systems for supervising, monitoring and reporting their EMP implementation. During the design, pre-construction and construction phases, contractors shall prepare and submit monthly EHS progress reports per an agreed template to the PMU of PGCB which will form part of their quarterly progress reports and the quarterly progress and semi-annual monitoring reports to be submitted to ADB by PGCB. The monthly EHS progress reports shall indicate any design changes made by the Contractor from the project as assessed in the IEE, and the Contractor's performance (including the performance of all their sub-contractors and any third parties) during pre-construction and construction regarding environmental safeguards implementation. The Contractor will also attend monthly meetings convened by PGCB to discuss EHS issues and establish a H&S Committee including worker representation who will also meet on a monthly basis.

901. The environmental monitoring reports of PGCB will describe the physical progress of the project, any scope or design changes, compliance with the loan covenants with regard to safeguards, implementation of mitigating measures described in the EMP, quantitative monitoring data and analysis, GRM implementation, and any noncompliance issue and corresponding corrective actions. Once cleared by ADB's environment specialists, the monitoring reports will be posted on ADB's website as required by its Safeguard Policy Statement (2009) and ADB's Access to Information Policy and disclosed by PGCB on its website and locally to the communities through notices boards, leaflets, brochures, or handouts.

902. In the event of any unanticipated environmental impacts including location, route, design or scope changes during implementation, or if monitoring identifies a breach of performance standards that should be complied with by PGCB and/or their Contractors, Contractors must inform PGCB if they are the ones to become aware of such a situation. PGCB will immediately need to inform ADB, assess the significance of such impacts, evaluate the options available to address the unanticipated impact, and submit to ADB a time-bound and budgeted corrective action plan or updates in the IEE/EMP for review and clearance as required.

903. Complete photographic records and documentary records will be kept by the Contractors covering all activities on the construction site as well as key locations such as receptors adjacent to substations, off-site access roads, construction stores, sanitation and welfare facilities, labor camps, or overnight accommodation etc. Photographs and condition surveys of all key locations will be taken prior to construction activities beginning, to provide the environmental baseline. Copies of all geo-referenced photographs/condition surveys will be submitted to the PMU along with the contractor's monthly EHS progress report. Specifically, the Contractor will be responsible for the documents and reports in Table 12.6. Documentation and records to be kept by all parties in hard copy as well as electronic format are as follows (not an exclusive list):

- Definitive IEE and EMP (as disclosed on the ADB website)
- Legal register (of all applicable national legislation
- National environmental clearance (EC) documentation

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

- Tree felling permits, vehicle emission test certificates etc.
- Training plan and training records with attendance records and photographs of the trainings
- Stakeholder engagement plan and records of all consultations undertaken with photographs and attendance records
- Records of emergency preparedness and response drills with photographs and attendance records
- Document review and approval records
- CSEMPs/H&S Plans and sub-plans and copies of approval records
- Contractor (subcontractor) certifications and insurances
- Contractor (subcontractor) worker records including documentation of working hours
- Completed site checklists and photographic records
- Non-compliance notifications and corrective action instructions
- Contractor and operational accident record and incident reports
- GRM register

904. PGCB and their contractors will facilitate DOE and ADB to carry out the following monitoring actions to supervise project implementation:

- Conduct periodic site visits during the project implementation to confirm compliance with the national environmental clearance, ADB's Safeguard Policy Statement 2009, the project's loan covenants and EMP requirements.
- Review and comment on the periodic Environmental Monitoring Reports (EMRs) submitted to ensure that adverse impacts and risks of the project are mitigated as was planned and agreed with DOE and ADB, that any corrective actions required have been duly implemented, and that the GRM is fully functional. Sample EMR report is attached in Appendix VII.
- Work with PGCB to rectify to the extent possible any failures to comply with their safeguard commitments, as covenanted in the loan agreement, and exercise remedies to re-establish compliance as appropriate.
- Prepare a project completion report that assesses whether the objective and desired outcomes of the EMP have been achieved, considering the baseline conditions, and monitoring results.

905. For this purpose, PGCB and their contractors will provide DOE and ADB with access to the project site and all requested information on the project. For any ADB supervision missions PGCB or their contractors will provide all ADB staff with a project site health and safety induction and adequate PPE in accordance with Table 2.7.1 of the IFC EHS General Guidelines - Occupational Health and Safety Section and ILO Code of Practice on Safety and Health in Construction.

Table 12.6: Main Documents Required from PGCB and Contractor

Documents	Originator	Destination of the	Submission Timing

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

		documents	Design and pre-construction period	Construction period	Operation period
Bid and contract documents including EMP requirements	PGCB	ADB	X (Once, prior to the issue and on award)		
Training Plan	SIC	PGCB	X (Once, prior to the design approval)		
Stakeholder Engagement Plan	SIC	PGCB	X (Once, prior to the design approval)		
Health and Safety Risk Assessment	Contractor	PMU and SIC (ESU)	X	X (at minimum annually updated and upon commissioning for handover to PGCB)	
Ecology survey and Pre-construction baseline monitoring reports	Contractor	PMU and SIC (ESU)	X (Once, prior to the start of construction)		
Updated IEE for route alignments and bird survey results	PGCB	ADB	X (Once, prior to the design approval)		
Final design for approval	Contractor	PMU and SIC	X (Once, prior to the start of construction)		
CSEMP, H&S including other subplans for approval (including subplans)	Contractor	PMU and SIC (ESU)	X (Once, prior to the start of construction)	X (Updated through construction as needed/reviewed monthly)	
Environmental, health and safety checklists including worker accommodation	Contractor	PMU and SIC (ESU)		X (Every week, to be completed daily)	
Environmental, health and safety checklists including worker accommodation	SIC	PMU (ESU)		X (Weekly checks of active construction sites, at least monthly visits to each contract package)	
Monthly EHS progress reports including EMoP results and records and record of monthly training and daily toolbox training plus incident records and grievances	Contractor	PMU and SIC (ESU)	X (Every month)	X (Every month)	
Monthly EHS progress reports on status of EMP	SIC	PMU (ESU)	X	X	

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Documents	Originator	Destination of the documents	Submission Timing		
			Design and pre-construction period	Construction period	Operation period
implementation and observations from site visits, minutes of site EHS meetings, incident records, grievances etc.			(Every month)	(Every month)	
Lost time and fatality incident reports	Contractor PGCB O&M	PMU and SIC (ESU) Onward Submission to ADB		X (24 hours)	X (24 hours)
Environmental Monitoring Report	PMU (ESU)	ADB	X Semi-annually from loan effectiveness	X Semi-annually	X Annually until PCR issued
Completion Report	PMU (ESU)	ADB			X

12.10 Implementation Arrangements

12.10.1 Government of Bangladesh

906. The Ministry of Power, Energy and Mineral Resources (MPEMR) is the main Project coordinating body on behalf of government. In addition, the DOE plays the role of environmental regulator - granting and enforcing environmental clearance for the project.

12.10.2 PGCB's Management, PMU, and O&M Staff

907. The overall responsibility for environmental and social performance of the project, implementation of the EMP and approving the detailed designs, CSEMP, H&S Plan, and subplans will rest with PGCB. PGCB has already established a dedicated PMU to lead Project implementation. The PMU is headed by a Chief Engineer (Project Director) with 2 Superintending Engineers (Deputy PD), 4 Executive Engineers, 5 Subdivision Engineers, 5 Assistant Engineers and 20 Sub Assistant Engineers. PMU. Each contract package will have a team of engineers (a project manager and field team) assigned to it for full time supervision, including day to day supervision of environment, health and safety with support of ESU and SIC. A key role of the PMU is to supervise and monitor environmental safeguards compliance and report to ADB. On commissioning of the project components these will be turned over to PGCB O&M staff to operate and maintain. PGCB O&M workers will need to abide, in their behaviour and work, to directives issued by their employer with regards to environmental, health and safety management, with ESU support.

