

Vol. 4: Draft Environmental and Social Impact Assessment for Proposed Kutubdia LNG Project

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BAN: Reliance Bangladesh LNG Terminal Limited

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Environment and Social
Impact Assessment (ESIA)
for Proposed Kutubdia LNG
Project, *Cox's Bazar District,*
Bangladesh

Reliance Power Limited

Draft Report

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ABBREVIATIONS

ADB	Asian Development Bank
ADIOS	Automated Data Inquiry for Oil Spills
ALARP	As Low as Reasonably Practicable
AP	Affected Persons
APHA	American Public Health Association
API	American Petroleum Institute
ARIPO	Acquisition and Requisition of Immovable Property Ordinance
BBS	Bangladesh Bureau of Statistics
BOG	Boil Off Gas
BOO	Built Own and Operate
CD	Chart Datum
CNG	Compressed Natural Gas
CO	Carbon Mono Oxide
CTMS	Custody Transfer Metering System
DFO	Divisional Fisheries Officer / Divisional Forest Officer
DMP	Disaster Management Plan
DO	Dissolved Oxygen
DOE	Department of Environment
DOF	Department of Fisheries
EC	Electrical Conductivity
ECA	Environment Conservation Act
ECC	Environment Clearance Certificate
ECR	Environment Conservation Rules
EGIG	European Gas pipeline Incident Data Group
EHS	Environment, Health and Safety
EIA	Environment Impact Assessment
ERL	Effects Range - Low
ERM	Effect Range - Median
ERM	Environment Resource Management
ERP	Emergency Response Plan
ESIA	Environment and Social Impact Assessment
ESMP	Environment and Social Management Plan
FEED	Front End Engineering and Design
FGD	Focussed Group Discussion
FSRU	Floating Storage and Regasification Unit
FSU	Floating Storage Unit

GIS	Geographic Information System
GoB	Government of Bangladesh
GRM	Grievance Redressal Mechanism
GTCL	Gas Transmission Company Limited
HD	High Duty
HH	Households
HME	Hazardous to Marine Environment
HSD	High Speed Diesel
IEE	Initial Environmental Examination
IFC	International Finance Corporation
IFV	Intermediate Fluid Vaporizers
IMO	International Maritime Organisation
IP	Indigenous People
IPP	Independent Power Producer
IR	Involuntary Resettlement
ITOPF	International Tanker Owners Pollution Federation Limited
JICA	Japan International Cooperation Agency
LBF	Land Based Facility
LD	Low Duty
LNG	Liquefied Natural Gas
LNGC	LNG Carrier
LOC	Level of Concern
LTD	Level Temperature Density
MARPOL	Marine Pollution
MLA	Marine Loading Arm
MLV	Main Line Valve
MMSCFD	Million Standard Cubic Feet Per Day
MTPA	Million Tonnes Per Annum
MW	Mega Watt
NGO	Non-Governmental Organisation
NOAA	National Oceanographic and Atmospheric Administration
NOx	Oxides of Nitrogen
NTU	Nephelometric Turbidity Unit
OGP	International Association of Oil & Gas Producers
OOSA	Online Oil Spill Advisory System
ORF	Onshore Receiving Facility / Onshore Regasification Facility
OSHA	Occupational Safety and Health Administration
PLEM	Pipeline End Manifold

PM	Particulate Matter
PS	Performance Standards
RBLPL	Reliance Bangladesh LNG and Power Limited
RBLTL	Reliance Bangladesh LNG Terminal Limited
REA	Rapid Environmental Assessment
RLNG	Regasified LNG
RPL	Reliance Power Limited
SO ₂	Sulphur di oxide
SOLAS	Safety of Life at Sea
SPS	Safeguard Policy Statement
SS	Suspended Solids
TDS	Total Dissolved Solids
TOC	Total Organic Carbon
TOR	Terms of Reference
UNDP	United Nation Development Programme
UNEP	United Nation Environmental Programme
UNO	Upazila Nirbahi Officer
UPS	Uninterruptible Power Supply
VCE	Vapour Cloud Explosion

EXECUTIVE SUMMARY

A) Introduction

1. Reliance Power Limited (Reliance Power) through its subsidiary in Bangladesh – Reliance Bangladesh LNG and Power Limited (RBLPL), has strategic plans to establish the subsidiary as an Independent Power Producer (IPP). Accordingly RBLPL proposes to develop a combined cycle gas based power plant of capacity 750 MW (Natural Gas/RLNG based) in Bangladesh to meet the existing power shortage and the demand-growth in future years. In Bangladesh, the demand for natural gas is rapidly rising due to its diversified use in industrial and electric power sector and fast depletion of existing reserves. As a result many of the gas fired power plants are experiencing gas shortages and running below their rated capacity.
2. Keeping this in view, Reliance Power Limited through another subsidiary in Bangladesh, Reliance Bangladesh LNG Terminal Limited (RBLTL) plans to establish a LNG storage and re-gasification facility of up to 5 million tonnes per annum (MMTPA) capacity. The terminal is proposed as a land based regasification facility along with a Floating Storage unit (FSU) in the range of 3.5 - 5 MMTPA (about 750 MMSCFD peak load) with a storage capacity of 145,000 m³ to 216,000 m³ located offshore of *Kutubdia* Island in *Cox's Bazar* region of Bangladesh (hereinafter referred to as the Project). Overall the Project will consist of:
 - (i) marine facility comprising of FSU and twin jetty
 - (ii) land based facilities (onshore gas receiving and regasification facilities, captive power plant and other utilities) and
 - (iii) cryogenic pipeline on motorable trestle of 2.4 km length to connect the FSU to the onshore terminal and onshore pipelines to transport the gas from the gas receiving facility on Kutubdia Island to National Gas Grid pipeline (Moheshkhali – Anwara Gas Pipeline of Gas Transmission Company Limited (GTCL) is of 36" with pressure up to 95 bar g) on mainland. It was also include installation of a valve station at Napura to help connect with GTCL Gas grid.
3. RBLTL has therefore initiated an environmental and social impact assessment (ESIA) study to comply with the requirements of environmental impact assessment ("EIA") guidelines of the Government of Bangladesh ("GoB") to obtain necessary Environmental Clearance Certificate for the Project. RBLTL is also seeking finance from international lenders for setting up of the Project hence the ESIA also needs to conform to the guidelines and requirements of the Asian Development Bank (ADB).

B) Policy, Legal & Administrative Framework

Environment

4. The Environment Conservation Act (ECA) 1995 and the Environment Conservation Rules (ECR), 1997 of the Department of Environment (DoE) under Ministry of Environment and Forest (MoEF), Govt of Bangladesh (GoB) which

classifies the proposed Project as Category Red and thus requiring an EIA to be conducted for obtaining the Environmental Clearance Certificate (ECC).

Land Acquisition

5. The proposed Project will have to acquire land for its land based facility, onshore gas pipeline and terminal valve station and the process will either be governed by requirements under the 'Acquisition and Requisition of Immovable Property Ordinance (ARIPO), 1982' or acquisition of land and other assets through negotiated settlement based on consultations with affected persons (both title-holders and non-title holders) which is encouraged by ADB, Safeguard Policy Statement, 2009.

International Safeguard Requirements

6. Financing support for the Project will be sought from multi-lateral financial institutions, such as the ADB and the EPFIs . This support from the multi-lateral financial institutions/ export credit agencies requires adherence of international best practices and environmental and social safeguard requirements of the lenders. The major relevant guidelines and policies considered for this project are as included in paragraph nos. 7 to 9.
7. **ADB's Safeguard Policy Statement, 2009** - The Safeguard Policy Statement (SPS), 2009 governs the environmental and social safeguards of ADB's operations. It applies to all ADB-financed and/or ADB-administered projects and their components, regardless of the source of financing, including investment projects funded by a loan; and/or a grant; and/or other means, such as equity and/or guarantees.
8. This **Project** has been classified as category A by the Asian Development Bank (ADB) and thus requiring an ESIA. The project will also confirm to the requirements under SPS, 2009 in respect of consultation, disclosure requirements and safeguard documentation to meet safeguard principles and requirements of ADB.
9. **Applicable EHS Standards** - The IFC Environmental, Health, and Safety (EHS) General Guidelines (April 30, 2007) will be applicable for this Project. In addition to that, IFC's Sector specific EHS Guidelines for LNG Facilities (April 30, 2007) will apply. The Project will conform to international maritime conventions, protocols and agreements as relevant to the project such as MARPOL.

C) Description of the Project

10. The land based facilities are proposed in north-western part of the Kutubdia Island. The site falls under Dakshin Dhurung and Kaiyabil Unions of the Kutubdia Upazila. The marine facilities are planned to be set up in the Bay of Bengal, 2.4 Km from the sea front. The landfall point is south of the existing Light House on the island. Approximately 2.4 Km of cryogenic pipeline on trestle is planned to connect the FSU to onshore gas receiving facility (ORF). Another onshore pipeline of approx. 17 km will be laid to transport the gas from the gas receiving facility on Kutubdia Island to GTCL grid pipeline on the mainland. The total investment for the proposed LNG facility and associated infrastructure would be approximately US\$ 400 million.

11. Overall the proposed LNG facility will include the following components:
- (i) Twin Jetty with topside facility
 - (ii) Floating Storage Unit (FSU) with a storage capacity 145,000-216,000 m³
 - (iii) Cryogenic Pipeline of ~ 30 " of 2.4 km on motorable trestle
 - (iv) Onshore regasification facility of 750 MMSCFD capacity with an option of building a 185,000 m³ (gross capacity) LNG tank later
 - (v) Onshore receiving facility including Custody Transfer Metering system (CTMS)
 - (vi) Spur pipeline upto 36" (High pressure i.e. 95 bar g) to transport gas from the onshore regasification facility to Valve station 2 (at Napura) of Moheskhalī- Anwara GTCL grid pipeline (of 32").
12. The Kutubdia Island is isolated from main shore of Bangladesh with no direct road access. One has to cross the Kutubdia Channel to reach the island. At present state, the channel is approximately 4 km wide between Boroghob (Kutubdia) - Magnama Ferry Ghat. Aerial distance from the nearest town at Cox's Bazar is approximately 50 km and by road approximately 85 km including the channel crossing. The nearest national highway is Chittagong-Cox's Bazar National Highway (N-1).
13. The Kutubdia Channel is directly connected with Bay of Bengal at both ends. The Chittagong Port is located on north of the Kutubdia Island and approximately 50 km from the Project site. An anchor point of the Chittagong Port is located in the Kutubdia offshore region along with an existing navigational channel, which is located approx. 3 km off the north western shore of the island.

Resource Requirement

14. **Manpower:** During construction phase, the Project would deploy ~1000 persons, mostly unskilled workers, during peak construction period. Construction of Project is expected to be completed in 30 months working three shifts a day. Construction manpower will be temporarily employed from within the local regions to the extent possible. During operation phase, the Project would employ 120 full time employees working in three shifts daily.
15. **Water:** During construction phase, the Project would require domestic water of ~20 m³/day (normal) to 40 m³/day (peak construction). Drinking water will be provided onsite after desired treatment. During operation phase, the Project would require ~20 m³/day of domestic water (to be sourced through barges from the Chittagong Port) for personnel working on-board the FSU and at the ORF. No ground water will be extracted for Project purposes.
16. **Land:** 40 acres land will be required for the ORF and it will be a mix of both government land and private land. The onshore pipeline of 17 km length will be laid from ORF to Banskhali. The gas pipeline will pass through Uttar Dhurung, Chhanua and Puichhari Union Parishads of Kutubdia and Banskhali Upazila respectively. The width land to be acquired for laying of pipeline is proposed to be 8 m along the pipeline corridor while an additional 15 m will be required during the pipeline laying phase for staging of materials used in construction. Land area up to 1.85 acres of will be acquired for the terminal station (Valve 2) at Napura adjacent to existing MLV station along the GTCL pipeline.

17. **Power:** Maximum 2 MW power would be required for construction phase. Diesel would be utilized as fuel in diesel generators. During operations phase a 20 MW-Power generation (LNG based) facility would be installed at the ORF to take care of Power requirements.

Pollution Sources and Characterisation

18. The Project will have following potential effects on the environment:
- a) **Air Emissions:** The operation of FSU and ORF will involve the following emissions to atmosphere:
- Emissions due to methane gas combustion for FSU and ORF power generation;
 - LNG carriers and Tugs (for maneuvering and LNG discharge to the FSU);
 - Methane gas combustion emission during emergency flaring (no cold venting will be resorted);
 - Fugitive emissions of vapourised gas from compressors, joints and valves FSU, ORF and send-out pipeline;
 - Exhausts of methane gas combustion will be represented by NO_x and CO emissions.
 - Combustion emission of (SO₂ and NO_x) from diesel engines operation in the event of back up power requirement.
- b) **Liquid Discharges:** The FSU will have a sewage treatment system to treat and discharge offshore and meet the MARPOL standards. Similarly, treatment facilities for bilge water will be provided on the FSU. A sewage treatment plant (STP) of capacity 20 m³/day will be installed for treatment of sewage generated at the ORF. No cold water discharges are anticipated from the project as the facility is planned using air based re-gasification systems.
- c) **Solid Waste:** Various kinds of solid wastes that will be generated at the FSU will be either safely incinerated or safely brought onshore and disposed in onshore waste facilities available with the Chittagong Port / Cox's Bazar Town.

Domestic waste generated onboard FSU will be segregated. Food wastes generated on board the FSU will be ground to a particle size capable of passing through a screen with openings of 25 mm and then discharged into the sea. While plastic and non-incinerable waste will be collected and disposed of along with solid wastes to be generated from ORF, in nearby approved waste handling facility.

- d) **Hazardous Wastes:** Both during construction and operation phases, the Project would generate hazardous waste comprising of used oil; empty containers of paints, varnishes, thinners and lubricating oil; rags containing oil and grease, filter materials and packages containing hazardous wastes. Dedicated areas will be earmarked for temporary storage of hazardous wastes on impervious surface at the project site. All construction and operation phase hazardous wastes will be brought to on-shore dedicated area for recycling and/or final disposal at approved hazardous waste handling facilities near to the project site.

- e) **Marine Pollution (MARPOL) Compliant:** The FSU related waste will be handled by a MARPOL compliant Ship-Board incinerator capable of handling burning of allowed waste (sludge oil and solid) generated on-board. Un-allowed items as per MARPOL will be collected in separate bins and brought onshore for disposal.
- f) **Noise Emissions:** The main noise emission sources in LNG facilities include pumps, compressors, generators and their drivers, air dryers, air coolers at liquefaction facilities, vaporizers used during regasification, and general loading /unloading operations of LNG carriers /vessels. Sound pressure levels (at 1 m from the source) of each equipment have been considered to be within 75 dB(A) to 95 dB(A). With reference to the ORF, in normal operating conditions noise emissions mainly refer to regasification, power generation system and gas compression skid. Sound pressure levels (at 1 m from the source) have been considered to be within 80 dB(A) to 90 dB(A).

D) Description of Environment

- 19. A 10 km radial zone around the FSU site has been considered as study area. Additionally, an area of 500 metres on both sides of the pipeline corridor from the ORF to Napura Valve Station is also included within the study area.

Physical Environment

- 20. **Oceanographic Conditions:** The bathymetry indicates a steep sea floor with 10 m contour reaching within 1 km from the Kutubdia Island on the west and with more than 13m water depth near the proposed FSU location. Predominant wave direction is from south west. Maximum wave height recorded near the Project areas during 2005-2009 was found to be 2.25 m. Strong longshore currents occur in the monsoon season near Kutubdia Island. Direction of current is predominantly north during peak flood tide and south during ebb tide and NE monsoon.
- 21. **Physiography and Geology:** Major physiographic unit of Kutubdia Island is young coastal plain surrounded by active coastal plain which is present at the boundary of the Kutubdia Island. Geologically major portion of the study area dominantly consists of tidal deposits, i.e. inter tidal and supratidal deposits composed of silty clay with organic clay mix and little sand. The elevation of the island varies between 0 to 7.6 m (25 feet) above mean sea level. The northern part of the island is having comparatively higher elevation and the slope of the island is from north to south. An earthen embankment is present along the entire stretch of the island. The average height of this coastal wall is 6 m.
- 22. **Landuse:** The predominant land use of the on-shore portion of the study area around ORF includes agricultural land (5.56%), salt pans (9.06%), and settlement (4.16%) and remaining sea front within 10 km radius from FSU in the study area.
- 23. **Shoreline Erosion and Accretion:** About 9 km² area of Kutubdia was eroded whereas 0.35 km² of land accretion occurred on the Kutubdia Island in a period between 1972 and 2013¹. Major erosion occurred on the southern part of the

^{1 1} Munshi Khaledur Rahman. 2015. Environmental and Social Vulnerabilities and Livelihoods of Fishing Communities of Kutubdia Island, Bangladesh by (A dissertation submitted to Kent State University).

island. The western side of the island, i.e. towards the Bay of Bengal side was less prone to erosion compared to the southern section. The ORF has been proposed on the north-western side of the island, south of the existing light house and appears to have less erosion potential in comparison to the southern part of the Kutubdia Island.

24. **Drainage:** A natural drainage channel *Pilat Kata Khal* flows along the mid of the island and discharges into the Kutubdia Channel. This channel is influenced by tidal effects. Several minor channels are also connected with the *Pilat Kata Khal*. Also, several salt pans and some fresh water ponds are located within the study area.
25. **Marine Water Quality:** Marine water samples were collected from six locations in the Bay of Bengal and Kutubdia Channel for analysis of water quality. The pH values of the marine water samples were found to be neutral to slightly alkaline with salinity levels varying between 10.4 ppt and 17.7 ppt. Concentration of most of the heavy metals analysed were found to be below their corresponding detection limits.
26. **Inland Surface Water Quality:** Water samples were collected from *Pilat Kata Khal* for analysis of inland surface water quality. Water quality analysed for *Pilat Kata Khal* was found to be in compliance with the use of water for fisheries as per the ECR, 1997.
27. **Groundwater Quality:** Groundwater samples were collected from four locations within Kutubdia Island for analysis of water quality. The groundwater analysis reveal that almost all the parameters were within the standard values of the ECR, 97 (excepting TDS) and the ground water quality was satisfactory for potable uses within the Kutubdia Island.
28. **Soil Quality:** Soil samples were collected from two locations within Kutubdia Island for analysis of soil quality. Soil of the Project area mainly formed from recent alluvial sediments. Primary analysis of soil samples collected from Kutubdia Island reveal that the soils are clay loam and acidic in nature. The soils were found to be non-saline to slightly saline. In general the soils were found to be of low nutrient content to very low nutrient content (except for potassium).
29. **Sediment Quality:** Marine sediment samples were collected from four locations in the Bay of Bengal and Kutubdia Channel for analysis of sediment quality. Sediment texture was found to be varying between sandy-loam to silty-loam in nature with neutral pH. Organic carbon contents of the sediment samples were found to be low. Heavy metal concentrations of the sediment samples were also found to be negligible.
30. **Meteorology:** Three distinct seasons *viz.* cool dry season (November-February), pre-monsoon hot season (March – May) and the rainy monsoon season (June – September) are recorded in Kutubdia Island. Average minimum temperature in Kutubdia region generally varied from 6.2°C to 13.4°C; while the maximum temperature of 39.5°C is observed in May. The maximum annual rainfall recorded during the last decade (2000-2010), was about 3,171 mm with about 80% of the total rainfall occurring during the monsoon season. Wind direction generally

prevails from south-southeast during June-September with maximum wind speed of 1.68m/s.

31. **Ambient Air Quality:** Ambient air quality was measured at six locations within the Kutubdia Island. The concentrations of PM₁₀, PM_{2.5}, SO_x, NO_x and CO were found to be in compliance to national standards, presented under the ECR, 1997 (as amended).
32. **Ambient Noise Quality:** Ambient noise quality was monitored at six locations within the Kutubdia Island. Daytime and night time equivalent noise levels at residential and commercial areas were found to in compliance with the Noise Pollution (Control) Rules, 2006. The equivalent noise levels at the Kutubdia Upazila Health Complex were found to be exceeding the respective noise standards of *Silent Zone*.
33. **Natural Hazards:** The Project site is located in Earthquake Zone -II, where building design of moderate levels will be necessary. Kutubdia region is affected by cyclone and storm surge almost every year. Kutubdia Island is falling in a high risk area where surge heights are above 1 m. The southern part of the island (Boroghop and Ali Akbar Deil Unions) are most affected by inundation (3m to 4m), whereas the northern Unions are relatively at lesser risk, except for the coastal stretches. The Cox's Bazar coast falls within Tsunamigenic Zone-I, which is reportedly most vulnerable.

Ecological Environment

34. **Terrestrial ecosystem:** Total 87 terrestrial floral species were recorded from the terrestrial ecosystem of the study area which included 48 trees, 16 shrubs and 23 herbs and climbers. No protected floral species were recorded.
35. A total of 17 species of terrestrial herpetofauna are reported from the study area which included Green Frog (*Euphlyctis hexadactylus*) (Endangered as per IUCN Red List) and Spotted Pond Turtle (*Geoclemys hamiltonii*) (Vulnerable as per IUCN Red List). A total of 91 Avifaunal species were observed in the study area. Black-headed Ibis (*Threskiornis melanocephalus*) is reported Vulnerable while Eurasian Curlew (*Numenius arquata*) is reported as Near Threatened as per IUCN Red List. A total of 11 species of mammals were reported within the study area. Large Indian Civet (*Viverra zibetha*) and Common otter (*Lutra lutra*) are listed as Near Threatened as per IUCN Red list.
36. **Aquatic Ecosystem:** Planktonic survey was conducted at six locations in the Bay of Bengal and Kutubdia Channel. Phytoplankton community was represented by 17 genera with *Nitzschia sp.* as the most dominant followed by *Navicula sp.* and *Synedra sp.* Zooplankton community was represented by 23 genera with *Crab Zoea* as the most dominant followed by *Copepod nauplii* and *Penaeus sp.* Sediment samples collected reveal poor density of benthic communities. Among the benthic organisms higher concentration was recorded for Nematodes and Bivalves.
37. Fishery survey indicated that around 400 numbers of ponds were present in Kutubdia Island and among them 20 ponds were used for commercial aquaculture. Major inland fish species cultured were Pangas (*Pangasius pangasius*), Tilapia and Rui (*Labeo rohita*).

38. There were two different kinds of fishing activities on Kutubdia Island, (i) deep sea fishing; (ii) Estuarine and near shore fishing. It was revealed through consultation with fishermen that about 57 fish species were caught during deep sea fishing and about 32 species of fishes were caught from nearshore and channels of Kutubdia. Two species of fishes were threatened and these were Korat mach (*Anoxypristis cuspidate*; endangered as per *IUCN Red List*) and Koiputi (*Anodontostoma chacunda*) is now a rare locally.
39. During the local consultation with local fishermen and Department of Fisheries, it was revealed that Hilsha migrate from deep sea to north of 150-200 km offshore of Kutubdia and then the Hilsha school crosses eastern Nearshore of Kutubdia and aggregate near Bashkhali at Gandamara point where they breed and then the school begin its journey to enter into Meghna river system.
40. Isolated Olive Ridley turtle nesting is reported by the villagers all along the west coast of Kutubdia Island (Olive Ridley's Turtle (*Lepidochelys olivacea*) *IUCN* listed Vulnerable 2016.3). However, sighting of Olive Ridley turtle nesting was not observed during survey.
41. Four marine Dolphin species were reported by the local fishermen (both near Shore and Deep Sea) to be present within 5 km area of Kutubdia Island.
42. There are no protected areas like National Park, Wildlife Sanctuary or Ecologically Critical Areas (ECAs) etc. within the study area.

Socioeconomic Environment

43. The Project footprint for ORF is located on two Unions i.e. Dakshin Dhurung and Kaiyabil Union of Kutubdia Upazila and proposed Right of Way (ROW) of onshore pipeline is located in four Union i.e. Dakshin Dhurung and Uttar Dhurung Unions in Kutubdia Upazila of Cox's Bazar District and Chhanua and Puichhari Union in Banskhalia Upazila of Chittagong District.
44. Among these five unions Puichhari Union (38,224) has the highest population while the lowest populations were recorded in Kaiyabil Union (12,945). Average literacy rate of these 5 Unions observed as 29.34% and highest and lowest literacy is recorded in Puichhari Union and Kaiyabil Union respectively. Employed population in Kutubdia Upazila and Banskhalia Upazila are 70% and 72% of the total working age population respectively. Workforce participation rate recorded in the Dakshin Dhurung, Kaiyabil, Uttar Dhurung, Chhanua and Puichhari Unions are 78%, 78.25%, 79.51%, 76.35% and 77.27% respectively.
45. It has been observed during site visits that agriculture, salt cultivation and fishing are three major livelihood earning activities observed in Kutubdia Island. Community consultation also revealed that most of the community people are engaged in this activity and all other livelihood activity like small business, boat making and maintenance, salt and dry fish marketing are all directly and indirectly dependent on these three activities.
46. The main profession of the habitants of Kutubdia Upazila is agriculture. 56% of the total population is dependent on agriculture. Agriculture has traditionally been the primary source of income for the inhabitants of this island Upazila, but

over the years due to frequent cyclonic events and sea water surge, the cultivable land on the island is increasingly being rendered infertile due to increased salinity. More and more agricultural lands are now being converted to salt fields.

47. Cox's Bazar is the only region in Bangladesh where salt harvesting is done. In Kutubdia Upazila, salt harvesting is one of the primary livelihood options of the island population and also practiced as a secondary seasonal source of income. It is mainly carried out at the central part of the island on both sides of the *Pilat Kata Khal*.
48. Fishing is also a key livelihood earner for the residents of Kutubdia. It was informed by the District Fisheries Officer (DFO), Cox's Bazar that number of registered fishermen with the Department of Fisheries as on 30th June, 2016 is 7,116 in the Kutubdia Upazila (it was also understood that there may be additional 20 percent more fishermen in the island those who have not been registered due to various reasons). Overall an estimated population of 8,500 fishermen, are mostly living in 14 fisherman settlement in Kutubdia. Predominance of fishermen communities are more in Uttar Dhurung, Ali Akbar Deil and Boroghop Unions followed by Dakshin Dhurung. In Lemshikhali and Kaiyarbil Unions there is no fishermen settlement in particular and fishermen are scattered all over the union.
49. Focus Group Discussions (FGDs) and interviews with the key informants revealed that in Kutubdia, traditionally fishing was practiced by the minority fishing community - *jeles (Hindu community)*, who had been residing in this island for all most four generations (approx. 200 years). The Muslim population of the island adopted fishing as occupation in the last 20-25 years.
50. Types of fishing practiced by the fishermen in Kutubdia region can be classified into three category i.e. Deep-sea fishing, Daily fishing, Foot fishing. The hydrological conditions of the Bay of Bengal make it favorable for a variety of shrimps and fishes. Although fishes remain scattered in the Bay of Bengal in some places they get concentrated and constitute important fishing grounds. Four fishing grounds have been identified in the exclusive economic zones - *South Patches, South of South Patches, Middle Ground* and *Swatch of No Ground*. Discussions with the fishermen brought out the fact that in winter season income from fish sale is higher than in summer and monsoon. In monsoon the income majorly depends and varies on the Hilsa catch.

E) Potential Impacts and Mitigation Measures

51. The impacts have been identified based on the information presently available from the project proponent on the Project configuration through stakeholder consultations with government officials, community members along with fishermen community, reconnaissance visit and broadly assessment of the high power satellite imagery. The potential environmental and social impacts have been assessed for each phase of the Project - construction (including pre-construction and operational).

Potential Impacts on Aesthetics and Visual Quality

52. The construction activity will be a short term activity. The sources of aesthetic and visual impacts can result from raising of land designated for the ORF; storage of construction materials; storage and disposal of waste, physical presence of labour camps; earth work along the pipeline route; disposal of HDD cut material generated from pipeline laying etc. Kutubdia region has a typical rural setting with flat terrain (agricultural land and salt pans) with small villages with homestead plantation. The above mentioned activities are expected to create measurable changes of the environmental setting. The aesthetics and visual impact is assessed to be moderate.
53. During the period of the construction, the Project will ensure that the entire ORF facility will be fenced with bamboo mat or tin sheet. All construction activities including material and waste stockpiling will be restricted between the boundaries of the proposed site. All temporary structures, surplus materials and wastes will be completely removed from site and disposed at only designated areas.
54. The physical presence of the ORF, cryogenic pipeline on trestle, FSU during the operational phase can be visible from a distance of 2-3 km. All the Project facilities will have bright illumination arrangements. The study area typically represents a rural setting with no industrial presence – more so the settlements close to the site like Ali Akbar Deil, Bindapara have no power supply. The impact of aesthetics and visual quality is assessed to be **moderate**. So in view of this the Project will consider appropriate shading of lights to prevent scattering.

Potential Impact on Land Use

55. The Project will result in permanent change in land use of the Project site due to the planned sub components in the area (like onshore gas pipeline, valve station, etc.) from agricultural and salt pan to industrial.
56. Land requirement for the ORF facility is 40 acres including agricultural land, salt pans, sea beach land and possibly homestead land which will be permanently converted into industrial land. The impacts are expected in form of reduction in land area available for agriculture and resultant livelihood impacts on land owners and share croppers and also reduction in area of land for salt cultivation. It is anticipated that there will be potential displacement of people living in those land parcels.
57. The total land required for the pipeline is estimated to be 34 acres which includes agricultural land, salt pan land and Govt. land/ private land. Laying of the pipeline will not significantly impact in the change of land use along the corridor. It is reported that once the construction is complete, Reliance Power might return the land back to the land losers for redevelopment including growing crops, grazing, salt cultivation, etc. However, no structural development would be permitted which may lead to loss of value for land. The impact of land use changes is assessed to be **minor**.

Potential Impact on Soil Quality

58. Before construction activity, the top soil of the agricultural land if not properly stripped and stored for future use, the entire volume of top soil will be

permanently lost or fertility/soil characteristics will be changed. Contamination of soil can happen only due to accidental spillage of fuel, lubricants and paints from storage areas and during the transfer of fuels and chemicals. The above mentioned soil quality impacts will be localised within the project site or immediate vicinity. The potential impact on soil quality is assessed to be **minor**.

59. Proper stripping of top soil, its conservation for future use in greenbelt or for reclaiming agricultural land along the pipeline shall be ensured. The drainage system at site will be designed with sedimentation tank and Oily-water Separator to prevent contaminants from entering soils.
60. During operation phase, contamination of soil can happen only due to accidental spillage of fuel, lubricants and chemicals from storage areas and during the transfer of fuels and chemicals. Sludge generated from the STP and during cleaning of LNG storage tank will be stored in pits with impervious liners and same will be periodically transferred to the disposal facility of the Chittagong port. Improper handling and mixing with surface runoff water can lead to contamination of soil in nearby area. Contamination of soil can happen only during accidental cases or in case of improper management. The potential impact on soil quality is thus assessed to be **minor**.
61. The Project will ensure proper spill control and management at site along with conduct of regular monitoring to detect any contamination on soil & ground water. It shall also be ensured that the waste from the Project is disposed only in designated storage and disposal area.

Potential Impact on Physiography & Drainage

62. Construction of the ORF site will entail the raising of the existing ground level by 8.0 m from the existing ground level. This will result in considerable change in the existing local physiography, given the fact that the area being considered for the project is flat agricultural land with a gradual slope towards the west. The excess runoff water from the agricultural fields drains through lower surfaces along the embankment and finally discharges into the Pilat Kata Khal through micro-drainage channels. The raising of land for ORF may disturb the low lying areas and its drainage slope towards west. After completion of pipeline laying, if the earth materials are not properly cleared, micro-drainage of the area may be disturbed. The impact on topography and drainage assessed to be moderate.
63. The ORF will be designed with an adequate drainage system to prevent any impedance to local micro drainage. It will be ensured that the cross drainage structures along the pipeline route are properly maintained during the process of pipeline laying and also that the sites are reclaimed immediately on completion of pipeline laying.

Potential Impact on Air Quality

64. During construction phase, the sources of emission are fugitive emission from construction material handling, earth work, and emission from machinery and vehicles. The pollutant especially particulate matter will be settled in areas surrounding proposed project site, however this activity will be continuing during the construction phase only. The impact is assessed to be of **minor** significance.

65. During the operation phase, the main source of air pollution from proposed project will be from the 20 MW natural gas based power generation facility at the ORF. The emissions from the captive power plant will primarily be NO_x, PM, CO.
66. Impacts due to the operation of onshore facility of the project were assessed by modelling projected emission through ISC-AERMOD View 9.2.0 model.
67. The results from the modelling exercise revealed that the resultant concentrations of the pollutants are expected well within the applicable standard and the impact magnitude is assessed to be **negligible**.

Potential Impact on Noise Quality

68. Construction activities such as transportation of materials, operation of heavy equipment and construction machinery are likely to cause increase in the ambient noise levels in and around the project site. The noise generated from the aforementioned activities may cause discomfort to the construction workers onsite and also to the nearby villagers. The potential impact on noise quality during construction stage is assessed to be **minor**.
69. Noise during operations will be primarily generated from captive power generation and from use of pumps and compressors. The environmental noise prediction model SoundPLAN 7.2 was used for modelling noise emissions from key noise generating equipment within the onshore LNG facility.
70. The noise modelling results indicate predicted noise levels at all receptors considered for the study to be within the applicable noise standard for day and night time. Furthermore there will be no change in the resultant noise levels at each receptor due to the Project. Therefore, the impact magnitude is considered to be **negligible**.

Potential Impact on Surface Water Quality

71. Surface run offs from construction material storage area, construction waste storage areas, hazardous waste (waste oil, used oil etc.) and chemical storage areas may lead to pollution of receiving natural drainage channels etc. It is also proposed to lay 17 km of onshore pipeline; during this process earth work (excavation and stacking of soil) will be required; the surface runoff from disturbed site may lead to pollution of the receiving water bodies. The surface run offs may contain high sediment load, oil residues, organic wastes, etc. This can cause adverse impact on water quality, which ultimately leads to impacts on aquatic ecology.
72. The excavation activities and pilling work in the seabed for construction of the island jetty and the trestle for the cryogenic pipeline will generate fine sediments and will also result in resuspension of sediments in water. This expected to increase the turbidity of water and this have an adverse impact on surface water quality. The turbid waters impact on aquatic ecology thus affecting primary productivity. The leakage and spillage of oil and lubricants from machineries and equipment can cause adverse impact on surface water quality.
73. During the pipeline laying, hydro-testing will be required. Hydro-testing water if directly discharged into the Kutubdia Channel or nearshore will affect the water quality. Hydro-testing water is generally characterized by high pH, turbidity,

metals, oxygen scavengers (like ammonium or sodium bisulphite etc.), biocide residues, etc. and can adversely affect aquatic ecology as well as benthic ecosystem. The potential impact on surface water quality due to construction activities is assessed to be **moderate**.

74. The Project shall try and restrict earth work activities during monsoon season and shall also install proper storm water drainage system with adequate size double chambered sedimentation tank. The Project shall also ensure that the hydro-testing water is treated before discharge into sea/channel
75. Surface run off during the operation phase from oil storage, waste handling unit may lead to the pollution of receiving water bodies. However, taking into account the provision of onsite drainage system with sedimentation tank, oil separators, etc., the pollution load is not expected to be significant. The grey water, black water, ballast water and bilge water from the FSU, LNG carriers, etc. will be discharged into the Chittagong Port facility or as per the requirement of MARPOL. No direct discharge is expected into the sea. The impact on surface water quality is assessed to be **minor**.

Potential Impact on Ground Water Quality

76. Spillage and seepage of chemical, oil and lubricants from storage area, waste handling area and generation of domestic waste/wastewater from construction labour camp area may adversely affect ground water quality in the area.
77. The existing groundwater quality analysis does not reveal any contamination or pollution of groundwater. The geographical extent of potential impact due to above activity is anticipated to be local and impact duration is expected to be short term. The sensitivity is high, as the water is unpolluted and provides services as drinking water, domestic uses for the region. The impact on ground water quality assessed to be **moderate**.

Potential Impact on Terrestrial Habitat (Flora & Fauna)

78. During the construction phase, vegetation removal at the ORF and along the pipeline route will cause loss of vegetation cover, habitat loss to the faunal species living within the project area and habitat disturbances to the faunal species in the nearby areas. The species of concern amongst mammals are Indian Grey Mongoose, Large Indian Civet both listed 'Near Threatened as per IUCN Red List'. Among avifauna Red-breasted Parakeet (listed Near Threatened as per IUCN Red List) and among herpetofauna Spotted Pond Turtle (Vulnerable as per IUCN Red List) and Indian Black Turtle (Near Threatened as per IUCN Red List) are reported from the area. No floral species was identified to be under the threatened category. The impact of the vegetation clearance is assessed as minor.
79. Plantation of local species will be carried out for stabilization of the filled in material within the ORF and also in surrounding areas. Additional plantation is also proposed at other identified areas such as in available areas along the inland pipeline line corridor
80. Operation phase impacts on terrestrial flora and fauna would be primarily from emission, noise and illumination from the ORF. A Green Belt Management Plan

will be developed and its strict implementation will be ensured within the project site and immediate surrounding areas.

Potential Impact on Aquatic Habitat

81. There is likelihood of turtle and dolphin mortality/injury during the construction period due to boat and vessel movement in sea and channel area. Turtle nest can be poached by the working labour force. Impact on aquatic habitat flora and fauna is assessed as moderate.
82. A pre survey of turtle nesting habitats at the ORF location and also pipeline route will be conducted prior to start of construction works. Adequate safeguard will be built in the contract of the EPC Contractor to prevent any poaching of turtle eggs by the construction workforce as well as to prevent any disturbance to aquatic habitats from construction activities.
83. During the operation phase, impacts may arise from spillage and leakage of fuel and lubricant, mortality caused due to movement of ships and vessels and from illumination. The Project will have in place specific procedures and necessary preparedness to contain any accidental spill at source and also prevent their spread in the surrounding environment. The Project will also plan vessel movement and design the site illumination in a manner to limit impacts on aquatic habitats.
84. The Project will also support the Local Forest Department and Local NGOs in their initiatives to study and protect turtle nesting activities on the island and also support government initiatives in terms of research and monitoring for dolphin studies in the region.

Potential Impact due to Land Acquisition

85. Land Loss: Based on the present information available from the Reliance Power the following land requirement is anticipated that will be acquired through land acquisition – 40 acres, both government and private land for Land Based facility, 34 acres of land for proposed onshore pipeline and an area up to 1.85 acres land for Terminal Station at Valve 2.
86. It is anticipated that during the construction phase the land owners will lose land due to land acquisition. Based on satellite imagery interpretation it also appears that few residential plots might be acquired for the project activity. It will be determined and accordingly APs will be identified once the project foot print is finalised through subsequent field surveys. Impact due to land loss is assessed to be **minor**.
87. **Change in Landuse:** The establishment of the Project will result in permanent change in land use of the Project site for the sub components areas (like land based facility and Terminal Station at Valve 2 from agricultural and salt pan to industrial. It is envisaged that the laying of the pipeline will not significantly impact in the change of land use along the corridor as it will be returned after construction for growing crops, grazing and salt cultivation, however no structural development will be permitted. Impact due to land use change for agriculture and salt cultivation in Dakshin Dhurung and Kaiyabil Union is assessed to be **minor**.

88. **Fragmentation of Land Holdings:** Parcels of land along the proposed RoW for gas pipeline may get temporarily fragmented due to the linear acquisition associated with the route of the gas pipeline.
89. This may either lead to partial loss of cultivable land and salt pans (primarily during the construction phase. In operation phase land will be restored and returned to the owners who may resume previous livelihood, such that no real loss is expected. There may be creation of orphan lands ¹which may be rendered too small or unviable for cultivation both for agriculture or salt. Valuation of the land prices may decrease.
90. As a mitigation measure it should be carefully assessed during socio-economic survey and the project proponent should try to avoid creation of such orphan land parcels. If creation of orphan land parcels could not be avoided, the land owners will be appropriately compensated as detailed out in Entitlement Matrix in the Resettlement Framework (to be compensated if remaining land is no longer viable) with special focus on vulnerable households. Impact assessed to be **negligible**.

Potential Livelihood Impacts

91. **Construction Phase:** The land parcels that will potentially go for land acquisition are agricultural lands and salt cultivation fields as assessed from satellite imagery and from the Reconnaissance Survey Report for the LNG Terminal and associated pipeline. The impacts on different stakeholder groups are as follows:
92. **Livelihood of Land Owners:** Land Based Facility & Terminal Station Valve 2 – Owners and families deriving income from the agricultural lands and salt pans from the proposed ORF plot will be impacted due land loss.
93. **Onshore pipeline:** Significant impact from loss of land for the RoW for the gas pipeline is not envisaged because of the temporary nature of acquisition. Once the construction is complete, Reliance Power might return the land back to the land losers for redevelopment including growing crops, grazing, salt cultivation, etc. Impact assessed to be **minor**.
94. **Sharecroppers, Lessee Farmers & Land Depended Groups Salt Pan Workers:** Sharecroppers (if any) and salt harvesting workers cultivating within the project area would have to discontinue their practice in the project area once the construction activities start.
95. Restriction on use of land in project area may lead to impacting their livelihood and income. This impact may be temporary i.e. loss of income during the transition phase and could be mitigated once the sharecropper and the salt harvesting workers finds a new site for cultivation and renews his sharecropping or salt harvesting practice. However, the impacts could also be long term and in some instances lead to change in occupational pattern (like cultivator to

¹ Orphan land parcel is that land located outside of the normal compensation area but is made uneconomic by occupation or acquisition part of the plot. It is eligible for compensation. Compensation may be determined based on reviewing of the land parcel by Revenue Department or any Valuation Committee on cases to case basis if any land owner lodges a request.

agricultural wage labour, contract worker etc.) if any sharecropping family or land depended workers is unable to find alternate land/ salt pan.

96. The land owners will receive cash compensation, transition allowance and they will also be allowed to take away the crops, also the affected employees and wage earners will receive cash grants as defined in the Entitlement Matrix in the Resettlement Framework. Impact assessed to be **moderate**.

Potential Impact on Fishing Activities

97. Fishing is one of the primary livelihood options of the inhabitants of Kutubdia Island. As per the Fisheries Department records there are 168 registered fishermen in Ali Fakir Deil and 23 fishermen¹ in Bindapara villages in Dakshin Dhurung and Kaiyabil Unions respectively. The fishermen practice deep-sea fishing, daily fishing, foot fishing/ shoreline fishing throughout the year as their livelihood means. The sand beach portion is used for anchoring of boats, fishing net drying and repairing, boat repairing, etc. Impact on fishing activities is anticipated both during construction phase and will continue through operation phase.
98. **Land Based Facility:** Shoreline fishing done by the fishermen of these two villages – Ali Fakir Deil and Bindapara, using the push nets and small setback nets (choto behundi jal) will be impacted during the construction and operational phase of the LNG Terminal. The fishermen will be prevented from fishing in this region and it may impact the family income partially. With steep sea floor with 10 m contour reaching within 1 km from west of Kutubdia Island may prevent the fishermen to go little deep and at other locations for foot and shoreline fishing. It is envisaged that impact will be localized and permanent in nature.
99. **Cryogenic Pipeline on Trestle:** It is proposed that a 2.4 km motorable trestle will be constructed from the LNG receiving facility off shore to land based onshore facility to hoist the gas pipeline. There will be an exclusion zone of about 100m on either side of the trestle for safety and security reasons to avoid potential accidents – this will potentially impact some of the deep-sea fishing routes. It will be a localised impact and especially for the fishermen of Ali Fakir Deil and Bindapara villages.
100. **Twain Berthing for FSU and LNG Carrier:** The Floating Storage Unit (FSU) will be located in the Bay of Bengal, approximately 2.4 km from the north western shoreline off Kutubdia Island; it will have an exclusion zone of about 500 m around the FSU for security and safety reasons. This may not directly impact fishing activities but they may have to sail further west or south-west for daily fishing. There could therefore be some disruption in existing fishing boat movements.
101. **Onshore Gas Pipeline:** The onshore gas pipeline will cross the Kutubdia Channel from the north-east part of the island. This may not directly impact the fishing activity, however it will impact the navigation of the trawlers and fishing boats

¹ Ward wise list of registered fishermen as on 30th June, 2016, data received from District Fisheries Office

that sail out through Kutubdia channel from north of the island upazila to Bay of Bengal.

102. A monitoring study may be undertaken by the project proponent that will help in identifying actual fishing routes, fishing zones and fish catch that may potentially get impacted. Fishermen families whose family income may be partially impacted will be compensated as detailed out in the Resettlement Framework and CSR programs may be undertaken by the project proponent for betterment of the fishing community.
103. **Impacts related to livelihood during Operation Phase:** Fishing, agricultural activities and salt cultivation would continue to be the same as in construction phase to operation phase. However, positive impact on local enterprise and economy will improve from construction phase to operation phase in the immediate vicinity of the project area that will see a spurt of entrepreneurial activity in the form of locals opening up food joist, tea stalls, spare-parts and repair outlets and general provisions.
104. As mitigation measure financial compensation for loss of income incurred as a result of the Project until fishing or alternative income is secured may be provided as detailed out in Entitlement Matrix in the RF.

Potential Impact on Community Health & Safety

105. Construction materials and heavy equipment used during the construction phase will be brought into the site by barges using the water ways. Though it will not cause any traffic congestions on roads and possible disruption to the community usage of roads – it will increase the inconvenience to community in terms of air and noise pollution caused by unloading of materials and construction.
106. Impacts, risks associated with access to waterways are comparatively lesser and the only identified impact is with respect to spillage and seepage in the sea due to increased material movement, handling and unloading. Additionally it may be a potential risk to the fishing boats and the fishermen involved in shoreline fishing. Impacts are assessed to be **moderate**. Adequate mitigation measures as outlined in the ESMP will be implemented to prevent and minimise impacts on community health and safety.

Potential Impact on Occupational Health & Safety

107. The health and safety risks during LNG terminal operations include potential for respiratory diseases, burns, allergies and industrial accidents among the employees and the workers of other sub-contractors would be exposed to such risks. Impact on workers health and safety is assessed to be **moderate**. Adequate mitigation measures as listed out in the ESMP will be implemented to prevent and minimise impacts occupational health and safety.

F) Analysis of Alternatives

Site Location Alternatives

108. Five locations on the west coast of Bangladesh have been studied as potential locations for the LNG terminal *viz.* Parki, Kutubdia, Matarbari, Maheshkhali / Sonadia and Elephant Point. Among the five sites Kutubdia was selected as it was

technically feasible; cost effective, least ecologically sensitive among the other sites.

Technology Alternatives

- 109.FSU/FRSU - The onshore regasification unit will protect the LNG facility from extreme weather conditions as the offshore facility would be more vulnerable to waves, currents and natural calamities (cyclones etc.). The operation cost of the offshore gasification would be higher due to high lease rate of FRSU. Moreover, with the FSRU solution, gas send out will be interrupted when the FSRU is required to disconnect. In view of this the FSU option is preferred over the FRSU option.
- 110.FSU Berthing Options (Dual or Single Berthing) - As the single berthing option is significantly less cost intensive, the option is preferred over the dual berthing option.
- 111.Offshore Pipeline - Submerged/ Pipeline on Trestle - As subsea cryogenic pipeline is not a field proven technology, construction of trestle mounted cryogenic pipeline is considered to be more feasible option.

Pipeline Route Alternatives

- 112.Four pipeline alignment options from Kutubdia ORF to Napura valve Station were studied to identify the alignment with least environmental and social sensitivity. Channel and road crossing is more for Alignment A and Alignment B compared to the other alignments. Among the 4 alignments considered Alignment A and B will pass through mangrove vegetation and the other two alignments would not. Minimum physical resettlement would take place for Alignment D. In view of this Alignment D is preferred over the other options.

G) Information Disclosure, Consultation and Participation

- 113.Series of consultations were held during the ESIA process with stakeholders to have an insight of the baseline situation of the site and regulatory and administrative setups in the proposed LNG Terminal site. This in turn helped in developing an understanding of the perceptions of stakeholders with regards to the project and also allowed for a means of recording their feedback. The stakeholder views expressed were incorporated in the ESIA and the planning and development of the project. Further disclosure will be done as a part of the environmental clearance process, as well as a part for ADB's disclosure requirements.

H) Grievance Redressal Mechanism

- 114.A Grievance Redressal Mechanism (GRM) will be in place to handle and resolve the conflicts and aggrieved situations. It is understood that Reliance Power already has GRM in place. There will be a specific GRM that will be put in place by RBLTL for this project. This project specific GRM will be formulated in keeping with the process and procedure of the existing GRM and will be integrated into the same. The GRM will aim to provide a time bound and transparent mechanism for expressing and resolving social and environmental concerns linked to the project.

I) Environment and Social Management Plan

115. Project specific Environment and Social Management Plans (ESMP) have been developed with an aim to avoid, reduce, mitigate, or compensate for adverse environmental and social impacts/risks and to propose enhancement measures.

The plan covers;

- mitigation of potentially adverse impacts;
- monitoring of impacts and mitigation measures during project implementation and operation;
- institutional capacity building and training;
- compliance to statutory requirements; and
- integration of the ESMP with project planning, design, construction and operation.

Resettlement Plan

116. As a part of the ESMP, a Resettlement Framework has been prepared. Based on further detailing of project plans and firming of the project footprint and subsequent land requirements, a Resettlement Plan (RP) will be prepared that will delineate the exact magnitude of impact, number of DPs and APs and their compensation entitlement along with cost for implementing the RP. Impacts related to land acquisition, involuntary resettlement and livelihood restoration of the affected persons (APs) - title holders, non-titleholders, land users groups, encroachers will be covered in the resettlement plan based on the final project footprint.

Institutional Setting and Implementation Arrangements

117. The ESMP (mitigation plan) will be included in the construction contract and the contractor will be responsible for implementation of the measures associated with design and construction. The Project Developer's staff, specifically the EHS Officer and Site Engineer, will monitor the implementation of these mitigation measures by the contractors at the site. These two officers will be responsible for the field level monitoring of the Project.

Environmental Monitoring

118. The environmental monitoring programme has been devised with the following objectives:

- To evaluate the effectiveness of the proposed mitigation measures and the protection of the ambient environment as per prescribed/ applicable standards for the Project;
- To identify the need for improvements in the management plans;
- To verify compliance with statutory and community obligations; and
- To allow comparison against baseline conditions and assess the changes in environmental quality in the Project area.

Reporting Mechanism for Environmental and Social Monitoring Program

119. A robust reporting system will provide the Project with the necessary feedback mechanisms to ensure quality and timely implementation of the works. The reporting system will ensure regular flows of information from the Project site to the Project headquarters and, as necessary, to regulatory authorities and funding agencies. The reporting system will provide a mechanism for ensuring that the measures proposed in the Project's ESMP are implemented. The quarterly reports of the management measures will form an integral part of the Quarterly Progress

Reports that can be submitted to the lenders. Additional compliance reports to the Regional Office and Head Office of the Department of Environment (DOE) required as a part of environmental clearance process shall also be prepared and submitted based on the necessary monitoring and reporting formats.

J) Conclusion and Recommendations

120. This environmental and social impact assessment of the Kutubdia LNG Project ('Project') has been prepared based on review of draft technical specifications of the Project as provided by Reliance Power and through analysis of primary and secondary information of the site and surroundings as collated by ERM. Through this process, an assessment has been undertaken of the potential environmental and social risks and impacts that may be attributed by the development of the project in its pre-construction, construction and operation phases.
121. The Project will have both positive and adverse impacts on social environment. The positive impacts will include temporary employment opportunity for the unskilled labourers during the construction period and business opportunities for the local people. Based on the present level of information available from the Project Developer it is anticipated that the Project is likely to have adverse social impacts pertaining to land loss, land fragmentation, potential physical displacement, loss of income (that may include agricultural labourers, sharecroppers, workers/labourers of salt pans), loss of productive land, potential income loss for fishermen and preventing to fishing related activities and fishing routes. The impacts may be localised and some are permanent in nature that can be mitigated with appropriate measures; it is anticipated that vulnerable groups (women headed households, to be identified during Census survey and social impact assessment) may also experience impacts due to the project implementation.
122. The construction phase of the Project will have an important role in the socio-economic development of the area, whereas the operation phase of the Project will play an important role by supplying gas in the region. A reliable and expanded gas supply will support future economic development of dependent sectors like industry and manufacturing enabling them to operate and compete.
123. During the operation phase of the Project, the two key impacts will be from the increase in ambient noise and air quality levels due to operation of plant equipment and auxiliary machinery.
124. Based on the analysis conducted in this environmental and social assessment, it is concluded that overall the Project will result in moderate to major positive socio-economic benefits and the potential negative environmental and social impacts that have been identified as mostly short-term and localised in nature, and can be minimized adequately through good design, appropriate application of mitigation measures and regular supervision of implementation.

1 INTRODUCTION

Reliance Power Limited (Reliance Power) has been established to develop, construct and operate power projects both in India as well as internationally. The Company on its own and through its subsidiaries has a portfolio of over 25,000 MW of power generation capacity, taking into account operational and plants under development.

Reliance Power Limited (Reliance Power) through its subsidiary in Bangladesh – Reliance Bangladesh LNG and Power Limited (RBLPL), has strategic plans to establish itself as an Independent Power Producer (IPP). Accordingly RBLPL proposes to develop a combined cycle gas based power plant of capacity 750 MW (Natural Gas/RLNG based) in Bangladesh to meet the existing power shortage and the demand-growth in future years. In Bangladesh, the demand for natural gas is rapidly rising due to its diversified use in industrial and electric power sector. On the contrary, the existing reserves are depleting. As a consequence, Bangladesh has been experiencing gas shortages, especially in respect of the gas fired power plants that has resulted in several of them running below the rated capacity and few remaining shut due to non-availability of gas.

Indications that indigenous gas resources are falling below sustainable economic operational levels and eventually may run out in the short- to medium-term have resulted in the need for supplementary feedstock in form of importing liquefied natural gas (LNG). Keeping this in view, Reliance Power Limited through another subsidiary in Bangladesh, Reliance Bangladesh LNG Terminal Limited (RBLTL) plans to establish a LNG storage and re-gasification facility of up to 5 million tonnes per annum (MMTPA) capacity. The terminal is proposed as a land based Regasification facility along with a Floating Storage unit (FSU) in the range of 3.5 - 5 MMTPA (about 750 MMSCFD peak load) with a storage capacity of 145,000 to 216,000 m³ located offshore of *Kutubdia* Island in *Cox's Bazar* region of Bangladesh (hereinafter referred to as the Project).

RBLPL, functional in Bangladesh from September 2016¹, is presently operating from its office premises at Rupayan Karim Tower at Kakrail, Dhaka. It is also planned to set up a site office within the identified LNG Facility project site on *Kutubdia* Island after initiation of construction stage. It is presently understood that approximately 1000 personnel (including managerial, skilled and unskilled workers) will be engaged by the Project during the construction phase whereas about 120 people will be required during the operational stage.

Presently at the project planning stage, an environmental and social impact assessment (ESIA) study has been commissioned to comply with the

¹ Reliance Bangladesh LNG and Power Limited (RBLPL) was incorporated in 21 Sep 2016 under the Companies Act (Act XVIII) of 1994 in Bangladesh.

requirements of environmental impact assessment (“EIA”) guidelines of the Government of Bangladesh (“GoB”) to obtain necessary Environmental Clearance Certificate for the Project. RBLTL is also seeking finance from international lenders for setting up of the Project hence the ESIA also needs to conform to the guidelines and requirements of the Asian Development Bank (ADB).

ERM India Private Limited (*hereinafter referred as “ERM”*) has been engaged to conduct this ESIA study. At the first phase, an Initial Environmental Examination (IEE) has been carried out as part of the ESIA process. The current deliverable presents the Draft ESIA report developed by ERM.

1.1 PROJECT BACKGROUND

The Liquefied Natural Gas (LNG) storage and re-gasification facility / terminal is proposed to be located offshore of *Kutubdia* Island in the *Cox’s Bazar* District of Bangladesh (Refer to *Figure 1.1*). The *Kutubdia* Island is isolated from main shore of Bangladesh. There is no direct road access to this island. The *Kutubdia* Channel has to be crossed to reach the island.

The proposed facility has is being planned as land based Regasification facility along with a Floating Storage unit. The techno economic feasibility for this project is currently being explored by Reliance Power. Cryogenic pipelines on trestle and onshore pipelines will also be installed to transport the gas from FSU to the proposed National Gas Grid.

Overall the Project will consist of:

- (i) marine facility comprising of FSU and twin jetty
- (ii) land based facilities (onshore gas receiving and regasification facilities, captive power plant and other utilities) and
- (iii) cryogenic pipeline on motorable trestle of 2.4 km length to connect the FSU to the onshore terminal and onshore pipelines to transport the gas from the gas receiving facility on *Kutubdia* Island to National Gas Grid pipeline on mainland.

The land based facilities is situated in *Dakshin Dhurung* and *Kaiyabil* Unions of *Kutubdia Upazila* in *Cox’s Bazar* District in Bangladesh. The sea front based marine facility will be situated in the Bay of Bengal off the north western shore of the *Kutubdia* Island. The onshore pipelines from *Kutubdia* Island will connect with the gas grid pipeline at the proposed valve station of Gas Transmission Company Limited (GTCL) at *Napura*.

1.2 PROJECT RATIONALE

Bangladesh is heavily dependent on natural gas and the demand for natural gas is growing rapidly while existing reserves are depleting. The country faces severe gas shortages of around 500-650 million standard cubic feet per day (MMSCFD) that are forecasted to increase. Its recoverable gas reserves of 16.36 trillion cubic feet is set to be exhausted within the next decade if no new gas fields are discovered.

Figure 1.1 Location of Project Site



The World Bank estimates that most industrial facilities in Bangladesh are operating at half of their installed capacity due to a lack of reliable power and gas. Reliable long-term availability of natural gas is critical to the development of competitive industry in the country. GoB faces significant challenges in attracting international oil companies to engage in exploration activities in Bangladesh due to, among others, (i) low gas prices, (ii) market access constraints (no local marketing rights and export barriers), (iii) weak financial strength of the state counterparties, and (iv) slow legal and sector reform, especially regarding pricing of natural gas and petroleum products.

This severe gas deficit has especially affected gas-fired power plants. These plants are either running below their rated capacity or have been shut down due to non-availability of gas. To address this gas crisis, the Government of Bangladesh (“GoB”) is initiating projects related to import of LNG on a Build Own Operate (“BOO”) basis.

Keeping this in view; Reliance Power has planned to establish a LNG storage and re-gasification facility/terminal of up to 5 MMTPA capacity off *Kutubdia* Island in the *Cox’s Bazar* District of Bangladesh.

1.3 PURPOSE AND SCOPE OF THE ESIA

1.3.1 Purpose of the ESIA

Reliance Power has approached the ADB for raising investment capital for the Project. As per the ADB’s environmental and social screening criteria, the proposed project falls under Category “A” and thus requires a comprehensive Environmental and Social Impact Assessment (ESIA) study.

Applicable regulatory regime in Bangladesh in this regard is principally driven through the Environment Conservation Act (ECA), 1995 (as amended in 2000, 2002 and 2010) and the Environmental Conservation Rules (ECR), 1997 and ensures that “no industrial unit or project shall be established or undertaken without obtaining, in the manner prescribed by rules, an Environmental Clearance Certificate from the Director General”. Ensuring compliance with the provision of this Act and Rules is the responsibility of the Department of Environment (DoE).

As per the ECR 1997, the proposed Project (FSU and LNG terminal, captive power plant, pipelines and associated facilities) falls under the Red category due to:

- *Item 6: Power Plants*
- *Item 65: Exploration/extraction/distribution of mineral resources;*
- *Item 64: Water, power and gas distribution line laying / relaying / extension.*

Hence, this ESIA study was carried out to meet the environmental and social safeguard requirements of the ADB as well as the relevant country’s

applicable laws. The applicable reference framework used for the study is as follows:

- Applicable Bangladesh national, regional and local regulatory requirements.
- ADB's Safeguard Policy Statement ("SPS") (2009);
- ADB Social Protection Strategy (2001);
- ADB's Public Communications Policy (2011);
- The IFC Performance Standards for Environmental and Social Sustainability (2012);
- The IFC General EHS Guidelines (2007); and
- IFC EHS Guidelines for LNG Facilities (2007)

The reference framework and its applicability with respect to the Project have been further described in Section 2 of this Report.

1.3.2 *Scope of the ESIA*

The detailed scope of the ESIA study is as outlined below:

- Screening of the Project based on applicable reference framework based on reconnaissance survey and desk based review of Project documents;
- Scoping for the ESIA study;
- Development of an integrated project description of the Project components including its sub-components, which are under the purview of the Project Proponent (Reliance Power);
- Development of a regulatory, policy and administrative framework relevant to the Project;
- Monitoring, analysis and reporting of the environmental and social baseline data of the study area including consultation with local communities and other stakeholders;
- Assessment of the environmental impacts of the Project in the study area based on professional judgement along with stakeholder consultation and feedback;
- Assessment of social impacts on the local community as well as Project affected people and any other stakeholders, which have been identified during the social consultation process;
- Risk assessment and consequence analysis of the Project;
- Formulation of an Environment and Social Management Plan and associated/specific mitigation plans for identified impacts; and
- Formulation of Stakeholder Consultation and Grievance Redress Mechanism for the Project.

1.4 *APPROACH AND METHODOLOGY*

As the first step, project screening and scoping exercise was undertaken to identify the parameters needed to be considered for the study and to outline the activities for collecting data on each parameter. Data pertaining to all facets of the environment *viz.* physical, ecological and socioeconomic

environment were collected from the study area (10 km around the FSU and 500 m around both sides of the onshore pipeline route) through both primary and secondary sources.

The stepwise activities are detailed in the following subsections:

1.4.1 *Discussions with Project Proponent*

- Discussions held with Reliance Power, to understand the proposed Project, current status of agreements (i.e. implementation, land, water, power supply, etc.), project milestones, legal requirements and scope; and
- Collation of relevant project documents such as the Site and Configuration Selection Report, Reconnaissance Survey Report for LNG Terminal and Associated Pipeline, Onshore Terminal Facility Layout, etc.

1.4.2 *Screening and Scoping Exercise*

- Desk based review of the relevant documents and available imagery of the project site and its surroundings;
- Reconnaissance survey of the site and surrounding areas and preliminary discussions with locals, local government officials and other stakeholders;
- Meetings and discussions with Regional Office of Department of Environment (DOE) at Cox's Bazar, to understand sensitivities and regulatory requirements associated with the proposed Project;
- The outcome of the screening was then used to identify the study area, key data to be collected and the categorization of the Project; and
- A preliminary stakeholder mapping exercise was also undertaken to identify key stakeholders from the Government, relevant Governmental Agencies, Non-Governmental Organisations (NGOs) as well as the community at the local, regional and national level. This information was then used for consultation during different stages of the Project.

Categorization

- Categorization of the Project was attempted based on the screening assessment, reconnaissance survey, environmental and social sensitivities, limited consultation and the DOE categorization; ADB's categorisation criteria based on environment categorisation, involuntary resettlement (IR) impact categorisation checklist and indigenous peoples (IP) impact screening checklist; as well as with reference to the IFC's approach to categorization.

Scoping

- The categorization with respect to ADB and IFC classifications was further used as a basis for defining scope for the impact assessment, planning and implementation of mitigation, monitoring and reporting mechanisms for the project to meet potential Lender's requirements as well as those of the GoB.

1.4.3 Baseline Data Collection

- Identification of the monitoring locations for air, water, soil, sediment, biomonitoring and noise as per sensitive receptors, key locations for project facilities, etc.;
- The baseline data collection, monitoring and analysis for environmental parameters was completed during the period from October – November, 2016;
- Socio-economic data collection and consultation was carried during August and November 2016;
- Secondary data was also collected from different government departments, local bodies and through literature surveys etc.; and
- All the data was compiled and compared with applicable standards where relevant, and is presented in Section 4 of this report.

1.4.4 Stakeholder Consultation

- Extensive consultation was conducted with key stakeholders' including the local population, government departments/agencies, fishermen, and NGOs;
- Stakeholder consultation was completed with the intent of collecting baseline information on the environmental and social conditions and sensitivities, developing a better understanding of the potential impacts, informing the public of the proposed project and to gain an understanding of the perspectives/concerns of the stakeholders;
- A summary of the stakeholder engagement process and the profile of the groups and their opinions forms a part of the Section on Information Disclosure, Consultation and Participation in this report (Section 7); and
- Information gathered was used for formulating mitigation measures and environmental and social management plan/s.

1.4.5 Impact Assessment and Mitigation Measures

- Analysis of the baseline results and the impacts of the Project were assessed in accordance with the Bangladesh national guidelines for air, water and noise emissions; standards stipulated in the Environment Conservation Rules (ECR), 1997 and amendments thereof and with reference to the IFC's Performance Standards, ADB Safeguard Policy Statement and the IFC's Environmental, Health and Safety (EHS) Guidelines;
- The impact assessment involved the prediction and evaluation of impacts from the Project in different phases, including site preparation, construction and operation phases of the project and included consideration of mitigation measures towards the same;
- Impact prediction covered residual impacts (impacts remaining after all possible mitigation has been incorporated) and took into account control measures that are part of the Project design. Additional measures aimed

at further avoiding, minimizing and mitigating predicted impacts were proposed where necessary or appropriate;

- Impact assessment has also covered potential for cumulative impacts if any on Valued Environmental and Social Components (VECs) due to presence of existing and planned future developments in the region.
- Impact assessment also involved risk assessment covering hazard identification, consequence analysis and risk reduction measures and recommendations; and
- Impacts have been further classified as insignificant, minor, moderate or major based on the criteria for rating of impacts.

1.4.6 Analysis of Alternatives

Analysis of alternative options was considered to minimise impacts of the Project while undertaking this ESIA study. The alternative options assessed in the study ranged from technology, transportation methods, site and operations, including the no project alternative. Alternatives are considered in terms of their potential environmental impacts, the feasibility of mitigating these impacts alternatives for mitigation measures for high residual impact/risk, if any etc.

1.4.7 Risk Assessment

A risk assessment study was carried out to provide a systematic analysis of the major risks that may arise as a result of the operation of the proposed LNG storage and regasification facility (LNG facility) including an Onshore Receiving Facility (ORF) at *Kutubdia* Island. It involved rational evaluations of the identified risks based on their significance and provided an outline for appropriate preventive and risk mitigation measures. The output of the assessment contributed towards strengthening of emergency response planning in order to prevent damage to personnel, infrastructure and receptors in the immediate vicinity of the proposed facilities. The Risk Assessment and Disaster Management Plan is presented in form of a separately attached report.

1.4.8 Management Plans and Grievance Redress Mechanism

- Environmental and Social Management Plan (ESMP) were developed for the mitigation measures suggested and included defined roles and responsibilities for implementation;
- A grievance redress mechanism was developed to address any complaints and concerns from all stakeholders;
- Based on the risk assessment, risk reduction measures and recommendations for a disaster management plan (DMP) were also developed; and
- Institutional review and finalization of the EMP and grievance redress mechanism were completed in consultation with Reliance Power.

1.5 LIMITATIONS

ERM would like to highlight the following limitations to this ESIA document:

A project configuration has been developed by Reliance Power and preliminary feasibility has been established around the same. Detailed feasibility of the project components is currently being evaluated and is expected to be finalized by March 2017. The present draft of the ESIA considers the current project configuration along with the most likely projects options (as has been summarized in Section 3 of this report) and impacts for the same has been accordingly assessed.

The land requirement, ownership details and current status of land for various project components: (i) Onshore regasification facility, (ii) onshore pipeline, (iii) Napura valve station, (iv) approach road and any other facilities developed as part of the project are presently in the process of getting finalised by the Project Proponent. Detailed land acquisition and involuntary resettlement related impacts will be addressed in a separate document Resettlement Plan (RP) in line with the ADB SPS 2009.

Discussions with the project proponent indicated that technical designs would be further optimised in the final Feasibility Report and efforts made to the extent possible to reduce and minimise Involuntary Resettlement impacts.

Uses of this Report

The Client acknowledges that report provided by ERM in relation to the provision of Services is delivered to the Client solely for the Client's benefit. ERM, its officers, employees, contractors, and agents shall owe no duties, obligations or liabilities to any persons in connection with any use of or reliance on the Project information provided by Reliance. We make no warranties, express or implied, including without limitation, warranties as to merchantability or fitness for a particular purpose.

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lender through foreclosure proceedings or otherwise will not expose the lender to potential environmental or social liability.

1.6 DATA SOURCES

Key relevant information sources have been summarized in

Table 1.1 Data Sources for the ESIA

Parameters	Information sources	Remarks
Project Background, Technical details on project components and associated pipeline corridor	<ul style="list-style-type: none"> ▪ Site and Configuration Selection Report - Reliance Bangladesh LNG Import Terminal Feasibility Study , September 2016 ▪ Report on Reconnaissance Survey for LNG Terminal and Associated Pipeline at Kutubdia Island, Bangladesh, December 2016 ▪ Desktop Study for Site Screening in Chittagong and Moheshkhali Region, Bangladesh, March 2016 	Reliance Power Limited (RPL) provided other information as available during the course of the study
Study area features and sensitivities	<ul style="list-style-type: none"> ▪ Ground physical survey ▪ Satellite imageries ▪ National web portal of Bangladesh: www.bangladesh.gov.bd 	Details of the satellite data used is included in Baseline Section
Legal framework	<ul style="list-style-type: none"> ▪ Department of Environment ▪ Board of Investment, Bangladesh ▪ IFC and ADB documents 	In discussion with the DOE and local Govt. departments and RPL
Landuse/ Land cover details	<ul style="list-style-type: none"> ▪ Ground Physical Survey ▪ GIS based landuse analysis 	Details of the satellite data used is included in Baseline Section
Meteorology and climatic conditions	<ul style="list-style-type: none"> ▪ Bangladesh Meteorological Department ▪ Kutubdia Observatory Surface Meteorological Data 	
Geology, topography, soil, hydrology , drainage and met oceanic conditions	<ul style="list-style-type: none"> ▪ RPL's Site and Configuration Selection Report ▪ RPL's Desktop Study for Site Screening in Chittagong and Moheshkhali Region ▪ Bangladesh Water Development Board ▪ Soil Research and Development Institute of Bangladesh ▪ Scientific Papers and Technical Journals ▪ Previous EIA / ESIA Studies conducted in the Matarbari / Moheshkhali region ▪ Web portal of National Encyclopedia of Bangladesh (Banglapedia) 	In association with field observations
Natural hazards	<ul style="list-style-type: none"> ▪ Bangladesh Meteorological Department ▪ Upazila Disaster Management Committee, Kutubdia ▪ Study Reports and Research Papers ▪ Web portal of National Encyclopedia of Bangladesh (Banglapedia) 	Included in consultation with locals

Parameters	Information sources	Remarks
Environmental baseline as air quality, water quality, soil and sediment quality, noise and traffic	<ul style="list-style-type: none"> ▪ Primary data collection ▪ Applicable Standards from Department of Environment (DOE), Bangladesh 	Monitoring was completed from October to November 2016
Ecological parameters	<ul style="list-style-type: none"> ▪ Primary data collection, observations, surveys and local consultations ▪ Websites of birdlife international ▪ IUCN Data base ▪ Chittagong Coastal Forest Division ▪ Coastal Forest Department Office, Kutubdia ▪ Marineliflife Alliance, Cox's Bazar ▪ Study Reports and Research Papers 	Survey was carried out in month of Nov 2016. Endangered, critical status was checked from the website www.iucnredlist.org
Socio-economic parameters	<ul style="list-style-type: none"> ▪ Primary data collection surveys, extensive consultations, meetings and discussions held with stakeholders ▪ Bangladesh population and housing census for 2011 for Cox's Bazar District ▪ General Economics Division, Planning Commission, Government of Bangladesh ▪ Bangladesh Bureau of Statistics ▪ Department of Fisheries, Ministry of Fisheries and Livestock, Bangladesh ▪ Divisional Fisheries Office, Cox's Bazar ▪ Office of Dy. Commissioner, Cox's Bazar ▪ Land Revenue Department, Cox's Bazar ▪ Office of Upazila Nirbahi Officer (UNO), Kutubdia ▪ Fisheries Cell, Kutubdia ▪ Upazila Health Complex, Kutubdia ▪ Upazila Education Office, Kutubdia ▪ Agriculture Department, Kutubdia ▪ BSCIC Salt Office, Cox's Bazar ▪ Web portal of National Encyclopaedia of Bangladesh (Banglapedia) 	Field surveys and consultations was carried out in month of August and November 2016 Details provided in section on baseline environmental and social conditions

A detailed list of references is annexed at the end of the report as *Annex1*.

1.7 STRUCTURE OF ESIA REPORT

The content of the ESIA has been largely structured based on the ADB's Safeguard Policy Statement (Outline of an Environmental Impact Assessment Report). The layout of the Report is as follows:

- Section 1 Introduction
- Section 2 Policy, Legal and Administrative Framework
- Section 3 Description of the Project
- Section 4 Description of the Environment

- Section 5 Anticipated Environmental and Social Impacts and Mitigation Measures
- Section 6 Analysis of Alternatives
- Section 7 Information Disclosure, Consultation and Participation
- Section 8 Grievance Redress Mechanism
- Section 9 Environment and Social Management Plan
- Section 10 Conclusions and Recommendations

2 *POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK*

2.1 *INTRODUCTION*

To address environmental and social risks of any project and its associated components and to protect and conserve the environment from any adverse impacts, the GoB has specified regulations, policy and guidelines. Potential Lenders' also have their own set of requirements (such as the ADB's Safeguard Policy and IFC's Performance Standards) to which any project funded by them must operate.

This Section focuses on the administrative framework under the purview of which the Project will fall and the ESIA study will be governed, namely:

- Bangladesh national and local, legal and institutional framework;
- ADB Policies and framework;
- IFC Performance Standards and EHS Guidelines.

2.2 *ENVIRONMENT-RELATED POLICIES IN BANGLADESH*

The GoB has developed a policy framework that requires environmental issues to be incorporated into economic development planning. The key tenets of the various applicable policies are detailed in the following subsections.

2.2.1 *National Environmental Policy, 1992*

The Bangladesh National Environmental Policy, approved in May 1992, sets out the basic framework for environmental action together with a set of broad sectoral action guidelines.

The Policy requires specific actions with respect to the industrial sector which are as follows:

- To phase-in corrective measures in polluting industries;
- To conduct Environmental Impact Assessments (EIAs) for all new public and private industrial developments;
- To ban, or find environmentally sound alternatives for, the production of goods that cause environmental pollution; and
- To minimize waste and ensure sustainable use of resources by industry.

The policy also states that EIA's should be conducted before projects are undertaken and the Department of Environment (DOE) is directed to review and approve all Environmental Impact Assessments.

2.2.2 Other Policies relevant to Environment

Other important policies in Bangladesh and their key features and applicability to the subject Project are detailed in *Table 2.1*.

Table 2.1 Policies relevant to Environment

Policy	Key Features	Applicability
National Conservation Strategy, 1992	<ul style="list-style-type: none"> ▪ All industries shall be subject to an EIA; ▪ Adoption of pollution prevention/control technologies shall be enforced; ▪ Hazardous or toxic materials/wastes shall not be imported as raw materials; ▪ Import of appropriate and environmentally-sound technology; ▪ Dependence on imported technology and machinery gradually be reduced in favour of sustainable local skills and resources. 	Applicable as the project is an industrial sector project
The National Forest Policy, 1994	<ul style="list-style-type: none"> ▪ Afforestation of 20% land ▪ Bio-diversity of the existing degraded forests ▪ Strengthening of the agricultural sector ▪ Control of Global warming, desertification ▪ Control of trade in wild birds and animals ▪ Prevention of illegal occupation of the forested land, tree felling and hunting of wild animals 	Applicable when considering global warming and the protection of forests
National Land Transport Policy, 2004	<ul style="list-style-type: none"> ▪ All new roads and major improvements will be subjected to an EIA ▪ Funding will be provided for mitigation measures ▪ The Government will publish environmental standards for new roads and new design standards addressing environmental issues 	Not directly applicable, however, the standards may apply for the project approach road (that will be refurbished and strengthened)
The National Water Policy, 1999	<ul style="list-style-type: none"> ▪ Protection, restoration and enhancement of water resources ▪ Protection of water quality, including strengthening regulations concerning agrochemicals and industrial effluent ▪ Sanitation and potable water ▪ Fish and fisheries ▪ Participation of local communities in all water sector development 	Applicable for the preservation of water quality Applicable, the bay and the <i>Kutubdia</i> Channel will also be used for transport of LNG and construction materials.
National Landuse Policy, 2001	<ul style="list-style-type: none"> ▪ Deals with several land uses including: agriculture (crop production, fishery and livestock), housing, forestry, industrialization, railways and roads, tea and rubber ▪ Identifies land use constraints in all these sectors 	Applicable as land use changes from sandy beach / agricultural to industrial

Policy	Key Features	Applicability
Draft Wetland Policy, 1998	<ul style="list-style-type: none"> ▪ Establishment of principles for the sustainable use of wetland resources ▪ Maintenance of the existing level of biological diversity ▪ Maintenance of the functions and values of wetlands ▪ Promotion and recognition of the value of wetland functions in resource management and economic development 	Not directly applicable, however may be applicable once the draft policy is finalised
National Fisheries Policy, 1998	<ul style="list-style-type: none"> ▪ Preservation, management and exploitation of fisheries resources in inland open water ▪ Fish cultivation and management in inland closed water. ▪ Prawn and fish cultivation in coastal areas ▪ Preservation, management and exploitation of sea fishery resources 	Applicable as fishing is the prime occupation of the community in Kutubdia.
National Agriculture Policy, 1999	<ul style="list-style-type: none"> ▪ The Policy deals with the programs related to make the nation self-sufficient in food through increasing production of all crops, including cereals, and ensure a dependable food security system for all 	Not applicable
The Energy Policy, 1996	<ul style="list-style-type: none"> ▪ Provides for utilization of energy for sustainable economic growth, supply to different zones of the country, development of the indigenous energy source and environmentally sound sustainable energy development programmes ▪ Highlights the importance of EIA's for any new energy development project 	Not directly applicable
The Power Policy, 1995	<ul style="list-style-type: none"> ▪ Is an integral part of the Energy Policy and deals with policy statement on demand forecast, long term planning and project implementation, investment terms, fuels and technologies, load management, institutional issues, private sector participation, technology transfer and research programme, environmental policy and legal issues 	Applicable as the interlinked project is a power plant. The project also includes a captive power plant.
Industrial Policy, 1999	<ul style="list-style-type: none"> ▪ Deals with industrial development, direct foreign investments, investment by public and private sector, introduction of new appropriate technology, women's participation, infrastructure development and environmentally sound industrial development 	Applicable as the Project is a private sector, industrial development

2.3 ENVIRONMENT AND SOCIAL RELATED LEGISLATIONS IN BANGLADESH

The main Acts and Regulations guiding environmental protection and conservation in Bangladesh are outlined in the following subsections and *Table 2.2*.

2.3.1 *The Environment Conservation Act, 1995 (as amended in 2000, 2002 & 2010)*

The provisions of the Act authorize the Director General of Department of Environment (DOE) to undertake any activity that is deemed fit and necessary

to conserve and enhance the quality of environment and to control, prevent and mitigate pollution. The main highlights of the act are:

- Declaration of Ecologically Critical Areas;
- Obtaining Environmental Clearance Certificate;
- Promulgation of standards for quality of air, water, noise, and soils for different areas and for different purposes;
- Promulgation of acceptable limits for discharging and emitting waste; and
- Formulation of environmental guidelines relating to control and mitigation of environmental pollution, conservation and improvement of environment.

2.3.2 *Environment Conservation Rules (ECR), 1997 (as amended in 2002 & 2003)*

The Environment Conservation Rules, 1997 are the first set of rules promulgated under the Environment Conservation Act, 1995. These Rules provide for, inter-alia, the following:

- The National Environmental Quality Standards (EQS) for ambient air, surface water, groundwater, drinking water, industrial effluents, emissions, noise and vehicular exhaust;
- Categorization of industries, development projects and other activities on the basis of actual (for existing industries/development projects/activities) and anticipated (for proposed industries/development projects/activities) pollution load;
- Procedure for obtaining Environmental Clearance Certificate;
- Requirements for undertaking IEE and EIA's as well as formulating EMP according to categories of industries/development projects/activities; and
- Procedure for damage-claim by persons affected or likely to be affected due to polluting activities or activities causing hindrance to normal civic life.

2.3.3 *Acquisition and Requisition of Immovable Property Ordinance, 1982*

The basic principles behind compensation of property in Bangladesh are founded in Articles 42 and 47 of the Constitution (1972). The current legislation for governing land acquisition in Bangladesh is the "Acquisition and Requisition of Immovable Property Ordinance (ARIPO), 1982 and amended in 1983, 1993 and 1994. Key features of the ordinance are as follows:

- This Ordinance provides the Deputy Commissioner (DC) with the power to initiate the acquisition of any property in any locality within his district that is likely to be needed for a public purpose or in the public interest.
- It also defines the process to claim compensation.
- It describes the entire procedure of notice and intimations prior to acquisition of any property and process and timeframes for raising objections.
- It defines the role and authority of Deputy Commissioner in decision making, compensation issues and in case of dispute. Among the matters to be considered in determining compensation are the following:

- The damage that may be sustained by the person interested, by reason of the taking of standing crops or trees which may be on the property at the time of taking possession thereof by the Deputy Commissioner,
 - The damage that may be sustained by reason of the acquisition injuriously affecting his other properties, movable or immovable, in any other matter, or his earnings; and
 - If in consequence of the acquisition of the property, the person interested is likely to be compelled to change his residence or place of business, the reasonable expenses, if any, incidental to such change; In terms of compensation, the Ordinance explicitly states that the DC, when determining compensation, shall neither consider any disinclination of the person to part with the property, nor any increase in the value of the property to be acquired likely to accrue from the use of it after it has been acquired.
- The Ordinance also covers the case of temporary acquisition of property for a public purpose or in the public interest.

It is anticipated that the project may undergo through land acquisition process for its facilities – onshore facilities and the onshore gas pipeline.

Property (Emergency) Acquisition Act, 1989

The Act was formulated to expedite the emergency acquisition of land to enable the Government 'to control inundation, flood and upsurge caused by natural calamity and to prevent river erosion.' The 1989 Act was not meant to replace the 1982 Ordinance, but to complement it for special circumstances. Normally, acquisition of land for development purposes would not come under the 1989 Act. Use of this Act to acquire land for development would require extremely compelling reasons.

2.3.4 Framework for Leasing of Government (Khas) Agricultural Land

The rules for managing and leasing Government-owned (*khas*) land are notified through two Bangladesh Gazette notifications i.e. : (1) Notification: Bhumo/Sho-8/Kha-jo-bo/46/84/261, Bangladesh Gazette Extra Edition dated May 12, 1997, pp 1527-1536; and (2) Notification: Shuno/Sho-4/Kri-kha-jo--bo-1/98-264, Bangladesh Gazette, September 15, 1998.

Under these regulations, the Government leases cultivable agricultural land in the rural areas to landless farming households. The allotments cannot be more than one acre, except in the southern districts where up to 1.5 acres of char land can be allotted.

The regulation further defines structure and responsibilities for management and leasing of *Khas* Lands at the National, District, and Thana levels.

2.3.5 Other Relevant National Legal Instruments for the Project

Table 2.2 presents an outline of other National legal instruments that will have relevance to the proposed Project with respect to the social and environmental considerations.

Table 2.2 National Legal Instruments relevant to the Project

Act / Rule / Law / Ordinance	Enforcement Agency – Ministry / Authority	Key Features	Applicability to the Project
The Environment Conservation Act, 1995 and subsequent amendments in 2000 and 2002	Department of Environment Ministry of Environment and Forests,	<ul style="list-style-type: none"> ▪ Define applicability of environmental clearance ▪ Regulation of development activities from environmental perspective ▪ Framing applicable limits for emissions and effluents ▪ Framing of standards for air, water and noise quality ▪ Formulation of guidelines relating to control and mitigation of environmental pollution, conservation and improvement of environment ▪ Declaration of Ecologically critical areas 	Applicable
Environmental Conservation Rules, 1997 and subsequent amendments in 2002 and 2003	Department of Environment Ministry of Environment and Forests	<ul style="list-style-type: none"> ▪ Declaration of Ecologically critical areas ▪ Requirement of environmental clearance certificate for various categories of projects ▪ Requirement of IEE/EIA as per category ▪ Renewal of the environmental clearance certificate within 30 days after the expiry ▪ Provides standards for quality of air, water and sound and acceptable limits for emissions/ discharges from vehicles and other sources 	Applicable Projects falls under Red Category and require environmental clearance
Environment Court Act, 2000 and subsequent amendments in 2002	Ministry of Environment and Forests and Judiciary	<ul style="list-style-type: none"> ▪ Highest priority accorded to environment pollution ▪ Completion of environment related legal proceedings effectively 	Applicable for completing environmental legal requirements effectively

Act / Rule / Law / Ordinance	Enforcement Agency - Ministry / Authority	Key Features	Applicability to the Project
The Vehicle Act, 1927; The Motor Vehicles Ordinance, 1983; and The Bengal Motor Vehicle Rules, 1940	Bangladesh Road Transport Authority	<ul style="list-style-type: none"> Exhaust emissions Vehicular air and noise pollution Road/traffic safety Vehicle Licensing and Registration Fitness of Motor Vehicles Parking by-laws. 	Applicable for proposed Project in relation to road transport
The Removal of Wrecks and Obstructions in inland Navigable Water Ways Rules 1973	Bangladesh Water Transport Authority	<ul style="list-style-type: none"> Removal of wrecks and obstructions in inland navigable waterways 	May be applicable if the Kutubdia Channel - a navigable waterway is used for transport of heavy equipment and raw material during the construction stage of the Project
Water Supply and Sanitation Act, 1996	Ministry of Local Government, Rural Development and Cooperatives	<ul style="list-style-type: none"> Management and Control of water supply and sanitation in urban areas. 	Not directly applicable, however, indirectly applicable when considering water usage management and sanitation facilities
The Ground Water Management Ordinance, 1985	Upazila Parishad	<ul style="list-style-type: none"> Management of ground water resources Installation of tube-wells at any place after license from Upazila Parishad only 	Proposed Project will use surface water source however, should groundwater also be required then licenses will need to be obtained prior to installation of any tube-wells.
The Forest Act, 1927 and subsequent amendments in 1982 and 1989	Ministry of Environment and Forests	<ul style="list-style-type: none"> Categorization of forests as reserve, protected and village forests Permission is required for use of forest land for any non-forest purposes 	Not directly applicable as proposed Project is not on forest land. However the identified project site includes social forestry plantations (i.e. Jhauban – Casuarina plantations) that have been planted by the Forest Department to act as shelter belts. Consultations with the Range Office, Kutubdia reported that land for such shelter belts are under the possession of UNO Kutubdia and are made available to the Forest Department for such plantation through community participation. Felling of such trees will necessitate approval from local level DFO, Chittagong Coastal Forest Division and at the central level from Chief Conservator of Forests, Dhaka and may require NOC from the Forest Department.