12.10.3 PGCB's Environment and Social Unit (ESU)

908. The Environment and Social Unit (ESU), comprising of 4 qualified environmental staff, who address both environment and social safeguards, will assist the PMU on issues related to environmental and social management and supervise the Safeguards Implementation Consultant and contractors. The ESU will review the regular monthly

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

progress reports of the contractor and SIC on EMP compliance, to be sent to the Project Director of the Project Management Unit (PMU) throughout the construction period. They will also review the semiannual environmental monitoring reports produced by the SIC during construction and be responsible for preparing the annual environmental monitoring reports once operational for submission to ADB.

909. Safeguards Implementation Consultants will support PMUPMU and ESU to supervise and monitor the construction contractors in order to ensure design compliance and quality assurance of the construction activities. The Safeguards Implementation Consultants, comprising of environmental and social development specialists along with gender specialist, will also supervise the contractors for CSEMP and H&S Plan implementation.

910. The contractors in turn will also have environmental, health & safety (EHS) officers and ecologists (as needed) who will be tasked to first develop CSEMP and H&S Plan in accordance with the present ESMP and then responsible for its implementation during construction activities. The ESU will support the PMU to approve these plans.

911. Capacity development will be required to build up the environmental and social management capabilities of the PMU and ESU with help from ADB TA consultants, funded under the capacity building component of the Project.

912. Specifically, for this project, the ESU staff will be delegated to work as part of the PMU (reporting to PD) to support EMP implementation, supervision, monitoring and reporting. A key role of the ESU (E&S Officer) will also be to manage the Grievance Redress Mechanism (GRM) at project level on behalf of the PMU. The ESU Manager will be given authority to instruct the PMU and be given delegated authority to instruct the Contractor to undertake corrective action in relation to any lapses in compliance with national laws and regulations or the EMP implementation.

913. The ESU will assist the PMU on issues related to environment, health and safety, labor and social management and work together with the SIC and Contractors' EHS staff. Contractors will submit progress reports on environment, health and safety and social issues to the PMU monthly during the pre-construction and construction period. The ESU technical staff and SIC will review them and report any issues to the PMU, compile quarterly environment safeguards implementation updates to be shared with the ADB through the quarterly progress reports, as well as preparing the semi-annual environmental monitoring reports with SIC on behalf of PMU up to the end of construction and then on an annual basis during the operation phase.During operation, ESU will continue to ensure and report on EMP implementation by the PGCB O&M staff and be responsible for the annual environmental monitoring report submission.

914. The ESU will provide facilitation support to the SIC in providing environmental training to the PMU staff and contractors responsible for implementing the EMP during the construction phases of the project.

12.10.4 Safeguards Implementation Consultant (SIC)

915. The PMU will engage a Safeguards Implementation Consultant (SIC) to supervise the construction contractors to ensure compliance with Safeguards documentation – IEE/EMP, CSEMP, H&S Plan and other sub-plans while adhering to detailed design standards and to assure the quality of the construction activities. The SIC will also support with updating of the IEE in response to final route alignments of the contractor before works can be started.

916. The SIC will also include consultants to supervise the contractors on EMP implementation. For this purpose, SIC will engage one Environmental Specialist 30 PM, one Health and Safety Specialist 30 PM, one ecologist 10 PM, one Social Development Specialist (Stakeholder Engagement and Labor) 30 PM on an intermittent basis with weekly checks undertaken. Other technical experts brought into the SIC team as required to address the EMP requirements. The Terms of Reference for SIC is attached in

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Appendix XIV.

12.10.5 Contractor and Subcontractors (if any)

917. The Contractor is responsible for the implementation of the EMP with supervision and monitoring by the PMU and SIC supported by the ESU staff. The requirement to undertake relevant mitigation and monitoring actions as set out in the EMP applies to the construction site as well as off-site locations such as construction stores and at any labor camps or overnight accommodation provided. The contractor is required to ensure that the EMP requirements are cascaded down to all sub-contractors undertaking works regardless they are formally or informally employed. It is recommended the EMP be included in all subcontracts and the number of subcontractors in the chain be minimized to facilitate compliance with EMP requirements.

918. All construction workers whether formally or informally employed will need to abide, in their behaviour and work, to directives issued by their employer with regards to environmental, health and safety management.

919. Contractors will have a corporate EHS policy and environmental management certification preferably ISO 14001 (or equivalent) and EHS certification such as ISO45001 or equivalent.

920. The Contractors will include the following dedicated, full-time, site-based staff on their EHS team: (i) an Environmental Officer, (ii) Health and Safety (H&S) Officer (iii) Ecologist, and (iv) a Social, Community Liaison and Labor Officer. Other technical experts brought into the EHS team as required to address the EMP requirements. In addition, the contractor will provide one EHS Supervisor for each transmission line under construction and for each substation site. This person will be based on-site full-time to ensure the health and safety of all workers and local communities. The EHS Supervisor will act as the main contact for the EHS Team and act on its advice regarding EMP implementation. If there is more than one active site of a transmission line or the construction team at a site comprises more than 50 persons, each EHS Supervisor will be supported by additional full-time, dedicated, on-site Health and Safety steward(s). There should be at least one full-time on-site supervisor/steward for each active site and construction team of up to 50 persons. For the transmission line works a suitable number of Health and Safety Steward(s) will be required depending on how the contractor undertakes the work since the workers may be more dispersed compared to substation works. No works should be undertaken without H&S supervision. If a contractor is awarded more than one contract package, then an entirely separate EHS team is to be employed for each of them. Contractor is to also ensure their subcontractors appoint an EHS representative for each construction site.

921. The EHS Team will be tasked to develop the CSEMP, H&S Plan and subplans in accordance with the EMP and be responsible for ensuring its implementation during the construction activities, supported by sufficient numbers of 24-hour onsite EHS Supervisors/H&S stewards. During construction, the EHS team will continually update the CSEMP, H&S Plan and subplans and oversee and report to PMU on the operation of the Project EMP/CSEMP/H&S Plans throughout the contract period.

922. The Environment Officer will be the Contractor's main focal point for all environmental, social, health and safety issues associated with the Project. They will be a suitably qualified and experienced full-time member of staff and must be on site at least five days per week with an alternative available during periods of annual or sick leave of more than 1-2 days. The required qualifications of the role of Environment Officer are as follows:

- BSc and MSc degree in environmental sciences or related subject.
- At least 15 years of experience in environmental assessment and management planning including for electrical infrastructure projects

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

- At least 10 years of on-site environment supervision, including experience of EMP implementation on at least five construction/electrical infrastructure projects of a similar type, location, size and scale
- Experience of pollution control including oil, PCB and SF6 management.

923. Specifically, the Environment Officer shall be responsible for the following:

- Identifying any areas of environmental sensitivity to be avoided with the support of field ecologists.
- Translate mitigation requirements written in the ECC/Project EMP/CSEMP/H&S Plans and its sub-plans into practical measures on the ground.
- Ensure that all contractor management, subcontractor management, and construction workers are fully aware of the environmental sensitivities of the sites and their responsibilities, as outlined in the Project EMP/CSEMP/H&S/ECC (e.g., through back-to-back contract provisions, formal induction and training provision, daily toolbox talks ahead of construction works etc.).
- Supervise construction works with regular site walkovers and spot-checks (audits) of compliance, take field notes and photographs to demonstrate compliance or non-compliance with the Project EMP/CSEMP/H&S plans and its sub-plans/ECC.
- Participate in monthly meetings with the PMU, SIC and ESU to discuss EMP implementation progress and any EHS concerns,
- Coordinate completion of quantitative environmental monitoring in accordance with the EMoP requirements.
- Maintain environment records e.g., training records, EMoP results, waste records etc.
- Act as the contractor's GRM focal person to keep affected persons informed of works and be available to receive and deal with any grievances at the project site level. The H&S and Social, Community Liaison and Labor Officers will help with managing all social and labor related grievances. They will also act as the GRM focal person for workers receiving and recording grievances in the logbook.
- Prepare weekly environmental checklists and monthly EHS progress reports that shall be submitted to PMU (ESU) for review. The SIC will provide a template of the checklist to the contractor, the monthly reports will also include general progress with the project and EMP implementation with photographs, regular site visits and spot checks (audits) undertaken, training provided, environmental incidents, e.g., spills of liquids, health and safety incidents, progress with any environmental initiatives, e.g., energy savings, recycling, community awareness etc., records of any environmental monitoring, conclusions and recommendations (corrective action), impacts on unanticipated changes in projects etc.

924. The qualifications for the H&S Officer are:

- BSc and MSc degree in health and safety or related subject.
- National Examination Board in Occupational Safety and Health (NEBOSH) or Institution of Occupational Safety and Health (IOSH) certification or similar.
- At least 10 years of experience in health and safety risk assessment and management planning including for electrical infrastructure projects
- At least at least 5 years on-site H&S supervision experience including risk assessment and management planning for at least five construction/electrical infrastructure projects of similar type, location, size, and scale.

925. The main responsibilities of the H&S Manager will be:

- Facilitate H&S Risk Assessments for detailed design and for specific construction work activities.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

- Produce H&S Plans for the construction work with subplans for specific construction work activities.
- Provide H&S training, including effective daily toolbox training sessions at each work site with the support of sufficient numbers of 24-hour onsite EHS Supervisors and H&S Steward(s).
- Participate in monthly meetings with the PMU, SIC and ESU to discuss EMP implementation progress and any EHS concerns,
- Establish a H&S Committee including appropriate representatives from PGCB, SIC, contractor and subcontractor management, and a representative number of construction workers and hold monthly meetings together with the Social, Community Liaison and Labor Officer to address any concerns,
- Conduct routine site inspections and issue internal stop notices, if necessary, for unsafe activities.
- Maintain H&S statistics records for near misses, as well as incidents.
- Keep records of accidents and report them accordingly with lessons learned to avoid future repeats.
- Undertake awareness raising activities to make the community aware of the H&S risks posed by the Project.
- Preparation of weekly H&S checklists and provide H&S input to the Contractor's monthly EHS progress reports.
- Support the Environment Officer as a GRM focal person for workers receiving and recording grievances in the logbook.

926. The qualifications for the Social, Community Liaison Officer are:

- BSc degree in social sciences and related expertise.
- At least 10 years of experience in stakeholder engagement
- At least at least 5 years of on-site stakeholder engagement experience including experience of construction/electrical infrastructure projects of similar type, location, size, and scale.

927. The main responsibilities of the Social, Community Liaison Officer will be:

- Produce stakeholder engagement plans for the construction work
- Develop community awareness raising materials and lead on the delivery of community awareness raising activities.
- Participate in monthly meetings with the PMU, SIC and ESU to discuss community awareness and stakeholder engagement progress and any community concerns,
- Participate in the H&S Committee and hold monthly meetings together with the H&S Officer,
- Support the Environment Officer as a GRM focal person for stakeholders receiving and recording grievances in the logbook.

928. The qualifications for the Labor Officer are:

- BSc degree in social sciences and related expertise.
- At least 10 years of experience in labor management planning
- At least at least 5 years of on-site labor management experience including experience of construction/electrical infrastructure projects of similar type, location, size, and scale.

929. The main responsibilities of the Labor Officer will be:

- Produce labor related management plans for the construction work

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

- Ensure management of construction workers is per national requirements with labor camps and other contractor provided accommodation meeting international good practice standards of ILO.
- Develop code of conduct and provide code of conduct training, including regular toolbox training sessions at each work site.
- Maintain labor records including copies of insurances, contracts and working hours, eligibility of construction workers for employment etc.
- Participate in monthly meetings with the PMU, SIC and ESU to discuss EMP implementation progress and any labor concerns,
- Participate in the H&S/Labor Committee and hold monthly meetings together with the H&S Officer,
- Preparation of weekly sanitation and welfare facility checklists and provide labor input to contractors monthly EHS progress reports.
- Support the Environment Officer as a GRM focal person for workers receiving and recording grievances in the logbook.

930. The qualifications for the Ecology Officer are:

- Bachelor's degree in Ecology/Zoology/Botany and ability to identify flora and fauna of Bangladesh.
- At least 10 years' experience in surveying ecology with experience in conduct of overwintering bird point counts and vantage point surveys.
- At least at least 5 years of on-site ecological supervision experience including experience of construction/electrical infrastructure projects of similar type, location, size, and scale.

931. The main responsibilities of the Ecology Officer will be:

- Conducting the ecology surveys which are the responsibility of the contractor including bird survey during appropriate periods round the year for the migratory and local birds in the project area and prepare report.
- Identifying any areas of environmental ecological sensitivity to be avoided.
- Preparing the Biodiversity Management Plan/Tree Plantation Plan.
- Ensure that all contractor staff and construction workers are fully aware of the ecological environmental sensitivities of the sites and their responsibilities, as outlined in the Project Biodiversity Management Plan/Tree Plantation Plan.
- Periodically supervise construction works with spot-checks (audits) of compliance, take field notes and photographs to demonstrate compliance or non-compliance with the BMP/Tree Plantation Plans. To issue internal stop notices to construction workers, if necessary, for unsafe activities that adversely impact sensitive ecology of the PIA.
- Participate in monthly meetings with the PMU, SIC and ESU to discuss BMP/Tree Plantation implementation progress and any concerns.

12.10.6 Institutional Arrangements and Roles and Responsibilities

932. The organogram of the PMU, including ESU, is shown in

933. Figure **11.1** with the institutional arrangement in Figure 12.1. Table 12.7 presents the responsibilities of PGCB's PMU (ESU) as well as the SIC and construction contractor(s).