Act / Rule / Law / Ordinance	Enforcement Agency - Ministry / Authority	Key Features	Applicability to the Project
The Private Forests Ordinance Act, 1959	Regional Forest Officer, Forest Department	<ul style="list-style-type: none"> Conservation of private forests and for the afforestation on wastelands 	Not applicable as the project area does not have any private forests.
Bangladesh Wild Life (Preservation) Act, 1974	Ministry of Environment and Forest; Bangladesh Wild Life Advisory Board	<ul style="list-style-type: none"> Preservation of Wildlife Sanctuaries, Parks, and Reserves 	Not applicable as the Project study area does not have any wildlife areas
National Biodiversity Strategy and Action Plan (2004)	Ministry of Environment and Forest Bangladesh Wild Life Advisory Board	<ul style="list-style-type: none"> Conserve, and restore the biodiversity of the country Maintain and improve environmental stability for ecosystems Guarantee the safe passage and conservation of globally endangered migratory species, especially birds and mammals in the country 	Applicable for conservation of bio-diversity
National Water Bodies Protection Act, 2000	Town development authority/Municipalities	<ul style="list-style-type: none"> The characterization of water bodies as rivers, canals, tanks or flood plains identified in the master plans formulated under the laws establishing municipalities in division and district towns shall not be changed without approval of concerned ministry 	Applicable due to the proximity to and use of surface water bodies
The Protection and Conservation of Fish Act 1950 subsequent amendments in 1982	Ministry of Fisheries and Livestock	<ul style="list-style-type: none"> Protection and conservation of fish in Government owned water bodies 	Applicable for the conservation of fish as the FSU will be located in the Bay of Bengal
The Embankment and Drainage Act 1952	Ministry of Water Resources	<ul style="list-style-type: none"> An Act to consolidate the laws relating to embankment and drainage and to make better provision for the construction, maintenance, management, removal and control of embankments and water courses for the better drainage of lands and for their protection from floods, erosion and other damage by water 	Applicable due to the site location and presence of an existing earthen coastal embankment near to the site for land based facilities

Act / Rule / Law / Ordinance	Enforcement Agency - Ministry / Authority	Key Features	Applicability to the Project
Antiquities Act, 1968	Ministry of Cultural Affairs	<ul style="list-style-type: none"> This legislation governs preservation of the national cultural heritage, protects and controls ancient monuments, regulates antiquities as well as the maintenance, conservation and restoration of protected sites and monuments, controls planning, exploration and excavation of archaeological sites 	Not applicable as the study area does not have any likely cultural heritage or ancient monuments of national or international significance. However in case, any such evidence of archaeological findings arise, the Project will act in consonance to the Act
The Acquisition and Requisition of Immovable Property Ordinance 1982 and subsequent amendments in 1994, 1995 and 2004	Ministry of Land	<ul style="list-style-type: none"> Current GOB Act and Guidelines, relating to acquisition and requisition of land 	Applicable
Administrative and Regulatory Guidelines and Instructions for Land Acquisition	Ministry of Land	<ul style="list-style-type: none"> Regulation of land acquisition process by certain administrative instructions and procedural requirements 	Applicable
Framework for Leasing of Government (Khas) Agricultural Land	Ministry of Land	<ul style="list-style-type: none"> The rules for allotting and leasing Government-owned (khas) land to land less families 	Not directly applicable but indirectly if a family becomes landless in the process of acquisition
The Building Construction Act 1952 and subsequent amendments	Ministry of Works	<ul style="list-style-type: none"> This act provide for prevention of haphazard construction of building and excavation of tanks which are likely to interfere with the planning of certain areas in Bangladesh 	Applicable
The Factories Act, 1965 Bangladesh Labour Law, 2006	Ministry of Labour	<ul style="list-style-type: none"> This Act pertains to the occupational rights and safety of factory workers and the provision of a comfortable work environment and reasonable working conditions 	Applicable
Ozone Depleting Substances (Control) Rules, 2004	Ministry of Environment and Forests	<ul style="list-style-type: none"> Ban on the use of Ozone depleting substances Phasing out of Ozone depleting substances 	Applicable

Act / Rule / Law / Ordinance	Enforcement Agency - Ministry / Authority	Key Features	Applicability to the Project
Noise Pollution (Control) Rules 2006	Ministry of Environment and Forests	<ul style="list-style-type: none"> Prevention of Noise pollution Standards for noise levels 	Applicable
Territorial Water and Maritime Zones Act- 1974 & Rules- 1977	Bangladesh Navy	<ul style="list-style-type: none"> Preventing and controlling marine pollution and preserving the quality and ecological balance in the marine environment in the high seas adjacent to the territorial waters 	Applicable as the Project has provision of transportation through marine and adjacent inland waterways within Bangladesh territory and may have pollution impact in the surrounding water ways.
Ports Act- 1908	Ministry of Shipping	<ul style="list-style-type: none"> Prohibits the discharge of ballast, rubbish and oil into any port or adjacent areas; Prohibits the discharge of ballast, rubbish and oil into any port or adjacent areas 	Applicable as the Project has likeliness of pollutant discharges (oil, grease, oily water, bilge and ballast water, rubbish etc.), creation of fires, creation of obstacles for navigation and spread of infectious diseases in the surrounding environment or damage of shore/bank
Bangladesh Merchant Shipping Ordinance- 1983	Ministry of Shipping	<ul style="list-style-type: none"> Regulates engagement of sea men for maritime activities 	Applicable as the Project has provision of engagement of seaman during project activities.
Coast Guard Act-1994	Bangladesh Coast Guard	<ul style="list-style-type: none"> Preventing and controlling marine pollution 	Applicable as the Project has likeliness of pollution discharges and requires compliance to this act.

Source: Websites of DOE, Legislative and Parliamentary Affairs Division: Bangladesh Laws and Bangladesh Board of Investment: Business laws

2.4 ADMINISTRATIVE SETUP RELATED TO ENVIRONMENT IN BANGLADESH

The Ministry of Environment & Forest (MoEF) is the nodal agency in the administrative structure of the GOB, for overseeing all environmental matters relating to national environmental policy and regulatory issues in the country. The MoEF oversees the activities of the following technical/implementing agencies:

- Department of Environment (DOE);
- Forest Department (FD);
- Bangladesh Forest Industries Development Corporation (BFIDC);
- Bangladesh Forest Research Institute (BFRI); and
- Bangladesh National Herbarium (BNH).

Other Related Organizations

Other organisations that would also govern social and environmental functions related to the proposed Project, include:

- Forest Department;
- Ministry of Land: Land reform and land acquisition directorate;
- Ministry of water resources: Bangladesh Water Development Board; and
- Local Government Engineering Department (LGED).

2.4.1 *Department of Environment (DOE)*

The DOE has been placed under the MoEF as its technical wing and is statutorily responsible for the implementation of the *Environment Conservation Act, 1995*. The principal activities of the DOE are:

- Defining EIA procedures and issuing environmental clearance permits - the latter being the legal requirement before the proposed Project can be implemented;
- Providing advice or taking direct action to prevent degradation of the environment;
- Pollution control, including the monitoring of effluent sources and ensuring mitigation of environmental pollution;
- Setting the Quality Standards for environmental parameters;
- Declaring Ecologically Critical Areas (ECAs), where the ecosystem has been degraded to a critical state; and
- Review and evaluation of Initial Environmental Examinations (IEEs) and EIAs prepared for projects in Bangladesh.

Environmental Clearance Process

The ECR 1997 has classified projects to be assessed by the DOE in four categories based on the severity of impacts on IECs:

- Green: Nil;

- Orange A: minor;
- Orange B: medium; and
- Red: severe.

The applicability of environmental clearance and the process in Bangladesh is described in *Figure 2.1*.

The EIA process consists of three stages, screening, IEE, and detailed EIA:

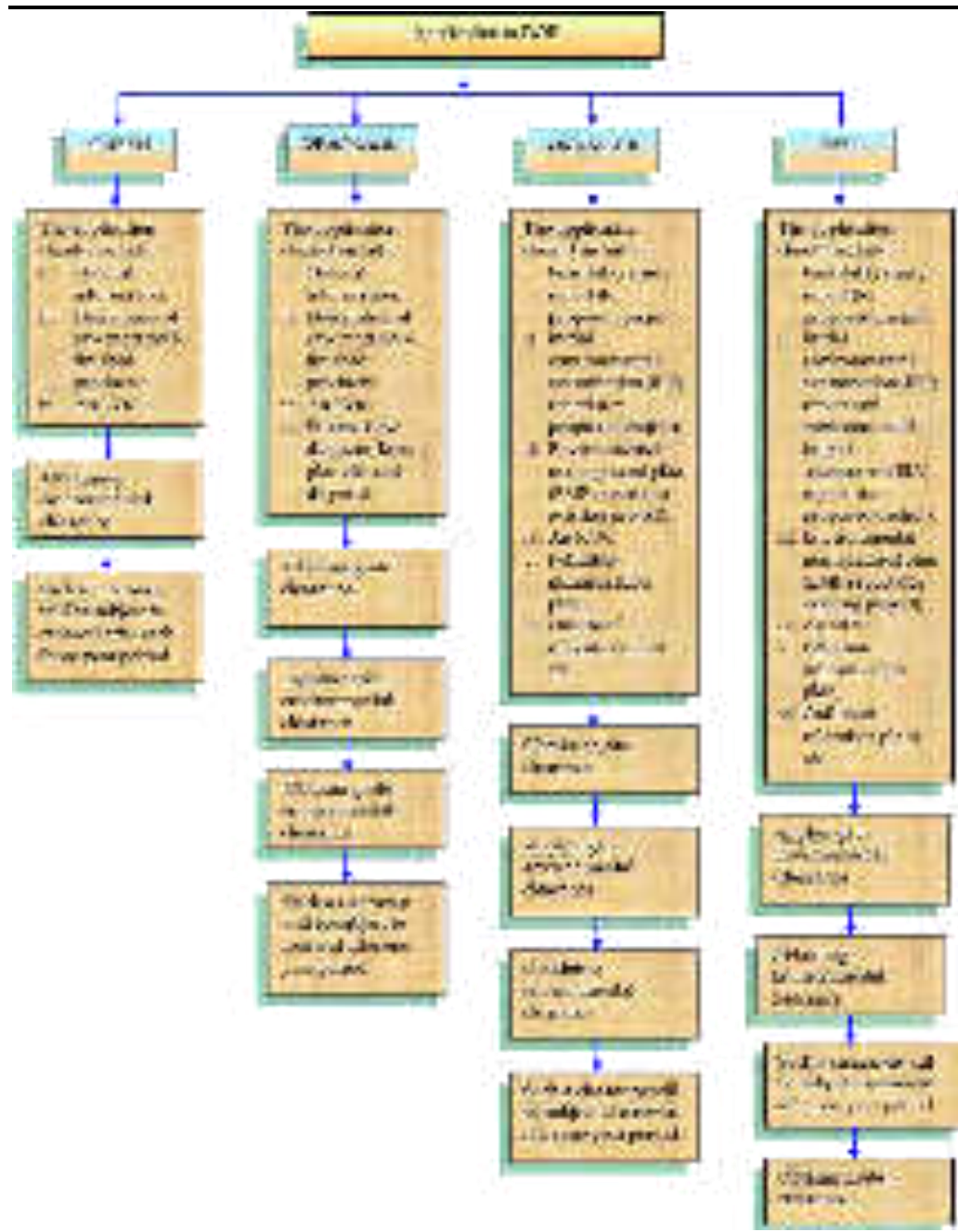
- Projects categorized as Green and Orange-A requires no IEE or EIA for environmental clearance however, the proponent has to submit an application in a prescribed format along with specified documents;
- Projects categorized as Orange-B require an IEE to be submitted to the DOE along with an application in a prescribed format and other specified documents; and
- Red category projects require both IEE and EIA. An IEE is required for the location clearance and an EIA is required for the environmental clearance.

As per the *ECR 1997*, the subject Project falls under the *Red* category as it falls within the following:

- Item 6: Power Plants
- Item 65: Exploration/extraction/distribution of mineral resources;
- Item 64: Water, power and gas distribution line laying / relaying / extension.

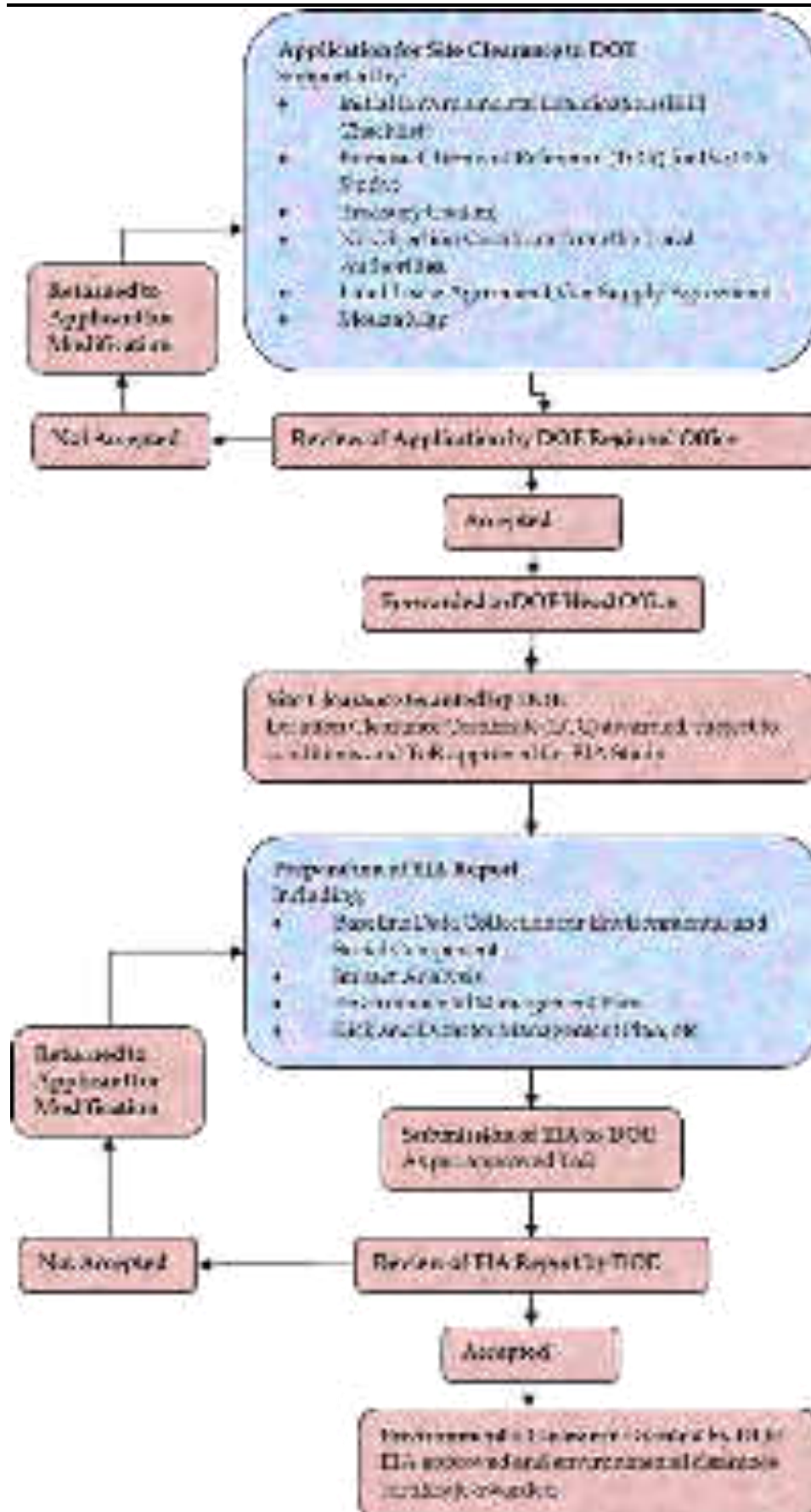
The process for obtaining an Environmental Clearance Certificate (ECC) for the proposed Project is outlined in *Figure 2.2*

Figure 2.1 DOE Environmental Clearance Applicability and Procedure



Source: Adapted from DOE

Figure 2.2 Flow Chart of EIA Process Applicable to the Proposed Project



Source: Adapted from DOE

2.4.2 Status of Project Approval from DOE

The Project will apply for the Site Clearance Certificate and Environmental Clearance Certificate after signing of formal agreement with the Govt. of Bangladesh.

The present ESIA Report, which has been prepared for potential lenders to fulfil the safeguard requirements, will be updated as and if necessary in accordance with the terms of reference (TOR) to be issued by the DOE and then submitted to the DOE for obtaining Environmental Clearance Certificate.

2.5 INSTITUTIONAL ARRANGEMENTS RELATED TO LAND ACQUISITION IN BANGLADESH

The administrative set up for land acquisition has two tiers under the Ministry of Land Administration. At the Division level, there is an Additional Commissioner dealing with land administration under the Commissioner. At the district level, there is an Additional Deputy Commissioner (ADC) in charge of land administration. Under him, there is at least one Land Acquisition Officer and several Assistant Land Acquisition Officers. The number of officers depends on the size of the District. Non-gazette officers in the land administration include Kanungos and surveyors.

The Deputy Commissioner allows 15 days to invite objections on the notice for land acquisition/requisition under section-3. If no objection is raised within the specified period, the Deputy Commissioner makes a decision within 10 days of the expiry of the notice period. If objections are received by Deputy Commissioner, then the records of the objection raised along with the inquiry made by him submits to the Divisional Commissioner if property does not exceed 50 standard bighas, and submits to Government of Republic of Bangladesh if the property exceeds 50 standard bighas. The decision of the Government or Divisional Commissioner as the case may be, is final provided the decision by Divisional Commissioner is made within 15 days and the decision made by Government of Bangladesh is done within 90 days. The decision by the Government or Divisional commissioner shall be conclusive evidence that the property is needed for a public interest.

The Deputy Commissioner serves the notice of acquisition of the property under section-6 requiring the all persons interested in the property to state the nature of their respective interests in the property and particulars of their claims to compensation for such interests not being earlier than fifteen days after the date of publication of the notice. After examining all the claims/statements received from all interested parties shall make an award stating the compensation and any apportionment of the said compensation. Deputy Commissioner shall give notice of his award to the persons interested and send the estimate of the award of compensation to the requiring person within 7 days from the date of making award of compensation.

Section 10 makes the payment of the compensation before taking the possession of the property. If the persons entitled do not consent to receive it, or any dispute over the apportionment then the amount of the compensation is deposited in the Public Account of the Republic which is considered as deemed payment for the purpose of taking over possession.

Any person interested who has not accepted any award made by the Deputy Commissioner within 45 days of the service of the award, make an application to the arbitrator for revision of the award. Section-30 restricts the scope of the enquiry by the Arbitrator to a consideration of interests of the persons affected by the objection. Arbitrator shall be guided by the provisions of the sections 8, 9 or 20 provided that the compensation determined by the Arbitrator shall not exceed more than 10 per centum of the award of the Deputy Commissioner. An appeal shall lie to the Arbitration Appellate Tribunal against the award of the Arbitrator and the decision of the Tribunal shall be final.

After the compensation for the property is paid or is deemed to be paid, Deputy Commissioner publishes a notice to that effect in official Gazette. The notice concludes the land acquisition procedure and vests the property absolutely in the government free from all encumbrances, and Deputy Collector takes the possession of the property.

2.6 PROJECT RELEVANT INTERNATIONAL TREATIES AND CONVENTIONS

Bangladesh is party to a number of international environmental convention, treaties and agreements. The Project relevant international treaties and conventions relevant to the project signed, ratified and in the process of ratification by Bangladesh are detailed in *Table 2.3*.

Table 2.3 *Project Relevant International Treaties and Conventions*

SN	Environment related International convention and Treaties	Status
1	International Plant Protection Convention (Rome, 1951.)	01.09.78 (ratified)
2	International Convention for the Prevention of Pollution of the Sea by Oil (London, 1954 (as amended on 11 April 1962 and 21 October 1969.)	28.12.81 (entry into force)
3	Plant Protection Agreement for the South East Asia and Pacific Region (as amended) (Rome, 1956.)	04.12.74 (accessed) (entry into force)
4	International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties (Brussels, 1969.)	04.02.82 (entry into force)
5	Convention on Wetlands of International Importance especially as Waterfowl Habitat (Ramsar, 1971) ("Ramsar Convention").	20.04.92 (ratified)
6	Convention Concerning the Protection of the World Cultural and natural Heritage (Paris, 1972.)	03.08.83 (accepted) 03.11.83 (ratified)
7	Convention on International Trade in Endangered Species of Wild Fauna and flora (Washington, 1973.) (CITES Convention)	18.02.82 (ratified)
8	United Nations Convention on the Law of the Sea (Montego Bay, 1982.)	10.12.82 (ratified)
9	Vienna Convention for the Protection of the Ozone Layer (Vienna, 1985.)	02.08.90 (accessed) 31.10.90 (entry into force)

SN	Environment related International convention and Treaties	Status
10	Montreal Protocol on Substances that Deplete the Ozone Layer (Montreal 1987.)	02.08.90 31.10.90 (accessed) (entry into force)
11	London Amendment to the Montreal Protocol on substances that Deplete the Ozone Layer (London, 1990)	18.03.94 (accessed) 16.06.94 (entry into force)
12	Copenhagen Amendment to the Montreal protocol on Substances that Deplete the Ozone Layer, Copenhagen, 1992	27.11.2000 (accepted) 26.2.2001 (entry into force)
13	Montreal Amendment of the Montreal Protocol on Substances that Deplete the Ozone Layer, Montreal, 1997	27.7.2001 (accepted) 26.10.2001 (entry into force)
14	Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Disposal (Basel, 1989.)	01.04.93 (accessed)
15	International Convention on Oil Pollution Preparedness, Response and Cooperation (London, 1990.)	30.11.90 (signed) In the process of ratification
16	United Nations Framework Convention on Climate Change, (New York, 1992.)	09.06.92 (signed) 15.04.94 (ratified)
17	Convention on Biological Diversity, (Rio De Janeiro, 1992.)	05.06.92 (signed) 03.05.94 (ratified)
18	International Convention to Combat Desertification, (Paris 1994.)	14.10.94 (signed) 26.01.1996 (ratification) 26.12.1996 (entry into force)
19	Convention on the Prohibition of Military or Any Other Hostile Use of Environmental Modification Techniques, (Geneva, 1976.)	03.10.79 (accessed) (entry into force)
20	Agreement Relating to the Implementation of Part XI of the United Nations Convention on the Law of the Sea of 10 December 1982 (New York, 1994.)	28.07.96 (signed)
21	Convention on the Prohibition of the Development, Production, Stockpiling and Use of Chemical Weapons and on their Destruction (Paris, 1993.)	14.01.93 (signed)
22	Convention on persistent Organic Pollutants, Stockholm	23.5.2001 (signed) 12.03.2007 (ratified)
23	Kyoto protocol to the United Nations Framework Convention on Climate Change	21.8.2001 (accessed)

Source: DOE, Bangladesh

2.7 RELEVANT NATIONAL & MARITIME REGULATIONS/STANDARDS

2.7.1 International Maritime Conventions, Protocols and Agreements applicable for LNG Transportation

The International Maritime Organization (IMO) came into existence in 1958 but before that, several important international conventions had already been developed including the International Convention for the Safety of Life at Sea of 1948, the International Convention for the Prevention of Pollution of the Sea by Oil of 1954 and treaties dealing with load lines and the prevention of collisions at sea. However, IMO was made responsible for ensuring that the majority of these conventions were kept up to date. It was also given the task of developing new conventions as and when required. Bangladesh is signatory of the IMO and therefore, all activities relating to shipment of LNG shall have to be done strictly in compliance with the standards set by the IMO, particularly the conventions, protocols and agreements. The conventions / protocols relevant for the proposed project and agreed by GOB are highlighted in table below:

Table 2.4 *International maritime conventions, protocols and agreements relevant to the Project*

Issues	Conventions, Protocols and Agreements	Remarks
Maritime Safety	<p>International Convention for the Safety of Life at Sea (SOLAS), 1960 and 1974 (and all other amendments which include IMSBC code to create an amendments to SOLAS chapter-VI and to make the code mandatory and adopted by maritime safety committee in 2008).</p> <p>International Convention on Load Lines (LL), 1966 (and all amendments)</p> <p>Convention on the International Regulations for Preventing Collisions at Sea (COLREG), 1972 (and all amendments)</p> <p>International Convention for Safe Containers (CSC), 1972 (and all amendments)</p> <p>Convention on the International Maritime Satellite Organization (INMARSAT), 1976 (and all amendments)</p> <p>International Convention on Maritime Search and Rescue (SAR), 1979</p>	<p>Applicable-as safety and pollution issues are addressed.</p> <p>Applicable-as limitation of draft and load issues are addressed for safety of the ship.</p> <p>Applicable-as the convention provided guidelines for avoidance of collisions.</p> <p>Applicable-as it provided guidelines for high level safety of containers to avoid incidents.</p> <p>Applicable- as it is related to guidance of maritime communication and safety at sea.</p> <p>Applicable- as search and rescue plan (SARP) through cooperation with relevant government are addressed.</p>
Marine pollution	<p>International Convention for the Prevention of Pollution of the Sea by Oil (OILPOL), 1954 (including all amendments)</p> <p>Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (LDC), 1972 (including all amendments)</p> <p>International Convention for the Prevention of Pollution from Ships (MARPOL), Adoption: 1973 (Convention), 1978 (1978 Protocol), 1997 (Protocol - Annex VI); Entry into force: 2 October 1983 (Annexes I and II).</p> <p>MARPOL, Annex I Regulations for the Prevention of Pollution by Oil (entered into force 2 October 1983)</p>	<p>Applicable-as the convention controls deliberate discharge of oil and oil mixture from the sea going vessels causing environmental impacts.</p> <p>Applicable-as the convention represents international control and prevention of marine pollution due to dumping of wastes and other matter.</p> <p>Applicable- The Convention includes regulations aimed at preventing and minimizing pollution from ships - both accidental pollution and that from routine operations - and currently includes six technical Annexes.</p> <p>Covers prevention of pollution by oil from operational measures as well as from accidental discharges; the 1992 amendments to Annex I made it mandatory for new oil tankers to have double hulls and brought in a phase-in schedule for existing tankers to fit double hulls, which was subsequently revised in 2001 and 2003</p>

Issues	Conventions, Protocols and Agreements	Remarks
	MARPOL, Annex II Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk (entered into force 2 October 1983)	Details the discharge criteria and measures for the control of pollution by noxious liquid substances carried in bulk; some 250 substances were evaluated and included in the list appended to the Convention; the discharge of their residues is allowed only to reception facilities until certain concentrations and conditions (which vary with the category of substances) are complied with. In any case, no discharge of residues containing noxious substances is permitted within 12 miles of the nearest land.
	MARPOL, Annex III Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form (entered into force 1 July 1992)	Contains general requirements for the issuing of detailed standards on packing, marking, labelling, documentation, stowage, quantity limitations, exceptions and notifications. For the purpose of this Annex, “harmful substances” are those substances which are identified as marine pollutants in the International Maritime Dangerous Goods Code (IMDG Code) or which meet the criteria in the Appendix of Annex III.
	MARPOL, Annex IV Prevention of Pollution by Sewage from Ships (entered into force 27 September 2003)	Contains requirements to control pollution of the sea by sewage; the discharge of sewage into the sea is prohibited, except when the ship has in operation an approved sewage treatment plant or when the ship is discharging comminuted and disinfected sewage using an approved system at a distance of more than three nautical miles from the nearest land; sewage which is not comminuted or disinfected has to be discharged at a distance of more than 12 nautical miles from the nearest land.
Marine pollution	International Convention for the Prevention of Pollution of the Sea by Oil (OILPOL), 1954 (including all amendments Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter (LDC), 1972 (including all amendments)	Applicable-as the convention controls deliberate discharge of oil and oil mixture from the sea going vessels causing environmental impacts. Applicable-as the convention represents international control and prevention of marine pollution due to dumping of wastes and other matter.
	International Convention for the Prevention of Pollution from Ships (MARPOL), Adoption: 1973 (Convention), 1978 (1978 Protocol), 1997 (Protocol - Annex VI); Entry into force: 2 October 1983 (Annexes I and II).	Applicable- The Convention includes regulations aimed at preventing and minimizing pollution from ships - both accidental pollution and that from routine operations - and currently includes six technical Annexes.
	MARPOL, Annex I Regulations for the Prevention of Pollution by Oil (entered into force 2 October 1983)	Covers prevention of pollution by oil from operational measures as well as from accidental discharges; the 1992 amendments to Annex I made it mandatory for new oil tankers to have double hulls and brought in a phase-in schedule for existing tankers to fit double hulls, which was subsequently revised in 2001 and 2003

Issues	Conventions, Protocols and Agreements	Remarks
	<p>MARPOL, Annex II Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk (entered into force 2 October 1983)</p>	<p>Details the discharge criteria and measures for the control of pollution by noxious liquid substances carried in bulk; some 250 substances were evaluated and included in the list appended to the Convention; the discharge of their residues is allowed only to reception facilities until certain concentrations and conditions (which vary with the category of substances) are complied with. In any case, no discharge of residues containing noxious substances is permitted within 12 miles of the nearest land.</p>
	<p>MARPOL, Annex III Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form (entered into force 1 July 1992)</p>	<p>Contains general requirements for the issuing of detailed standards on packing, marking, labelling, documentation, stowage, quantity limitations, exceptions and notifications.</p> <p>For the purpose of this Annex, “harmful substances” are those substances which are identified as marine pollutants in the International Maritime Dangerous Goods Code (IMDG Code) or which meet the criteria in the Appendix of Annex III.</p>
	<p>MARPOL, Annex IV Prevention of Pollution by Sewage from Ships (entered into force 27 September 2003)</p>	<p>Contains requirements to control pollution of the sea by sewage; the discharge of sewage into the sea is prohibited, except when the ship has in operation an approved sewage treatment plant or when the ship is discharging comminuted and disinfected sewage using an approved system at a distance of more than three nautical miles from the nearest land; sewage which is not comminuted or disinfected has to be discharged at a distance of more than 12 nautical miles from the nearest land.</p>

Issues	Conventions, Protocols and Agreements	Remarks
	<p>MARPOL, Annex V Prevention of Pollution by Garbage from Ships (entered into force 1 January 2013)</p>	<p>Deals with different types of garbage and specifies the distances from land and the manner in which they may be disposed of; the most important feature of the Annex is the complete ban imposed on the disposal into the sea of all forms of plastics.</p> <p>Shippers need to consider whether or not the cargo and hence residues, including those contained in wash water are 'harmful to the marine environment' (HME).</p> <p>In essence the discharge of cargo residues contained in wash water is governed by the following criteria:</p> <p>No discharge of cargo residues should occur less than 12 nautical miles from the nearest land or the nearest shelf; No discharge of any cargo residues specified as HME. Wash water should be discharged to a suitable reception facility.</p>
	<p>MARPOL Annex VI Prevention of Air Pollution from Ships (entered into force 19 May 2005)</p>	<p>Sets limits on SO_x and NO_x emissions from ship exhausts and prohibits deliberate emissions of ozone depleting substances; designated emission control areas set more stringent standards for SO_x, NO_x and particulate matter. A chapter adopted in 2011 covers mandatory technical and operational energy efficiency measures aimed at reducing greenhouse gas emissions from ships.</p>
	<p>International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties (INTERVENTION), 1969 (and all amendments)</p>	<p>Applicable- as this convention applied to casualties involving pollution by oil and other matter and impacts in the surrounding environment.</p>
	<p>International Convention on Oil Pollution Preparedness, Response and Cooperation (OPRC), 1990</p>	<p>Applicable- as the convention provides guidelines for combating incidents of marine pollution and ensure Ships to carry a shipboard oil pollution emergency plan, the contents of which are to be developed by IMO.</p>
<p>Liability and Compensation</p>	<p>International Convention on Civil Liability for Oil Pollution Damage (CLC), 1969 (and all amendments)</p> <p>International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage (FUND), 1971 (including all amendments and related protocol)</p>	<p>Applicable- as oil pollution related penalties are addressed</p> <p>Applicable- as the convention and related protocol has provision for imposing greater compensation to be paid to victims of oil pollution incidents.</p>

2.8 *INTERNATIONAL SAFEGUARD REQUIREMENTS*

Financing support for the Project will be sought from multi-lateral financial institutions, such as the IFC, the ADB, and the EPFIs as well as from the export credit agencies of the countries where major pieces of equipment for the Project will be sourced. This support from the multi-lateral financial institutions/ export credit agencies are also linked with the adherence of international best practices and environmental and social safeguard requirements of the lenders. The following subsections outline the key environmental and social requirements of the ADB and the IFC, applicable to the Project.

2.8.1 *ADB's Safeguard Policy Statement, 2009*

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 SPS builds upon ADB's previous safeguard policies on the Environment, Involuntary Resettlement, and Indigenous Peoples, and brings them into one consolidated policy framework with enhanced consistency and coherence, and more comprehensively addresses environmental and social impacts and risks. The SPS also provides a platform for participation by affected people and other stakeholders in the project design and implementation.

The SPS applies to all ADB-financed and/or ADB-administered projects and their components, regardless of the source of financing, including investment projects funded by a loan; and/or a grant; and/or other means, such as equity and/or guarantees. ADB works with borrowers and clients to put into practice the requirements of SPS.

The objectives of ADB's safeguards are to:

- avoid adverse impacts of projects on the environment and affected people, where possible;
- minimize, mitigate, and/or compensate for adverse project impacts on the environment and affected people when avoidance is not possible; and
- assist borrowers and clients to strengthen their safeguard systems and develop the capacity to manage environmental and social risks.

ADB's SPS sets out the policy objectives, scope and triggers, and principles for three key safeguard areas:

- Environmental safeguards;
- Involuntary Resettlement safeguards; and
- Indigenous Peoples safeguards.

To help borrowers and clients and their projects achieve the desired outcomes, ADB adopts a set of specific safeguard requirements that borrowers and

clients are required to meet in addressing environmental and social impacts and risks. These safeguard requirements are as follows:

- Safeguard Requirements 1: Environment (Appendix 1 of SPS);
- Safeguard Requirements 2: Involuntary Resettlement (Appendix 2 of SPS);
- Safeguard Requirements 3: Indigenous Peoples (Appendix 3 of SPS); and
- Safeguard Requirements 4: Special Requirements for Different Finance Modalities (Appendix 4 of SPS).

In addition, ADB does not finance activities on the prohibited investment activities list (Appendix 5 of SPS). Furthermore, ADB does not finance projects that do not comply with its safeguard policy statement, nor does it finance projects that do not comply with the host country's social and environmental laws and regulations, including those laws implementing host country obligations under international law.

Consultation and Disclosure requirements of ADB

ADB's *Safeguard Policy and Public Communications Policy (2011)* sets out disclosure requirements for various ADB activities, including safeguard requirement. Safeguard Requirements 2: Involuntary Resettlement (Appendix 2 of SPS); and Safeguard Requirements 3: Indigenous Peoples (Appendix 3 of SPS) sets out the need for meaningful consultation and information disclosure during project preparation and operation to the affected population and other stakeholders. Key requirements include:

- Information Disclosure: The borrower/client will submit the following documents to ADB for disclosure on ADB's website as per the applicability with respect to the Project:
 - Draft EIA including draft EMP;
 - Final EIA/IEE;
 - Updated EIA/IEE and corrective active plan;
 - Environmental Monitoring Reports.
 - Resettlement Plan ("RP")
 - Indigenous Peoples Plan ("IPP")
- Information disclosure to affected people or stakeholders: The borrower/client will provide relevant environmental information in a timely manner, in an accessible place and in a form and language(s) understandable to affected people and other stakeholders. For illiterate people, other suitable communication methods will be used.
- Consultation and Participation: The borrower/client will carry out meaningful consultation with affected people and other concerned stakeholders, including civil society, and facilitate their informed participation.
- Timing and Frequency for consultation and participation: Meaningful consultation begins early in the project preparation stage and is carried out on an on-going basis throughout the project cycle,

2.8.2 ADB Project Categorisation

The SPS, 2009 further outlines a classification system for the categorization of projects. The classification tentatively occurs at the project identification stage, during the initial screening of anticipated impacts. However, classification is an on-going process, and the classification can be changed at any time with the concurrence of the Chief Compliance Officer (CCO), as more detailed information becomes available and a project proceeds.

Environment

A project's environment category is determined by the category of its most environmentally sensitive component, including direct, indirect, induced, and cumulative impacts. Each proposed project is scrutinized as to its type, location, scale, sensitivity and the magnitude of its potential environmental impacts. The level of detail and comprehensiveness of the EIA or IEE are commensurate with the significance of the potential impacts and risks.

A proposed project is assigned to one of the following categories depending on the significance of the potential environmental impacts and risks:

- *Category A:* A proposed project is classified as category A if it is likely to have significant adverse environmental impacts that are irreversible, diverse, or unprecedented. These impacts may affect an area larger than the sites or facilities subject to physical works. An EIA, including an environmental management plan ("EMP"), is required;
- *Category B:* A proposed project is classified as category B if its potential adverse environmental impacts are less adverse than those of category A projects. These 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. An IEE, including an EMP, is required;
- *Category C:* A proposed project is classified as category C if it is likely to have minimal or no adverse environmental impacts. An EIA or IEE is not required, although environmental implications need to be reviewed; and
- *Category FI:* A proposed project is classified as category FI if it involves the investment of ADB funds to, or through, a financial intermediary (paragraphs 53–58).

Involuntary Resettlement

A project's involuntary resettlement category is determined by the category of its most sensitive component in terms of involuntary resettlement impacts. The involuntary resettlement impacts of an ADB-supported project are considered significant if 200 or more persons will experience major impacts, which are defined as (i) being physically displaced from housing, or (ii) losing 10% or more of their productive assets (income generating). The level of detail and comprehensiveness of the resettlement plan are commensurate with the significance of the potential impacts and risks. A project is assigned to one of

the following categories depending on the significance of the probable involuntary resettlement impacts:

- *Category A:* A proposed project is classified as category A if it is likely to have significant involuntary resettlement impacts. A resettlement plan, including assessment of social impacts, is required;
- *Category B:* A proposed project is classified as category B if it includes involuntary resettlement impacts that are not deemed significant. A resettlement plan, including assessment of social impacts, is required;
- *Category C:* A proposed project is classified as category C if it has no involuntary resettlement impacts. No further action is required; and
- *Category FI:* A proposed project is classified as category FI if it involves the investment of ADB funds to, or through, a financial intermediary (paragraphs 53–58).

Indigenous Peoples

ADB also screen all projects to determine whether or not they have potential impacts on Indigenous Peoples¹. For projects with impacts on Indigenous Peoples, an Indigenous Peoples Plan needs to be prepared. The degree of impacts is determined by evaluating (i) the magnitude of the impact on Indigenous Peoples' customary rights of use and access to land and natural resources; socio-economic status; cultural and communal integrity; health, education, livelihood systems, and social security status; or indigenous knowledge; and (ii) the vulnerability of the affected Indigenous Peoples.

Indigenous people's or ethnic minorities' issues are likely to be significant when it is established that groups in the project area have one or more of the following attributes: (i) self-identification or identification by others as a distinct cultural group; (ii) a display of a desire to preserve such cultural identity; (iii) a linguistic identity distinct from that of the dominant society; (iv) distinct social, economic, and political traditions and institutions; (v) an economic system oriented more toward a traditional system of production; and (vi) a unique tie with and attachment to traditional habitat and ancestral

¹ As per the working definition of indigenous peoples by ADB, two significant characteristics of indigenous peoples would be:

- descent from population groups present in a given area, most often before modern states or territories were created and before modern borders were defined; and
- maintenance of cultural and social identities; and social, economic, cultural, and political institutions separate from mainstream or dominant societies and cultures. In some cases, over recent centuries, tribal groups or cultural minorities have migrated into areas to which they are not indigenous, but have established a presence and continue to maintain a definite and separate social and cultural identity and related social institutions. In such cases, the second identifying characteristic would carry greater weight.

Additional characteristics often ascribed to indigenous peoples include

- self-identification and identification by others as being part of a distinct indigenous cultural group, and the display of a desire to preserve that cultural identity;
- a linguistic identity different from that of the dominant society;
- social, cultural, economic, and political traditions and institutions distinct from the dominant culture;
- economic systems oriented more toward traditional systems of production than mainstream systems; and
- unique ties and attachments to traditional habitats and ancestral territories and natural resources in these habitats and territories.

(Source: *Policy on Indigenous Peoples*, ADB)

territory and its natural resources; such groups are found to exhibit historical, socioeconomic, political, or demographic vulnerability; project intervention will be (positively or negatively) affecting one of these areas: customary rights to (ancestral) land and natural resources; their socioeconomic status; their health, education, livelihood, and social security status; indigenous people's knowledge; the project involves new construction, rehabilitation or expansion of large-scale infrastructure; or such interventions as water supply, sanitation, education, health, nutrition, or social protection target indigenous people; the project is located within or nearby the habitat of indigenous people; and/or project impacts are potentially long term, or irreversible or permanent, affecting a substantial portion of the indigenous community or the community as a whole.

A project is assigned to one of the following categories depending on the significance of the probable impact on the indigenous peoples:

Category	Impact	Actions Required
Category-A	Expected to have significant impact	Both IPP and SIA are required
Category-B	Expected to have limited impact	Both IPP and SIA are Required. A specific action favourable to indigenous peoples/ethnic minority is required and addressed through a specific provision in RRP and in related plans such as a resettlement action plan, a gender action plan, or a general community participatory plan.
Category-C	Not expected to have any impact on ethnic minority	No specific action required.

2.8.3 IFC Performance Standards

The Performance Standards (PS) (January 2012) established by IFC stipulates that the Project shall meet certain requirements throughout the life cycle of an investment by IFC or other relevant financial institution such as other DFIs (e.g. DEG, FMO) or commercial banks, which are signatory to the *Equator Principles, 2006*.

A brief description of the Performance standards is provided in *Table 2.5*.

Table 2.5 IFC Performance Standards

Performance Standards	Specific Areas
Performance Standard 1:	Assessment and Management of Environmental and Social Risks and Impacts
Performance Standard 2	Labour and Working Conditions
Performance Standard 3	Resource Efficiency and Pollution Prevention
Performance Standard 4	Community Health, Safety and Security
Performance Standard 5	Land Acquisition and Involuntary Resettlement
Performance Standard 6	Biodiversity Conservation and Sustainable Management of Living Natural Resources
Performance Standard 7	Indigenous Peoples
Performance Standard 8	Cultural Heritage

IFC Performance Standards, January 2012

These PS and guidelines provide ways and means to identify impacts and affected stakeholders and lay down processes for management and mitigation of adverse impacts.

2.8.4 IFC EHS Guidelines

The *Environmental, Health, and Safety (EHS) General Guidelines*¹ (April 30, 2007) will be applicable for this Project. In addition to that, IFC's Sector specific *EHS Guidelines for LNG Facilities* (April 30, 2007)² and for *Thermal Power Plants*³ (December 19, 2008) will also apply.

2.9 COMPARISON OF SAFEGUARD PRINCIPLES

2.9.1 Gap Analysis -Environment Safeguard Framework

SPS 2009 has 11 environmental safeguard principles and **Table 2.6** presents a comparison of the environmental safeguard principles of ADB and the GoB. There are existing gaps between ADB and GoB requirements (e.g., setting up of grievance redress mechanism and public disclosure of environmental reports) but they can be readily addressed and complied with by the EAs.

¹ [http://www.ifc.org/ifcext/sustainability.nsf/AttachmentsByTitle/gui_EHSGuidelines2007_GeneralEHS/\\$FILE/Final+-+General+EHS+Guidelines.pdf](http://www.ifc.org/ifcext/sustainability.nsf/AttachmentsByTitle/gui_EHSGuidelines2007_GeneralEHS/$FILE/Final+-+General+EHS+Guidelines.pdf)

² <http://www.ifc.org/wps/wcm/connect/87e7a48048855295ac04fe6a6515bb18/Final+-+LNG.pdf?MOD=AJPERES>

³ http://www1.ifc.org/wps/wcm/connect/dfb6a60048855a21852cd76a6515bb18/FINAL_Thermal%2BPower.pdf?MOD=AJPERES&id=1323162579734

Table 2.6 Comparison of Environment Safeguard Principles

ADB SPS 2009		GoB Framework	Measures to Bridge Gaps
Principles	Delivery Process		
1	Use of screening process to determine the appropriate environmental assessment	<ul style="list-style-type: none"> ECA 1995 and ECR 1997 set screening criteria to classify industries/projects based on potential environmental impacts as follows: <ul style="list-style-type: none"> Green (pollution-free), Orange-A, Orange-B and Red (cause significant environmental impacts). These 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. 	<ul style="list-style-type: none"> Both ADB and GOB screening and classification procedure be applied and more stringent classification be followed.
2	Conduct an environmental assessment	Industry/project category <ul style="list-style-type: none"> Green - no environmental assessment required Orange A - no IEE or EIA required but must provide process flow, lay-out showing effluent treatment plant, etc. Orange B - IEE required Red - both IEE and EIA are required 	<ul style="list-style-type: none"> Conduct an environmental assessment to identify potential direct, indirect, cumulative, and induced impacts and risks in the context of the project's area of influence.
3	Examine alternatives	<ul style="list-style-type: none"> Regulations (i.e., ECA 1995 and ECR 1997) do not require specifically the identification and analysis of alternatives 	<ul style="list-style-type: none"> Analysis of alternative will be conducted as a part of impact assessment study to reduce potential environmental and social impacts and document the rationale for selecting the particular alternative.

ADB SPS 2009		GoB Framework	Measures to Bridge Gaps
Principles	Delivery Process		
4	Prepare an environmental management plan (EMP)	<ul style="list-style-type: none"> EMP and procedures included in the IEE and EIA (i.e., Orange-A, Orange-B, and Red category projects) 	<ul style="list-style-type: none"> As per the GOB and ADB requirement EMP with budgetary provision will be included with EIA report and project proponent will stress training and capacity development to ensure satisfactory implementation of the EMP.
5	Carry out meaningful consultation	<ul style="list-style-type: none"> Public consultation and participation are not mandatory based on ECA 1995 and ECR 1997 Grievance redress mechanism is not mentioned in ECA 1995 and ECR 1997 EIA format required by DOE includes stakeholders consultation 	<ul style="list-style-type: none"> Gender inclusive and responsive consultation will be held with all level of stakeholder in deferent phases of the project and include relevant views of the stakeholder during implementation of the project. Specific consultation will be held with vulnerable groups for identification of their need and concern related to the project Appropriate grievance redress mechanism will be developed before initiation of project
6	Timely disclosure of draft environmental assessment (including the EMP)	<ul style="list-style-type: none"> 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-bd.org/minutes.php 	<ul style="list-style-type: none"> The 120 days prior disclosure requirement of ADB will be followed and feedback received will be considered.
7	Implement EMP and monitor effectiveness	<ul style="list-style-type: none"> EMP to include monitoring, budget and implementation arrangements 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 Draft EIA report posted on ADB website at least 120 days prior to Board consideration Draft EA/EARF prior to appraisal Final or updated EIA/IEE upon receipt Environmental monitoring report submitted by borrowers upon receipt Prepare monitoring reports on the progress of EMP Retain qualified and experienced external experts or NGOs to verify monitoring information for Category A projects Prepare and implement corrective action plan if non-compliance is identified Requires submission of quarterly, semi-annual, and annual reports to ADB for review 	<ul style="list-style-type: none"> ECC is subject to annual renewal based on compliance of the conditions set by DOE Project proponent will monitor compliance to agreed EMP Post monitoring will be carried out to ensure all necessary permits and renewals are in place. For select Red category or Category A (per ADB) projects or where noncompliance is observed, field monitoring will be carried out through third party agencies. Results of monitoring will be reported to ADB and DOE on regular basis.

ADB SPS 2009		GoB Framework	Measures to Bridge Gaps
Principles	Delivery Process		
8	Avoid areas of critical habitats (use of precautionary approach to the use, development and management of renewable natural resources)	Provides guidance on critical habitats	<ul style="list-style-type: none"> ECA 1995 and ECR 1997 identifies ecologically-critical areas and the rules to protect them Ecologically Critical Areas to be avoided for development of the project. Habitat and species specific management plans to be developed for ecologically critical areas and protected species if found in proximity to the project footprint.
9	Use pollution prevention and control technologies and practices consistent with international good practices	Refers to World Bank's Environmental Health, and Safety (EHS) General Guidelines 2007 <ul style="list-style-type: none"> 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 	<ul style="list-style-type: none"> Ambient and emission standards included in ECA 1995 and ECR 1997 Where applicable to the type of project apply international standards with special reference to World Bank's Pollution, Prevention and Abatement Handbook. Alternative accepted standards and approaches may be allowed to best reflect national or local conditions, if they are justified and recommended in the EIA report.
10	Provide workers with safe and healthy working conditions	Refers to EHS General Guidelines 2007 (or any updates)	<ul style="list-style-type: none"> Occupational health and safety standards included in the Factories Act 1965 and the Bangladesh Labour Law 2006. Both international and GOB standard will be followed for the project and more stringent one will be applied
11	Conserve physical cultural resources (PCR) and avoid destroying or damaging them	Use of field-based surveys and experts in the assessment <ul style="list-style-type: none"> Consult affected communities on PCR findings Use chance find procedures for guidance 	<ul style="list-style-type: none"> Preservation and protection of cultural resources are within the Antiquities Act 1968. Extensive field based survey by the sector expert and consultation with local people and concern government department will be carried out for finding PCR within the project area of influence

2.9.2 Gap Analysis –Social Safeguard Framework

The Acquisition and Requisition of Immovable Property Ordinance, 1982 (ARIPPO) regulations does not cover project-affected persons without titles or ownership records, like – informal settlers/squatters, tenants and leaseholders. ARIPPO only covers the legal compensation for land, structures, crops and trees and has no provision for loss of income, livelihood restoration and transfer, reconstruction and vulnerability measures. The compensation paid does not constitute replacement cost of the property acquired.

Gap analysis of the key components of the Government led land acquisition process against the international safeguard requirements of ADB SPS, 2009 is presented in **Table 2.7**.

Table 2.7 IFC Performance Standards

Issues	ADB SPS, 2009	GoB, ARIPPO	Measures to Bridge Gaps
Payment of compensation	Requires affected persons to be compensated prior to start of civil work	Land is handed over to the project proponent once payment of awards has been initiated	Physical and economic displacement will occur after full compensation at replacement cost or resettlement benefits have been paid
Valuation of land	Valuation of land at replacement cost	ARIPPO determines the land price as the average market value during last 12 months of the land parcel from date of publication of the notice under section 3. Tax is deducted from the total land value and 50 percent premium is added	Provisions to be adopted for additional top up payments to ensure replacement costs
Valuation of structure	Structural cost at replacement cost of assets without taking into consideration the depreciation cost	As per law the structural cost is determined by deducting construction profit, overhead charge, value added tax (VAT) and depreciation, plus 50 percent premium is added	
Eligibility criteria	Non-title holders are eligible for compensation for loss of assets and income	Eligibility of non-title holders are not recognized for compensation under the law	All affected persons (APs) title holders and non-title holders to be compensated and provided with assistance
Relocation assistance	Affected households to be assisted in the relocation process	No provision for relocation assistance	Affected households (HHs) and businesses will receive relocation assistance in the form of additional lumpsum as well as support by the project proponent in identifying and negotiating as alternative place to stay.

Issues	ADB SPS, 2009	GoB, ARIPO	Measures to Bridge Gaps
Economic displacement	Improve or at least restore the livelihoods of all displaced persons	No compensation for loss of income	Affected households, especially vulnerable HHs are eligible to participate in livelihood improvement trainings along with seed grants as outlined in resettlement plan.
Consultation/disclosure	Affected Persons (APs) must be consulted during project design and resettlement plan preparation; disclosure of the resettlement plan (RP) including documentation of the consultation in an accessible place and languages understandable by the APs and other stakeholders. All documents must be disclosed locally and on the ADB website.	ARIPO does not emphasize on consultation/ disclosure	Extensive consultations have been carried out during design and the ESIA stage; consultations with APs and other stakeholders must be done during the RP preparation and its implementations. RP along with the Entitlement Matrix (EM) must be disclosed locally and also on the website of ADB and project proponent.
Safeguarding needs of vulnerable groups	RP must have provisions for vulnerable groups	ARIPO does not have any especial provision or assistance for vulnerable groups	Special assistance measures for vulnerable groups

2.10 APPLICABLE EHS STANDARDS

The Project has to comply with Bangladesh environmental, health and safety laws and Lender Guidelines with special attention to comply with the Bangladesh (GOB Environmental Conservation Rule 1997) and World Bank Group EHS requirements.

Therefore, the EHS standards as stipulated in ECR 1997 and amendments thereof as well as in the IFC EHS guidelines (General, LNG Facilities and Thermal Power Plant specific) for air quality, surface and ground water quality, ambient noise levels, emissions and effluent discharge will be applicable.

The ADB SPS policy Statement 2009 (SPS) also 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.*" For this purpose IFC EHS guidelines are recommended. The relevant environmental standards (national as well as international) applicable to this project are indicated in *Annex 2*.

It is evident from Annex 2 that except noise level standards, the WB/IFC guidelines are more stringent than the local standards. The Project needs to comply with the Bangladesh environmental, health and safety laws and World Bank Group Guidelines. Hence, it is mandatory for the Project to meet the stringent standards, as per applicability.

2.11 CATEGORISATION OF THE PROJECT

2.11.1 Project Classification as per DOE, Ministry of Environment and Forest, Bangladesh

Depending upon location, size and severity of pollution loads, projects/ activities have been classified in the ECR, 1997 into four categories: *Green*, *Orange A*, *Orange B* and *Red*, respectively, to nil, minor, medium and severe impacts on important environmental components (IECs).

As per the Schedule-1 of the ECR 1997, corresponding category related to FSRU and LNG terminals, captive power plant and associated facilities (e.g. laying of LNG pipeline from the Onshore Receiving Facility to connect to the gas grid of Petro Bangla), fall under **Red Category** for the following components:

- *Item 6:* Power Plants
- *Item 65:* Exploration/extraction/distribution of mineral resources;
- *Item 64:* Water, power and gas distribution line laying / relaying / extension.

2.11.2 Project Classification as per ADB Safeguard Policy Statement

Categorization for the proposed Project was undertaken by using ADB's Rapid Environmental Assessment (REA), Involuntary Resettlement (IR) and Indigenous People (IP) Assessment checklists during the screening and scoping exercise. The findings of the assessment are presented in *Table 2.8*.

Table 2.8 Project Categorisation as per ADB Safeguards

SN	Criteria	Relevance	Remarks	Category
1	Environmental Categorization			
(a)	Irreversible	Environmental issues and impacts of the Project are anticipated during the construction and operation of the FSU and onshore regasification facility (ORF), captive power plant and development of associated infrastructure (such as LNG pipeline, jetty, trestle, etc.).	<p>Irreversible impacts due to the Project include:</p> <ul style="list-style-type: none"> ▪ Increase noise and vibration during the plant construction and operation ▪ Change in air quality due to proposed ORF and Power Plant ▪ Affected aquatic ecology and surface water quality during construction of twin jetty and trestle ▪ Change in water quality due to discharge of ballast and bilge water ▪ Occupational health and safety; ▪ Community health and safety; ▪ Risks due to transport, storage and handling of highly flammable chemicals; ▪ Associated development in the area. 	<i>Based on irreversible, diverse and unprecedented impacts, it should be categorized as 'A'.</i>
(b)	Diverse	Nature of activities	The nature of activities is diverse for the area, as there are no FSUs/LNG Terminals, industrial installations or power plants in the <i>Kutubdia</i> Island and surrounding areas which is largely rural in nature with an agrarian character.	
(c)	Unprecedented	Change in landuse	<p>The establishment of the project will result in permanently change in land use of the project site (ORF, Power Plants and other land based facilities) and areas for associated infrastructure (like gas pipeline, etc.) from agricultural and coastal uses to industrial character.</p> <p>Total land required for land based facilities is expected around 38 acres. In addition, approx. 34 acres of land will also be acquired for RoW of the onshore gas pipeline and about 1.4-1.85 acres for the terminal station</p>	
2	Involuntary Resettlement Categorization			
(a)	Unprecedented	Land	Requirement of agricultural land and salt pans for industrial development (land based facility, onshore pipeline and terminal station at valve 2 of the LNG Terminal)	
(b)	Adverse	Land Acquisition (LA)	Land Acquisition will occur for the land based facility, the onshore pipeline and terminal station at valve station 2 of the upcoming LNG Terminal and involuntary resettlement impact is envisaged. The area of land earmarked for land based facility has approximately 240 plots. Livelihoods of the land owners and the land users of these plots are likely to be impacted adversely.	<i>Based on current magnitude related to number of plots that will go for land acquisition, the resettlement issues and issues associated with project affected households, project shall</i>

SN	Criteria	Relevance	Remarks	Category
(c)	Irreversible	Project Affected Households	Loss of livelihood; loss of productive agricultural and salt cultivation land to a limited degree; Need for social compliance audit	<i>be categorized as 'A'.</i> <i>The LA and IR impacts will be addressed in "Resettlement Plan", a separate document, as per ADB SPS requirement.</i>
3 Indigenous People Categorization				
(a)	Presence	Existence of Indigenous People (IP)	The census data (2011) of Bangladesh shows that in the entire Kutubdia Upazila, there are only 5 households of ethnic minority population and within the project footprint area, where the project will be located; it is currently that there is no population under this group.	<i>In case of no foreseen adverse impact, project shall be categorized as 'C'</i>
(b)	Impact	Impact on indigenous/ ethnic/ scheduled tribes	No adverse impact on the Ethnic Minority is foreseen	

3 DESCRIPTION OF PROJECT

3.1 TYPE OF PROJECT

Reliance Power Limited (RPL) intends to develop a LNG storage and re-gasification facility (LNG Facility) of about 3.5 – 5 MMPTPA, including onshore receiving facility (ORF) at *Kutubdia* Island in *Cox’s Bazar* District of Bangladesh. The land based facilities are planned in *Dakshin Dhurung* and *Kaiyarbil* Unions of *Kutubdia Upazila*.

LNG Facility will include the following:

- (i) Twin Jetty with topside facility
- (ii) FSU with a storage capacity 145,000-216,000 m³
- (iii) Cryogenic Pipeline of ~ 30 “on motorable trestle
- (iv) Onshore Regasification Facility (ORF) of 750 MMSCFD capacity with an option of building a 185,000 m³ (gross capacity) LNG tank later
- (v) Onshore receiving facility (ORF) including Custody Transfer Metering system (CTMS)
- (vi) Spur Pipeline upto 36” (High pressure i.e. 95 bar g) to transport gas from ORF to Valve station 2 (at Napura) of Moheskhali- Anwara Pipeline

The regional setting map indicating the proposed location of the LNG facility is presented as **Figure 3.1**. A schematic representing the different project components is shown in **Figure 3.2** whereas a map showing the administrative (union) boundaries in *Kutubdia* Island is presented in **Figure 3.3**. It is to be noted here that the *Kutubdia Upazila* entirely comprises of the *Kutubdia* Island. LNG will be brought by LNG carriers of sizes ranging from 125,000 m³ to 263,000 m³ capacity. LNG carriers will unload LNG to the FSU (moored to Jetty) with hard arms / soft arms wherein they are stored in membrane tanks. The salient features of the proposed LNG Facility is provided in **Table 3.1**

Table 3.1 Salient Features of the LNG facility

Parameter	Specifications
Cargo Storage Capacity	145,000 m ³ -216,000m ³
Minimum Regasification Output	50 mmscfd
Nominal Regasification Output	500 mmscfd
Peak Regasification Output	750 mmscfd
Boil Off Rate	Max. 0.15% per day
Major Regasification Equipment Sparing	N+1
Major Maintenance Plan	22 years docking cycle
LNG Regasification System	Open loop / closed loop / combined loop
Nominal Pressure of Send-Out Gas Required	70-100 bar g after Regasification
Boil Off Gas (BOG) Management	Efficient BOG management for at least 7 days of zero send-out. No venting allowed under normal operating conditions required.

Source: Reliance Power from their study titled “Reliance Bangladesh LNG Import Terminal Feasibility Study – Site and Configuration Selection Report, Advisian Worley Parsons Group, Singapore, July 2016”

Figure 3.1 Regional Setting Map of Proposed LNG Facility

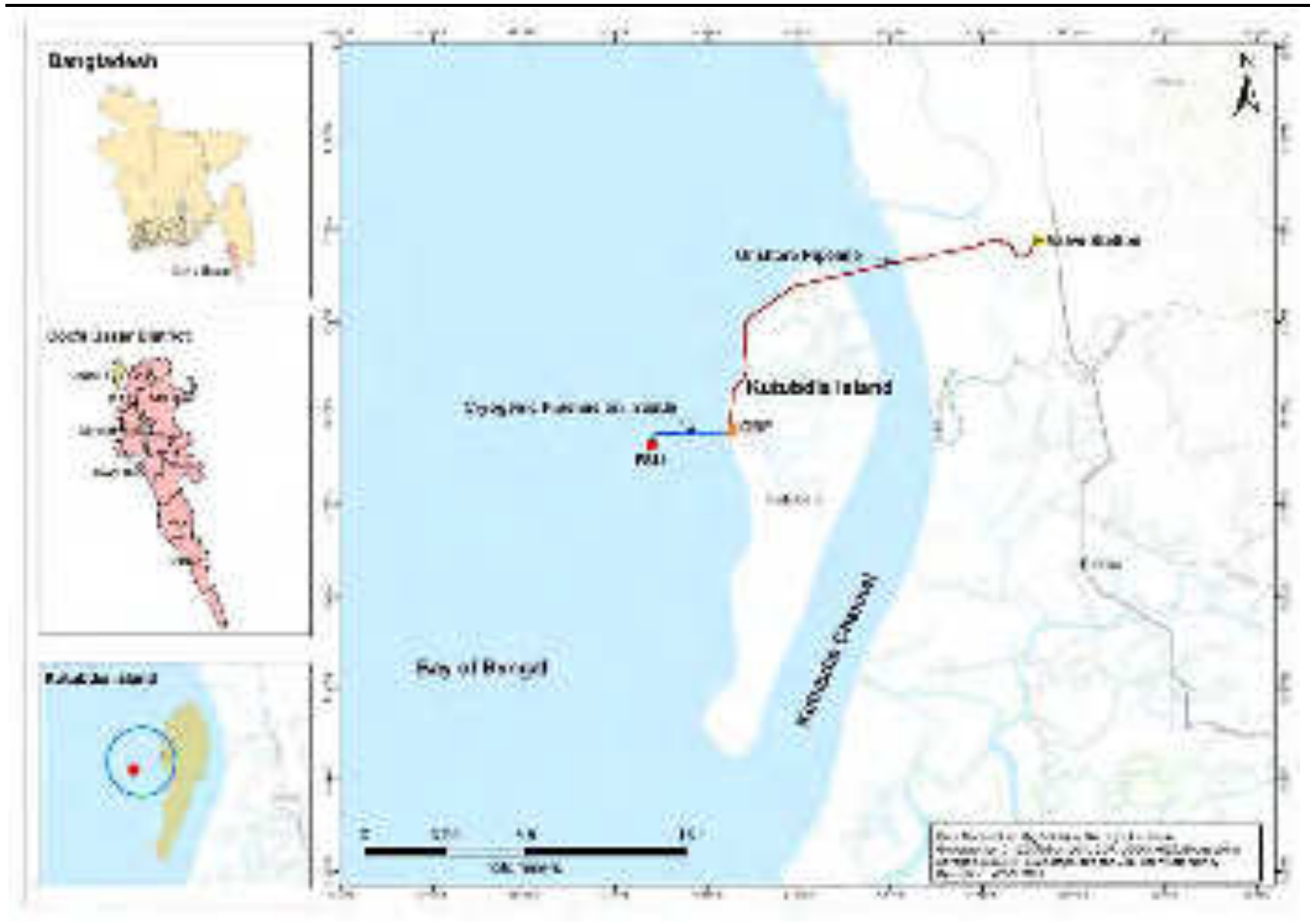


Figure 3.2 Kutubdia LNG Facility - Schematic

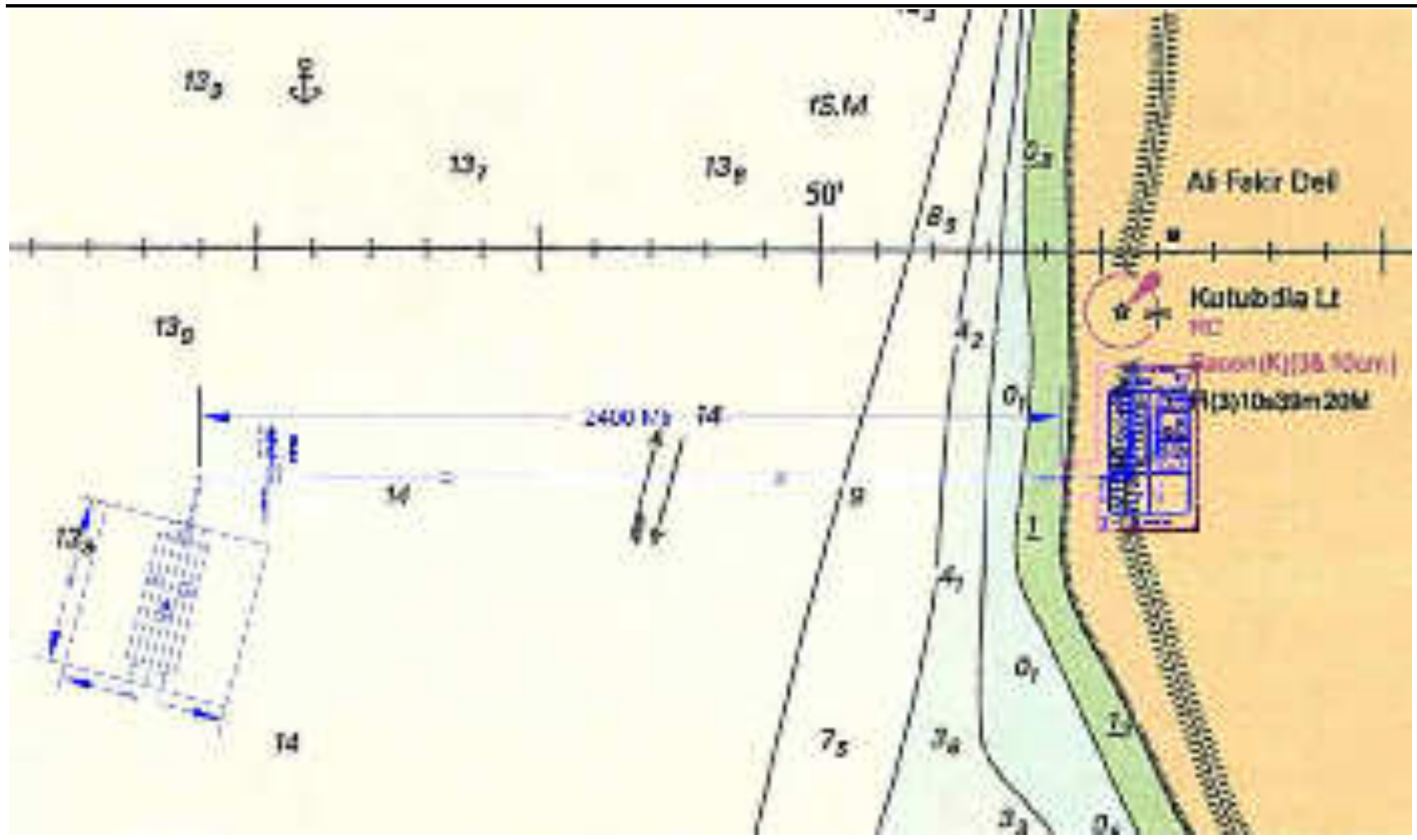


Figure 3.3 Administrative (Union) Boundaries in Kutubdia



3.1.1 *Project Facilities*

The project will involve seafront based facilities and Onshore Regasification facilities. The facilities are described below.

3.1.2 *Seafront Based Facilities*

The proposed LNG Facility Project will consist of (i) seafront based marine facilities (FSU) and (ii) land based facilities (ORF). The locations of these facilities are as follows:

Floating Storage Unit (FSU)

The Floating Storage Unit (FSU) will be located in the Bay of Bengal, approximately 2.4 km from the north western shoreline off *Kutubdia* Island semi-permanently moored to the Jetty. The FSU will be designed for a storage capacity of 145,000-216,000 m³ of LNG Storage.

Jetty

Jetty with offshore steel/concrete structures and mooring facilities on either side is planned offshore near the FSU. The proposed jetty configuration comprises of two parallel berthing facilities so as to manage simultaneous berthing of both FSU and LNG Carriers (LNGCs).

Trestle with Cryogenic Pipeline

Trestle mounted Cryogenic Pipeline of diameter 30" and of length upto a maximum 2.4 km from Jetty to Onshore Regasification facility is proposed. It will be a motorable trestle with width around 3 m and will provide easy access to the FSU. Height of the trestle is expected to be around approx. 10-12 m above the water level. The cryogenic pipeline mounted on the trestle will carry the LNG from the FSU to the Onshore Regasification Facility.

3.1.3 *Onshore Regasification Facility*

The potential site selected for the Onshore Regasification Facility (ORF) is on the western part of the *Kutubdia* Island. The landfall point has been selected south of an existing light house on this island. The ORF would be distributed on either side of the beribandh area (coastal embankment). As per present planning considerations, Reliance Power is considering a potential site of approx. 560 m x 310 m. The overall land requirement is expected around 40 acres. However, the exact dimensions of the site will be confirmed after necessary review and scrutiny by the Land Revenue Department and the Deputy Commissioners Office at *Cox's Bazar*. It is also understood that green buffer zone and necessary setbacks to screen the facility from surrounding landuses will be accommodated within this identified site area.

The selected site falls within *Dakshin Dhurung* and *Kaiyabil Mouzas* in *Dakshin Dhurung* and *Kaiyabil Unions* of *Kutubdia Upazila*.

Western portion of the proposed site (sea ward side) primarily composed of sandy beach area. At present no encumbrances (in form of houses or any other structures) are visible on this part of the site on the western side of the *beribandh* (coastal embankment). Social forestry plantations have been carried out by the Forest Department in the coastal areas of the island and mostly Casuarina trees have been planted as part of such shelter belts. Three separate patches of such Casuarina trees have been recorded from this part of the delineated project site. However this portion of the site does not support any agricultural activities.

The eastern part of the site (i.e. on the eastern side of the coastal embankment) supports typical landuses such as agriculture, salt cultivation, etc. In addition certain groves of trees have been noticed in this portion of the site along with possible presence of homestead land. The actual status of this portion of the site on the eastern side of the coastal embankment will be confirmed through subsequent field surveys and scrutiny by the Land Revenue Department and the Deputy Commissioners Office at *Cox's Bazar*.

Figure 3.4 *Land Based Project Site and Surroundings*



Project Site - Western Side of the Beibandh



Project Site - Eastern Side of the Beibandh



Beribandh – Coastal Embankment



The Existing Lighthouse (North of Site)



Tree Groves and Homestead Land



Casuarina Plantation

The location of the ORF on Google Earth Imagery and Cadastral Maps is presented in *Figure 3.5* and *Figure 3.6* respectively.

Figure 3.5 Proposed Site for Onshore Regasification Facility



Figure 3.6 ORF Superimposed on Cadastral Maps



3.1.4 Onshore Pipeline

Onshore spur pipeline from the Onshore Receiving Facility (ORF) will be laid to connect to the proposed national gas grid of GTCL (Moheshkhali Anwara section) at *Banskhali*. This proposed 36" spur pipeline is proposed to connect at valve station 2 (at Napura) of the GTCL pipeline.

Figure 3.7 Proposed Onshore Pipeline Route



3.1.5 Napura Valve Station

A terminal station of GTCL at Napura is presently being constructed where the proposed onshore project pipe line shall join the existing GTCL gas grid. This terminal station is located in Bhaskhali Upazila of Chittagong Division and at around 0.6 km west of Chittagong-Pekua Highway (Highway No R170).

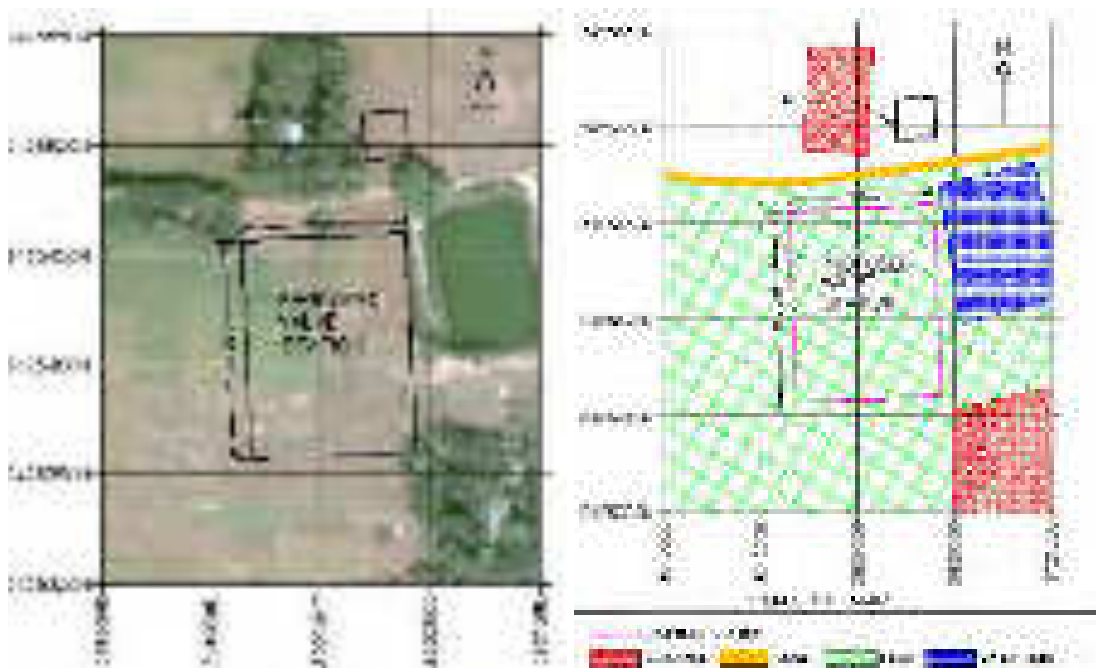
Figure 3.8 GTCL Terminal Station at Valve 2



Source: Imagis. 2016. A Report on Reconnaissance Survey for LNG Terminal and Associated Pipeline at Kutubdia Island, Bangladesh

A terminal station at Napura for the project is also being proposed adjacent to the existing MLV station along GTCL pipe line. For this purpose a site admeasuring 75 m X 100m has been identified. This site comprises agricultural land and will involve private land acquisition. The site is flat and located close to an existing road.

Figure 3.9 Site for RPL's Proposed Terminal at Napura



Source: Imagis. 2016. A Report on Reconnaissance Survey for LNG Terminal and Associated Pipeline at Kutubdia Island, Bangladesh

3.1.6 Site Approach Road

Movement of man, material and machinery to the site is expected during the construction and operation stages of the project. The present approach to the site is through a narrow and constricted road passing through the Ali Fakir Deil settlement. In order to avoid regular use of this approach to the site passing right through the island, the project plans to use the existing abandoned jetty at northern tip of Kutubdia Island along with refurbishment and strengthening of the existing connecting road for all logistics purposes. This site access being planned follows the alignment of the coastal embankment for most of its length and the existing width of the road available is around 3 m (max.) The total length shall be in the range of 9 km. It is also understood that the strengthening work is planned to be executed through the UNO Office on deposit work basis.

Figure 3.10 Proposed Site Approach Road



3.2 CONNECTIVITY

The *Kutubdia* Island is isolated from main shore of Bangladesh. There is no direct road access to the island. One has to cross the *Kutubdia* Channel to reach the island. At present state, the *Kutubdia* Channel is approximately 4 km wide between *Boroghop (Kutubdia) – Magnama Ferry Ghat*.

Aerial distance from the nearest town at *Cox's Bazar* is approximately 50 km and by road approximately 85 km including the channel crossing. The nearest national highway is *Chittagong-Cox's Bazar* National Highway (N-1). Speed boat, trawler, ferry are the primary means of transport from the mainland to the island. For communicating by road the inhabitants of the island use the *Magnama Ghat* on the mainland and then use the regional roads (R-170 and R-172) to reach *Chokoria* on the national highway. However, buses are available at *Pekua* (approx. 5 km from *Magnama Ghat*) from where one can travel to other locations of the country.

The *Kutubdia* Channel is directly connected with Bay of Bengal at both ends. The *Chittagong* Port is located on north of the *Kutubdia* Island and approximately 50 km from the Project site. An anchor point of the *Chittagong* Port is located in the *Kutubdia* offshore region along with an existing navigational channel, which is located approx. 3 km from the sea front on the north western part of the island (Refer to *Figure 3.12*).

Figure 3.11 Existing Navigational Channel off *Kutubdia*



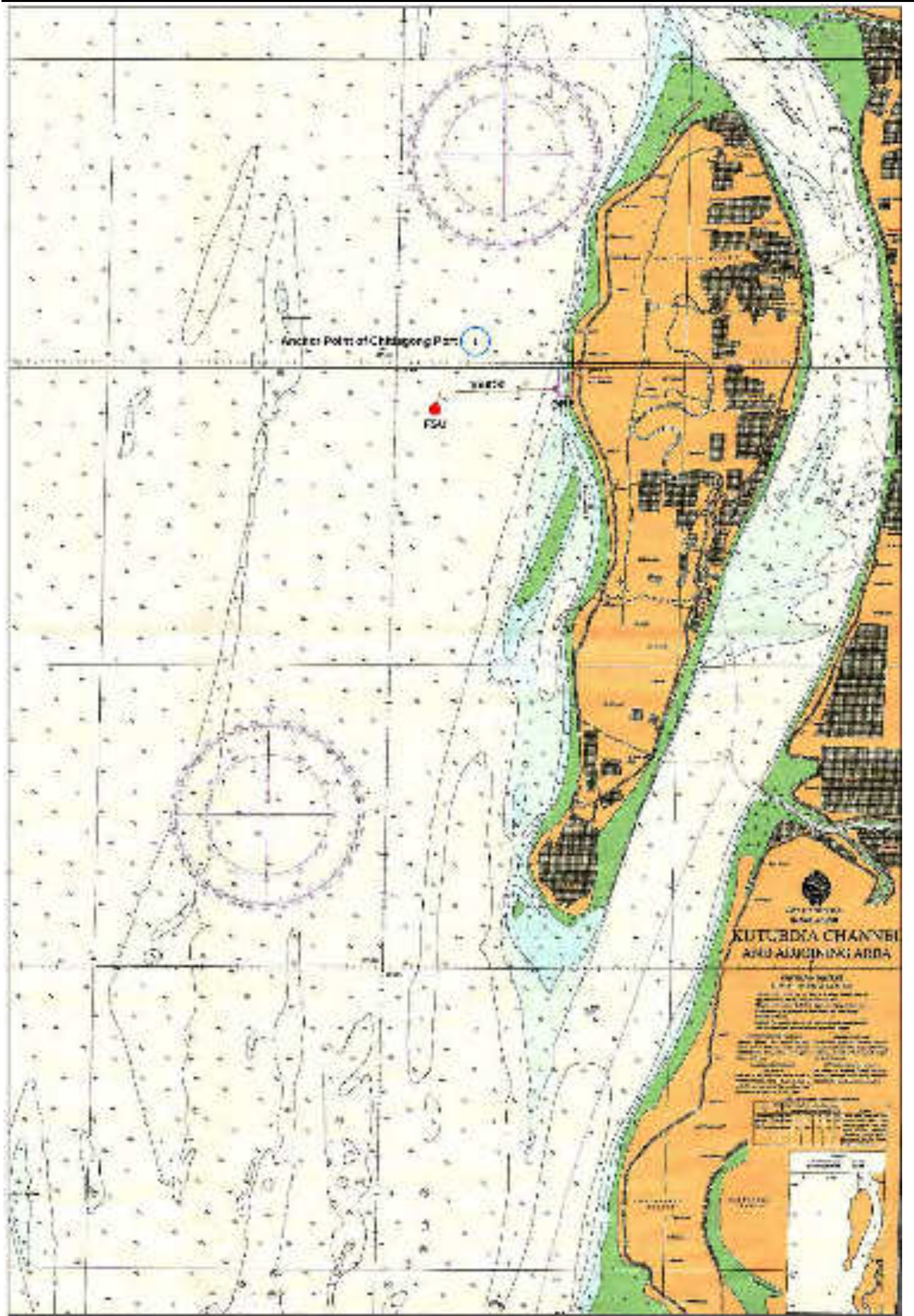
Imported plant and equipment can be transported to the site by this sea route through all seasons of the year. Most of the heavy equipment is expected to be unloaded at *Chittagong* Port, and same will be transported to the Project site at *Kutubdia* Island.

The accessibility map of the Project site is presented in *Figure 3.12* whereas the navigational chart of this region showing the anchor point of the *Chittagong* port is presented in *Figure 3.13*.

Figure 3.12 Accessibility Map of the Proposed Project site



Figure 3.13 Navigational Chart - Kutubdia Channel and Adjoining Areas



3.3 *PROPOSED SCHEDULE FOR IMPLEMENTATION*

The duration of the construction and commissioning of the Project has been preliminarily assumed as lasting 24/36 months. The whole development of the Project will involve the following main activities:

- Conceptualization stage;
- Pre-FEED and FEED studies;
- Fabrication, inclusive of procurement of long lead items;
- Installation, including estimation of the time needed to tow the FSU to site for hook-up; and
- Commissioning activities.

The following construction activities can be developed separately:

- Jetty construction on Piles with Topside Facility;
- Cryogenic Pipeline on trestle;
- Onshore Facilities

3.4 *TECHNOLOGY AND PROCESS DESCRIPTION*

FSU based solution provides flexibility in terms of the following:

- Storage
- Regasification
- Transition to Land based LNG terminal

3.4.1 *Floating Storage Unit*

FSU is primarily an LNGC designated as a Cryogenic storage unit with or without Propulsion. FSU will function as an LNG receiving and Storage Facility.

Mooring System

FSU will be permanently moored on Jetty. Capability of disconnection and moving to a sheltered location under emergency conditions will be undertaken during detail design of the facility.

Power Generation System

The FSU will be provided with a main power generation system designed for power supply. The actual power requirement is expected to be less than 5 MW. Because of the necessity to handle the boil off gas (BOG) that naturally boils from cargo tanks, almost all LNG carriers (FSU) are designed to use the vaporized LNG as fuel for power production and propulsion. The boil off gas is collected in the vapour header and compressed by the low duty (LD) compressors into the fuel gas main that feed the power plant and/or boilers. If the natural boil off is not sufficient, forced vaporizers will be used for vaporizing part of the cargo and feed the fuel gas main.

The main power requirements will be for:

- Accommodation load
- Low duty and high duty compressors;
- Ballast pumps; and
- Cargo pumps.

In addition to the main power production system, a generator will be provided to guarantee the availability of essential systems in case of failure of the main power generator system; such essential systems necessarily include:

- Navigational aids;
- Lighting;
- Communication systems;
- Fire and gas detection; and
- Firewater pumps.

Furthermore an uninterruptable power supply (UPS) system will be available on board to power vital systems such as navigation lights, communication, emergency lighting, etc.

Ballast System

FSU will be provided with a ballast system sized on the basis of the following philosophy:

- The ballast tanks capacity shall be able to compensate the full unload of the stored LNG;
- The ballast pumps shall be able to discharge outboard the ballast water at a sufficient rate to compensate the LNG loading and keep the draught almost constant.

LNG carriers will have their own ballast water exchange plant or treatment system as per regulations in force.

Accommodation

In order to face operative conditions, the number of people on board the FSU will be a maximum of 45 (covering all shifts), inclusive of technical personnel dedicated to typical terminal operations. Based on that, accommodations will include the following:

- Public spaces: officers' dining room, officers' lounge, crew mess, crew lounge, duty mess, hospital/dispensary, gymnasium;
- Service spaces: galley, officer and crew pantries, pantry at cargo control room, officer, FSU and crew laundries, storage lockers, linen (clean, dirty) lockers, incinerator room, waste handling room;
- Sanitary spaces: public toilets, officer and crew changing rooms;
- Operational spaces: combined wheelhouse with chart and radio room, engine control room, cargo control room with related meeting room, conference room, main administration office, one office each for Captain, Engineer and Senior Officers, document store, central fire control station, fire equipment rooms; and

- Provisions stores: Dry provision (18°C), meat (-25 °C), fish (-25°C), vegetable (2°C), lobby (4°C), bonded store.

Jetty

The Island Jetty consisting of two parallel berthing facilities with offshore steel/concrete structures and mooring facilities on either side so as to manage simultaneous berthing of a Floating Storage Unit (FSU) and LNG carriers (LNGCs) for unloading LNG (adjacent / side-by-side) berthing and mooring on either side of jetty with fenders. The Jetty and associated facilities will be built to operate in a draft of more than 12 m. The design of Jetty and necessary facilities would be such that it puts no restriction for the movement of FSU / LNG carrier ships (entry channel, turning circle, berthing / mooring pockets) to and from proposed jetty with required navigational aids.

3.4.2 Trestle Mounted Cryogenic Pipeline

The pipeline length will be approximately 2.4 km and will be designed for LNG at delivery pressure of max 20 bars (g). It will be designed for operability of the plant design life (at least 22 years).