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

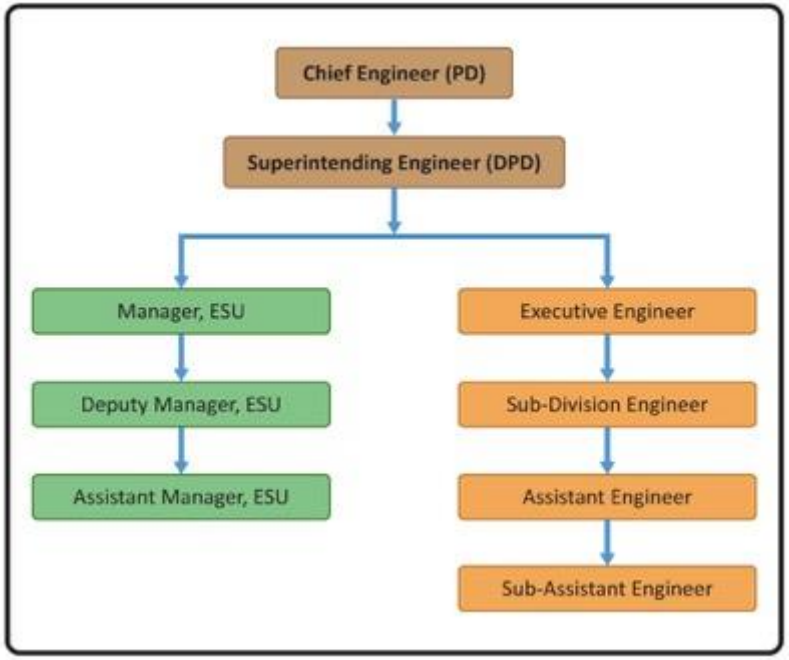


Figure 12.1: Organogram for Environmental and Social Management of Project

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

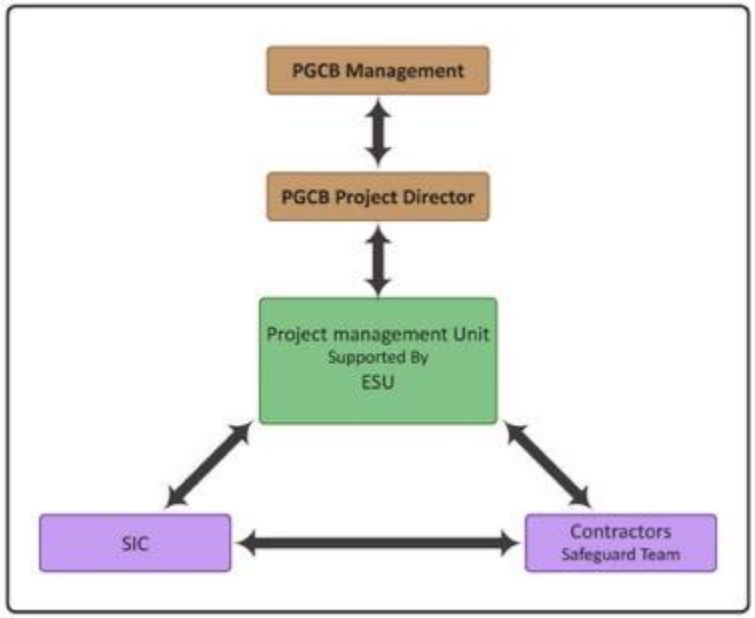


Figure 12.2: Project Implementation Organogram

934. The roles and responsibilities of the PMU, ESU, Consultant Team and contractor for the implementation and monitoring of ESMP have been outlined in the following Table 12.7.

Table 12.7: Roles and Responsibilities for EMP Implementation

Organizations	Responsibilities
PGCB Management	• Appointing ESU within PGCB to the project as a constituent part of PMU to support EMP implementation during construction and operation and expanding the staffing inside of two years of loan effectiveness. ESU staff shall be suitably qualified and experienced on environmental, social, and health and safety matters to ensure implementation of safeguards across PGCB operations. Additional staff or consultants may be engaged by the ESU full-time or intermittently, as needed to support. • Ensuring adequate management support, budget, staff, and other resources are allocated to satisfactorily implement, supervise, and monitor implementation of the EMP during all phases. • Ensuring that all PMU (ESU) and O&M staff support and attend all capacity development and training activities provided for them. • Adopting a zero-tolerance approach to H&S and developing and adopting systems, institutional arrangements, and guidelines (standard operating procedures) to ensure compliance with national environment, health and safety, social and labor laws and regulations and

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Organizations	Responsibilities
	international good practice across PGCB operations and its projects. • Once operational, any contractors hired for maintenance works or decommissioning will be supervised and monitored by PGCB (ESU) with roles and responsibilities being the same as those of the contractors for the construction. • Ensure that monitoring reports (semi-annual during construction and annual during O&M phase) are submitted to ADB up until the project completion report is issued.
PMU	• Ensure effective implementation of construction of the project in accordance with the definitive EMP. Seek the support of ESU for (i) updating the national EIA for the purposes of Environmental Clearance, and (ii) updating the IEE/EMP subject to ADB review and clearance because of any location, route, design or scope changes. This includes finalization of the IEE in respect of the substations and transmission line routes before construction works.[90] • Ensuring adherence to all applicable national environment, health, safety, and labor laws and regulations in force at the time. • Ensuring adherence to ADB's Safeguard Policy Statement (2009), the related IFC Environment, Health and Safety (EHS), general and power transmission and distribution guidelines (2007) and the ILO Safety and Health in Construction guidelines (2022). • Recruitment and supervision of Safeguards Implementation Consultant (SIC). • Incorporating the EMP into the bidding and contract documents before issuing tenders and contract awards. • Reviewing bids to ensure they are in accordance with the EMP requirements prior to contract award. • Ensuring the IEE with at least the executive summary translated into Bangla is disclosed on the PGCB website with hard copy available at construction sites and full translation free of change into Bangla if it is requested by the public, publishing the key findings and availability through notices boards, leaflets, brochures, or handouts. • Reviewing and approving the contractor's detailed designs as well as CSEMP/H&S Plan and subplans to ensure they incorporate and are in accordance with the EMP requirements. • Implementing the EMP throughout all phases or, if responsibilities are delegated, supervising, and monitoring its implementation by the contractor with support of ESU. • Ensuring all necessary national permits and permissions, and any requirements for renewal, are complied with before the commencement of related work, maintain records with copies of all the clearances, permits, licenses, and insurances obtained. • Ensuring the contractor provides adequate training to their subcontractors and all workers including daily EHS toolbox talks and emergency