General Data/ Information –Cryogenic pipeline

Main information about the subsea pipeline is presented in the table below:

Table 3.2 Salient Features of the Cryogenic Pipeline

Parameter	Units	Value
Length	Km	2.4
Diameter	Inch	10
Design pressure	bars (g)	20
Design temperature	°C	-160

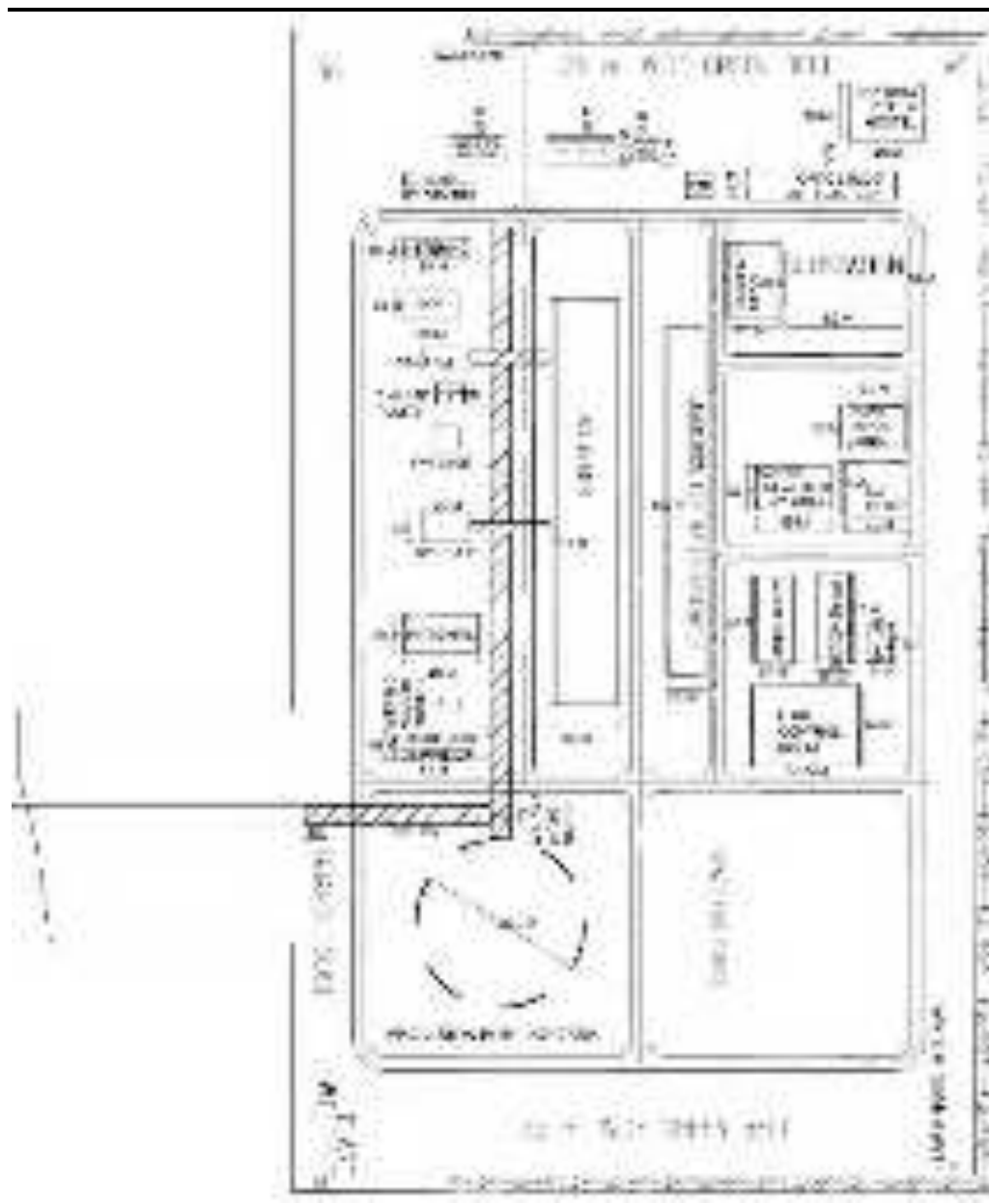
3.4.3 Onshore Regasification Facility (ORF)

The cryogenic pipeline will make a landfall point south of to the existing Light House in *Dakshin Dhurung* Union of *Kutubdia Upazila*. The land based facilities will be spread in an area of 40 acres bounded by the following coordinates:

- 21°51'47.76"N 91°50'28.26"E
- 21°51'47.91"N 91°50'39.14"E
- 21°51'29.75"N 91°50'39.45"E
- 21°51'29.54"N 91°50'28.56"E

However, discussion with RPL reveals that the actual land requirement for the ORF within this delineated area will be optimised with a view to reduce the project footprint. A typical layout of the ORF is presented in **Figure 3.14**.

Figure 3.14 ORF Layout



The ORF would consist of:

- Air based intermediate fluid vaporizers system.
- Nitrogen facilities (Air Separation facilities)
- Gas receiving and metering facilities.
- Gas pumping system
- Gas flaring system
- Pipeline maintenance
- Control Room
- Chemical Laboratories
- Maintenance Workshop
- Stores
- Custody transfer and Metering System
- 25 m wide greenbelt at the periphery of the facility

ORF Utilities

Additionally, the land based utility facility consisting of:

- Power generating system, about 20 MW (2 X 10 MW);
- Water management system;
- Firefighting system.

LNG Storage

It is proposed to construct a full containment LNG storage tank on land in order for transition to a shore based terminal within a period of 8 years from first commissioning of the facility. Proposed to construct one LNG tank of 185000 m³ (Gross Capacity).

3.4.4 Onshore Pipeline

Onshore pipeline from the Onshore Receiving Facility (ORF) will be laid to connect to the proposed national gas grid of GTCL (*Moheshkhali Anwara* section) at *Banskhali*. The route is about 17 km long and runs from the landfall location till the tie-in location of the proposed *Moheshkhali Anwara* pipeline. Main information about the onshore pipeline is presented in the **Table 2.4**.

Table 3.3 *Salient Features of the Onshore Pipeline*

Parameter	Specification Required
Length	17 Km
Diameter	36"
Operating Pressure	70-100 bar (g)
Operating Temperature	5-15 °C

The onshore and channel portion of pipeline will be buried, in order to minimize potential interferences with human activities (fishing, anchoring) in the area. The onshore portion will be realized adopting an open-trench methodology. Realization of the shore approach will involve the following:

- Preparation of the work area and excavation of the trench;
- Pulling operations and laying of the pipeline; and
- Coverage of the trench and restoring areas.

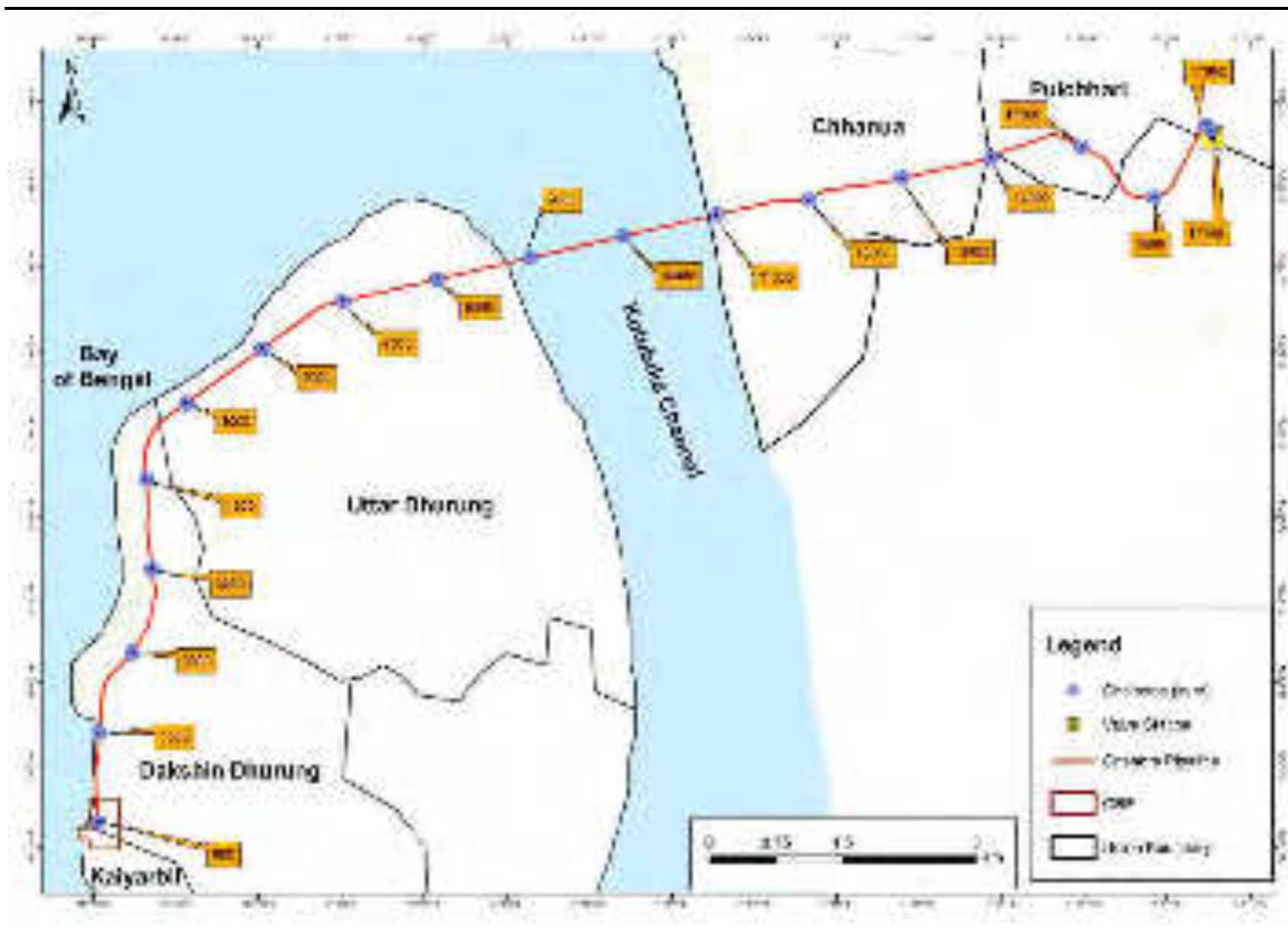
A survey agency has been engaged by Reliance Power for identification of route for the proposed onshore pipeline from Kutubdia ORF to Gas Transmission Company Limited (GTCL) terminal at Napura- Valve station No.2. A chainage survey has been conducted for four probable pipeline routes and an alignment has been identified as most suitable for development of the pipeline. The alternative analysis of the proposed pipeline route is presented in Section 6 of this report. Chainage survey of the selected pipeline route is presented in **Table 3.4**. The selected route of the pipeline is presented in **Figure 3.15**.

Table 3.4 Selected Pipeline Route

Sr. No.	Chainage (m)		Length (m)	Present land use	Land owner	Remark
	From	to				
1	0	5900	5900	Along Sea Shore	Private	
2	5900	6000	100	Bund	Govt.	
3	6000	6470	470	Salt Pan	Private	
4	6470	6477	7	Road	Govt.	Road Crossing
5	6477	6700	223	Salt Pan	Private	
6	6700	6708	8	Water Channel	Govt.	Channel Crossing
7	6708	7210	502	Salt Pan	Private	
8	7210	7216	6	Water Channel	Govt.	Channel Crossing
9	7216	8566	1350	Salt Pan	Private	
10	8566	11328	2762	Kutubdia Channel	Govt.	Channel Crossing
11	11328	11698	370	Agricultural Land	Private	
12	11698	11768	70	Private Use	Private	
13	11768	11938	170	Agricultural Land	Private	
14	11938	12108	170	Salt Pan	Private	
15	12108	12120	12	Road	Govt.	Road Crossing
16	12120	13970	1850	Salt Pan	Private	
17	13970	14040	70	Water Channel	Govt.	Channel Crossing
18	14040	14100	60	Private Use	Private	
19	14100	14670	570	Agricultural Land	Private	
20	14670	14677	7	Road	Govt.	Road Crossing
21	14677	14727	50	Agricultural Land	Private	
22	14727	14734	7	Road	Govt.	Road Crossing
23	14734	15284	550	Agricultural Land	Private	
24	15284	15294	10	Nallah	Govt.	Nallah Crossing
25	15294	15334	40	Agricultural Land	Private	
26	15334	15344	10	Road	Govt.	Road Crossing
27	15344	16380	1036	Agricultural Land	Private	
28	16380	16387	7	Road	Govt.	Road Crossing
29	16387	16910	523	Agricultural Land	Private	
30	16910	16920	10	Road	Govt.	Road Crossing
31	16920	17000	80	Agricultural Land	Private	

Source: Imagis, 2016 - A Report on Reconnaissance Survey for LNG Terminal and Associated Pipeline at Kutubdia Island, Bangladesh

Figure 3.15 Pipeline Map



3.5 ASSOCIATED FACILITIES

Onshore pipeline from the ORF of the Kutubdia LNG project will be laid to connect to the proposed national gas grid of Gas Transmission Company Limited (GTCL) at Banskhali.

This 30" dia 90 km Gas Transmission Pipeline from Moheshkhali to Anwara is an associated facility for the Kutubdia LNG Project. This trunk infrastructure is being constructed by GTCL with a view to supply re-gasified LNG from proposed FSRU of Petro Bangla at Moheshkhali to Chittagong and its adjacent regions. RPL also proposes to use the same gas grid to transport the RLNG from their LNG facility at Kutubdia. Delivering gas through this pipeline will eventually contribute to national gas grid and help narrow the existing production-consumption gap significantly. The volume of gas outgo through this pipeline is estimated approximately to be 500-600 mmcf/d.

Details of the pipeline are presented in the table below.

Table 3.5 *Details of Moheshkhali- Anwara Gas Transmission Pipeline Project*

Name of the Project	:	Moheshkhali-Anwara Gas Transmission Pipeline Project.
Sponsoring (Ministry/Division)	:	Ministry of Power, Energy & Mineral Resources/ Energy & Mineral Resources Division
Project Executor	:	Gas Transmission Company Limited (GTCL).
Project Location	:	Within and around Anwara, Banskhali, Pekua, Moheshkhali Upazila, Chittagong & Cox's Bazar districts.
Diameter & Length of Transmission line	:	30 inch diameter 91 km
Pressure	:	1000 psig
Studies and Investigations	:	Pipeline route Survey, EIA reports and Soil Investigation activities
Physical Construction	a) Pipeline Construction	: 91 kms (30") Transmission pipeline, pipeline accessories Installation of CGS and CTMS
	b) Crossing	River (5 Nos.)
Land Requirement	a) Acquisition	: 169.467 acre
	b) Requisition	304.82 acre
Manpower	:	Officers: 15 Nos., Staff: 10 Nos.

Source: EIA Study of Moheshkhali- Anwara Gas Transmission Pipeline Project

The onshore pipeline from the Kutubdia LNG Project will plug into the GTCL gas grid through the Napura terminal. This terminal station is located adjacent to the existing MLV station along the GTCL pipeline. The proposed Napura terminal land is agricultural in nature with elevation of 8 m above mean sea level.

EIA Process Followed

The EIA process for the associated facility was conducted in the period between 2010 and 2012. The Moheshkhali- Anwara Gas Transmission Pipeline Project falls under the “Red Category” as per the Environmental Conservation Rules of 1997, which required submitting IEE and EIA report to obtain both Site Clearance and Environmental Clearance from the DoE. In order to mitigate the existing gas supply crisis of Chittagong and nearby areas, the project was considered for expeditious implementation. As such necessary exemption from submitting IEE for site clearance was obtained from DoE and subsequently a Terms of Reference (TOR) for the EIA was issued by DoE on 02.11.2010 (*Memo No: DOE/Clearance/5028/2010/365*).

Based on this approved TOR, an environmental impact assessment study was conducted for this pipeline route. This EIA covered the impacts on ambient air quality, water quality, noise, potential economic displacement of persons involved in salt production and shrimp cultivation, temporary loss of income of farmers due to disturbance of irrigation canals and preparation of ROW for pipeline, destruction of aquatic habitat and generation of employment.

38.22 ha and 30.36 ha land was acquired for ROW and 64.1 ha and 59.23 ha was requisitioned for construction activity in Chittagong and Cox Bazar district respectively. Affected persons were compensated as per the land acquisition law of Government of Bangladesh. An environmental management plan (EMP) including a monitoring plan was also prepared as part of the EIA study. A snapshot of this EMP is presented in *Table 3.5*

In addition to the EMP an emergency response and disaster management plan that cover the both construction and operation phase was included in the EIA.

Table 3.6 The EMP of Moheshkhali- Anwara Gas Transmission Pipeline Project

Source of Impact	Type of Impact	Mitigation Measures	
Pre-Construction Activities			
<ul style="list-style-type: none"> • Clearing vegetation • Excavation of earth • Filling lowlands • Land occupation • Sewage of kitchen waste disposal • Movement of heavy vehicles • Non-routine accidental spillages 	Air	<ul style="list-style-type: none"> - Selecting short and direct routes for all traffic; - Wetting onsite areas - Vegetation clearance during dry weather periods; - Maintaining generator engines and other heavy duty engines in good repair, to reduce exhaust emissions; - Good housekeeping (i.e., strict fuel/chemical inventory and minimization of spillages, to reduce fugitive vapor emissions). 	
	<ul style="list-style-type: none"> • Emission of dust • Emission of greenhouse gas • Emission of heat 		<ul style="list-style-type: none"> • Traffic to and from the site to be controlled with respect to routing of vehicles and timing of vehicle movements (i.e. working hours); • Site activities during Pre-Construction works will, to the extent practicable, be limited to day time working • Equipment will be maintained in good working order and, where appropriate, acoustic hoods will be provided • Taking maximum advantage of shielding provided by onsite structures and offsite natural features (trees, etc) to minimize noise levels at offsite receptor locations. • Appropriate engineering of slopes to prevent slumping, slippage and erosion. • Restoration of disturbed soil to its original use or to an approved use; • Re-vegetation of barren surfaces; • Adopting erosion control and soil stabilization measures; • Installing (and maintaining for the duration of the Horizontal Directional Drilling campaign) adequate runoff channels and carefully monitoring should be there to prevent polluting the local drainage channels and to prevent flooding, inundation and silting. • Domestic sewage will be treated in a septic tank and the treated effluent will be released into an adjoining leach field. • Environment friendly water based mud will be selected for the HDD and appropriate drainage system will be set around the rig and mud tank area
	Noise and Vibration		
	<ul style="list-style-type: none"> • Disturbance to general amenity • Disturbance to religious performance 		
	Land		
	<ul style="list-style-type: none"> • Change in land use • Soil erosion and sedimentation • Soil stability and compactness • Loss of soil fertility 		
	Groundwater		
	<ul style="list-style-type: none"> • Reduction in recharge potential • Contamination 		

Source of Impact	Type of Impact	Mitigation Measures
		to contain potentially contaminated surface drainage if any, for on-site treatment prior to offsite discharge.
		<ul style="list-style-type: none"> • Surface drains will be adequately graded, kept debris-free and will be routed to a suitable location so as to prevent silting, flooding and inundation. • Preparation of a waste management plan to achieve reuse, reclamation and recycling of materials as far as practicable • Vegetation clearance will be minimized; • Site will be fenced and site access will be strictly controlled; • Damage to habitat in non-work areas will be encouraged to re-grow to as near as possible its original condition.
	Biodiversity <ul style="list-style-type: none"> • Loss of species diversity • Increase in poaching • Loss of species due to disposal of petroleum oil lubricants and toxic refuse 	
	Socio-Economic <ul style="list-style-type: none"> • Resource use • Employment • Income • Property value • Induced development • Traffic movement • Health 	<ul style="list-style-type: none"> • Employment of local labor as much as possible; • Planning adequate drinking water and sanitary facilities to meet the needs of the labor force (while ensuring that established resources are adequately preserved for local communities); • Providing adequate sewage treatment, drainage control and effluent disposal facilities so as not to impair local surface water bodies and groundwater resources; • Maintaining effective community liaison throughout the Horizontal Directional Drilling campaign to minimize disruption in local communities; • Safe traffic movement to avoid accidents: introducing appropriate traffic signs and markers; • Providing sufficient notification to nearby villages of the intended onset of well testing operations.
Construction Phase:		
<ul style="list-style-type: none"> • Physical presence of rig • Atmosphere emissions 	Air <ul style="list-style-type: none"> • Emission of dust • Emission of heat 	<ul style="list-style-type: none"> • Maintaining generator engines and other heavy duty engines in good condition, to reduce exhaust emissions; • Good housekeeping (i.e., strict fuel/chemical inventory and minimization of spillages, to reduce fugitive vapor emissions).

Source of Impact	Type of Impact	Mitigation Measures
<ul style="list-style-type: none"> • Drilling mud • Noise from generators • Noise from Horizontal Directional Drilling of river • Chemical spills • Fire and explosion • Surface drainage 	Noise and Vibration	<ul style="list-style-type: none"> • Equipment will be maintained in good working order and, where appropriate, acoustic hoods will be provided; • Taking maximum advantage of shielding provided by onsite structures and offsite natural features (trees, etc) to minimize noise levels at offsite receptor locations. • Restoration of disturbed soil to its original use or to an approved use; • Installing (and maintaining for the duration of the Horizontal Directional Drilling campaign) adequate run-on and runoff drainage channels to prevent flooding, inundation and silting; • Good housekeeping during mixing of mud chemicals; • Provision of a test separator and flare system sufficient to prevent accidental releases during pipeline pigging, purging test and commissioning etc. • Restoration of disturbed soil to its original use or to an approved use; • Drilling fluid used will be managed through bioremediation and applied to irrigable land; • Monitoring routine discharges to ensure conformance with Bangladesh standards. • The facilities shall be designed and operated to ensure that the risks of accidental releases and spills of environmentally hazardous compounds are minimized. • Vegetation clearance will be minimized; • The site will be fenced and site access will be strictly controlled; • Damage to habitat in non-work areas will be encouraged to re-grow to as near as possible its original condition. • Employment of local people as much as possible; • Providing adequate fencing to safeguard communities from risks posed by project activities;
	<ul style="list-style-type: none"> • Disturbance to general amenity • Disturbance to religious performance 	
	Land	
	<ul style="list-style-type: none"> • Change in land use • Soil erosion and sedimentation • Soil stability and compactness • Loss of soil fertility • Loss of land for salt and Shrimp Cultivation/ Production 	
	Groundwater	
	<ul style="list-style-type: none"> • Reduction in recharge potential • Contamination 	
	Biodiversity	
	<ul style="list-style-type: none"> • Loss of Species diversity • Damage to habitat • Loss of species due to disposal of petroleum oil lubricants and toxic refuse 	
	Socio-Economic	
	<ul style="list-style-type: none"> • Resource use • Income 	

Source of Impact	Type of Impact	Mitigation Measures
	<ul style="list-style-type: none"> Property value Induced development 	<ul style="list-style-type: none"> Public relations programs with local communities should be continually maintained to advise on risks and safety High standards of project operation, environmental impact mitigation measures and safety procedures must be maintained at all times Establish good relationships with local communities and help to support their community activities.
Operation Phase		
	<ul style="list-style-type: none"> Variety of adverse effects Long term positive impact national environmental and economic aspect Hazardous type wastes can pose serious environmental and health / safety hazards 	<ul style="list-style-type: none"> High standards of project operation, environmental impact mitigation measures and safety procedures must be maintained at all times During operation some problem may occur. So, necessary precautionary measures are required for protection Ensure that air emissions from the project site comply with standards Ensure that the noise level around the project complies with standards An inspection and maintenance (I&M) program should be implemented Hazardous wastes shall be managed in accordance with the requirements of the concerned authority as stated above

Source: Environmental Impact Assessment Report of Moheshkhali to Anwara Gas Pipeline

Environmental Clearance from DOE

Based on that EIA study and EMP, the DoE issued the Environmental Clearance Certificate (ECC) on 18th December, 2012 (*Memo No: DOE/Clearance/5028/2010/268*) subject to fulfilling certain terms and condition. The key conditions as listed in the ECC are listed hereunder:

1. The activity under Moheshkhali to Anwara 90 km 30" diameter Gas Transmission Pipeline Construction Project shall not result in the loss of containment of any materials that would affect health or will have damaging impact on the environment or natural resources.
2. Proper and adequate sanitation facilities shall be ensured in labor camps throughout the proposed Transmission Pipeline construction program.
3. No solid waste can be burnt in the project area. An environment friendly solid waste management should be in place during whole the period of the project in the field.
4. Proper and adequate on-site precautionary measures and safety measures shall be ensured so that no habitat of any flora and fauna would be demolished or destructed.
5. All the required mitigation measures suggested in the EIA report along with the emergency response plan are to be strictly implemented and kept operative/ functioning on a continuous basis.
6. To reduce dust, spraying of water over the earthen materials should be carried out from time to time.
7. Resettlement plan should be properly implemented and people should be adequately compensated.
8. After the construction work, top soil should be properly restored.
9. Construction material should be properly disposed off after the construction work is over.
10. As describe in the report environmental monitoring should be strictly followed and monitoring report should be shared with DOE to ensure the environmental management properly.
11. At the time of commissioning of the Gas Transmission Pipeline utmost precautionary measures should be taken to reduce the possibility of accident.
12. The Environmental Management Plan (EMP) include in the EIA study shall strictly be implemented and kept functioning on a continuous basis.
13. In case of any emergency, the following information shall immediately be reported to Dhaka Divisional office and Headquarters of the Department of Environment (DOE) simultaneously
 - a. Nature of incident (fire, accident, collision etc.)
 - b. Personnel affected (injured, missing, fatalities, etc.)
 - c. Emergency support available and its location (stand transport, medical facilities, etc.)
 - d. Weather conditions
 - e. Current operations (abandoning the site, firefighting, etc.)
14. All pollution incidents shall be reported immediately and simultaneously to the Chittagong Divisional office and Headquarters at Dhaka of the Department of Environment.
15. Full and adequate utilization of the techniques for mitigation of pollution and environmental damages well as that for treatment of waste shall be ensured.

16. Gas Transmission Company Limited (GTCL) shall submit a details work plan with time schedule of development activities at least 7 (seven) days ahead of the work commences in the field to Chittagong Divisional office and Headquarters of the Department of Environment (DOE) simultaneously.
17. On completion of the gas transmission pipeline construction, the project authority shall hand over and leave the land to the actual land owner in a replenished condition in terms of fertility and topography.
18. Comprehensive Environmental performance report shall be submitted on a monthly basis to both the DOE office including actual intervention and rehabilitation, mitigation and treatment option adopted at the project site.
19. All parameters of effluents, gaseous emission, noise, solid waste, etc. shall be within the limits in the Environmental Conservation Rule (ECR) 1997. In case of non-coverage of ECR 1997 the World Bank Environmental, Health and safety Guideline shall be adhered to.
20. There shall be specific format for Environmental Monitoring. Environmental Monitoring Reports shall be made available simultaneously to DOE Head Quarter and Chittagong Divisional office on a monthly basis during the whole period of the pipe construction project.
21. Rehabilitation of human settlement or compensation for any sort of activities which will incur damage or loss of public or private property or any natural resources shall be addressed as per Government of Bangladesh Rule and regulations.
22. No activities of cutting/razing/dressing of hilly land in endorsed under this clearance without due permission/clearance of the concerned authority of the Government of Bangladesh.
23. Appropriate permission would be required to obtain from forest department in favor of cutting /felling of any plant/tree/sapling forest by any individual or government before doing such type of activity.
24. Violation of any of the above conditions shall render this clearance void.
25. This Environmental Clearance is valid for one year from date issuance and GTCL shall apply for renewal to the Chittagong Divisional office of DOE at Chittagong with a copy to the Head Office of DOE in Dhaka at least 30 days ahead expiry.

3.6 OPERATIONAL DETAILS OF LNG TERMINAL

3.6.1 Process Description of FSU

LNG Cargo

LNG cargo will be brought by LNG carriers of sizes ranging from 125,000 m³ to 216,000 m³ capacity (the maximum being equivalent to Q-Flex LNG Carrier).

LNG Storage

LNG will be unloaded to the Floating Storage Unit (FSU) (moored to Jetty) with hard arms / soft arms wherein they are stored in membrane tanks of capacity varying from 145,000 m³ to 216,000 m³.

LNG Offloading

LNG will be offloaded from the LNG Carrier via twin jetty (with topside facility) to the FSU – which serves as LNG receiving and storage facility. The cryogenic LNG will be stored in the FSU Storage Tanks with storage capacity varying from 145,000 m³ to 216,000 m³. The offloading will be performed through Marine Loading Arms (MLAs) on both the LNG Carrier and FSU sides of the jetty. The offloaded LNG will flow through 4 nos. (3 working+1 standby) of MLAs (each of 16” diameter and of arm length of up to 12 m) on the FSU side of the jetty to the FSU Storage Tanks with attached couplings. At an average offloading rate of 10,000m³/hour, LNG cargo of 145,000 m³ will be transferred in 14.5 hours while 216,000 m³ will be transferred in 21.6 hours. For the total production up to 5.0 MMTPA, there will be requirement of 51 LNG cargos of 216,000m³ or 76 cargos of 145,000 m³.

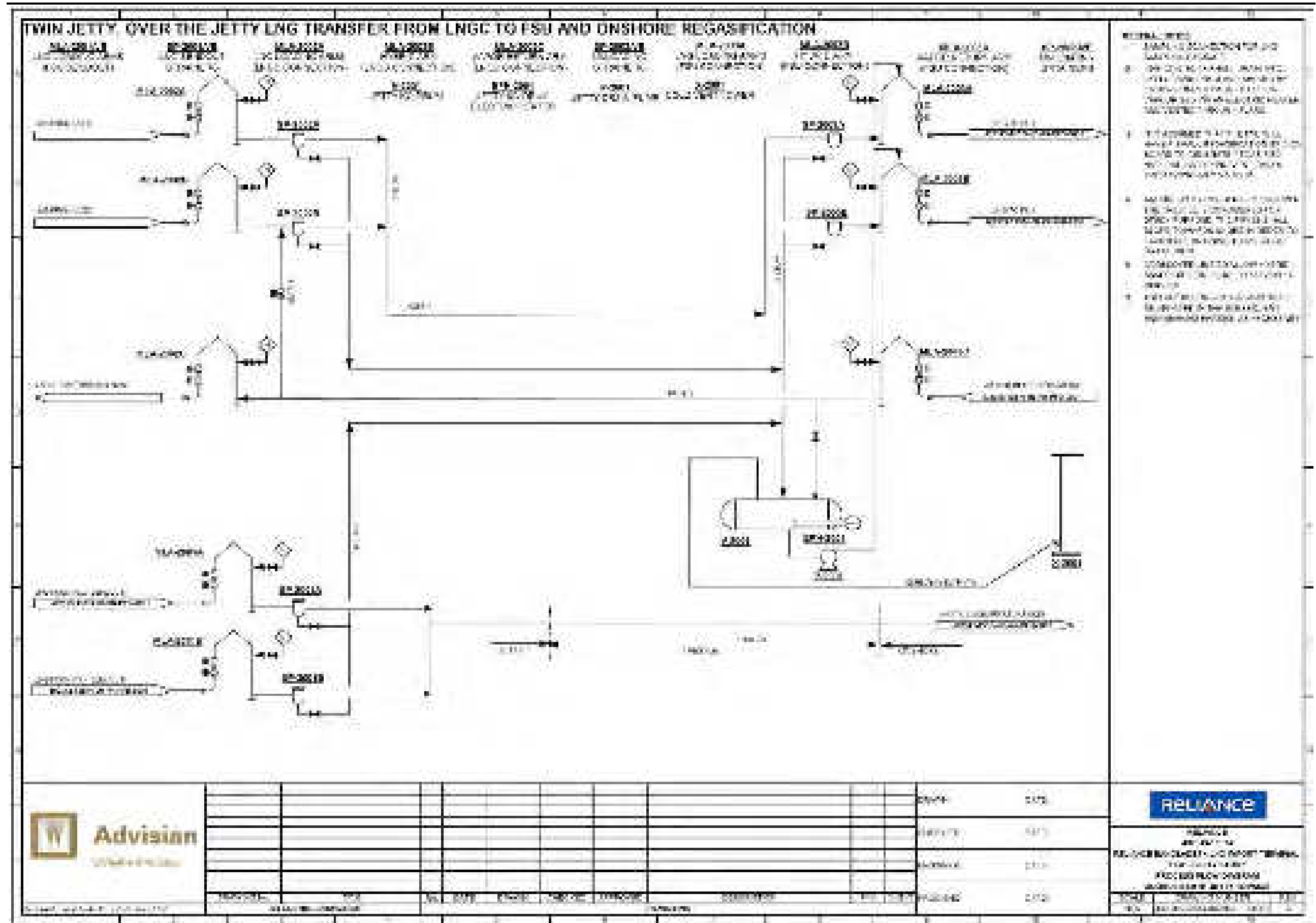
Thus with representative offloading of approximately 24 hours per day, there will be LNG cargo offloading at roughly 5 days per cycle. The LNG storage within FSU will be maintained at the 0.1 bar g. The LNG offloading will be done at the pump inlet pressure of 5 barg connecting MLAs of LNGC with MLAs of FSU at the jetty. Displaced vapour is balanced from the FSU back to the LNG Carrier.

LNG Transfer to ORF

LNG will be transferred across 30” diameter cryogenic pipeline (~2.4 km length without any flanges) placed on a motorable trestle to the ORF. The LNG transfer through cryogenic pipeline will be done at the pump inlet pressure upto 5 barg connecting the ORF. During the period of non-unloading of FSU, the cryogenic LNG pipeline will be kept in cold condition, which will be achieved by circulation of LNG through small capacity pumps (~ 1,600 m³/hour) located on board the FSU. Approximately 0.15% of boil off gases (BOG) (generated on board the FSU) will be compressed and transferred to onshore receiving facility (ORF) for use as internal fuel for in captive power plant (20 MW) at the ORF;

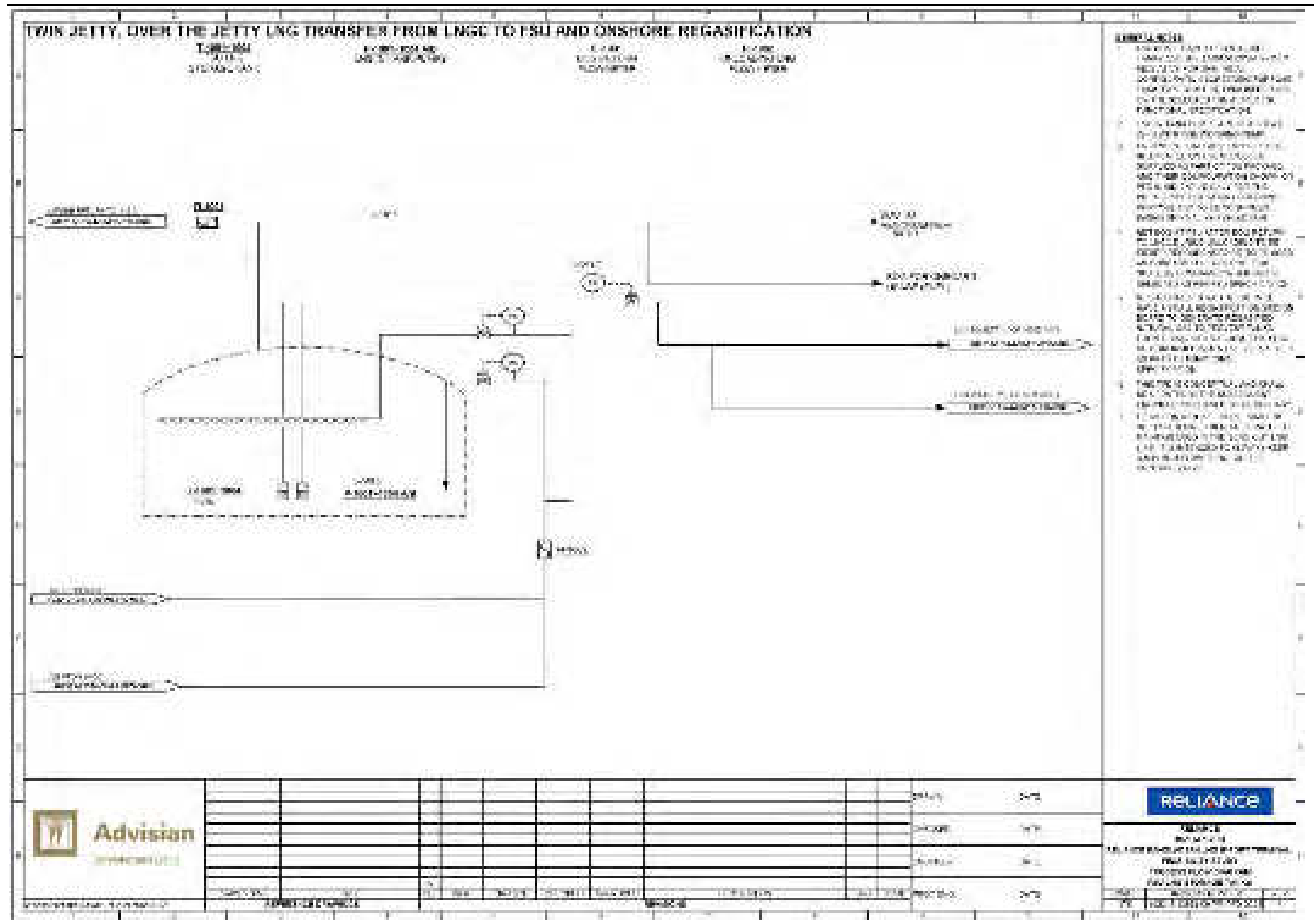
Typical operational of the LNG Terminal project is presented in *Figure 3.16*, *Figure 3.17*, *Figure 3.18* and *Figure 3.19*.

Figure 3.16 Process Flow Diagram - Double Berth Jetty Topside



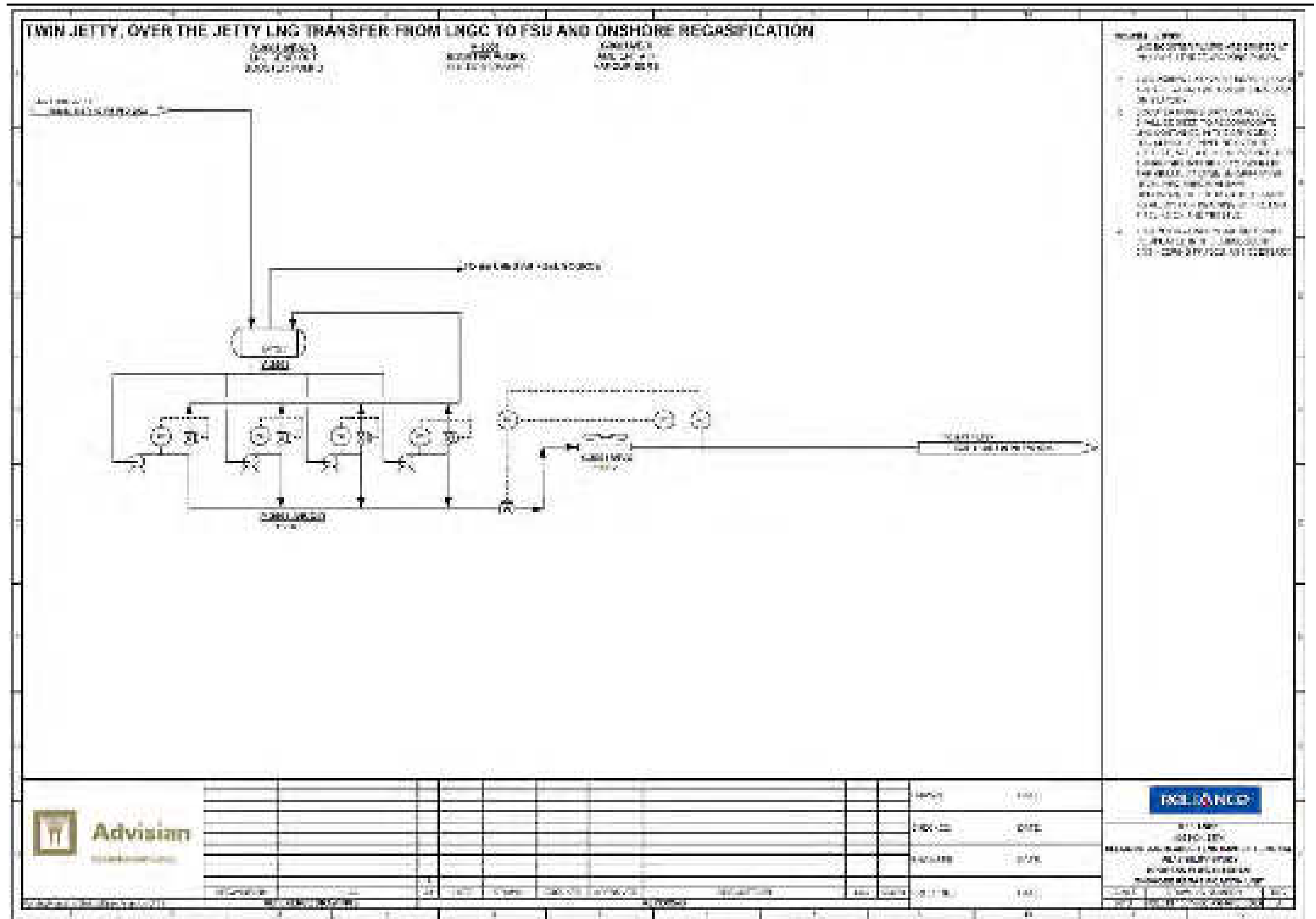
Source: Reliance Power Limited

Figure 3.17 Process Flow Diagram-FSU LNG Storage Tanks



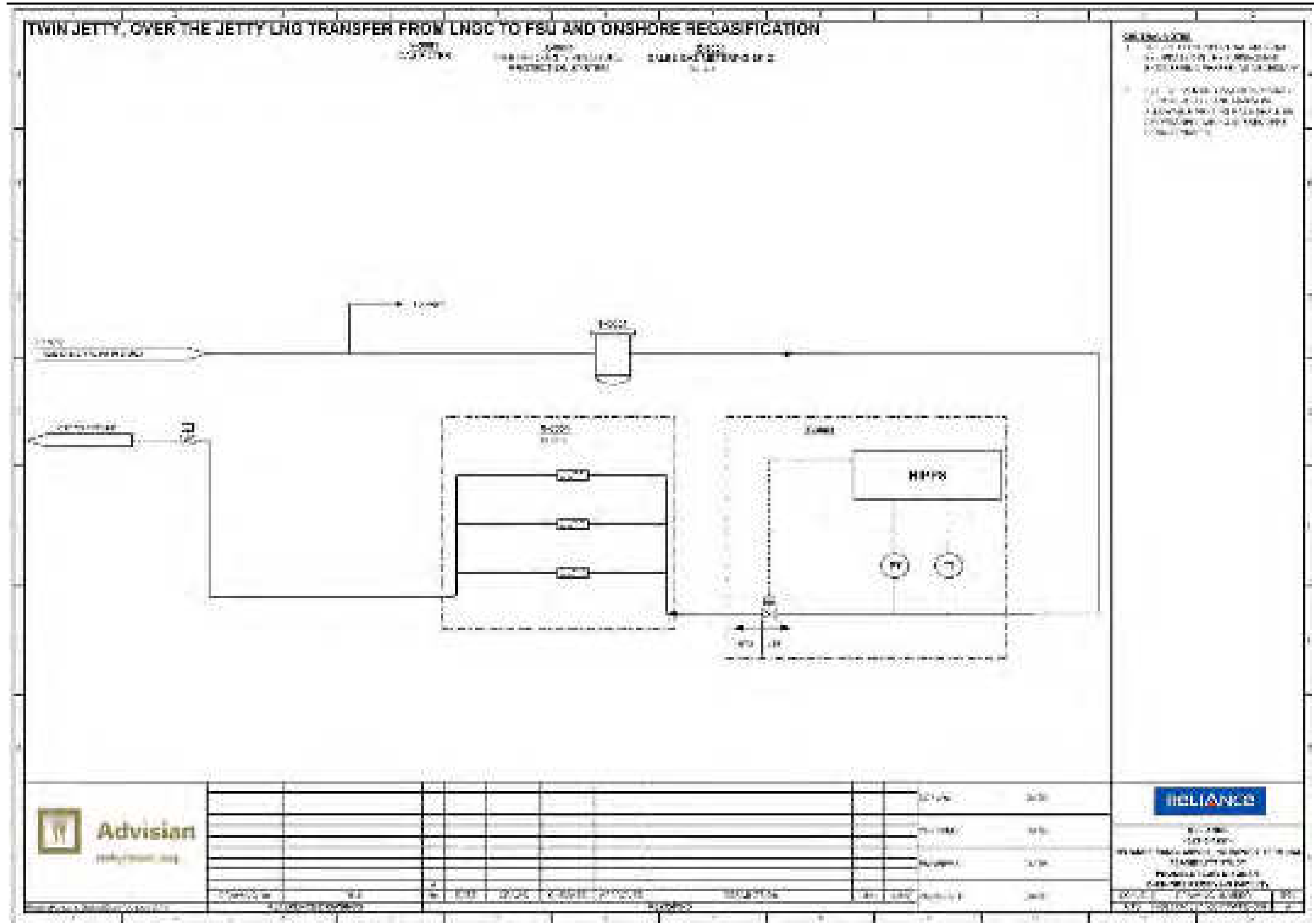
Source: Reliance Power Limited

Figure 3.18 Process Flow Diagram-Onshore Regasification Unit



Source: Reliance Power Limited

Figure 3.19 Process Flow Diagram-Onshore Receiving Facility



Source: Reliance Power Limited

3.6.2 *Process Description of Onshore Facility*

LNG Storage

LNG will be stored in membrane / moss type cargo tanks, having an overall gross capacity of about 185,000 m³.

Each storage tank will be equipped with block valves on the filling lines which will allow isolating the tank in case of emergency. Moreover, in case of failure of the tank pressure control system, each tank is protected against overpressure by independent safety valves discharging directly to the atmosphere via a dedicated vent mast.

Tanks will be provided with one radar type level instrument to monitor the level and give high and low level alarms. In addition, an independent high level switch will be fitted to initiate the shut-down of the LNG carrier loading operation to protect the tank from overflowing in case all other preventive actions fail.

Each tank will be also supplied with a Level Temperature Density (LTD) measurement instrument which allows measuring of liquid level, tank temperature profile and tank density profile. This instrument will be used to monitor tank stratification and as a backup for the radar level instrument. Tanks will be equipped with submerged electric LNG In-tank pumps used to lift LNG from storage tanks to the Re-gasification plant. The cooling of the electric motor and bearings and bearings lubrication is ensured by pumped LNG.

The start/stop of each LNG in-tank pump will be controlled by the operator who shall ensure that enough pumps are in operation to fulfil the FSRU send out flow rate.

Each pump discharge will be equipped with:

- A minimum flow recirculation which ensures that the pumps never operate below their minimum flow. The minimum flow recirculation will also be used for pump start-up.
- A vent to tank. During pump start-up sequence the vent will be opened to allow venting the gas contained in the pump well. The vent opening will be controlled by a timer. After an adjustable time, the vent will close.

Tanks will be equipped with spray pumps. Each pump discharge will be equipped with a control valve which enables to control the pump electrical current. Moreover, a return line to tank with an additional control valve will be provided in order to control the spray nozzles inlet pressure.

Onshore LNG Re-gasification

At the ORF, cryogenic LNG to flow through an intermediate vessel which separates any vapour generated in the pipeline. The medium pressure LNG is pressurized to above send-out line pressure using the onshore LNG pumps. The pressurized cryogenic LNG is then sent to a vaporizer for gasification and transfer to spur pipeline. The ORF will have regasification capacity of 750 MMSCFD. As an option there will be a storage tank of gross capacity ~185,000 m³ which will be connected to vaporizer to spur pipeline

Venting System

The venting system will aim to discharge any flammable vapour release to atmosphere at safe location, thus minimizing any potential risk to involved personnel.

Nitrogen System

A nitrogen system will be available for the following types of services:

- Purging of unloading arms: vapour and liquid unloading arms shall be purged after any loading;
- Intermittent services (tank barriers, sealing system between compressors and relevant motors, other seals, vent system purging);
- Continuous (essential) services (tank barriers, purging of the vent mast (first purge) and of unloading arms, continuous services).

The system will be made up of two redundant nitrogen generation packages - a buffer tank & a nitrogen distribution system.

Gas Metering and Send-Out

The natural gas from ORF then to flow through a metering skid at *Kutubdia* metering station to determine and record the flowrate of gas through Custody Transfer Metering system (CTMS) which is then transported to the Napura valve station via up to 36" high pressure (HP of ~95 bar g) spur pipeline of ~17 km length to connect into the proposed national gas grid of GTCL (*Moheshkhali - Anwara* section) at *Banskhali*. The receiving grid *Moheshkhali - Anwara* gas pipeline will have pressure of 80 to 85 bar.

3.7 RESOURCE REQUIREMENTS

3.7.1 Manpower

Construction Phase

The construction phase of the project is expected to span over a period of 24/36 months. Approximately 1000 workers would be required during the peak construction period, most of whom (approx. 600) would be unskilled workers. The construction workers (as recruited by the construction contractors) will be employed from the local area to the extent possible, in

order to benefit local people by giving them employment opportunities during the project construction phase. Labour camps (if any) that need to be setup during the constructed phase will be restricted within the boundaries of the identified project site.

Operation Phase

The FSU operations personnel will recruited by the FSU. The operation of the facility post-construction will require up to 120 full time employees for all working shifts.

The expected manpower requirement during the construction and operation phases is presented in *Table 3.7* . The man power projected is tentative and may vary by $\pm 20\%$ from the stated figures.

Table 3.7 *Manpower Requirement*

Stage	Managerial Personnel	Skilled Personnel	Unskilled Personnel	Total Manpower
Construction	100	300	600	1000
Operation	21	49	50	120

3.7.2 *Water*

During construction phase, the Project would require domestic water of ~20 m³/day (normal) to 40 m³/day (peak construction). Drinking water will be provided onsite after desired treatment. During operation phase, the Project would require ~20 m³/day of domestic water (to be sourced through barges from the Chittagong Port) for personnel working on-board the FSU and at the ORF. No ground water will be extracted for project purposes.

3.7.3 *Land*

Land will be required for the land based facilities and onshore pipeline from the ORF to the proposed national gas grid of GTCL at Banskhalī.

Land based facility: The ORF will be spread over an area of 40 acres and it will be a mix of both government land and private land. The proposed location for the land based facility is south of the new lighthouse and distributed on both sides of the existing embankment (*'beribandh'*). Western portion of proposed land is the sand beach side. The eastern part of the proposed plot, which is east of the embankment, is partly in Dakshin *Dhurung* mouza and partly in *Kaiyarbil mouza* of the two Union Parishads of *Kutubdia Upazila* under Cox's Bazar District. The overall land based facility comprises of approximately 240 plots (131 in Dakshin *Dhurung* and 109 in *Kaiyarbil*). The plots under private ownership are expected to go for land acquisition as per land acquisition and requisition law of the country.

Onshore Pipeline and Terminal: The gas pipeline will pass through Uttar Dhurung, Chhanua and Puichhari Union Parishads of Kutubdia and Banshkhali Upazila respectively. 8 m wide area will be acquired along the pipeline route for laying the pipeline and an additional 15 m will be required during the pipeline laying phase for staging of materials used in construction. 1.45-1.85 acres of land will be acquired for a terminal station (Valve 2) at Napura adjacent to existing MLV station along the GTCL pipeline. The following table provides details of the land requirement of different components of the Kutubdia LNG Project.


Table 3.8 *Land Requirement of Kutubdia LNG Project*

Project Component	Land Ownership		Total Land (acres)
	Govt. land (%)	Private land (%)	
Land Based Facility	13.2%	86.8%	40
Onshore Underground Pipeline	17.7%	82.3%	33.6
Terminal Station at Valve 2		100%	1.85

The ownership of the land parcels and other associated details will be addressed in a separate document Resettlement Plan (RP) in line with the ADB SPS 2009.

In this regard it is also important to note the following in respect of reclaimed land in this region.

Box 3.1 *Ownership of Reclaimed Land*

<p>Reclaimed land ownership is always bestowed with the government, however a private owner can always claim a 'reclaimed land' within a period of 30 years with proper land ownership documents; otherwise it remains with government as 'Khas land'. This has been stated in the State Acquisition & Tenancy Act.</p>	<ul style="list-style-type: none"> There is private land from existing 'Beribandh' upto 300 ft (ie. West of Beribandh). Erosion of this portion started since 1994 The Land Revenue Department usually maintains details on Alluvion Diluvian Land (AD Land); a record is maintained on mouza sheet to demarcate erosion of land on map. This has not been prepared for Kutubdia in the recent past. Also under State Acquisition and Tenancy Act any private owner can make claimant within a period of 30 years. In Dakshin Dhurung the eroded land portion on the coastal side (west) is less than 30 years. Government has not declared the land vested as on date.
	

Onshore Pipeline: The onshore pipeline from the ORF will be laid to connect to the proposed national gas grid of GTCL (*Moheshkhali Anwara* section) at *Banshkhali* – length of the pipeline is 17 km. Per unit area required for laying of the gas pipeline is 8 m, which will be acquired and an additional 15 m will be

required during the pipeline laying phase for staging of materials used in construction. The gas pipeline will pass through Uttar Dhurung, Chhanua and Puichhari Union Parishads of Kutubdia and Banshkhali Upazila respectively. It is understood that a total of 34 acres (17 Km X 8 m) is proposed to be acquired for laying of the onshore pipeline.

Figure 3.20 *Typical Cross Section for Pipeline Laying*



Terminal Station at Valve 2: Land will be acquired for a terminal station at Valve2 at Napura adjacent to existing MLV station along GTCL pipeline in Banshkhali. For the terminal station a land parcel of 75m x 75m or 75m x 100m will be acquired, which is about 1.4 acres or 1.85 acres.

3.7.4 Power

Maximum 2 MW power would be required for construction phase. Diesel would be utilized as fuel in diesel generators.

During operations phase a 20 MW-Power generation (LNG based) facility would be installed at the ORF during operation to take care of Power requirements. The exhaust stacks to be put with a height of approx. 43m.

3.7.5 Earth Requirements

Estimated soil requirement for the project during the construction stage is 1,000,000 cum ($\pm 20\%$). No soil storage is presently envisaged for during construction stage, however, in case of any emergency requirements, the soil shall be stored inside project area.

There will also be no spoil storage area inside construction site. RBLTL will be evolving procedures for disposal of the same after discussing with local administration.

3.7.6 Equipment and Machineries

The equipment and machineries required for the construction stage are highlighted in the Table below.

Table 3.9 List of Equipment to be used during Construction

Construction Activity	Equipment to be used
Onshore LNG Facility	Excavators, Dozers, Graders, Vibro Rollers, Back Hoe Loaders, Generators (Backhoe dredger, Rock hammer, Trenchers/Excavators).
Trestle with cryogenic pipeline construction	Pipe laying Crane, Barges, Dozers, Generators (Backhoe dredger, Rock hammer, Split hopper/Side dumping vessels, Survey Spread including ROV, Tugboats, Multipurpose shallow draft vessel and Diving support, Trenchers / Excavators).
Onshore Pipeline Laying	Pipe laying Crane, Dozers, Generators (Backhoe dredger, Rock hammer, Trenchers/Excavators).
FSU Jetty Construction and LNGC Mooring Dolphins	Material Carrying Barges / Vehicles, Diesel Generators.
Gas Metering Station	Material Carrying Vehicles, Construction Equipment

3.7.7 Construction Camps

The construction camp for the project will be located with the site earmarked for the ORF. The peak manpower estimated for the Project during the construction phase is 1000 worker of which 600 are unskilled workers. Most of the unskilled workers will be sourced from Kutubdia and surrounding regions and maybe a small percentage of the unskilled workers will be required to stay in the construction. The maximum extent of the managerial personnel is expected to be based out nearest urban centres at Pekua, Chitagong, Cox Bazar, etc. The skilled labourer estimated as 300 personnel during the peak construction period will be housed within the proposed construction camp. So at point of the time during the construction satge, the camp is not expected to house more than 350-400 personnel.

The construction camp will be designed in conformance to international standards with inbuilt safeguards especially in relation to workers accommodation, drinking water supply, sanitation facilities, garbage disposal systems, ventilation, natural and artificial lighting, cooking fuel and facilities, etc. In this case, the Guidance note by IFC and the EBRD on '*Workers' accommodation - processes and standards*'¹ will be refered and the safeguards as recommended by IFC/EBRD will be duly considered while planning for the construction camp for this project. Some of the key benchamarks in this regard are highlighted in the Box below.

These benchmarks as relvant and others as specified in the refred Guidance Note will be complied with while designing, construction and managing the construction camp under this project.

¹ http://www.ebrd.com/downloads/about/sustainability/Workers_accomodation.pdf

- The relevant national and local regulations have been identified and implemented.
 - Living facilities are located to avoid flooding and other natural hazards.
 - Living facilities are built with adequate materials, kept in good repair and kept clean and free from rubbish and other refuse.
 - The camp site is adequately drained to avoid the accumulation of stagnant water.
 - Adequate ventilation and/or air conditioning systems are provided.
 - Both natural and artificial lighting are provided and maintained in living facilities. It is best practice that the window area represents not less than 5% to 10% of the floor area. Emergency lighting is provided.
 - For worker accommodation a minimum ceiling height of 2.10 metres is provided.
 - Rooms/dormitories are built with easily cleanable flooring material.
 - In collective rooms, which are minimised, in order to provide workers with some privacy, only a reasonable number of workers are allowed to share the same room. Standards range from 2 to 8 workers.
 - All doors and windows should be lockable, and provided with mosquito screens
 - A separate bed for each worker is provided
 - There is a minimum space between beds of 1 metre
 - Double deck bunks are not advisable for fire safety and hygiene reasons, and their use is minimised
 - Facilities for the storage of personal belongings for workers are provided.
 - Separate storage for work boots and other personal protection equipment need to be provided
 - Access to an adequate and convenient supply of free potable water is always available to workers. Depending on climate, weather conditions and accommodation standards, 80 to 180 litres per person per day are available.
 - Rooms/dormitories are kept in good condition and are aired and cleaned at regular intervals.
 - Drinking water meets national/local or WHO drinking water standards.
 - All tanks used for the storage of drinking water are constructed and covered as to prevent water stored therein from becoming polluted or contaminated.
 - Wastewater, sewage, food and any other waste materials are adequately discharged, in compliance with local or World Bank standards – whichever is more stringent – and without causing any significant impacts on camp residents, the biophysical environment or surrounding communities.
 - Specific containers for rubbish collection are provided and emptied on a regular basis. Standards range from providing an adequate number of rubbish containers to providing leak proof, non-absorbent, rust and corrosion-resistant containers protected from insects and rodents. In addition it is best practice to locate rubbish containers 30 metres from each shelter on a wooden, metal, or concrete stand. Such containers must be emptied at regular intervals (to be determined based on temperatures and volumes generated) to avoid unpleasant odours associated with decaying organic materials.
 - Pest extermination, vector control and disinfection are carried out throughout the living facilities in compliance with local requirements and/or good
-

practice. Where warranted, pest and vector monitoring should be performed on a regular basis.

- Sanitary facilities are located within the same buildings and provided separately for men and women.
- Sanitary and toilet facilities are constructed of materials that are easily cleanable.
- Sanitary and toilet facilities are cleaned frequently and kept in working condition.
- Sanitary and toilet facilities are designed to provide workers with adequate privacy, including ceiling to floor partitions and lockable doors.
- Sanitary and toilet facilities are not shared between men and women, except in family accommodation
- An adequate number of toilets are provided to workers. Standards range from 1 unit to 15 persons to 1 unit per 6 persons. For urinals, usual standards are 1 unit to 15 persons.
- An adequate number of handwash facilities are provided to workers. Standards range from 1 unit to each 15 persons to 1 unit per 6 workers. Handwash facilities should consist of a tap and a basin, soap and hygienic means of drying hands.
- An adequate number of shower/bathroom facilities are provided to workers. Standards range from 1 unit to 15 persons to 1 unit per 6 persons.
- Canteen, cooking and laundry facilities are kept in a clean and sanitary condition.
- If workers can cook their own meals, kitchen space is provided separate from sleeping areas.
- Adequate facilities for washing and drying clothes are provided. Standards range from providing sinks or tubs with hot and cold water, cleaning soap and drying lines to providing washing machines and dryers
- Wall surfaces adjacent to cooking areas are made of fire-resistant materials. Food preparation tables are also equipped with a smooth durable washable surface. Lastly, in order to enable easy cleaning, it is good practice that stoves are not sealed against a wall, benches and fixtures are not built into the floor, and all cupboards and other fixtures and all walls and ceilings have a smooth durable washable surface.

Source: Workers' accommodation - processes and standards, IFC and EBRD

3.8 *POLLUTION SOURCES AND CHARACTERIZATION*

The project development might involve following potential effects on the environment:

- Air emissions;
- Water discharges;
- Waste generation; and
- Noise emissions.

3.8.1 *Air Emissions*

The operation of FSU and ORF will involve the following emissions to atmosphere:

- Emissions due to methane gas combustion for FSU and ORF power generation;
- LNG carriers and Tugs (for maneuvering and LNG discharge to the FSU);
- Methane gas combustion emission during emergency flaring (no cold venting will be resorted);
- Fugitive emissions of vapourised gas from compressors, joints and valves FSU, ORF and send-out pipeline;
- Exhausts of methane gas combustion will be represented by NO_x and CO emissions.
- Combustion emission of (SO₂ and NO_x) from diesel engines operation in the event of back up power requirement.

Exhausts of LNG combustion will be represented by NO_x and CO emissions. In case diesel engines are used, potential additional emissions of sulphur oxides and particulate might occur.

3.8.2 *Liquid Discharges*

During construction phase, the Project will generate domestic wastewater of ~16 m³/day during normal to 32 m³/day during peak construction period.

During operation phase, FSU deployed will have a sewage treatment system onboard to treat and discharge offshore and meet the MARPOL standards. Similarly, treatment facilities for bilge water will be provided onboard the FSU

A sewage treatment plant (STP) of capacity 20 m³/day will be installed for treatment of sewage generated at the ORF. The STP is proposed to be located next to the north eastern boundary of the proposed site adjacent to the administrative building (Refer *Figure 3.14*). The treatment technology to be selected will be finalised subsequently during the detailed design stage. The options being considered include standard aerobic treatment vis-à-vis utilisation of reed bed technology. In case reed bed technology, no sludge will be generated from the STP. However, in case of aerobic systems, sludge drying beds shall be provisioned along with STP inside the project premises.

No cold water discharges are anticipated from the project as the facility is planned using air based re-gasification systems.

3.8.3 *Waste Generation*

Solid Waste and Disposal

During construction phase, the Project would generate domestic solid waste of ~150 kg/day. About 60% of the domestic waste to be generated is expected to be biodegradable. Both biodegradable and non-biodegradable waste will be disposed of in separate bins at the nearby disposal site. Other waste during construction phase would be construction civil waste of ~50 tonnes per annum which will be used in raising the ground levels within the LNG ORF site.

During operation phase, the LNG Project would generate solid wastes onboard from FSU and LNG Carrier will be segregated and will be either safely incinerated onboard or brought onshore at onshore waste disposal facilities available with the Chittagong Port / Cox's Bazar Town. Food wastes of ~10 kg/day to be generated on board the FSU will be ground to a particle size capable of passing through a screen with openings of 25 mm and then discharged into the sea. While plastic and non-incinerable waste (~5 kg/day) will be collected and disposed of along with solid wastes (~15 kg/day) from ORF to be disposed of at an approved waste handling facility.

The FSU related waste will be handled by a MARPOL compliant Ship-Board incinerator capable of handling burning of allowed waste (sludge oil and solid) generated on-board. Un-allowed items as per MARPOL will be collected in separate bins and brought onshore for disposal.

Hazardous Wastes

Both during construction and operation phases, the Project would generate hazardous waste comprising of used oil; empty containers of paints, varnishes, thinners and lubricating oil; rags containing oil and grease, filter materials and packages containing hazardous wastes. Dedicated areas will be earmarked for temporary storage of hazardous wastes on impervious surface at the project site. All construction and operation phase hazardous wastes will be brought to on-shore dedicated area for recycling and/or final disposal at approved hazardous waste handling facilities near to the project site.

3.8.4 Noise Emissions

The main noise emission sources in LNG facilities include pumps, compressors, generators and their drivers, compressor suction / discharge, recycle piping, air dryers, air coolers at liquefaction facilities, vaporizers used during regasification, and general loading /unloading operations of LNG carriers /vessels.

Sound pressure levels (at 1 m from the source) of each equipment have been considered to be within 75 and 95 dB(A). With reference to the ORF, in normal operating conditions noise emissions mainly refer to regasification, power generation system and gas compression skid. Sound pressure levels (at 1 m from the source) have been considered to be within 80 and 90 dB(A).

3.9 CAPITAL & RECURRING DREDGING

As reported by RPL, no capital dredging is involved for the Project during the construction stage. Also no recurring dredging is involved during the operation phase of the Project.

3.10 PROJECT TIMELINE

Construction phase of the project is expected to continue for approximately 24/36 months. Target dates for the key milestones are presented in *Table 3.10* while the preliminary project schedule is presented in **Figure 3.21**.

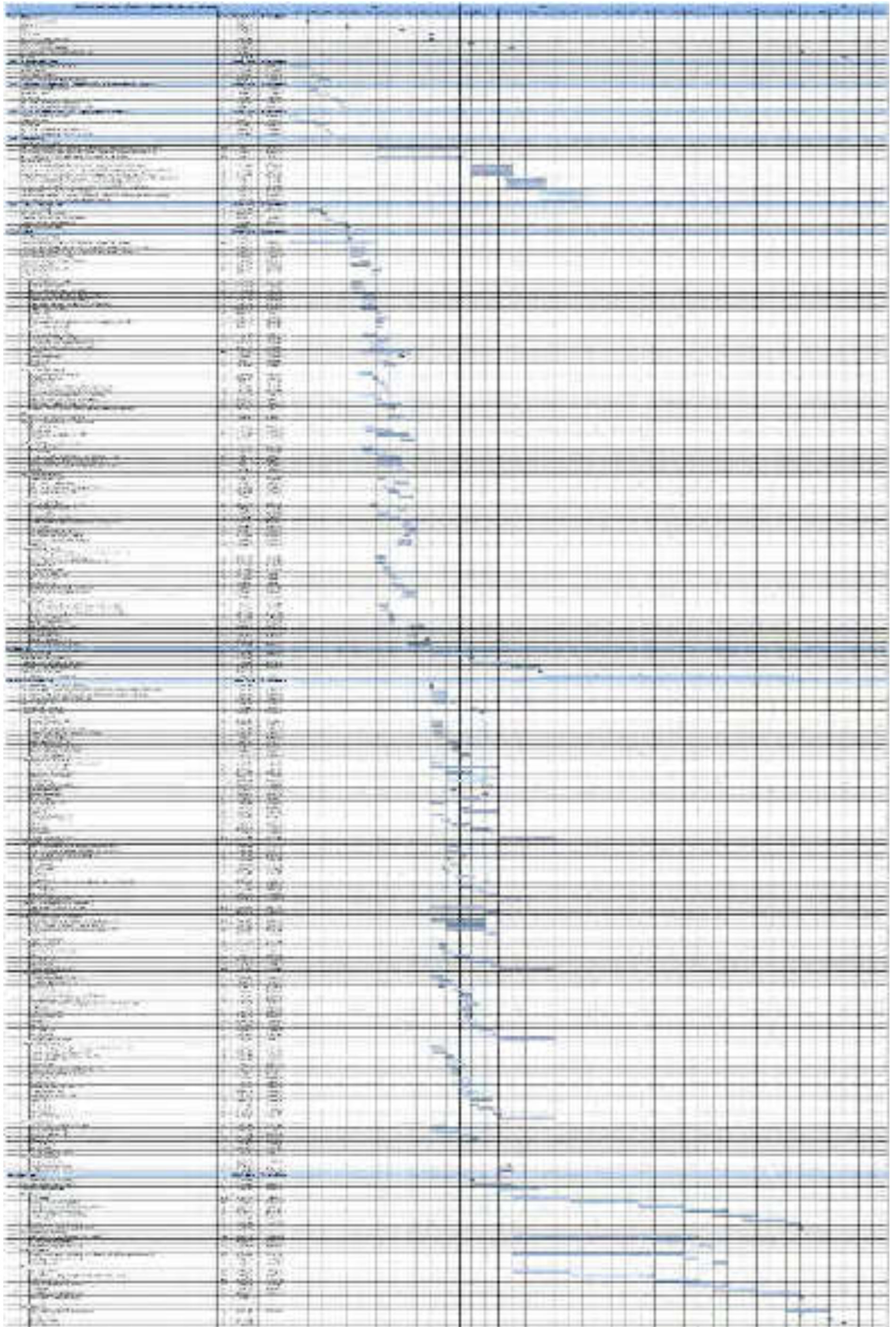
Table 3.10 *Tentative Project Timeline*

Milestone	Tentative Date
End of Feasibility Study	31 Jan 2017
FEED Award	30 Apr 2017
IFD	31 Aug 2017
End of FEED	31 Oct 2017
Start of Detailed Engineering	01 Nov 2017
Start of Construction	01 Feb 2018
End of Detailed Engineering	30 Apr 2018
FSU Conversion and Reclassification Complete	15 Dec 2019
First Gas	31 Mar 2020

3.11 *PROJECT COST*

Total investment for the proposed LNG facility and associated infrastructures would be approximately US\$ 400 million.

Figure 3.21 Kutubdia LNG Terminal - Preliminary Schedule



4 DESCRIPTION OF THE ENVIRONMENT

4.1 INTRODUCTION

This section describes the existing environmental and social baseline of the study area around the FSU location and along the pipeline corridor. This includes relevant components of physical, biological and socio-economic environment.

The purposes of describing the environmental settings of the study area are:

- To understand the project needs and environmental characteristics of the area; and
- To assess the quality of the existing environment, as well as the environmental impacts of the future developments being studied.

The baseline environment for the ESIA was studied through primary survey, information collected from secondary sources and discussion with local stakeholders.

4.2 STUDY AREA

A 10 km radial zone around the FSU site has been considered to ascertain presence of sensitivities/ sensitive receptors in this region. *Figure 4.1* shows the study area map of 10 km radius. Also an area of 500 metres on both sides of the pipeline corridor from the ORF to Napura Valve Station is also included within the study area.

The study area comprises of two distinct zones, i.e. offshore & intertidal zone and the onshore areas. The onshore area is dominated by agricultural land, salt pans, settlements with homestead plantation and block plantation areas (coastal shelter belts). The offshore area includes the Bay of Bengal which is located on the western periphery of the Kutubdia Island and the Kutubdia channel.

For the socio-economic baseline, data collection extended beyond a 10 km study area (when required) for implications on fishing grounds and fishing practices as well as the impact on land and livelihoods from the proposed LNG Project .

Figure 4.1 Study Area Map



4.3 METHODOLOGY

Environmental and social baseline data was collected through primary baseline surveys, information available through secondary literatures and discussion with local stakeholders. Primary baseline data was collected during the post monsoon season (October-November, 2016).

Primary environmental monitoring can be conducted in any season apart from monsoon. Environmental monitoring conducted in any of the three remaining seasons viz. post-monsoon, winter or pre-monsoon are considered representative. For the purpose of this ESIA, the baseline environment was monitored in course of the post monsoon season between October – November 2016 and was considered representative of the environmental quality in the proposed area of influence.

Further with a view to monitor and collate information for the other seasons it is also recommended that primary monitoring be also conducted prior to initiation of construction activities during the pre-monsoon season (March-April) before the advent of monsoon. The same monitoring framework is proposed to be followed as conducted during the ESIA study. The details are subsequently provided in Section 9 of this report.

4.3.1 Primary Baseline Data Collection: Environment and Ecology

ERM deputed specialist teams and conducted site surveys and field studies related to environment and biodiversity components. ERM also engaged EQMS Consulting Limited (EQMS), Bangladesh for conducting primary environmental baseline data collection in respect of ambient air, surface and ground water, soil and sediment quality, noise levels and traffic. **Table 4.1** provides an outline of the typical baseline information which was collected and analyzed by ERM and EQMS for the current study. In addition, studies related to certain specific component were also conducted by:

Mitra SK Laboratory - Due to very limited availability of high precision equipment (*NDIR-Non Dispersive Infrared Spectroscopy*) in Bangladesh for analysis of carbon monoxide (CO) from ambient air, ambient air samples were collected from study area and brought to India for analysis of CO. Mitra S.K Pvt. Ltd., a Kolkata based Indian laboratory was engaged by ERM to conduct the analyses of the CO samples using NDIR technology.

Fishery Expert - Dr. Mohammad Mamun Chowdhury (Associate Professor, Department of Fisheries, University of Dhaka), a local fishery expert was engaged for conducting a site specific fishery study in Kutubdia Island.

The detailed methodology for baseline data collection is presented in **Table 4.1**.

Table 4.1 Methodology for Baseline Data Collection-Environment and Ecology

No.	Items	Frequency	Sampling Details	Rationale for Collection of Data
1.1	Air quality Respirable Particulate Matter (PM ₁₀ , PM _{2.5}), Sulphur Dioxide (SO ₂), Oxides of Nitrogen (NO _x), Carbon Monoxide (CO)	6 weeks, once a week at each location during post monsoon season (October-November, 2016)	6 locations (Refer <i>Figure 4.2</i>)	<p>Primary air pollutants that are expected to be emitted from the project activities will include PM₁₀, PM_{2.5}, SO₂, NO_x, CO.</p> <p>Monitoring of ambient air quality is important to establish the baseline levels of air pollutants in ambient air before the commencement of the project. The baseline data collected would be later compared with the ambient air quality data to be collected during the construction and operation phases of the project to identify the contribution of the current project in releasing air pollutant in the local air environment.</p> <p>Rationale for selection of the monitoring locations are provided below</p> <ul style="list-style-type: none"> - AQ1 (Lighthouse): The location is selected at the nearest settlement to the ORF - AQ2 (Dakshin Dhurung): Location crosswind to the ORF near the approach road to the site - AQ3 (Lemshikhali): Location crosswind to the ORF - AQ4 (Kaiyarbil): Location cross wind to the project site - AQ5 (Uttar Dhurung): Location upwind to the ORF; also this settlement is in proximity to the pipeline crossing route - AQ6 (Boroghop): Location downwind to the ORF
1.2	Marine and Inland Surface water quality monitoring for physical, chemical, and biological parameters	Once during post monsoon season (November, 2016)	6 marine water samples from Bay of Bengal and Kutubdia Channel and one inland surface sample taken from Kutubdia Island in one season. (Refer <i>Figure 4.2</i>).	<p>Marine and inland water quality analysis was conducted to establish the baseline level of physicochemical factors of water. The baseline data collected would be later compared with the water quality data to be collected during the construction and operation phases of the project to identify the contribution of the current project in releasing pollutants to the water.</p> <p>Four locations for marine water samples collection in Bay of Bengal was selected to cover the entire stretch of footprints of marine facilities viz. FSU, trestle to be developed as part of the project. One</p>

No.	Items	Frequency	Sampling Details	Rationale for Collection of Data
			Surface and mid depth water samples were collected for Bay of Bengal water samples.	location was selected (SW1) in proximity to the ORF. Another location was selected at a distance of 3000 m west of the ORF (SW2) at the sea near the proposed FSU location. Two other locations (SW3 and SW4) were selected north west and south west of the ORF and the trestle. Two locations were selected at Kutubdia channel near the pipeline entry point (SW6) at the channel (near Kutubdia Island) and exit point (SW7) in Banskhal Upazila.
1.3	Ground water quality monitoring for physical, chemical, and biological parameters as per ECR 1997 including heavy metals	Once during post monsoon season (November, 2016)	4 samples taken in one season. (Refer <i>Figure 4.2</i>)	One location was selected (SW5) at the major inland water channel within the island (Pilat Kata khal) Groundwater quality analysis was conducted to establish the baseline level of physicochemical factors of groundwater which could be compared with the water quality data to be collected during the construction and operation phases of the project to identify the contribution of the current project in releasing pollutants to the groundwater. Groundwater in the area is collected mostly through tube wells. Samples were collected from shallow tube wells in Dakshin Dhurung, Kaiyabil, Lemshikhali and Boroghop Unions of Kutubdia Island to understand the groundwater quality of the Kutubdia island.
1.4	Meteorology	Data for one year (2015) was collected and analyzed	Secondary data from BMD for the Kutubdia Station was collected.	Meteorological data was collected from the Bangladesh Meteorological Station within the Kutubdia Island. The data is important to understand the pre-dominant meteorological conditions which affect in dispersal of air pollutants at the area.
1.5	Noise (At receptors such as settlements/ hospitals etc.) ambient noise levels	Once over 24 hours during post monsoon season (October, 2016)	At 6 locations, 24 hour measurements recorded at each location. (Refer <i>Figure 4.2</i>)	Monitoring of ambient noise levels is important to establish the baseline levels on the island. These baseline noise levels can be compared with noise monitoring to be conducted during project implementation phase to assess the impact of project activities on the baseline noise environment. Noise monitoring was conducted at 6 locations within Kutubdia Island to assess the baseline noise levels. The locations covered residential areas (Light House, Ali Fakir Deil; Kata Para, Lemshikhali; Ismail Haji Para, Kaiyabil; Uttar Masjid Para, Uttar Dhurung); mixed (Dakshin Dhurung union complex, Pachar Para)

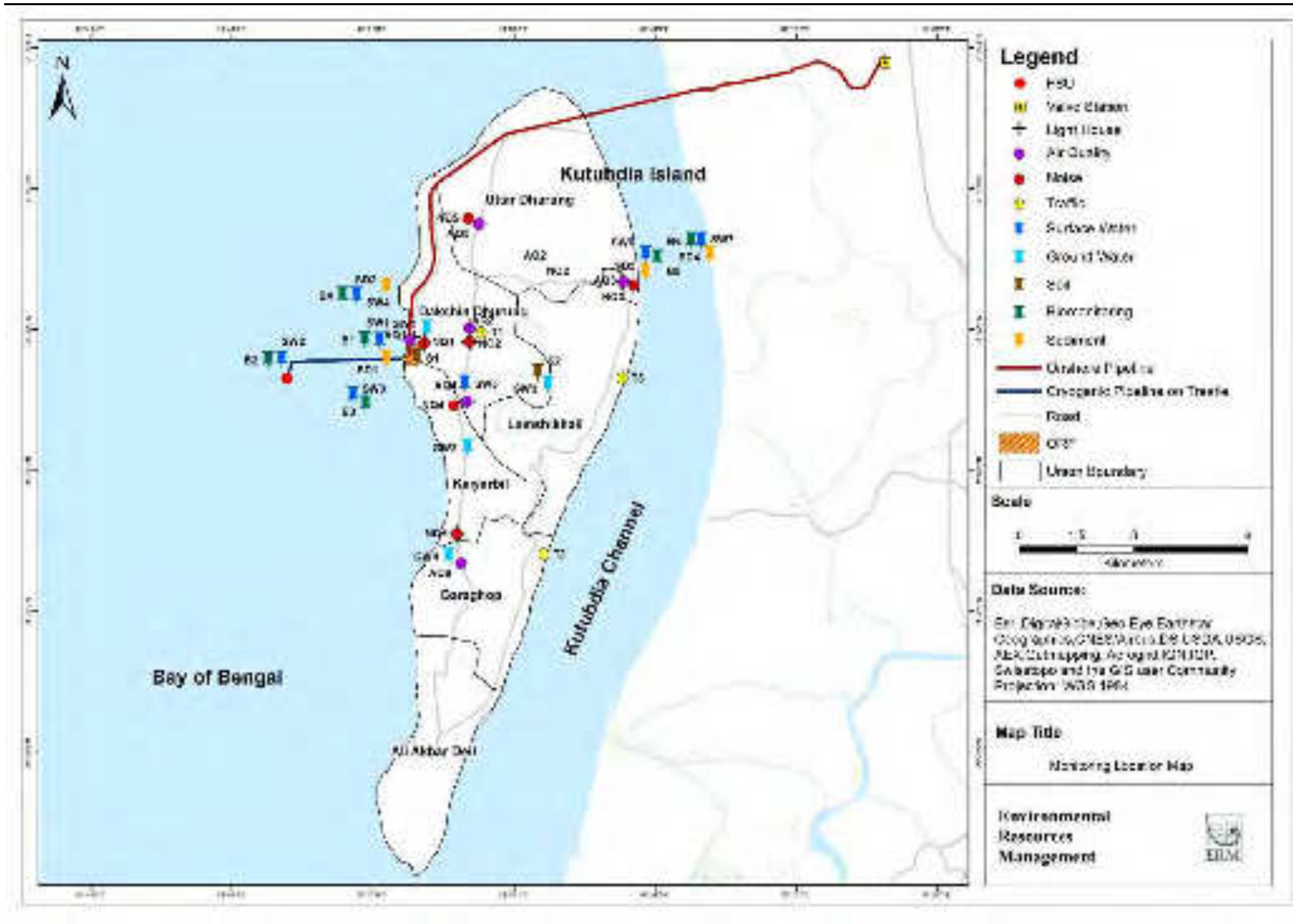
No.	Items	Frequency	Sampling Details	Rationale for Collection of Data
2.0	Soil and Sediment Quality for essential physio-chemical parameters	Once during post monsoon season (November, 2016)	2 soil samples from Kutubdia Island. 4 sediment samples, from Bay of Bengal and Kutubdia Channel (Refer <i>Figure 4.2</i>)	and Silent Zone (Kutubdia Upazila Health Complex). Soil samples were collected from agricultural lands of Ali Fakir Deil and Darbar village to understand physical properties of the soil and baseline levels of nutrients. The baseline soil quality can be compared with the soil quality at the time of project implementation phase. Marine sediment samples were collected at four locations <i>viz.</i> two from the Bay of Bengal and two from Kutubdia Channel. The sediment samples collected from Bay of Bengal was meant to assess the baseline marine sediment quality status which can be compared with the future sediment quality levels to be assessed during construction and operation stages of the FSU, pipeline on trestle and ORF. Marine sediment samples were also collected from two locations on the Kutubdia Channel to assess the impact of construction and operation of gas pipeline (ORF-Napura valve station) passing through the stretch of Kutubdia Channel.
3.0	Traffic Survey <ul style="list-style-type: none"> ▪ Road Traffic ▪ Waterway Traffic 	Once during post monsoon season (November, 2016)	Road traffic in the nearby road to the Project Site and Waterway traffic in the Kutubdia Channel for 24 hrs in a week day. (Refer <i>Figure 4.2</i>)	Road traffic survey was conducted at the approach road to the site i.e. road connecting Ali Fakir Deil with Uttar Dhurung Road to assess the existing traffic density on this road. River traffic densities were surveyed at two major ferry ghats (Boroghop Ferry Ghat and Darbarghat Ferry Ghat) which are used for connecting Kutubdia Island with the main land.
4.0	Ecological Survey <ul style="list-style-type: none"> ▪ Terrestrial survey including vegetation and habitat mapping, ▪ Terrestrial wildlife surveys (avifauna, herpetofauna and mammal surveys) ▪ Aquatic survey including plankton, benthos and fish ▪ Fishery Survey ▪ Migratory birds 	Once during post monsoon season (November, 2016)	1 time survey of terrestrial and freshwater aquatic ecology including wildlife.	Baseline ecological surveys were conducted at the aquatic and terrestrial habitats in proximity to the Kutubdia Island. The surveys were conducted to identify the major habitats, pre-dominant flora and faunal community structure that may get impacted due to the implementation of the proposed projects.

4.3.2 *Primary Baseline Data Collection: Socio-economic and Livelihood*

To capture the socio-economic environmental condition within the Project area of influence, following activities were undertaken:

- Identification of stakeholders;
- Undertaking consultations, interviews and focussed group discussions;
- Discussions with Government Departments, Local Authorities, District Officials, etc., as required;
- Socio-economic survey, including sample household survey of land users and displaced/resettled families (if any) supplemented by community and village level consultations.
- Discussion with fishermen and salt pan cultivators;
- Discussion with UNO Office, Kutubdia and Land Revenue Department, Cox's Bazar

Figure 4.2 Monitoring Location Map



4.4 OCEANOGRAPHIC CONDITIONS

4.4.1 Bathymetry

Kutubdia Island is located in the south-eastern part of Bangladesh and separated from the main land by the Kutubdia channel.

Bathymetry at the west coast

The bathymetry map indicates a steep sea floor with 10 m contour reaching within 1 km from the Kutubdia Island on the west. An area with more than 13m water depth can be found less than 3km from shore (current project location). Access to this area by LNGCs would be possible without dredging. A Dolphin shoal is located at about 7 km from shore. This shallow patch is approximately trending N-S; extending for about 35 km, almost parallel to the coastline. The depths in this shoal are up to ~6.5 m. Another small shoal (depth 0.1-1 m) was also observed close to the west coast also extending north-south between Kaiyabil and Boroghob. This shoal is about 6-7 km in length at a distance of 0.5-1 km from the shore.

Bathymetry of Kutubdia Channel

The depths are greater at the north ranging between 5.2-16.4 m, less at the central portion of the channel (2.2- 4.4 m) and again greater at the south ranging between 5.2-7.8 m. In general the depth is greater at the east near the landward side. Near the proposed pipeline crossing area the depth is about 7.9 m at the west, reducing upto 6.1 m in the east and then again increasing to 9 m further east and decreasing to 2.5 m, near the shore. According to hydrographic map of Kutubdia to Elephant point the depths in Kutubdia channel are subject to rapid change and therefore vessels should exercise extreme caution while traversing in this channel.

Figure 4.3 Navigational Chart Showing water Depth & Shoreline near Kutubdia Island and Kutubdia Channel



Source: Advisian WorleyParson Group, 2016. Reliance Bangladesh LNG Import Terminal Feasibility Study - Site and Configuration Selection Report

4.4.2 Tide

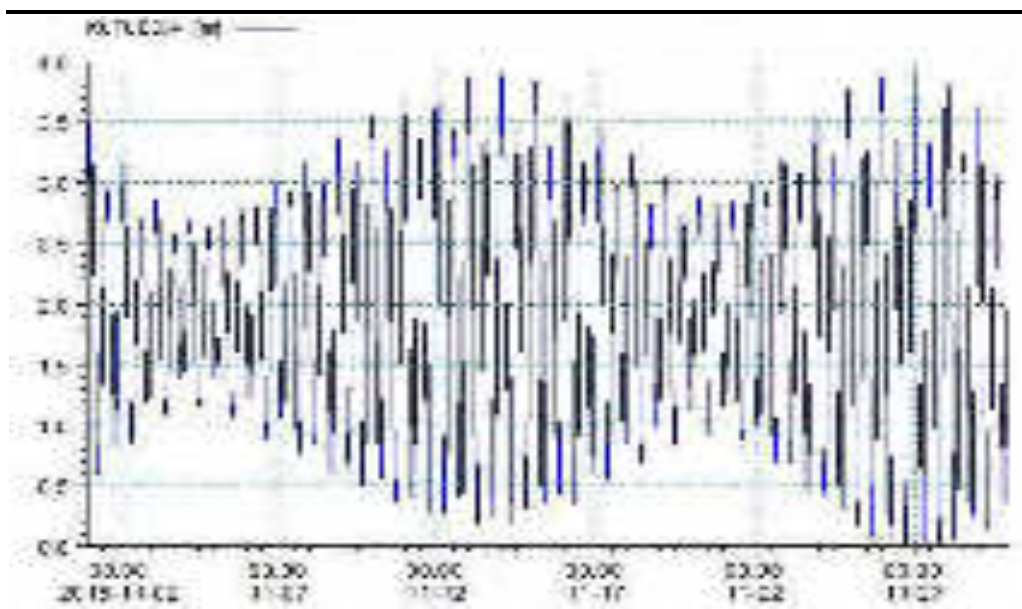
Tide data available near Kutubdia Island as mentioned on the Naval Hydrographic Chart No. 319 & 361 with reference to Chart Datum (CD) is given in *Table 4.2*.

Table 4.2 Tidal levels at Kutubdia island with respect to Chart Datum (in metres)

Station Name	Coordinate		Tidal levels w.r.t CD (m)				
	Latitude	Longitude	MHWS	MHWN	MSL	MLWN	MLWS
Kutubdia Island	21° 52' N	91° 50' E	3.9	2.7	2.0	1.3	0.2

Strong tidal current occur near Kutubdia Island. Results of hydrodynamic modelling analysis carried out for the period 15 October 2015 to 30 November 2015 to cover the full spring and neap phase tidal cycle are shown in *Figure 4.4*.