[90] Per national requirement, an Environmental Impact Statement needs to be prepared to secure an Environmental Clearance Certificate. In the context of ADB SPS 2009 requirement, an IEE is required. The EIA constitutes the IEE in this document and given updates since the EC was granted will be resubmitted to DOE as part of renewing the EC for the Project.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Organizations	Responsibilities
	response drills; suggesting topics for the training based on site observations. • Undertaking, with the support of ESU and SIC, monthly EHS meetings including site walkover inspection to determine the status of EMP implementation by the contractor during construction as well as random "spot check" site visits to audit their EMP implementation. Minutes of meetings and findings of site walkover inspections will be attached to the EMRs to be submitted to ADB. • Identifying areas for improvement, unsafe acts, and any noncompliance with the EMP by the contractor and/or PGCB staff and instructing corrective actions to be taken by them to bring implementation back on track. • Thoroughly investigating all unanticipated impacts, near-misses, incidents, and chance finds; preparing a detailed incident report where applicable, identifying and instructing on corrective actions particularly to avoid any repetition of near-misses and accidents. • Monitoring and reporting with support of ESU on EMP implementation including reporting on EMP implementation in quarterly progress reports and preparing semi-annual EMRs for submission to ADB up until the completion of construction, reverting to annual up until the ADB project completion report, or for longer period if it is required by the ADB PCR. • Reporting to ADB of any noncompliance or breaches with ADB safeguard requirements in a timely manner and take corrective actions promptly. Developing and taking all requisite corrective action in case of any noncompliance with the EMP including repair of any property damages and financial compensation (insurance) for health and safety incidents. • Reporting any unanticipated impacts, accidents, and chance finds to ADB within 48 hours of them occurring along with a corrective action plan. • Reporting immediately to ADB any grievances submitted to the GRM upon receipt.
ESU	• Supervising Safeguards Implementation Consultant Team for the implementation of ESMP. • Closely coordinate with other concerned agencies, local governments and communities to support implementation of ESMP/CSEMP • Ensure effective implementation of ESMP components not directly tasked to the contractor including components dealing with indirect, induced and cumulative effects, as well as plans and measures for O&M phase. • ESU will review the ES related reports and submit to PMU for approval.
SIC	• Appointing one environmental, one H&S, one ecologist, one social development (stakeholder engagement and labor) specialist as key team members as well as part time technical specialists such as field ecologists, to ensure adequate supervision and monitoring of the contractors and capacity development. • Providing a suite of training activities for PGCB staff and contractors in relation to awareness raising on EMP implementation. • Supporting PMU in reviewing contract documents for inclusion of EMP measures before contract award, detailed designs and CSEMP/H&S Plans in accordance with the EMP requirements.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Organizations	Responsibilities
	• Supervising contractors for EMP implementation and preparing monthly reports to submit to PMU. • Supporting the ESU in updating the environmental assessment, preparing inputs to quarterly progress reports, semi-annual EMRs for submission to ADB up until the completion of construction.
Contractor	• Preparation and implementation of CSEMP/H&S Plan and subplans which needs to be cleared by PMU and SIC prior to mobilization. • Ensuring adequate budget, staff and other resources are allocated to comply with and implement the contractor's responsibilities under the EMP and to supervise and monitor the active construction site to protect the environment and ensure the health and safety of all workers and affected communities. • Recruitment of at least one Environmental Officer, one Health and Safety (H&S) Officer, one Social, Community Liaison and Labor Officer, one ecologist, and sufficient 24-hr EHS Supervisors/H&S Steward(s) for each active construction site and construction team of more than 50 persons to be able to undertake regular on-site supervision and monitoring activities before the commencement of works. • Implementing of all measures and responsibilities allocated to the EPC Contractor under the EMP for the full duration of the contractor's involvement including maintenance period. • Ensuring adherence to all applicable national and state environment, health, safety, and labor laws and regulations in force at the time. • Ensuring adherence to ADB's Safeguard Policy Statement (2009) and the related IFC Environment, Health and Safety (EHS) general and power transmission and distribution guidelines (2007) and the ILO safety and health in construction (2022) and ILO worker accommodation guidelines. • Whilst PGCB will obtain ECC, the Contractor will be required to obtain any necessary outstanding permits and permissions before the commencement of related work. Copies of all clearances, permits, licenses, and insurances to be kept. • Ensuring the detailed design reflects the EMP requirements; seeking to ensure it has the same or no worse impact than the indicative designs which were assessed in the IEE. • Supporting PGCB to update (as required) the IEE in respect of the detailed design by providing sufficient details to inform a revised project description and any subsequent reassessment of impacts and risks. • Undertaking and documenting a facilitated health and safety (H&S) risk assessment considering for all phases. • Adopting a zero-tolerance approach to H&S on the project, enforce all workers to comply with the H&S requirements of the EMP including the wearing of appropriate PPE on the construction site. • Ensuring that all construction workers including all formal and informal employees and subcontractors understand their responsibilities to implement the EMP and mitigate environmental impacts and risks associated with pre-construction and construction activities. • Providing EHS training for subcontractors, formal and informal construction workers and other personnel as required.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Organizations	Responsibilities
	• Supporting PGCB in undertaking ongoing consultation and implementing the site-level GRM; in particular, the contractor's GRM Focal person shall thoroughly document details of complaints and make its best efforts to resolve the complaints at project site level; all this information is to be included in the contractor's monthly reports to PGCB. • Undertaking environmental monitoring as set out in the Environmental Monitoring Plan (EMoP) during pre-construction and construction and documenting both qualitative and quantitative monitoring results; for quantitative monitoring the contractor is to hire surveyors and accredited, and quality assured, third-party laboratories. • Participating in monthly meetings with the PMU, SIC and ESU to discuss EMP implementation progress and any EHS concerns and establishing a H&S Committee who will also meet monthly. • Submitting monthly environmental management reports to PGCB (monthly EMP reports will be stand-alone but included as part of the contractors' monthly progress reports) relating to the work undertaken over the reporting period and documenting the environmental measures including monitoring activities that have been carried out, problems encountered, record data including near misses and accidents, grievances received, and follow-up actions that were taken (or will be taken) to correct the problems. • Informing PGCB immediately in case of any approved detailed design changes or unanticipated environmental impacts occurring during implementation, and as required, provide any information needed to PGCB to enable them to promptly update the national EIA for Environmental Clearance or the IEE/EMP for clearance by ADB before any changes are implemented. • Informing PGCB within 24 hours in case of chance find or accident on site and providing within 48 hours an incident report with corrective action detailing how reoccurrence will be prevented. • Informing PGCB immediately in case of any non-compliance and help them to prepare as necessary a corrective action plan for clearance by ADB. Contractor is required to implement all necessary corrective action requested by PGCB to ensure the project remains in compliance with national and state regulatory requirements, ADB's SPS 2009, the project's loan covenants and EMP requirements.

12.10.7 Capacity Building and Training Requirement

935. The PGCB has a dedicated Environmental and Social Unit (ESU) and has good familiarity with EHS requirements. PGCB's current portfolio of development projects includes 24 on-going projects, 2 upcoming projects and 6 planned projects. These projects are funded by a variety of development partners including ADB, WB, AIIB, JICA, KfW Development Bank, GoB and others. However, with only four staff all of an environment background the capacity of the Environmental and Social Unit (ESU) to fulfil its responsibilities falls short of requirements. Typically, international development partners provide relatively short-term implementation support to the ESU for their projects whilst trying to build inhouse capacity through training and mentoring. However, capacity remains low in both manpower and expertise to properly fulfil their mandate.

936. Support for ESU safeguards implementation in respect of monitoring and reporting is essential during the 5-year implementation period. Such support would include a capacity building component for institutional strengthening of PGCB's ESU. The PGCB will employ Safeguards Implementation Consultant (SIC) who would support PGCB in overall environmental/social management. However, since the overall responsibility of environmental management lies with the PGCB, they need to ensure that the consultants are carrying out their responsibilities properly. For this purpose, it is important that the PGCB engineers/officials receive training on environmental

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

management and monitoring. Such training will assist them in properly overseeing the activities of the consultant engaged in environmental management of the project.

937. PGCB staff who will be working on the project will need to be provided with the appropriate training on environmental safeguards in general and the specifics of management and monitoring requirements. The contractor's staff as well would also need some training and awareness raising to ensure they fully understand the EMP requirements. As such, a preliminary training program is being proposed to equip PGCB staff and contractor with the needed safeguards capacity. The training modules will be delivered through SIC who will bring in technical expertise for any specialized trainings. The exception is the facilitated H&S workshop which will be attended by the SIC but organized by the Contractor. Training modules may be changed during project implementation depending on the needs; ESU will develop a training plan upon loan effectiveness to reconfirm requirements.

938. Separate training and capacity building will be provided in relation to the Project outcome to establish the ESU with ESMF.

Table 12.8: Proposed Trainings

Training Session	Required Attendees/Recipients	Delivery Mode/Duration	Training Conducted by	Budget Source
Introduction to ADB's Safeguard Policy Statement (2009), IFC EHS Guidelines, national requirements, and Project EMP including EMoP	PMU, ESU, Contractors' Management and Environment Safeguards Teams	Lecture session, presentation, and discussion. In Person/ 1 day	SIC	SIC Budget
Corrective action for existing substations (good practices)	SS staff of PGCB, PMU, ESU	Lecture session, presentation, and discussion. In Person/ 2 day	SIC	SIC Budget
EMP implementation for detailed design, development of CSEMP/H&S plans as well as all sub-plans	PMU, ESU, Contractors' Design Teams and Environment Safeguards Teams	Lecture session, presentation, and discussion. In Person/ 3 day	SIC	SIC Budget
Facilitated H&S workshop (detailed design stage)	PMU, ESU, SIC, Contractors' Management, Design, Construction, and Environment Safeguards Teams, SS and O&M representatives of PGCB	Facilitated workshop In Person/ 1 day	Contractor	Contractor Budget
Ecology survey requirements	PMU, ESU, SIC, Contractors' Environment Safeguards Teams	Lecture session, presentation, and discussion. Online/ 0.5 day	SIC	SIC Budget
Bird sensitive design	PMU, ESU, SIC, Contractors'	Lecture session, presentation, and discussion.	SIC	SIC Budget