Figure 4.4 *Predicted Tidal Levels at Kutubdia w.r.t. CD (in metres)*



Source: DHI, 2016 - Desktop Study for Site Screening in Chittagong and Moheshkhali Region

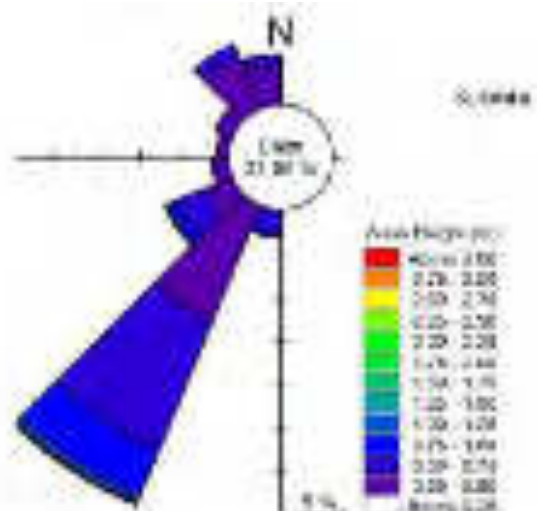
4.4.3 Waves

The area around Kutubdia Island is represented by benign wave conditions. Wave characteristics near Kutubdia Island from offshore wave data at 10 m water depth are represented below¹.

- Predominant wave direction is from south west (represented in *Figure 4.5*)
- Wave data presented for the period of 2005-2009 showed maximum wave height of 2.25 m and a maximum zero crossing periods of 14 seconds.
- The percentage occurrence of significant wave heights and peak wave periods near Kutubdia Island derived for 2011 showed maximum wave height of 2 m and occurrence of peak period greater than 18s (represented in *Table 4.3*).

¹ Advisian WorleyParson Group, 2016. Reliance Bangladesh LNG Import Terminal Feasibility Study – Site and Configuration Selection Report

Figure 4.5 Annual Wave Rose of Significant Wave Heights and Mean Wave Direction near Kutubdia



Source: Advisian WorleyParson Group, 2016 - Site and Configuration Selection Report

Table 4.3 Percentage Occurrence of Significant Wave Heights & Peak Wave Periods near Kutubdia

Peak wave Period in second	Significant wave height Vs Peak wave period (%) during the Period of 2011													Total (%)
	Significant (Resultant) wave height in metre													
	0-0.25	0.25-0.5	0.5-0.75	0.75-1.0	1.0-1.25	1.25-1.5	1.5-1.75	1.75-2.0	2.0-2.25	2.25-2.5	2.5-2.75	2.75-3.0	≥ 3.0	
0-2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
2-3	0.14	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.21
3-4	1.37	2.47	0.07	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.91
4-5	0.14	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.27
5-6	0.00	0.00	0.21	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.41
6-7	0.00	0.00	1.17	0.69	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.85
7-8	0.00	0.00	1.37	4.87	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.25
8-9	0.00	0.00	0.89	4.53	0.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.70
9-10	0.00	0.41	1.10	2.75	1.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.70
10-11	0.00	1.72	0.41	0.34	0.34	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.81
11-12	0.96	4.53	1.51	0.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.62
12-13	0.75	6.86	3.71	1.65	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.97
13-14	0.48	7.82	7.62	5.28	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	21.21
14-15	0.41	4.32	4.26	4.39	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	13.52
15-16	0.21	1.10	2.54	2.13	0.21	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.18
16-17	0.07	1.03	2.68	2.68	0.48	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.93
17-18	0.00	0.21	0.14	0.14	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.48
≥ 18.0	0.00	0.55	1.92	0.96	0.55	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.98
Total %	4.53	31.23	29.58	31.23	3.43	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00

Source: DHI, 2016 - Desktop Study for Site Screening in Chittagong and Moheshkhali Region

4.4.4 Current

Strong longshore currents occur in the monsoon season near Kutubdia Island. Direction of current is predominantly north during peak flood tide and south during ebb tide and NE monsoon.

Hydrodynamic Modelling

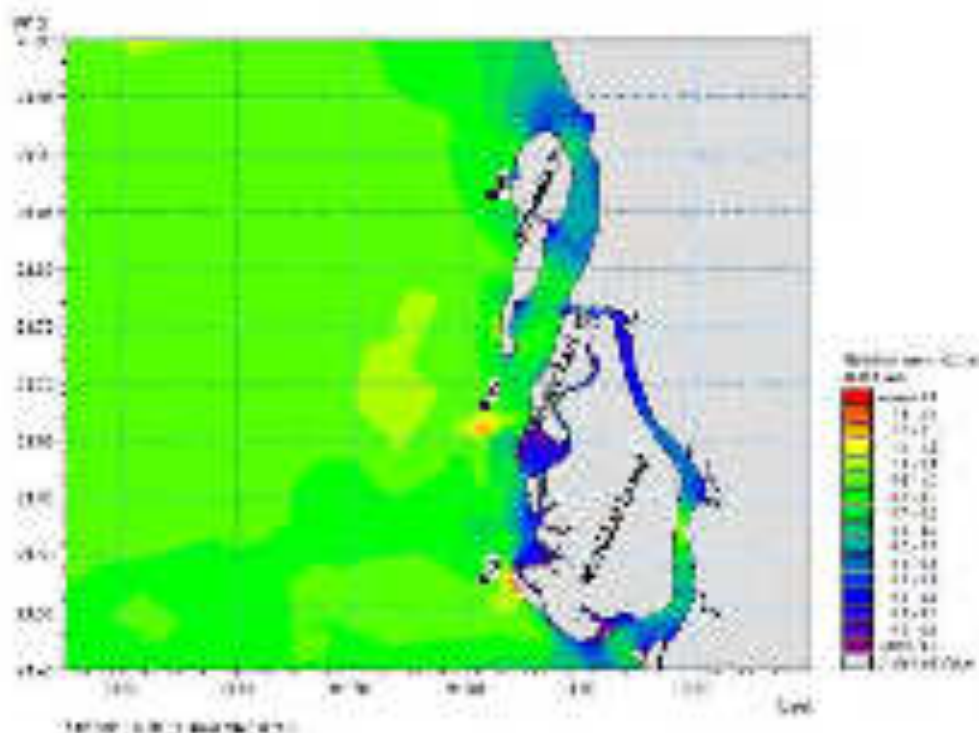
As part of the site screening study conducted by DHI for this project¹, hydrodynamic modelling analysis was carried out around the project area for a period of over one month (15 October 2015 to 30 November 2015) to cover the full spring and neap phase of tidal cycle. The hydrodynamic model was executed for periods representing north east monsoon.

The Hydrodynamic modelling was carried out using DHI's MIKE21 FM (Flexible Mesh) HD model. The model simulates 2D free-surface flows, solving the depth averaged Navier-Stokes equations and is applicable to the simulation of hydrodynamic processes in lakes, estuaries, bays, coastal areas and seas.

The model was executed for periods representing NE monsoon. The simulated depth averaged currents were analysed statistically to estimate mean currents speed and maximum current speeds as shown in *Figure 4.6*. The normal operating current speeds were found to be less than 1.0 m/s near Kutubdia Island with the maximum current speed recorded as 2m/s.

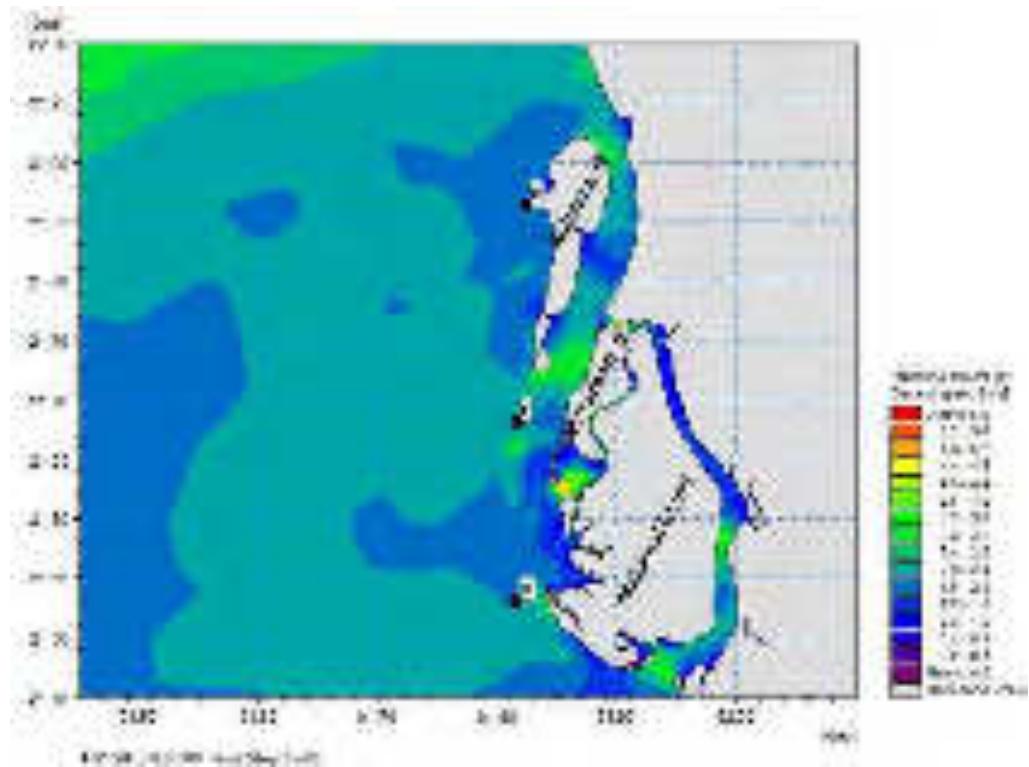
Current direction is predominantly to North during peak flood tide and to South during ebb tide and NE monsoon. The snapshot of current pattern during peak flood tide and ebb tide is shown in *Figure 4.7* and the corresponding rose plot is shown in *Figure 4.8*

Figure 4.6 Mean and Maximum Current Speeds near Kutubdia Island



Mean Current Speed during NE Monsoon

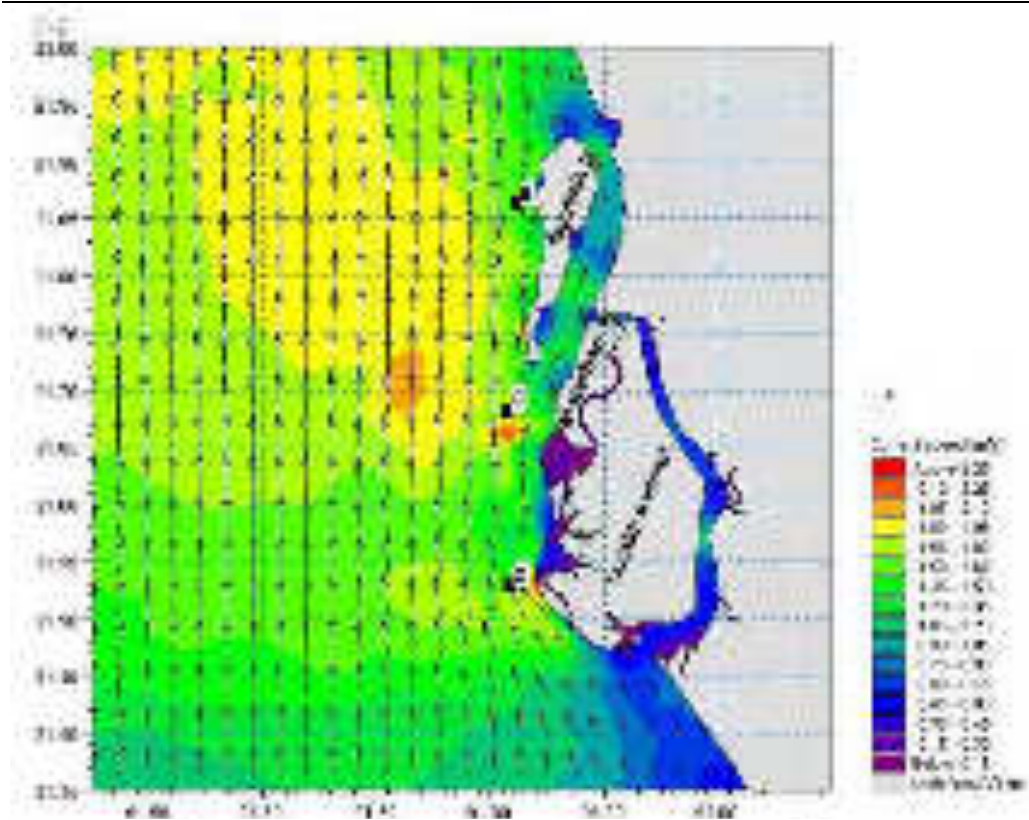
¹ Source: DHI, 2016 - Desktop Study for Site Screening in Chittagong and Moheshkhali Region



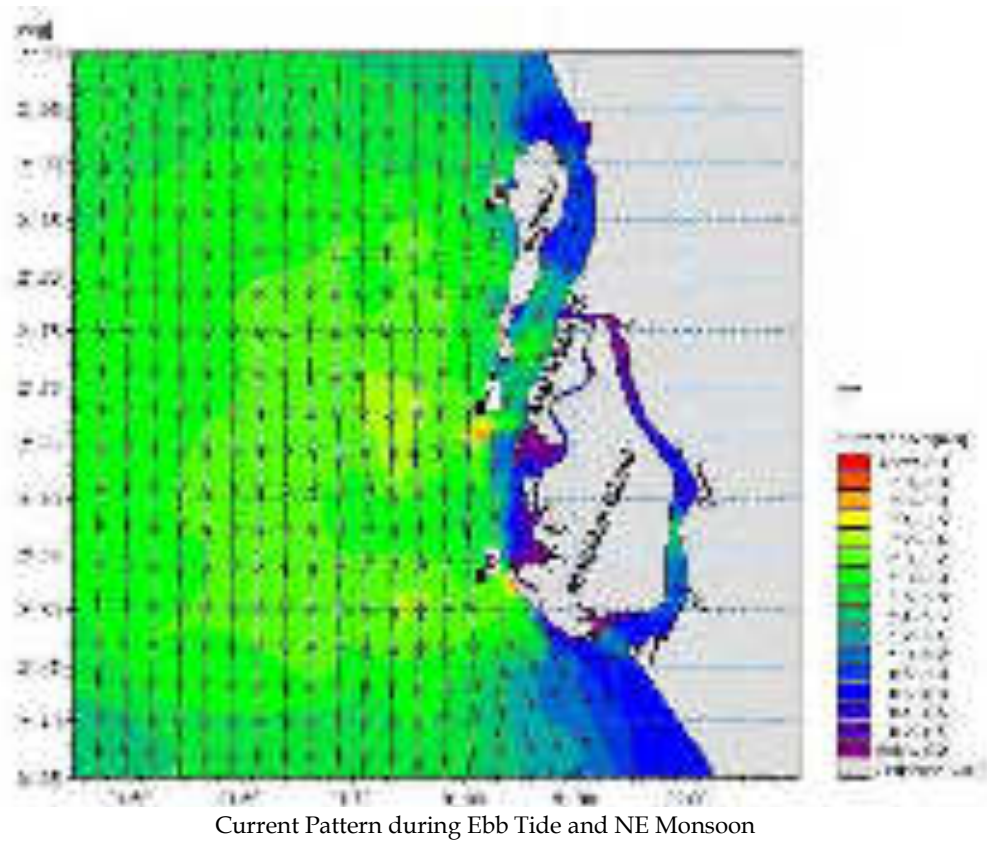
Maximum Current Speed during NE Monsoon

Source: DHI, 2016 - Desktop Study for Site Screening in Chittagong and Moheshkhali Region

Figure 4.7 Current Pattern near Kutubdia Island

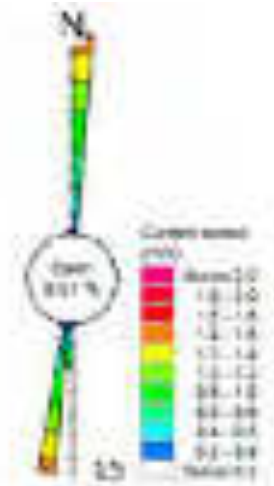


Current Pattern during Peak Flood Tide



Source: DHI, 2016 - Desktop Study for Site Screening in Chittagong and Moheshkhali Region

Figure 4.8 *Roseplot of Current Pattern near Kutubdia Island*



Source: DHI, 2016 - Desktop Study for Site Screening in Chittagong and Moheshkhali Region

Utilising the findings from the Hydrodynamic Model, the study on current pattern of the Bay of Bengal near the proposed project area reveals that the area experiences maximum current speed of approximately 2 m/s with an average current speed of 1 m/s. As also explained in Section 4.5.6 the proposed project area is not prone to erosion. The ocean environment near the proposed project area is found to be more stable as compared to other alternative sites (Matarbari, Moheshkhali etc.) that were considered and experiences less harsh wave and current.

Given the stable hydrodynamic nature around the proposed project areas as established through the hydrodynamic modelling exercise and the nature of marine components proposed under this project (i.e. FSU as a floating unit moored to an island jetty and a trestle on sub-marine footings), any significant alternation of hydro dynamic behaviour / flow regime is not really foreseen.

4.5 LAND ENVIRONMENT

4.5.1 Physiography

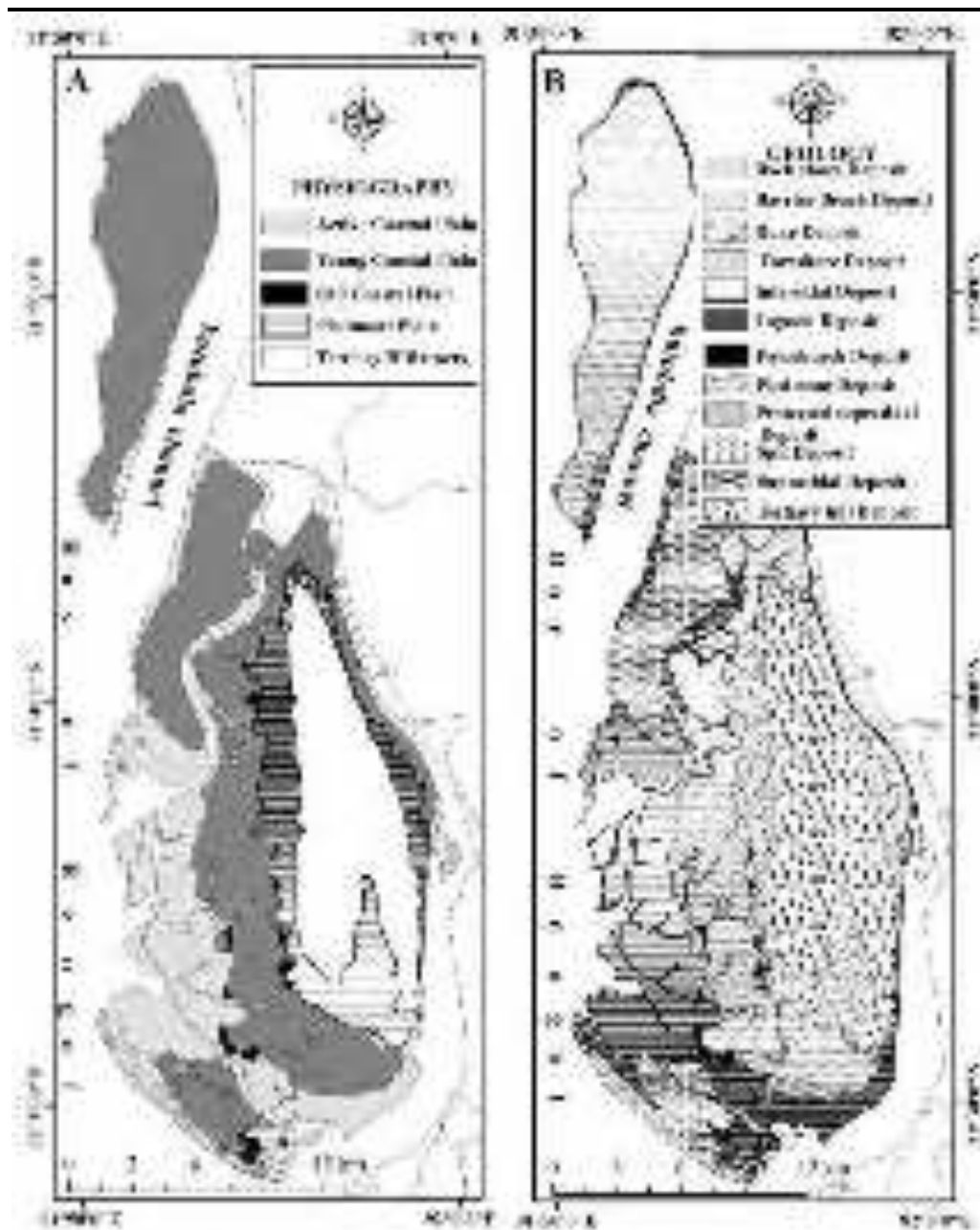
The Kutubdia Island falls under the physiographic unit '**Upper-tidal deposit of Bangladesh**'. According to *Majlis et al. 2013*¹ major physiographic unit of the Islands is **young coastal plain** having average elevation of approximately 6 meters and surrounded by active coastal plain which is present at the boundary of the Kutubdia Island. The study area faces strong longshore currents in the rainy season which eventually cause rapid erosion along the southern and western shorelines of the island. The physiography of Kutubdia Island is presented in *Figure 4.9*.

4.5.2 Geology

Geologically this island is young and is dominantly consisting of unconsolidated sediments. According to *Majlis et al. (2013)*, major portion of the study area dominantly consists of tidal deposits, i.e. inter tidal and supratidal deposits composed of silty clay with organic clay mix and little sand. The beaches and dunes are composed of loose, fine to medium sand with considerable quantity of heavy minerals. The geology map of Kutubdia Island is presented in *Figure 4.9*.

¹ Majlis, A.B.K., M.A. Islam, M.H. Khasru and M.K. Ahsan. 2013. Protected to Open basin depositional system: an appraisal for the late quaternary evolution of the Moheshkhali Kutubdia coastal plain, Bangladesh. *Bangladesh J. Geology* 31-32: 16-28.

Figure 4.9 Generalized Physiography and Geology Map



Source: Majlis, A.B.K., M.A. Islam, M.H. Khasru and M.K. Ahsan. 2013. Protected to open basin depositional system: an appraisal for the late quaternary evolution of the Moheshkhali Kutubdia coastal plain, Bangladesh. Bangladesh J. Geology 31-32: 16- 28.

4.5.3 Topography

The study area is part of an estuarine island in the south-eastern part of Bangladesh. The elevation of the island varies between 0 to 25 feet (7.6 m) above sea level. The site selected is located along the north western part of the island and is principally flat. The northern part of the island is having comparatively higher elevation and the slope of the island is from north to south. An earthen embankment is present along the entire stretch of the island. The average height of this coastal wall is 6 m. Several stretches of this embankment have got badly damaged resulting from repeated cyclonic events in this region.

4.5.4 Land use

Land Use of Study Area

Land uses of the project site and its surrounding area have been studied using high resolution satellite imagery (dated May 2015) and through subsequent ground truthing exercise conducted during the site reconnaissance surveys.

A major part of the 10 km radial study area falls in the Bay of Bengal, which approximately covers 70.37% of the study area. The predominant land use-land cover of the on-shore portion of the study area includes agricultural land (5.56%), salt pans (9.06%), and settlement (4.16%). Results of the land use-land cover analysis for the study area, as mentioned above, is presented in **Table 4.4**. The land use of the site selected for the land based facilities area is categorised as 'coastal sandy area', 'agriculture' and 'salt pans'. Corresponding land use and land cover map of study area is presented in **Figure 4.10**.

Landuses along onshore pipeline construction corridor of 23 m width has been studied and represented in **Table 4.5** and **Figure 4.11**.

Table 4.4 *Land Use/Land Cover in 10 Km Radial Study Area*

S No.	Land Use Category	Area (sq. km)	Percentage
1	Agriculture	17.47	5.56
2	Block Vegetation	0.07	0.02
3	Channel	31.86	10.14
4	Coastal Sandy Area	1.03	0.33
5	Creek	0.48	0.15
6	Mudflat and Mangrove	0.49	0.16
7	Saltpan	28.45	9.06
8	Sea	221.04	70.37
9	Settlement	13.07	4.16
10	Swamp	0.15	0.05
11	Waterbodies	0.01	0.003
	Total	314.12	100.00

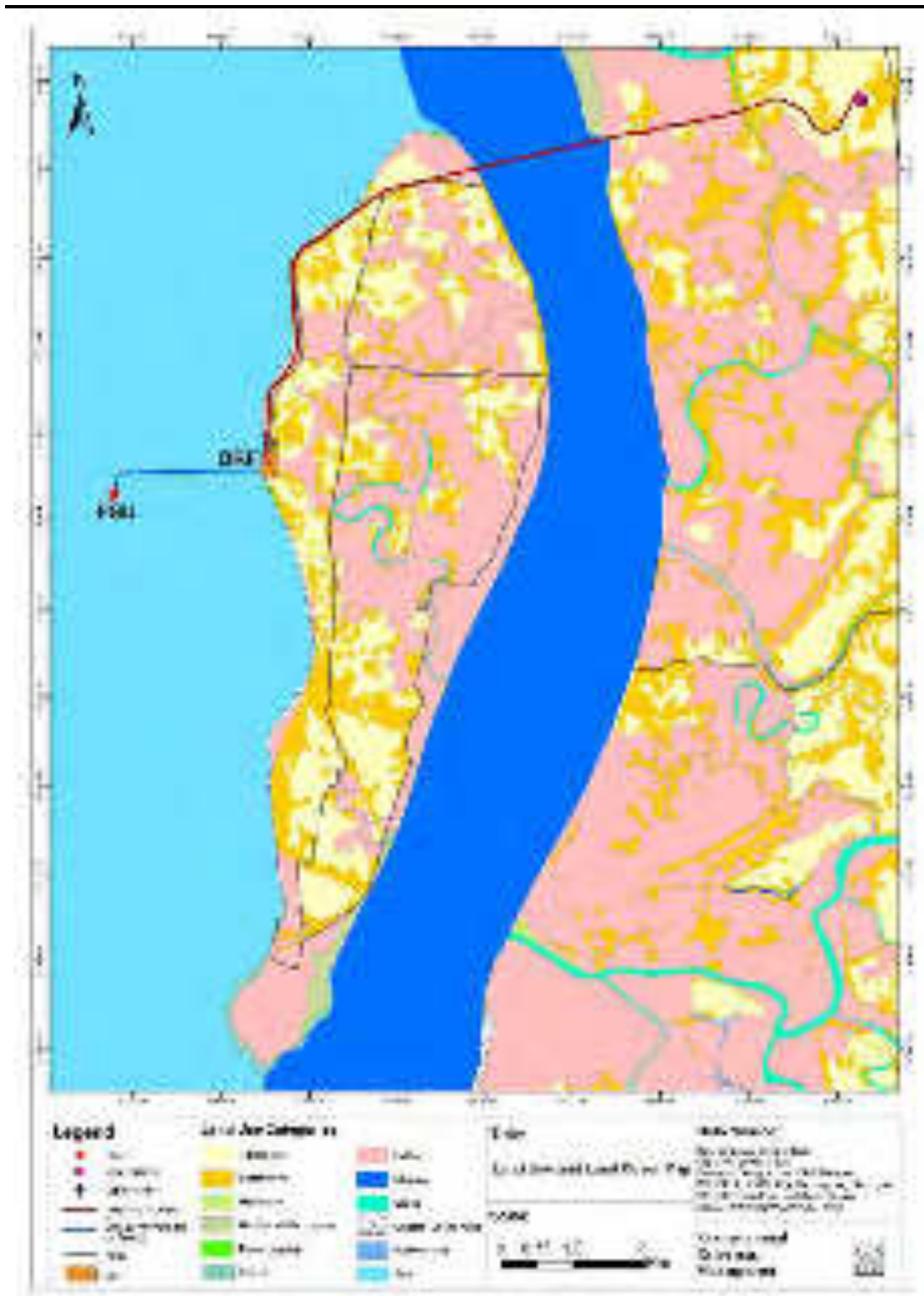
Source: GIS mapping and interpretation of satellite imagery and supplemented with findings from the ground truthing surveys conducted during the site reconnaissance study

Table 4.5 *Land Use/Land Cover along the Pipeline Construction Corridor*

S. No.	Land Use Category	Area (sq. km)	Percentage
1	Agriculture	0.1420	36.0
2	Block Vegetation	0.0035	0.87
3	Channel	0.0632	16.03
4	Coastal Sandy Area	0.0743	18.83
5	Creek	0.0006	0.15
6	Road	0.0019	0.49
7	Saltpan	0.0997	25.27
8	Sea	0.0014	0.35
9	Settlement	0.0079	2.01
	Total	0.3945	100.00

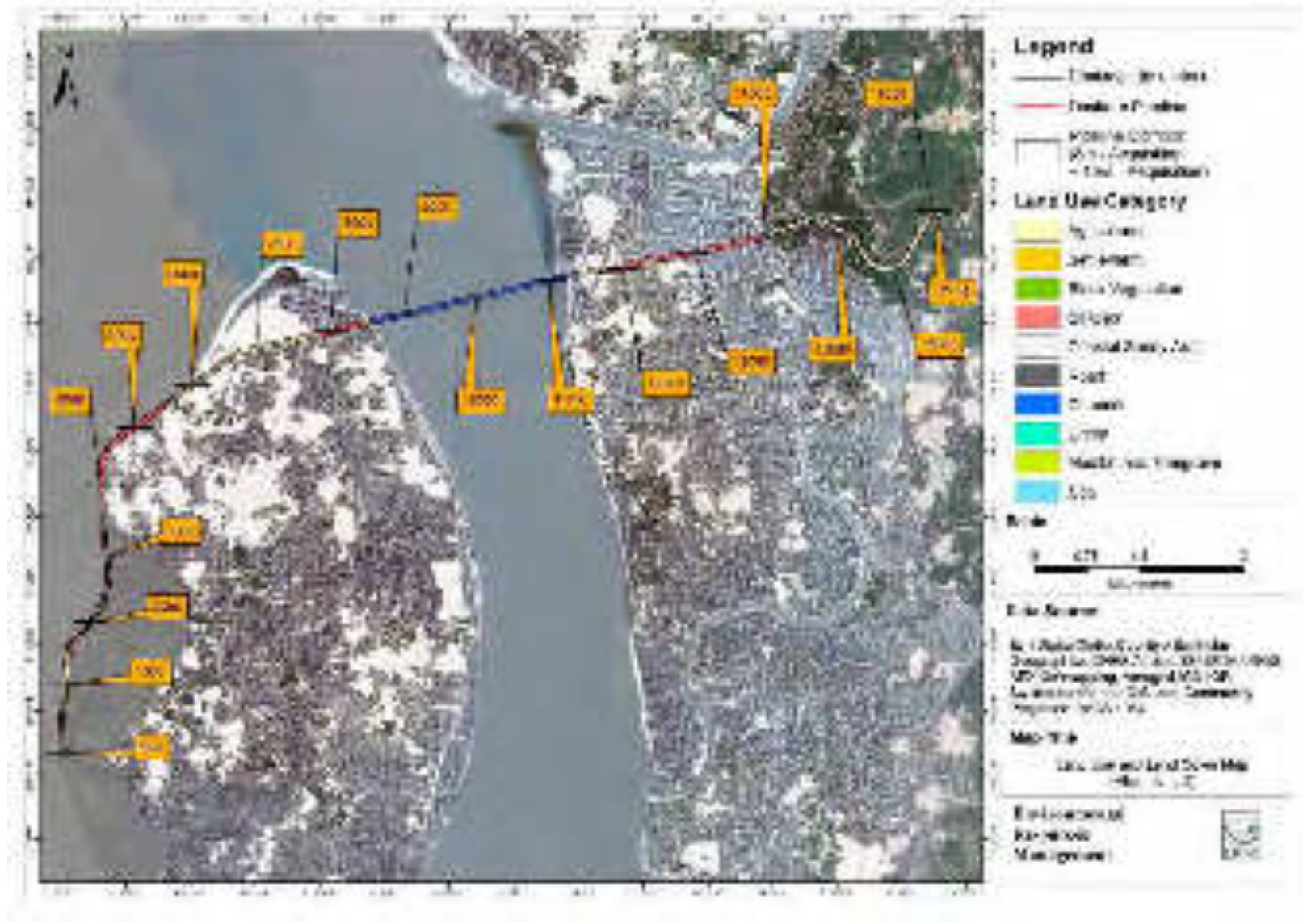
Source: GIS mapping and interpretation of satellite imagery

Figure 4.10 Land use/Land cover Map of the Study Area



Source: GIS mapping and interpretation of satellite imagery and supplemented with findings from the ground truthing surveys conducted during the site reconnaissance study

Figure 4.11 Land use/Land cover Map of Pipeline Corridor



Source: GIS mapping and interpretation of satellite imagery

4.5.5 Soil

Soil of the Project area mainly formed from recent alluvial sediments. The major types of soils reported from the study area include:

Tidal Flood Plains - Tidally flooded, very poorly drained, finely stratified - now silty to clayey alluvium. Occurring on tidal mud flats, they are tidally flooded on a regular basis and remain wet throughout the year. This type of soil is found in the southern and south eastern part of the Kutubdia Island.

Alluvium - Mostly moderately to strongly saline. These soils are grey coloured, silty clay loam to clayey non-saline soils occurring on high to medium highlands.

Medium Lowlands - Seasonally moderately or deeply flooded. Soils found in this type of land forms are grey coloured, moderately fine textured and strongly saline (often used for salt bed). This type of soils is mainly occurring in the middle part of the island and is currently used as salt pans.

Beach Sands Soils - Mainly grey in colour and sandy in texture. They are tidally flooded and strongly saline. This type of soil is mainly occurring in the western side of the island; i.e. on and around the sea beach.

Primary Monitoring Results

Soil samples were collected from 2 locations Kutubdia Island for analysis of physicochemical parameters. The two locations selected are agricultural lands of Ali Fakir Deil near ORF and agricultural land near Darbar Village.

Soil samples were collected using tools from a depth of 45 cm from the top soil surface. At each location, soil samples were collected from three spots and homogenized. The homogenized samples were collecting following quartering technique and then packed in polythene plastic jars and sealed. The sealed samples were sent to the laboratory for analysis.

Details of the sampling locations are presented in **Table 4.6** and the soil sampling locations are shown in **Figure 4.2**.

Table 4.6 *Soil Sampling Locations*

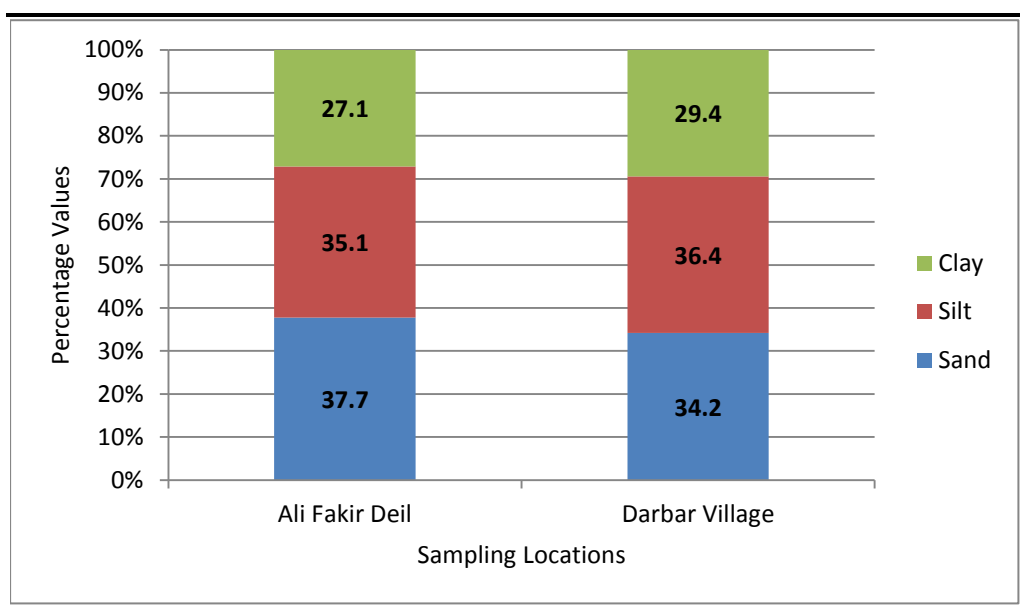
S No.	Sampling location	Code	Monitoring date	Geographic location
1	Agricultural land near embankment of Ali Fakir Deil village	S1	19.11.16	21°51'43.91"N 91°50'33.22"E
2	Agricultural land of Darbar village	S2	19.11.16	21°51'22.84"N 91°52'20.15"E

Interpretation of Soil Results

Texture & pH

Soil texture is an important soil characteristic that could influence water retention capacity, aeration, drainage, and susceptibility to erosion which drive crop production and management. Sand, silt and clay contents of the soil samples collected from Ali Fakir Deil and Darbar village were found to be 37.7% & 34.2%, 35.1 & 36.4% and 27.1 & 29.4% respectively (**Figure 4.12**). The soil samples collected from agricultural lands of Ali Fakir Deil and Darbar village were found to be clay loam in nature with pH values indicating *strongly acidic soils* (pH value between 4.6-5.5)¹.

Figure 4.12 Clay, Silt and Sand Contents of Soil Samples



Permeability

Soil permeability depends upon pore size distribution of the soil. Permeability values of the soil samples were found to be 0.8 and 0.9 cm/hr which is found to be *slow*².

Electrical Conductivity

Electrical conductivity (EC) is used to estimate the soluble salt concentration in soil, and is commonly used as a measure of salinity. EC values of the soil samples were found to be *non saline* (0.89 dS/m for Ali Fakir Deil sample) and *slightly saline* (3.76 dS/m for Darbar village sample)³.

¹ Fertilizer Recommendation Guide 2005, Bangladesh Agricultural Research Council (BARC).

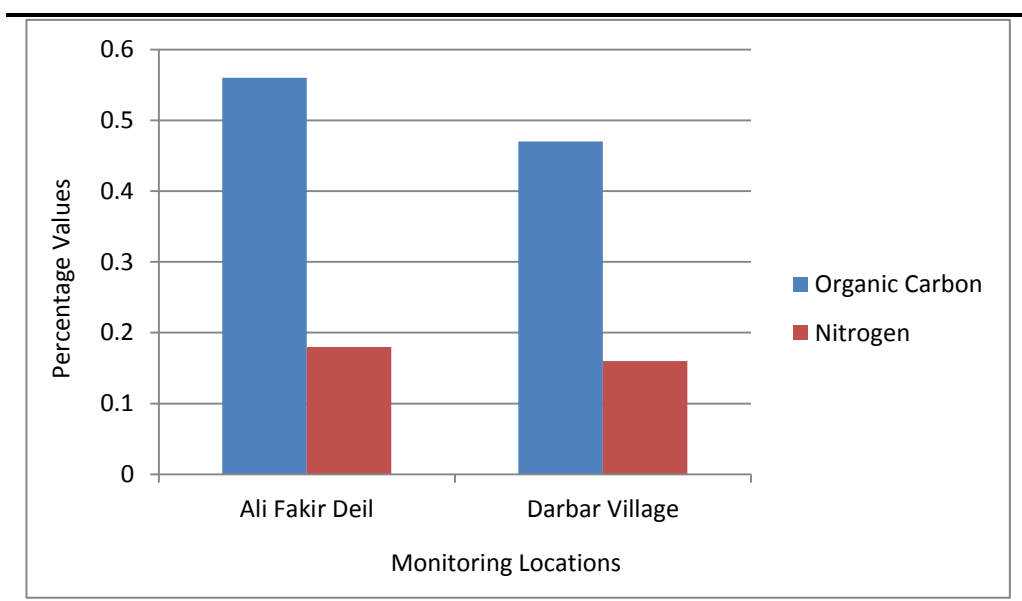
² Soil Crop Suitability Classification for Bangladesh. 1985. FAO/UNDP Agricultural Development Adviser Project (BGD/81/035), Agriculture & Forest Division, Ministry of Agriculture, Dhaka, Bangladesh.

Nutrient Content

The nutrient content of the soil samples were compared with the recommended values of *Fertilizer Recommendation Guide 2005, Bangladesh Agricultural Research Council (BARC)*. Organic carbon contents of the soil samples (0.56% and 0.47%) were found to be *very low*. Nitrogen contents of the soils (0.18% & 0.16%) were found to be *low* and phosphorus (2.3 µg/g and 2.0 µg/g) content *very low*. Potassium content was found to be *medium* for the Ali Fakir Deil sample and *very high* for the Darbar village sample. Calcium contents of both the samples were found to be *low*.

Organic carbon and nitrogen contents of the soil samples are shown in **Figure 4.13**.

Figure 4.13 *Organic Carbon and Nitrogen Values of Soil Samples*



The soil analysis results reveal the soil samples are clay loam and strongly acidic in nature. The soils were found to be non-saline to slightly saline. In general the soils were found to be of low nutrient content to very low nutrient content (except for potassium). Detailed soil analysis results are presented in **Table 4.7**.

Table 4.7 *Soil Analysis Results*

S No.	Parameter	Unit	Soil Quality	
			S1	S2
1	Particle Size Distribution	g/cm ³	2.06	1.96
2	Sand	%	37.7	34.2
3	Silt	%	35.1	36.4
4	Clay	%	27.1	29.4
5	Texture	-	Clay loam	Clay loam
6	Bulk density	g/cm ³	1.36	1.34
7	pH	-	4.7	5.2
8	Salinity	-	Non saline	Slightly saline
9	SAR	m.e/100g soil	0.54	0.73
10	Electrical Conductivity	dS/m	0.89	3.76

S No.	Parameter	Unit	Soil Quality	
			S1	S2
11	Organic Carbon	%	0.56	0.47
12	Nitrogen	%	0.18	0.16
13	Phosphorous	µg/g	2.3	2.0
14	Potassium	m.e/100g soil	0.17	0.43
15	Sodium	m.e/100g soil	0.54	1.43
16	Magnesium	m.e/100g soil	1.26	1.19
17	Calcium	m.e/100g soil	2.69	2.72
18	Chloride	mg/g	1.32	6.72
19	Fluoride	ppm	210	239
20	Permeability	cm/hr	0.9	0.8
21	Porosity	%	34	32
22	Cation Exchange Capacity	m.e/100g soil	0.47	0.52
23	Infiltration rate	mm/hr	7.6	7.1

Source: Primary Monitoring, November 2016

4.5.6 Shoreline Erosion & Accretion

The island estuarine system is very dynamic. Sedimentation as well as erosion is a common feature in this region of Bangladesh. Within a span of three decades, this estuarine region has seen, some of its land forms being completely/majorly eroded whereas at some other locations new formations have come up. In view of this dynamic scenario, review of erosion /deposition trends of this estuary assumes a lot of importance, before locating any facility near the coastal areas.

A study conducted by M.K Rahman (2015)¹ reviewed long term erosion and accretion trends prevailing in Kutubdia. This study revealed that about 9 km² area was eroded whereas 0.35 km² of land accretion occurred on the Kutubdia Island in a period between 1972 and 2013. Major erosion occurred on the southern part of the island. The western side of the island, i.e. towards the Bay of Bengal side was less prone to erosion compared to the southern section. Photographs of erosion at the southern and northern section of Kutubdia Island are presented in *Figure 4.14*.

The accretion occurred mostly along the eastern side of the island; i.e. towards the Kutubdia Channel. The proposed ORF has been proposed on the north-western side of the island, south of the existing light house and appears to comparatively have less erosion potential.

A map showing erosion and accretion trends as established by the above referred study in a period between 1972 and 2013 is presented in *Figure 4.15*.

¹ Munshi Khaledur Rahman. 2015. Environmental and Social Vulnerabilities and Livelihoods of Fishing Communities of Kutubdia Island, Bangladesh by (A dissertation submitted to Kent State University).