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Training Session	Required Attendees/Recipients	Delivery Mode/Duration	Training Conducted by	Budget Source
	Management, Design, Construction, and Environment Safeguards Teams, SS and O&M representatives of PGCB	Online/ 0.5 day		
Pollution control and waste management, detailed design considerations for substations	PMU, ESU, SIC, Contractors' Management, Design, Construction, and Environment Safeguards Teams, SS and O&M representatives of PGCB	Lecture session, presentation, and discussion. Online/ 0.5 day	SIC	SIC Budget
PCB and SF6 awareness raising	SS staff of PGCB, PMU, ESU, Contractors' Management, Design Teams and Environment Safeguards Teams	Lecture session, presentation, and discussion. Online/ 0.5 day	SIC	SIC Budget
GRM operation (initial run at start of project, and then again on handover to operational staff)	PMU GRM Focal Points, ESU, Contractors' Management and Focal Points, and other GRC committee members	Lecture session, presentation, and discussion. In Person/ 1 day	SIC	SIC Budget
EMP implementation for pre-construction and construction, including workshop on CSEMP preparation, review/discussion on implementation of CSEMP/H&S plans as well as all sub-plans	PMU, ESU Contractors' Construction and Environment Safeguards Teams	Lecture session, presentation, and discussion. In Person/ 3 day	SIC	SIC Budget
Managing the environmental impacts of landfilling works including preparation of site-specific management plans	PMU, ESU Contractors' Construction and Environment Safeguards Teams	Lecture session, presentation, and discussion. In Person/0.5 day	SIC	SIC Budget
Managing the EHS impacts and risks of piling works including piling-specific H&S risk assessment workshop	PMU, ESU Contractors' Construction and Environment Safeguards Teams	Lecture session, presentation, and discussion. In Person/1 day	SIC	SIC Budget
Facilitated H&S workshop (construction stage)	PMU, ESU, SIC, Contractors' Management, Design, Construction, and Environment Safeguards Teams, SS and O&M representatives of PGCB	Facilitated workshop In Person/ 1 day	Contractor	Contractor Budget
Environmental quality monitoring requirements; site supervision and monitoring including use of	PMU, ESU Contractors'	Lecture session, presentation, and discussion.	SIC	SIC Budget

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Training Session	Required Attendees/Recipients	Delivery Mode/Duration	Training Conducted by	Budget Source
detailed monitoring framework (checklists) and preparing Environmental Monitoring Reports	Management, Construction, and Environment Safeguards Teams	In Person/ 2 days		
Facilitated H&S workshop (commissioning stage)	PMU, ESU, SIC, Contractors' Management, Design, Construction, and Environment Safeguards Teams, SS and O&M representatives of PGCB	Facilitated workshop In Person/ 1 day	Contractor	Contractor Budget
EMP implementation at handover upon commissioning (site restoration and O&M)	PMU, ESU, Contractors' Management and Environment Safeguards Teams, SS and O&M representatives of PGCB	Lecture session, presentation, and discussion. In Person/ 1 day	SIC	SIC Budget

12.10.8 Implementation Schedule

939. Strictly no contracts will be awarded before the EMP cleared by ADB as disclosed on the ADB website has been incorporated into the contract documentation. Further, no site establishment or construction activity is to take place before PGCB has received and approved the contractor's CSEMP/H&S Plan including all subplans. Environmental clearance has already been obtained for the Project from DoE. The tentative implementation schedule of the project is listed in Table 12.9. The contractors will submit a more detailed implementation schedule for the detailed design, pre-construction, and construction once the contract is awarded.

940. PGCB will need to ensure all detailed design and pre-construction requirements including obtaining statutory clearances and permissions are complied with by the contractors prior to allowing them to commence construction, including site establishment and any site clearance work. If there are any changes to the scope, sites or routings during detailed design, PGCB must inform ADB and provide an addendum to the IEE providing the updated project description and an assessment of any differential impacts and risks to those already assessed in the IEE with the EMP updated as required. The addendum to the IEE, including any EMP update, prepared by SIC and submitted by PMU must be reviewed and cleared by ADB and disclosed before detailed designs are approved and any works commence on site including site clearance work. If any other unanticipated impacts occur during project implementation, these shall be reported to ADB and, if required, the IEE and EMP updated accordingly, reviewed and cleared by ADB, and disclosed before any related works start or are cleared to continue work. Close supervision and monitoring of all components is needed during the implementation with a zero-tolerance approach to health and safety risk management.

Table 12.9: Key EMP Milestones in Implementation Schedule

	Description	Indicative Time Frame

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

	Description	Indicative Time Frame
1	**Project Implementation**	
A	Bidding Documents Approval	Q4 2024 to Q4 2025
B	Procurement (Contract Award)	Q2 2025 to Q2 2026
C	Construction commencement	Q4 2026
D	Construction Completion	Q1 2030
E	Defects Liability Period	1.5 years from construction completion
2	**Pre-Construction Phase**	
A	Implementation of mitigation measures and conduct environmental monitoring for which PGCB is responsible	Upon loan effectiveness or earlier if advanced contract
B	Establishment of GRM	Upon loan effectiveness or earlier if advanced contract
D	Appointment of the ESU staff to the project, nomination of PMU focal persons for EHS on site	Upon loan effectiveness or earlier if advanced contract
E	Appointment of Safeguards Implementation Consultant	Upon loan effectiveness or earlier if advanced contract, the latest date for appointment is before the approval of detailed design
F	Implementation of mitigation measures and conduct of environmental monitoring for which contractor is responsible	Upon award of the contract
G	Updating the national EIA and ADB IEE/EMP to reflect detailed design and obtaining DoE and ADB clearance of the updates	Prior to approval of the detailed design
H	Submission and approval of the Contractor's Specific Environmental Management Plan (CSEMP), H&S Plan	One month before the start of works including any site establishment, site preparation, demolition, and earthworks
3	**Construction Phase**	
A	Implementation of mitigation measures and conduct of environmental effects monitoring following the EMP and EMoP.	After award of the contract
B	Monthly Progress Report (EHS)	5th day after effective month (covering the month prior)
C	Semi-Annual EMR during construction for submission to ADB	15th day after end of first June or December once loan has been effective for at least one

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

	Description	Indicative Time Frame
		full quarter, the last construction EMR will be submitted after the commissioning and DLP of all works documenting in depth how all pre-construction and construction activities were complied with
D	Restoration of construction sites	Before demobilization of contractor
4	**Operation Phase**	
A	Implementation of mitigation measures and monitoring activities for operational period	Upon commissioning and the handover to PGCB
B	Annual EMR during construction for submission to ADB	First operational EMR will be submitted 12 months after the last construction EMR was submitted up until the ADB PCR is issued.

12.10.9 Cost Estimate/EMP Budget

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

13 Conclusions and Recommendations

13.1 Conclusion

941. The EIA/IEE presents the environment safeguards assessment and specific arrangements for management of the identified environmental impacts and risks (both negative and positive) including supervision, monitoring and reporting for the project. There will be negative impacts as a result of the project but implementation of the EMP will ensure they are managed to avoid, minimize and mitigate impacts to the extent possible with land acquisition and compensation for temporary damages paid per the RP and compensation planting for tree loss. Satisfactory EMP implementation will be assured by a program of environmental supervision and monitoring to be conducted by PGCB PMU during the construction and operation stages. The detailed design would ensure inclusion of any such environmental impacts that could not be specified or identified at this feasibility stage assessment are taken into account and mitigated where necessary.

942. The Project Area is mixed with urban and rural areas, characterized by a low to medium population density with all the associated environmental challenges: dust, noise, traffic and associated air pollution, and insufficient waste management. In the parts of the project location at rural area, pollution levels are less. Lands in predominantly agricultural areas were selected for all substations and alternatives were not identified, as these areas avoid the settlements, and individual homesteads. Only a few trees were found in most of lands chosen for construction of substations. The new substations of this proposed project are located on a combination of cultivated agricultural and saltpan land in rural areas. The only substation site which is substantially different in character is the proposed substation at Pekua, Cox's Bazar. The setting is also a rural area, but the location is saltpan in character, still being used for salt farming during dry season and fish farming during monsoon, this is small-scale local fish and shrimp cultivation mainly for local consumption, with no large-scale commercial fishing or export activities. The substation site lies adjacent to a canal connected to a river which carries a lot of water during the rainy season but reduces in size during the dry season. This area has been heavily modified by the salt farmers. Initial desktop baseline investigations did not identify any particular biodiversity value of the site. However, local people and the ornithologists gave the impression migratory birds, which may also include threatened species, could be supported, so a bird survey will be conducted by an avifauna expert during the detailed design to confirm the situation. There are no indigenous people in the Project Area. For the construction of substations, PGCB will get the land according to the Resettlement Plan (RP) prepared. The 232.55 km of transmission lines follow low lying lands which is extensively farmed (mainly with paddy and seasonal crops), and terrestrial lands with homesteads. The proposed transmission lines will cross several rivers. There will be 633 towers, of which 199 are angle towers and 434 are suspension towers to carry the transmission line conductors. Alternatives for the nine LILO lines and five transmission lines were studied.

943. Environmental screening and assessment for the substation sites and transmission lines were carried out to identify the potential impacts and risks based on the collected baseline information/data by the safeguard survey team, during feasibility study. Most impacts are expected to occur during the construction phase and are considered to be temporary in nature. Sites and routes are away from ecologically sensitive areas, forest reserves, and protected areas in the country. It is estimated that 4,079 number of trees will be cut for the transmission lines and 128 number of trees for the substations. For the trees that will be cut, according to the compensatory rules of Bangladesh, 12,237 and 384 (in 1:3 ratio) trees respectively for the transmission line and substations would be planted again in the project area to preserve the biodiversity and prevent the environmental degradation. No threatened species of or protected trees will need to be cut. The EMP includes a budget for planting of seedlings, and it is recommended that 3 trees be planted for every tree that is removed, or as directed by the Bangladesh Forest Department. About 78 acres (out of which 5 acres were already acquired for Paikgacha

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

substation) of lands will be permanently changed by the construction of 10 substations. A total size of 44.01 acres for tower footings will be permanently changed for the tower construction. Land acquisition is not required for transmission towers. Compensation will be provided per the RP with the help of the census and associated land data collected from the local land office. Once the tower construction is completed the area beneath the tower can still be utilized for cultivation of crops including paddy. 4 of 32 structures in the ROW [2 commercial, 1 residential cum commercial, and 1 community property] do not meet the horizontal safety distance (7.6m for 132 kV line, 9.2m for 230 kV line, and 12.8m for 400 kV line) requiring relocation per the RP provisions.

944. Potentially significant impacts relate to construction, no significant impacts are anticipated during operation subject to confirmation following migratory bird surveys by ecologists to be hired by Contractors for Pekua and Paikgacha substations. Impacts and risks of the project are summarized as follows:

- Dust generation affecting the public and occupants of properties in immediately adjacent buildings due to land filling and levelling works, earthworks for construction, and transportation of materials.
- Noise and vibration causing disruption and disturbance to the public and occupants of properties in immediately adjacent buildings especially from piling work.
- Use of hazardous materials, including transformer oils and batteries, and the generation of solid and hazardous wastes including e-wastes for disposal during both construction and operation.
- Loss of trees and vegetation at substation sites and beneath the RoW of transmission lines including potential disturbance to nesting birds during site clearance and requiring 1:3 compensatory plantation, details to be set out in a Tree Plantation Plan to be prepared by the contractor(s) after contract award and prior to design approvals.
- Electrocution and collision of avifauna on the transmission lines especially where they cross waterbodies or run in proximity to the coast where habitat supports migratory and local bird populations including threatened species.
- No protected area, forest land or natural habitat is impacted. There are waterbodies (salt pans) around the Pekua and Paikgacha (naturally low-lying land inundated round the year) substations and transmission lines. These habitats are of local importance to non-threatened bird species and fish and provide various ecosystem services to the local community – they also have the potential to support migratory birds based on consultations and must be subject to further study prior to detailed design. Most of the project components do not impact on critical habitat, however, the Pekua substation and VRE Hub area of analysis covering South Chattogram support critical habitat with spotted greenshank (endangered species) recorded in the coastal habitat near to the existing power plant. Additionally, there are some low-lying areas around the substations, which are inundated year around. Height of these lands will be raised up to the standard height of main access road during the construction stage according to the design.
- Occupational health and safety risks to workers including from working at height, lightening hazard, fall of materials from height and with electrical equipment.
- Community health and safety due to the presence of workers, electrical works in the public domain and crossing roads, due to construction traffic, structural safety of immediately adjacent buildings due to vibrations from piling work etc.
- Construction impacts that will adversely affect the baseline environment parameters already above national standards and/or international guidelines (e.g., particulate levels) such as the WHO guidelines must be minimized through targeted mitigation measures and regular monitoring of impacts.
- Concerns of the community and other key stakeholders regarding potential contractors' violations of the environmental management plan (EMP) that may affect them adversely as noted by the consultees (related to noise, dust, health and safety etc.) need to be incorporated

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

into the detailed design and construction methods with supervision and monitoring to ensure compliance by the contractor

945. The potential impacts and risks of the project's construction phase on the physical, biological and social environment include soil erosion and sediment laden surface water runoff particularly close to rivers and khals; dust emissions caused by operation of machinery for earthworks, especially at the new substation sites requiring landfill to raise their level, and running vehicles on earthen tracks within the RoW and along the access routes; gaseous emissions and noise from construction vehicles, machinery, and generators; spills or leaks of fuels, oils and other hazardous materials, release of wastewater effluents and solid and hazardous wastes (spoil, piling mud, oil and sludge, domestic waste) from construction areas and camps causing soil and water contamination; discharge of piling mud causing surface water pollution; loss of or damage to agricultural lands; loss of vegetation and trees at one substation and in the RoWs; and finally, occupational health and safety (OHS) hazards for the construction staff and other project site personnel and community health and safety hazards for the public including access to construction works in the public domain, disruption, disturbance and traffic congestion adjacent to overhead power line works.

946. The potential impacts of the transmission lines and substations during the operation and maintenance stage include electrocution and collision risk to birds particularly in the vicinity of salt pans, pollution risk to soil and water from transformers, occupational health and safety risks for the operation and maintenance workers, community health and safety risks due to project infrastructure being within the public domain and accessible e.g., electromagnetic radiation, and solid and hazardous waste generation (sanitary waste, transformer oil and sludge, oil-laced wastewater) with limited waste management facilities available.

947. The potential environmental impacts of the project are all well understood and can be mitigated by PGCB through adherence to national requirements and international good practice measures and standards as set out in the IFC General and Electric Power Transmission and Distribution Environment, Health and Safety Guidelines and the ILO Code of Practice on Safety and Health in Construction. Mitigation measures have been developed for all predicted adverse impacts and risks. Dust, noise and vibration during construction will be managed and the community will be kept informed through regular communication. The construction period will be kept to a minimum, night-time construction in residential areas will be avoided, temporary acoustically designed noise barriers will be used and only well-operated and maintained equipment will be employed. Water spraying and use of screens will help to manage dust at the construction sites.

948. During the implementation of the project, measures will be undertaken to keep impacts to a minimum. All the mitigation measures to control impacts are defined in the Project's EMP whose implementation, primarily by the contractors, will be supervised and monitored by PGCB. The EMP includes (i) the mitigation and compensation measures reflecting national requirements and international good practice, (ii) the requirement to approve contractors' Contractors Site-specific Environmental Management Plans (CEMPs) including health and safety risk assessments and health and safety plans, prior to commencement of any works, (iii) an environmental monitoring plan to ensure that the mitigation measures are effective, including the monitoring of health and safety incidents; and (iv) the requirement to submit regular environmental monitoring reports to ADB. It also includes the Corrective Action Plan informed by the environmental audit to address environment, health and safety management at existing substations. Implementation of the EMP will be assured by a program of environmental supervision and monitoring during the preconstruction, construction, and operation and maintenance stages by the contractors, SIC and PGCB as applicable. Any unanticipated impacts or requirements for corrective action during implementation will be reported by PGCB to ADB. To support PGCB with EMP implementation, supervision and monitoring a Safeguards Implementation Consultant (SIC) including Environment Specialist, Health and Safety Specialist, Social Development Specialist (labor and stakeholder engagement), and Ecologists will also be appointed. The contractors will be required to have on-site counterpart officers to the SIC.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

949. A total of 825 people which includes 448 male and 377 women of affected people and other interested stakeholders were consulted between during the study leading up to preparation of this IEE/EIA report. Thirty-two (32) project consultation meetings, twenty-seven (27) FGDs, twenty-one (21) Key Informant Interviews (KIIs) and one (1) national consultation at PGCB Headquarter in addition to informal consultations during the preparation of the IEE/EIA report. General support for the project was expressed, as the need for a stable electricity supply in Bangladesh is paramount. It was considered the project could support development of the area and potentially lead to more employment opportunities. The key concerns shared by the consultees during these consultations included managing traffic congestion caused by the construction activities, maintaining liaison and coordination with other departments and entities, minimizing blockage of access particularly for essential facilities such as hospitals, removal of excavated soil and other debris from the construction sites, and provision of employment opportunities to the local population. The EIA/IEE report will be disclosed on ADB's website and locally by PGCB on their website, at their head office and local government offices, at the substation sites, and at the transmission line construction site offices with a translation of the Executive Summary into Bengali. The meaningful consultation process will continue during project implementation to ensure that all affected people and other interested stakeholders are fully engaged and can participate in the project's development, particularly before the commencement of works and to inform the final routings for transmission lines.

950. A three-level grievance redress mechanism (GRM) will be established with (i) the first tier with the PGCB field teams for each project component and local (Upazila) level GRC, (ii) the second tier at Project Level with the PMU team, and (iii) the third tier will be at central level of PGCB with a GRC at corporate level as well as an informal tier with the contractors. Training will be provided under the project for all people involved in the GRM. Awareness will be raised with local communities and workers on ways to access it. Contact details of the GRM will be displayed at the construction sites. The GRM is to promptly record and address any informal and formal grievance received however minor and to keep adequate records and documentation of timely grievance resolution. Each safeguard-related grievance received is to be reported in the environment monitoring reports from the reporting period of receipt until the reporting period of closure. Records to include but are not limited to, name of the complainant and contact details, date the complaint was received, details of the complaint and status, minutes of meetings held, decisions made, and agreements reached up to the resolution of the complaint. The decision made by the project level GRC will be binding on the project. The GRC will handle cases related to land acquisition, resettlement, environmental quality of works on site, ownership and inheritance disputes, and compensation payment, and provide resolution to environment and social related complaints. Overall, the grievance redress mechanism aims to ensure transparency, accountability, and fairness in the implementation of the project. The aggrieved party/affected persons can approach the country's judicial system any time during the project cycle independent of the GRM proposed for the Project. An aggrieved party can directly contact ADB's resident mission in Dhaka regarding a grievance or problem that the GRM has failed to resolve. The affected party can use the ADB's Accountability Mechanism by writing to the Complaint Receiving Officer at the ADB Headquarters in Manila as a last resort if they are not satisfied with decision and/or actions of the project GRM and resolution by the ADB.

13.2 Recommendations

951. This EIA/IEE has been prepared for PTSIRE according to the environmental guidelines published by the DOE. Submission of IEE report is one of the requirements of the DOE for issuing necessary environmental clearances. It is mandatory in the Bangladesh Environmental Conservation Act (BECA), 2023 and The Environment Conservation Rules, 2023 for any new industrial set up or project. Mitigation and monitoring measures have been included in the Project Environmental Management Plan (EMP) incorporated into the IEE. PGCB will implement the EMP measures ensuring adequate budget and human resources are allocated to this. PGCB will also complete the activities outlined in the Corrective

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

Action Plan (CAP) for existing substations.

952. Based on the findings of the EIA study (as per DoE) and IEE report (as per ADB) the following recommendations will be taken up by PGCB:

- The EMP of the EIA (DOE) and IEE (ADB) including mitigation and monitoring programs will be included in the bid document of the civil works for all project components along with suitable experience, staffing and BOQ requirements and eventually become part of the civil works contract(s) – the definitive version of the EMP to be followed by contractors will be that disclosed on the ADB website. The Bid documents will state that the EPC Contractor will be responsible for the implementation of the requirements of the EMP allocated to them (including specific design phase actions) through their own CSEMP which will adopt all the conditions of the EMP and add site specific elements that are not currently known, such as the EPC Contractor's storage and camp locations. This will ensure that all potential bidders are aware of the environmental requirements of the Project and its associated environmental costs. The EMP and all its requirements will then be added to the EPC Contractor's Contract, thereby making implementation of the EMP a legal requirement according to the Contract.
- The project components are falling in "red" category under the ECR 2023 and require environmental clearance. PGCB, through its consultant, shall obtain requisite environmental clearance from the Department of Environment for all components in a timely manner before contract award.
- Pre-construction physical environment monitoring (air quality, noise, water and soil quality etc.) plus ecology surveys and, at Pekua and Paikgacha, bird surveys during the overwintering season will be conducted by SIC and the EPC contractors. The Contractors shall appoint a part-time ecologist to undertake ecology surveys at the substations and along the TL, prepare ecological survey reports and advise on implementation of ecological mitigation measures. The Safeguard Implementation Consultant team will also include an Ecologist, who will also conduct ecological surveys, oversee the contractor's survey work and construction activities, and prepare relevant reports. Considering the timing of the overwintering season in relation to the project schedule, it is recommended that the ecological survey be conducted by PGCB either prior to the awarding of the contract or, if incorporated within the contractor's scope, prior to the approval of detailed designs.
- The EIA/IEE will be updated or an addendum produced, to reflect any changes in sites or routes during detailed design, to incorporate the results of bird surveys and site-specific biodiversity management plans, or if any unanticipated environmental impacts become apparent during project implementation. The EIA/IEE update or addendum is to be reviewed, cleared and disclosed by ADB prior to the start of construction and will be submitted to DOE with the renewal of the ECC.
- Based on the EMP of the EIA (DOE) and IEE (ADB) and any updates to it prior to construction, Contractor's Site-specific Environment Management Plan (CSEMP) to be prepared by the contractor for approval by PGCB prior to start construction, contractors to act accordingly during construction.
- The mitigation measures for the negative impacts and enhancement measures for the positive impacts of the project, as well as monitoring requirements, capacity building activities and reporting, as mentioned in the EMP must be implemented by PGCB and the contractors in scheduled time with corrective action taken timely in the case of any non-compliances observed.
- The main tool for the successful implementation of the EMP is the environment supervision and monitoring during various stages of the project, which must be carried out day-to-day by PGCB supported by the Safeguards Implementation Consultants (SIC) and other relevant organizations. To ensure compliance with the CSEMP the EPC Contractor is required to employ an a team of environment, health and safety experts to monitor and report on EMP activities throughout the project construction phase. Safeguards implementation consultants will also include

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.

environment, health and safety experts to support supervision and monitoring of Project EMP implementation and to build the capacity of PGCB.

- Should PGCB note any non-conformance with the EMP (and CSEMP) the EPC Contractor can be held liable for breach of the contractual obligations of the EMP.

953. This EIA/IEE report, including EMP, is considered sufficient to meet national requirements and ADB's Safeguard Policy Statement (2009) requirements for the Category B project. In case of any scope, sites or routing change, and/or unanticipated impact during project implementation, the EIA/IEE and EMP will be updated as required by PGCB for review and clearance by DOE (as required by law) and ADB (as per ADB Safeguard Policy Statement (2009) requirements) before any related works commence or are allowed to continue. The EPC contractors will prepare their detailed designs and CSEMP which will be approved and monitored by PGCB and SIC. Notably since the transmission line routings assessed in this IEE/EIA report are only indicative and will not be finalized until the contractors are on board, during project implementation it will need to updated, reviewed and cleared with disclosure on the ADB website and locally before final routings are approved by PGCB and works commence.

INTERNAL. This information is accessible to ADB Management and Staff. It may be shared outside ADB with appropriate permission.