Figure 4.14 Erosion at the Southern and Western Banks



Erosion at Southern Bank near Tabaleshwar



Erosion at Western Banks near Kaiyabil

Figure 4.15 Erosion & Accretion Map of Kutubdia Island (1972-2013)



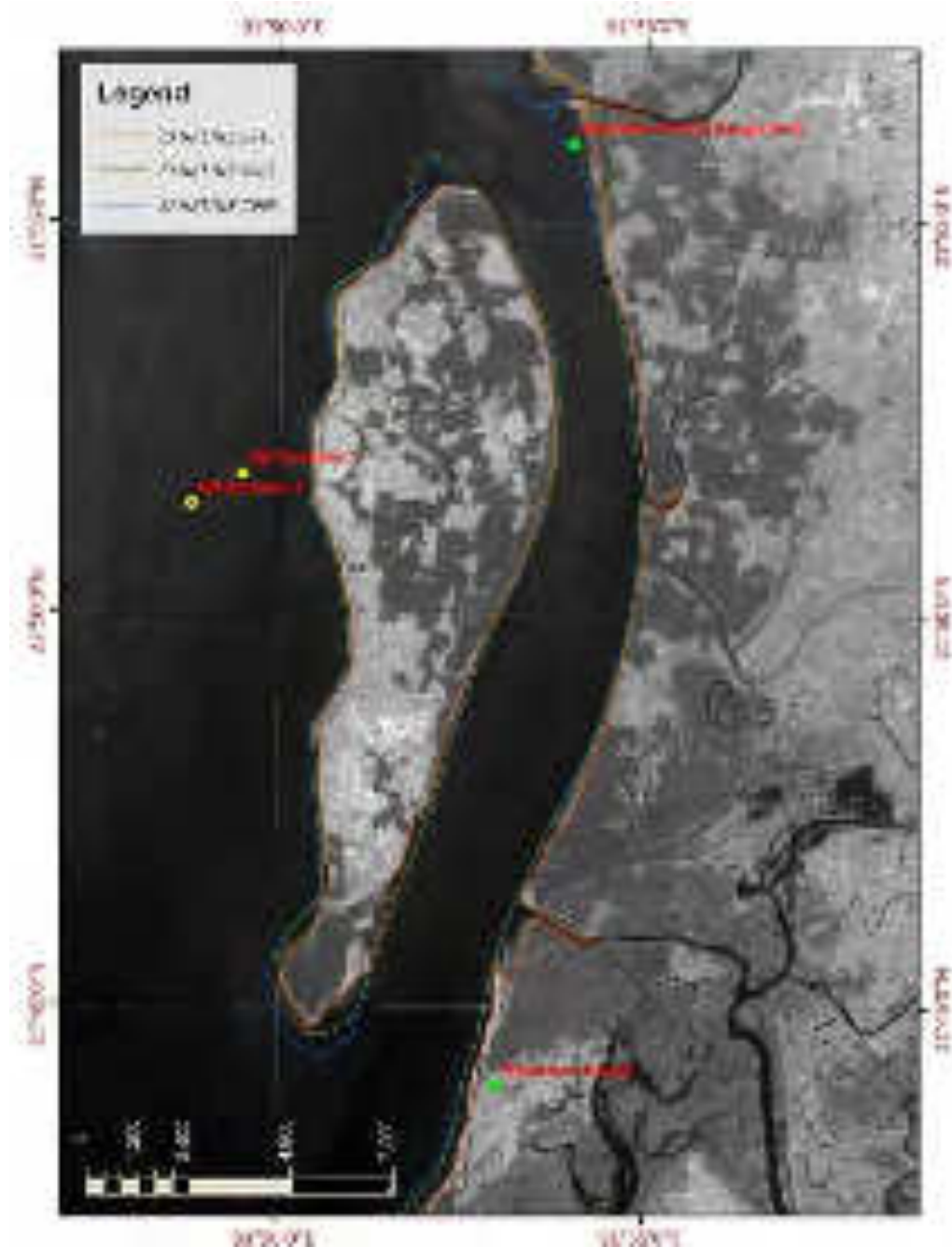
Source: Environmental and Social Vulnerabilities and Livelihoods of Fishing Communities of Kutubdia Island, Bangladesh by *Munshi Khaledur Rahman*, August 2015

Shoreline Evolution

As part of the site screening study conducted by DHI for this project¹, shoreline erosion and accretion along with shoreline evolution off the Kutubdia Island was studied utilizing time series satellite data (2003, 2007, 2015). The examination of the high water line at Kutubdia Island for the past 10 years (**Figure 4.16**) indicates that the southern part of this island is severely affected by coastal erosion. The area near Ali Fakir Deil where the ORF is planned is not affected significantly by shoreline erosion in the past 10 years.

¹ Source: DHI, 2016 - Desktop Study for Site Screening in Chittagong and Moheshkhali Region

Figure 4.16 Kutubdia Island 2015, 2007, 2003 Bankline with 2015 Satellite data



Source: DHI, 2016 - Desktop Study for Site Screening in Chittagong and Moheshkhali Region

Sediment Transport

Suspended sediment concentrations off Kutubdia Island have also been studied as part of site screening studies conducted¹. As part of this study, the Landsat ETM+ image analysis was performed to estimate the suspended sediment concentration using the empirical multivariate regression algorithm. The spectral reflectance values corresponding to sediments and water content have been distinguished by the algorithm for estimating sediment concentration and their spatial distribution. The sediment deposition map is presented in *Figure 4.17*.

¹ Source: DHI, 2016 - Desktop Study for Site Screening in Chittagong and Moheshkhali Region

Figure 4.17 Suspended Sediment Concentration near Off Kutubdia Island



Source: DHI, 2016 - Desktop Study for Site Screening in Chittagong and Moheshkhali Region

It is revealed from the map that the high sediment deposition areas near Kutubdia Island are present mostly along the coast of the Pekua Upazila with high sediment deposition near Magnama ghat area. Greater sediment deposition was observed at Matarbari Island near the southern tip of the Kutubdia Island. The southern tip of Kutubdia Island is severely affected by erosion; the eroded sediment of Kutubdia Island has probably contributed to sediment deposition at Matarbari Island on the other bank of Kutubdia channel.

Within Kutubdia Island major sediment deposition occurred at the western side of the island in Kaiyabil and Boroghob Unions. However, significant level of sediment deposition has not been observed near Ali Fakir Deil where the proposed ORF is planned.

Given the nature of construction activities planned under this project close to the shoreline (i.e. the Onshore Regas Facility), any significant aggravation of erosion potential around the proposed site is not quite foreseen.

4.6 *HYDROGRAPHY*

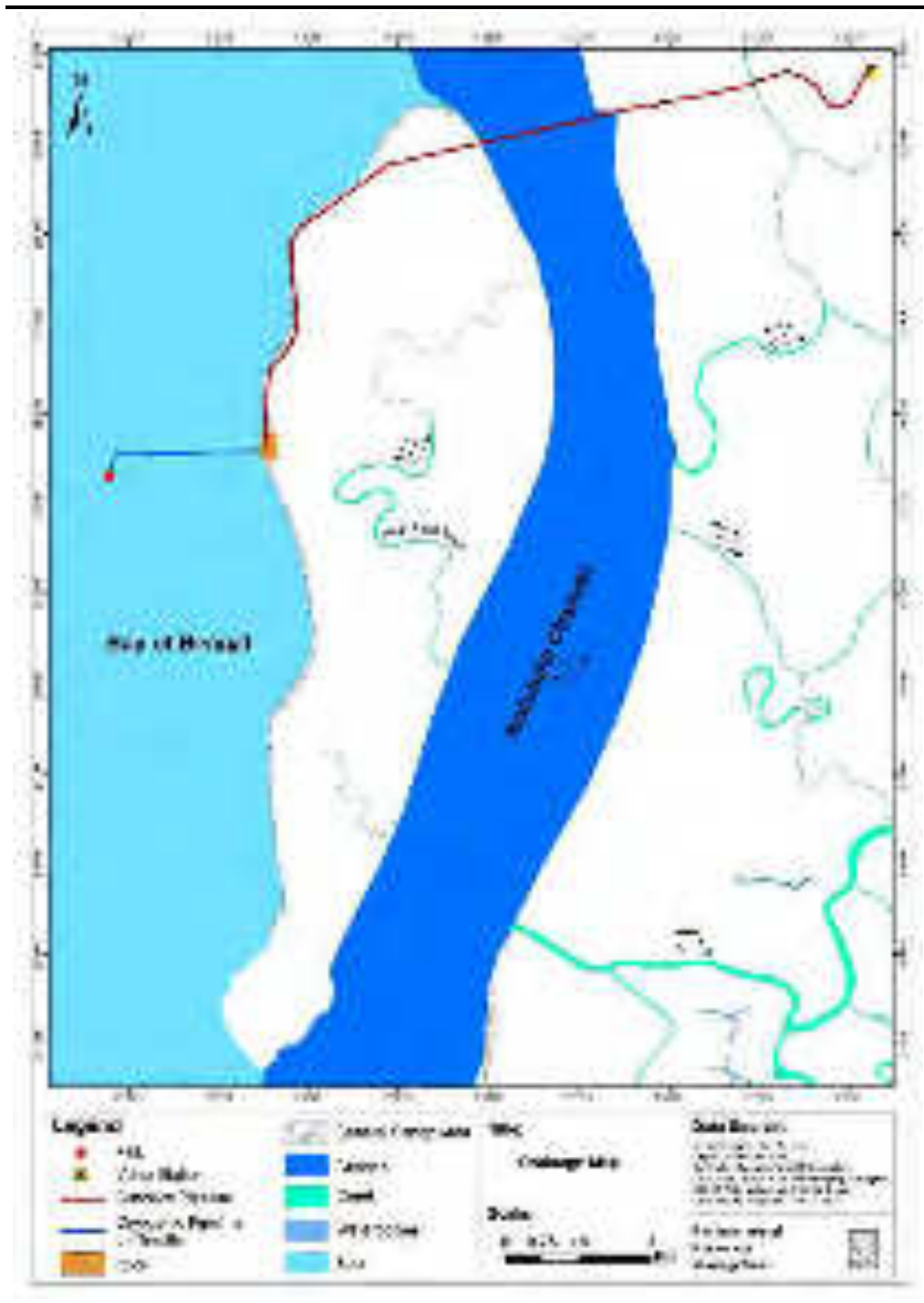
Hydrographic and bathymetric information available for this region from project level studies¹ indicated a steep sea floor with 10 m contour reaching within 1 km from the Kutubdia Island. A Dolphin shoal is located at about 7 km from shore. This shallow patch is approximately trending N-S; extending for about 35 km, almost parallel to the coastline. The depths in this shoal are up to ~6.5 m. Admiralty chart showing water depths in the offshore areas of Kutubdia Island is presented in **Figure 3.13**.

4.7 *HYDROLOGY AND DRAINAGE PATTERN*

A natural drainage channel the '*Pilat Kata Khal*' flows along the mid of the island and is connected with Kutubdia Channel. This channel is influenced by tidal effects. Inflow and outflow of water from the Kutubdia Channel into this *Pilat Kata Khal* is regulated by several sluice gated located at different locations. The flow of water in this *Kata Khal* is regulated to suit the requirements of salt cultivators. Several minor channels are also connected with the *Pilat Kata Khal*. Also, several salt pans (used for commercial salt production) and some fresh water ponds are located within the study area. The drainage map in the study area is presented in **Figure 4.18**.

¹ DHI, 2016 - Desktop Study for Site Screening in Chittagong and Moheshkhali Region

Figure 4.18 Drainage Map of the Study Area



4.8 MARINE WATER QUALITY

Marine water quality is analyzed from six locations, which included 4 locations in Bay of Bengal and two locations in Kutubdia Channel. Samples were collected from the surface (0.3-0.5 m below the surface) and mid depth for the Bay of Bengal samples while samples were only collected from the surface (0.3-0.5 m below the surface) for Kutubdia Channel. All the samples were collected during mid tide.

The samples were analysed for parameters covering physical and chemical characteristics. Parameters such as temperature, pH, Total Dissolved Solids (TDS), electrical conductivity (EC), dissolved oxygen (DO) and salinity were measured onsite. Water samples were collected as grab water sample in a pre-washed 5-litre plastic jerry can for complete physio-chemical tests.

The samples were analysed as per standard procedure/method given in Standard Method for Examination of Water and Wastewater Edition 20, published by APHA.

Details of the sampling locations are presented in *Table 4.8* and the surface water sampling locations are shown in *Figure 4.2*. Photographs of marine water sampling are presented in *Figure 4.19*.

Table 4.8 *Marine Water Sampling Locations*

S No.	Sampling Location	Marine / Inland Surface Water	Code	Monitoring Date	Geographic Location
1	500 m west towards the sea from the proposed ORF	Marine	SW1	16.11.16	21°51'50.09"N 91°50'5.85"E
2	3000 m west towards the sea from the proposed ORF	Marine	SW2	16.11.16	21°51'33.90"N 91°48'42.55"E
3	1500 m South West towards the sea from the proposed ORF	Marine	SW3	16.11.16	21°51'3.26"N 91°49'42.81"E
4	1500 m North West towards the sea from the proposed ORF	Marine	SW4	16.11.16	21°52'28.49"N 91°49'46.05"E
5	300 m towards the Kutubdia channel from right bank near to the Dhurung ghat	Marine	SW6	17.11.16	21°53'3.25"N 91°53'51.61"E
6	300 m towards the Kutubdia channel from left bank near to the Chunura ghat	Marine	SW7	17.11.16	21°53'14.81"N 91°54'39.05"E

Figure 4.19 Photographs of Marine Water Sample Collection

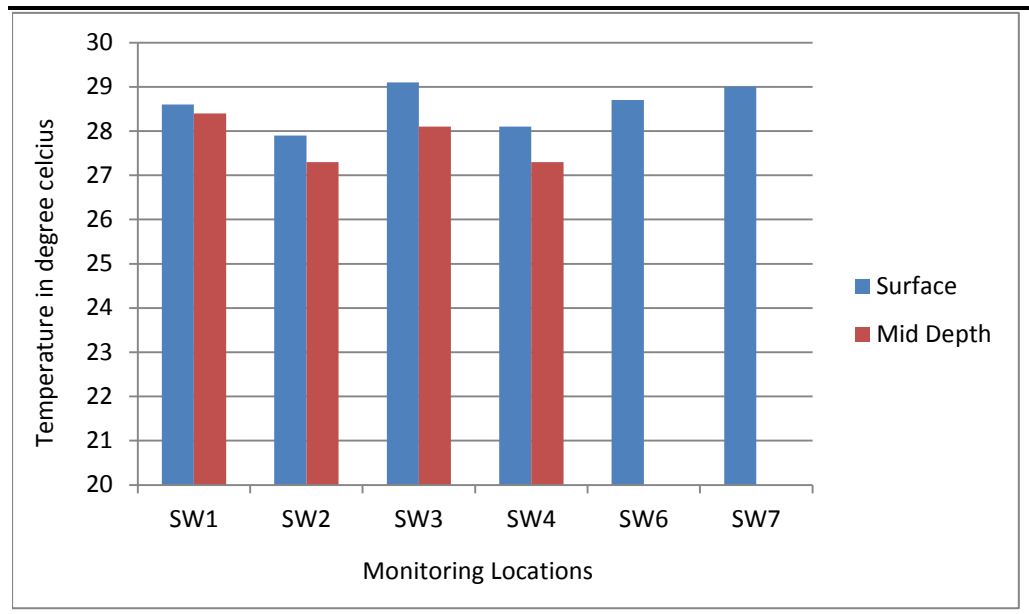


Interpretation of Primary Monitoring Results

Temperature

There is very little temperature variation between the sites ranging between 27.3-20.0 °C. Samples collected from sea surface and at mid depth also showed very little difference. Water temperature measurements at surface and mid depth of the monitoring locations are presented in *Figure 4.20*.

Figure 4.20 Water Temperature at Surface and Mid Depth for Monitored Locations

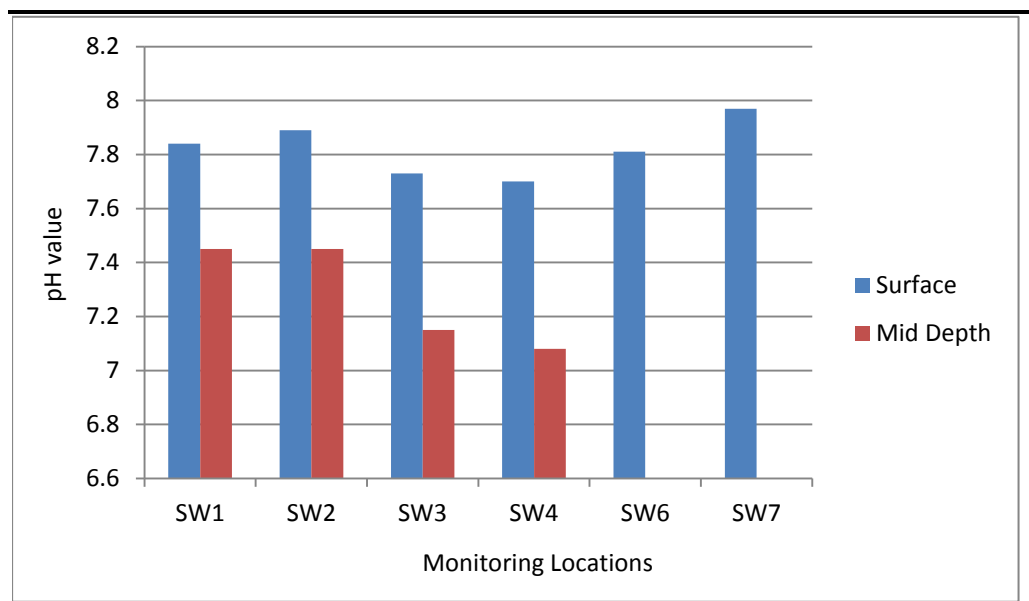


pH

pH values of the surface water samples varied between 7.73-7.97 and that of the mid depth water samples varied between 7.08-7.45. The mid depth water samples have lower pH compared to the surface water samples. The pH values at surface and mid depth water samples are presented in *Figure 4.21*.

pH values were compared with marine water analyses conducted at Kutubdia channel as part of *EIA for Construction of Matarbari 600X2 MW Coal Fired Power Plant and Associated Facilities (JICA, 2013)*. The JICA study found pH levels during October, 2012 at surface and mid depth as 8.11 and 7.94 respectively and during January, 2013 at surface and mid depth as 8.12 & 7.92 respectively. The JICA studies reveal slightly more alkaline pH than the current study.

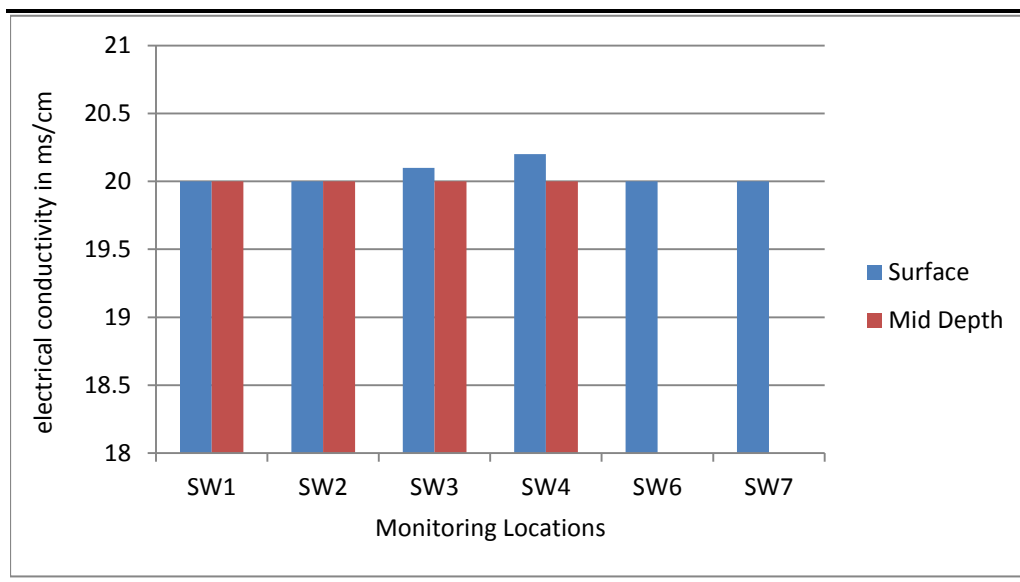
Figure 4.21 pH values at Surface and Mid Depth for Monitored Locations



Electrical Conductivity (EC)

EC values of the surface water samples varied between 20-20.2 ms/cm and that of the mid depth water was found to be 20 ms/cm. No variation was found between the EC values of surface and mid depth samples. The EC values at surface and mid depth water samples are presented in *Figure 4.22*.

Figure 4.22 *Electrical Conductivity values at Surface and Mid Depth for Monitored Locations*



Salinity

An understanding of salinity of marine water plays an important role in understanding the hydrological cycle of water. Salinity can influence circulation and biological processes in the ocean. On average, the ocean has a salinity of 35 ppt which translates to 35 grams of salt per 1000 grams of water. Major components of this salt include sodium, chlorine, magnesium, calcium, potassium and sulphate, which comprise of a total of 99.4% of the salt in the ocean.

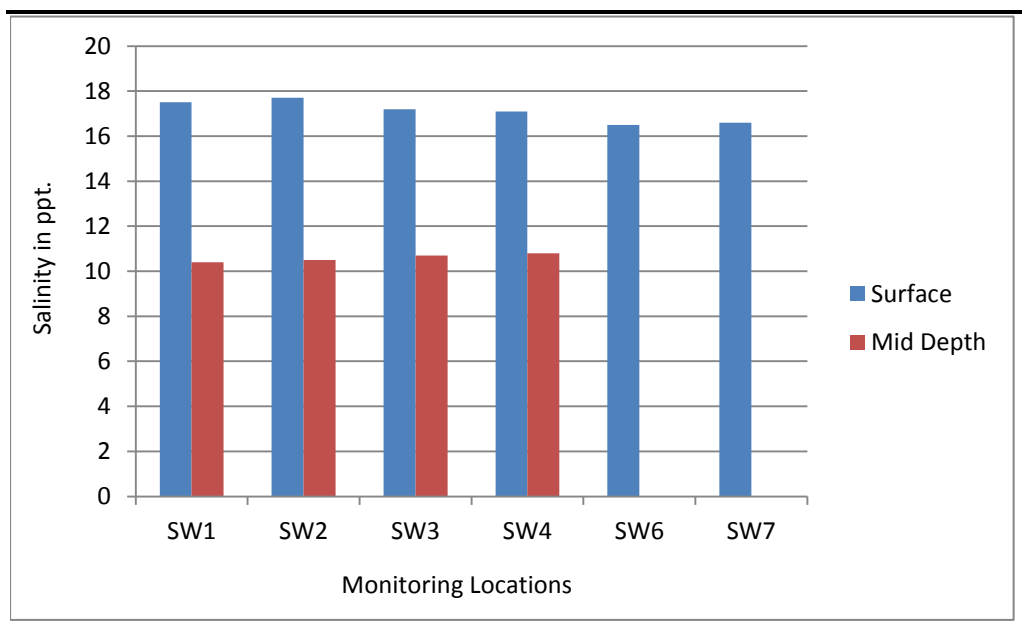
The salinity values at surface and mid depth water samples are presented in *Figure 4.23*.

Salinity values of the surface water samples varied between 16.5-17.7 ppt and that of the mid depth water samples varied between 10.4-10.8 ppt. The mid depth water samples have lower salinity compared to the surface water samples. Moreover, salinity levels at the samples collected from the surface of the Kutubdia Channel were also lower than the samples collected from the surface of Bay of Bengal.

The salinity values were compared with marine water analyses conducted at Kutubdia channel by JICA (2013). The JICA study found salinity levels during October, 2012 at surface and mid depth as 17.8 ppt and 18.4 ppt respectively and during January, 2013 at surface and mid depth as 35.3 ppt & 35.6 ppt

respectively. The JICA study reveal slightly more salinity for the October values while the winter samples collected during January 2013 reveal significantly higher salinity values compared to the present study.

Figure 4.23 *Salinity values at Surface and Mid Depth for Monitored Locations*

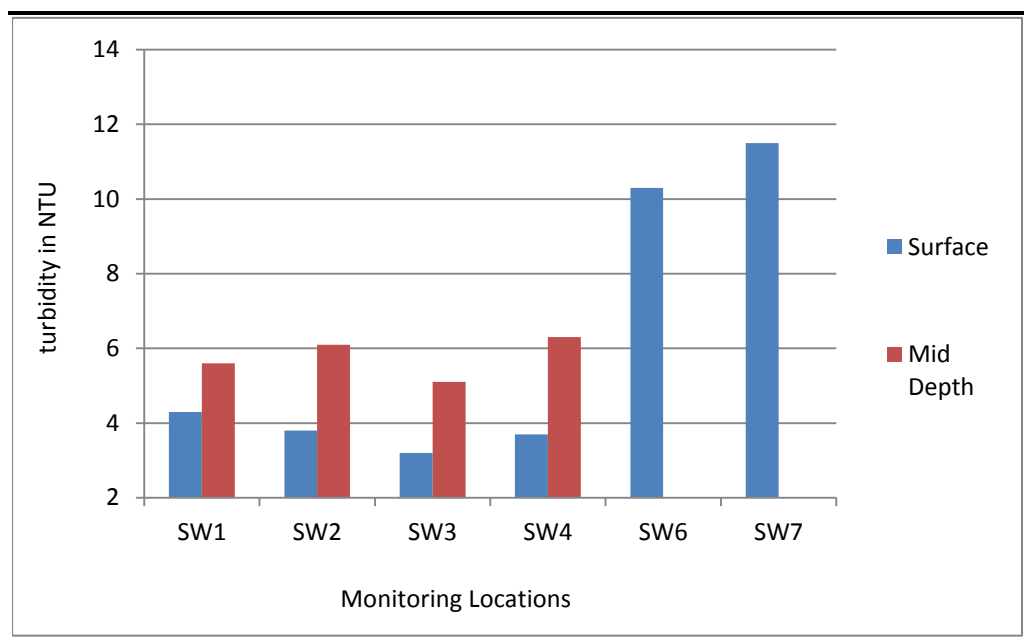


Turbidity

Turbidity refers to optical clearness of sea water and is affected by dissolved and suspended impurities in the sea water. Turbidity values at surface and mid depth at the monitoring locations are shown in *Figure 4.24*.

Water samples collected from surface of Bay of Bengal revealed turbidity values between 3.7-4.3 NTU while the mid depth samples showed turbidity values between 5.6 & 6.3 NTU. As the mid depth samples were closer to the sea floor, re-suspended solids from the sea floor could reach the mid depth more easily compared to the sea surface, which possibly had resulted in higher turbidity levels at the mid depth samples. Turbidity values for the samples collected from surface of Kutubdia Channel revealed much higher values (10.3-11.5 NTU) compared to the Bay of Bengal samples which could possibly be attributed to shallow depth of the channel compared to the open sea.

Figure 4.24 Turbidity values at Surface and Mid Depth for Monitored Locations



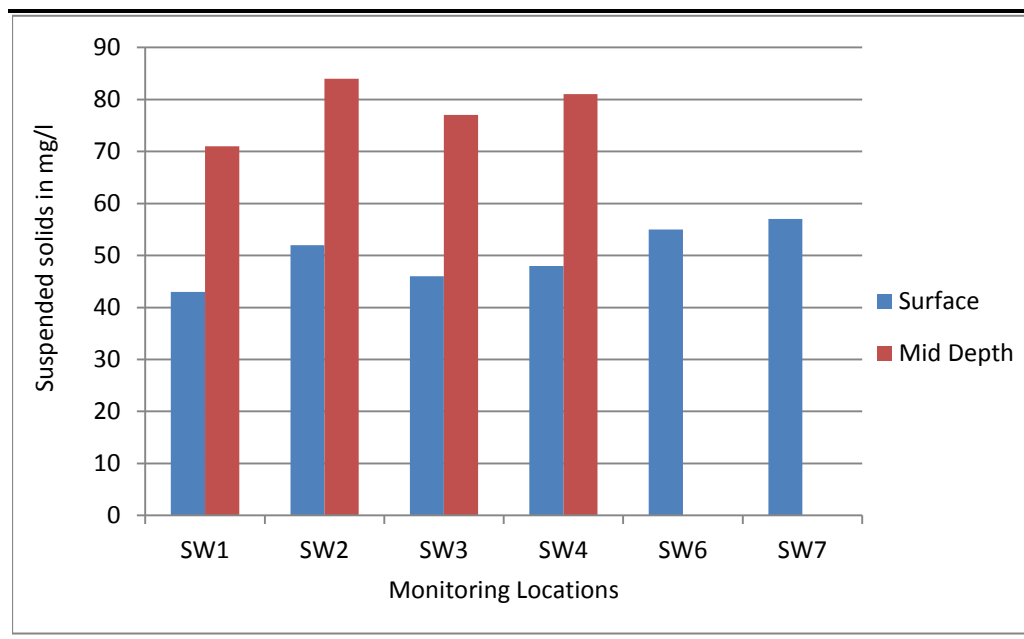
Suspended Solids (SS)

Suspended solids are the measure of particulate matter suspended in the sea water column. The total suspended solids are directly proportional to the turbidity, as higher numbers of suspended solids increase the turbidity of the sea water. Suspended solids concentrations at surface and mid depth at the monitoring locations are shown in *Figure 4.25*.

Water samples collected from surface of Bay of Bengal revealed suspended solids values between 43-52 mg/l while the mid depth samples showed suspended solids values between 71-81 mg/l. As explained earlier this could possibly be due to lesser depth of the mid depth samples from the sea floor. Suspended solids values for the samples collected from surface of Kutubdia Channel revealed values between 55-57 mg/l.

The suspended solids concentrations were compared with marine water analyses conducted at Kutubdia Channel by JICA (2013). The JICA study found average suspended solids levels during October, 2012 at surface and mid depth as 798 and 696 mg/l respectively and during January, 2013 at 49 & 80 mg/l respectively. The JICA studies reveal very high suspended solids for the October samples probably due to increased surface runoff to Kutubdia Channel due to heavy rains. However, the dry season samples (January, 2016) revealed suspended solids concentrations comparable to the current survey values.

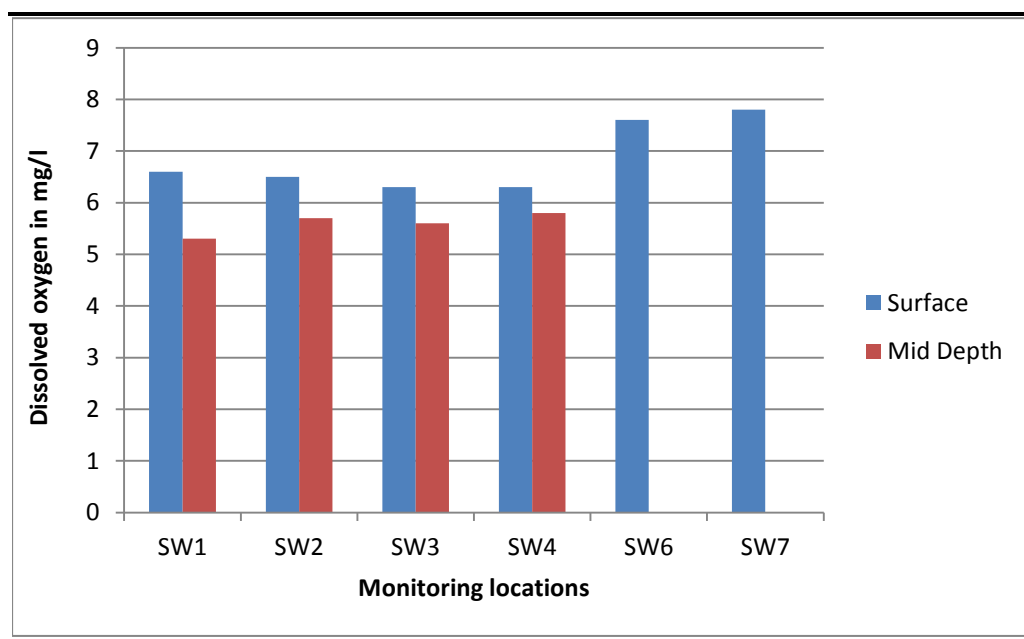
Figure 4.25 *Suspended solids concentrations at Surface and Mid Depth for Monitored Locations*



Dissolved Oxygen (DO)

DO values of the surface water samples varied between 6.3-7.8 mg/l and that of the mid depth water was found to be 5.3-5.8 mg/l. Water samples collected from the surface reveal higher DO values compared to the mid depth samples due to dissolution of oxygen from the atmosphere at the sea surface. The DO values at surface and mid depth water samples are presented in *Figure 4.26*.

Figure 4.26 *DO values at Surface and Mid Depth for Monitored Locations*



Heavy Metals

Concentrations of cadmium and nickel at the surface and mid depth samples for all monitoring locations were found to be below detection limits.

Concentration of lead was below detection limits for all surface and mid depth samples collected from Bay of Bengal, while the samples collected from Kutubdia Channel revealed lead values of 0.01 mg/l. Almost all the samples revealed zinc and copper concentrations below detection limits. Chromium contents of the samples collected from the surface varied between 0.028-0.067 mg/l and mid depth samples varied between 0.034-0.075 mg/l.

Concentrations of heavy metals at the marine water samples are shown in *Table 4.9*

The heavy metals concentrations were compared with marine water analyses conducted at Kutubdia channel by JICA (2013). The concentration of heavy metals lead, zinc, copper and cadmium were lower compared to the JICA study while chromium concentrations were slightly higher (refer *Table 4.9*).

Table 4.9 *Marine Water Analysis Results*

S No.	Parameter	Unit	SW1		SW2		SW3		SW4		SW6	SW7	JICA, 2013*	
			At sea surface (a)	Mid Depth (b)	At sea surface (a)	Mid Depth (b)	At sea surface (a)	Mid Depth (b)	At sea surface (a)	Mid Depth (b)				
1	Temperature	°C	28.6	28.4	27.9	27.3	29.1	28.1	28.1	27.3	28.7	29.0	18.2-30	18.2-29.3
2	pH		7.84	7.45	7.89	7.45	7.73	7.15	7.70	7.08	7.81	7.97	7.94-8.11	7.92-8.12
3	Electrical Conductivity	mS/cm	20	20	20	20	20.1	20	20.2	20	20	20	-	-
4	Dissolved Oxygen	mg/l	6.6	5.3	6.5	5.7	6.3	5.6	6.3	5.8	7.6	7.8	-	-
5	Turbidity	NTU	4.3	5.6	3.8	6.1	3.2	5.1	3.7	6.3	10.3	11.5	-	-
6	Salinity	ppt	17.5	10.4	17.7	10.5	17.2	10.7	17.1	10.8	16.5	16.6	17.8-35.3	18.7-35.6
7	TDS	ppt	10	10	10	10	9.8	10.2	10	10	10	10		
8	Suspended Solids	mg/l	43	71	52	84	46	77	48	81	55	57	49-798	80-696
9	Cadmium	mg/l	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001	0.001
10	Lead	mg/l	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	0.010	0.010	0.010	0.010-0.018
11	Chromium	mg/l	0.028	0.034	0.067	0.075	0.038	0.046	0.042	0.050	0.057	0.054	0.013-0.043	0.016-0.045
12	Zinc	mg/l	<0.1	0.16	<0.1	0.18	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.010-0.050	0.010-0.013
13	Copper	mg/l	<0.1	<0.1	<0.1	0.23	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.010	0.010-0.029
14	Nickel	mg/l	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005	-	-

Source: Primary Monitoring, November 2016

*JICA, 2013. Environmental Impact Assessment of Construction of Matarbari 600X2 MW Coal Fired Power Plant and Associated Facilities

4.9 INLAND SURFACE WATER QUALITY

Inland surface water quality was monitored at one location in *Pilat Kata Khal* within Kutubdia Island. The water sample was collected from the surface during mid tide.

Details of the sampling location are presented in *Table 4.10* and the surface water sampling location is shown in *Figure 4.2*.

Table 4.10 *Inland Surface Water Sampling Locations*

S No.	Sampling location	Marine/Inland Surface water	Code	Monitoring date	Geographic location
1	Pilat Katakhal	Inland surface water	SW5	17.11.16	21°51'8.71"N 91°51'17.39"E

The analyzed results for inland surface water was compared to *Best Practice Based Classification of ECR, 1997* (refer *Annex 2*). pH of the water sample was found to be 7.75. Dissolved oxygen concentration was found to be 6.3 mg/l. BOD and COD concentrations were found to be 1.9 mg/l and 18.6 mg/l respectively. The EC and salinity values of the water sample were found to be 20 ms/cm and 15.1 ppt respectively. The water is primarily used for the fisheries and the analysis results are in compliance to the use of water for fisheries as per the ECR, 1997. As the EC values were high the water cannot be used for irrigation.

Results of inland surface water analysis are presented in *Table 4.11*.

Table 4.11 *Inland Surface Water Analysis Results*

S No.	Parameter	Unit	SW5
1	Temperature	°C	30.2
2	pH	-	7.73
3	Electrical Conductivity	mS/cm	20
4	Dissolved Oxygen	mg/l	6.3
5	BOD ₅	mg/l	1.9
6	COD	mg/l	18.6
7	Turbidity	NTU	11.7
8	Salinity	ppt	15.1
9	TDS	ppt	10
10	Suspended Solids	mg/l	36
11	Nitrate	mg/l	0.13
12	Nitrite	mg/l	0.01
13	Manganese	mg/l	0.21
14	Phosphate	mg/l	1.12
15	Iron	mg/l	3.56
16	Oil and Grease	mg/l	2.9

Source: Primary Monitoring, November 2016

4.10 MARINE SEDIMENT QUALITY

Marine sediment samples were collected from 4 locations for analysis of physicochemical parameters. The samples were collected at 2 locations in Bay of Bengal and 2 locations in Kutubdia Channel.

Sediment samples were collected using a sediment sampler. At each location, sediment samples were collected from three spots and homogenised. Care was taken to minimize the surface disturbance to the sediments. The homogenised samples were then packed in polythene plastic bags, sealed and sent to the laboratory for analysis.

Details of the sampling locations are presented in *Table 4.12* and the sediment locations are shown in *Figure 4.2*.

Table 4.12 *Sediment Sampling Locations*

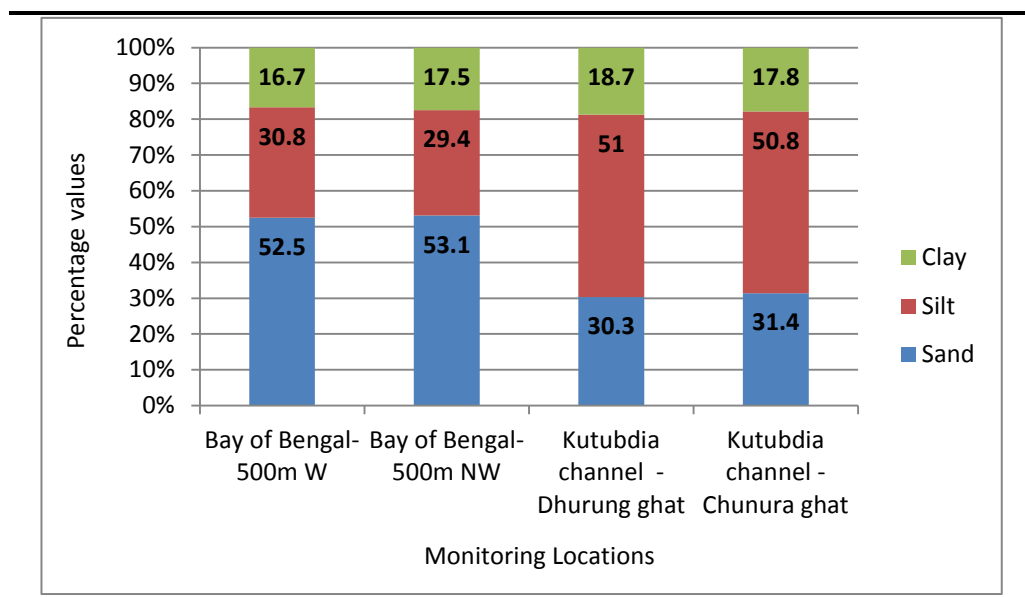
S.No.	Sampling location	Code	Monitoring date	Geographic location
1	500 m west of the ORF in Bay of Bengal	SD1	18.11.16	21°51'34.40"N 91°50'11.37"E
2	500 m North West of ORF in Bay of Bengal	SD2	18.11.16	21°52'29.23"N 91°50'11.37"E
3	300 m towards the Kutubdia channel from right bank near Dhurung ghat	SD3	17.11.16	21°53'2.78"N 91°53'51.84"E
4	300 m towards the Kutubdia channel from left bank near to the Chunura ghat	SD4	17.11.16	21°53'15.55"N 91°54'38.65"E

Interpretation of Primary Monitoring Results

Texture

Analysis of sediment texture is important in understanding the hydrodynamic conditions of aquatic environment. The sand, silt and clay contents of the sediment samples are presented in *Figure 4.27*. Percentage contents of sand were higher in the samples collected from Bay of Bengal compared to the Kutubdia channel, while the silt percentages were higher in Kutubdia channel samples compared to the Bay of Bengal samples. The Bay of Bengal sediment samples were found to be sandy loam in nature while those from Kutubdia Channel were found to be silty loam in nature.

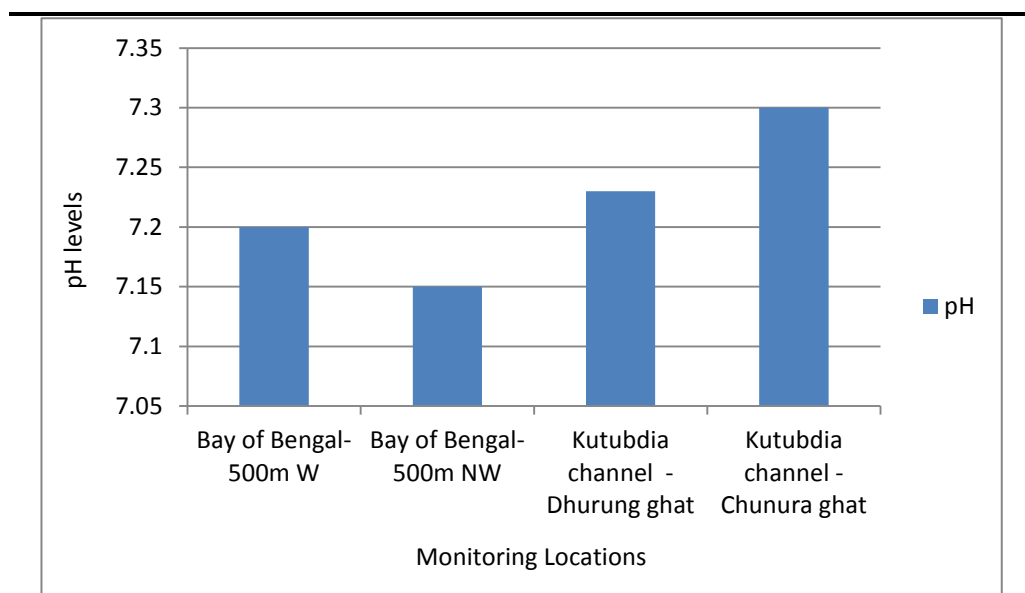
Figure 4.27 Sand, Silt and Clay Contents of Sediment Samples



pH

pH was measured in sediment samples to determine the reliability of the biological and chemical processes. Change in pH can have an effect on these processes with highly acidic pH (below 5.0) and alkaline pH (above 9.0) drastically affecting the efficiency of marine ecosystems. The pH values of the sediment samples are shown in Figure 4.28. pH of the sediment samples were found to be neutral in nature varying between 7.15-7.30.

Figure 4.28 pH Values of Sediment Samples

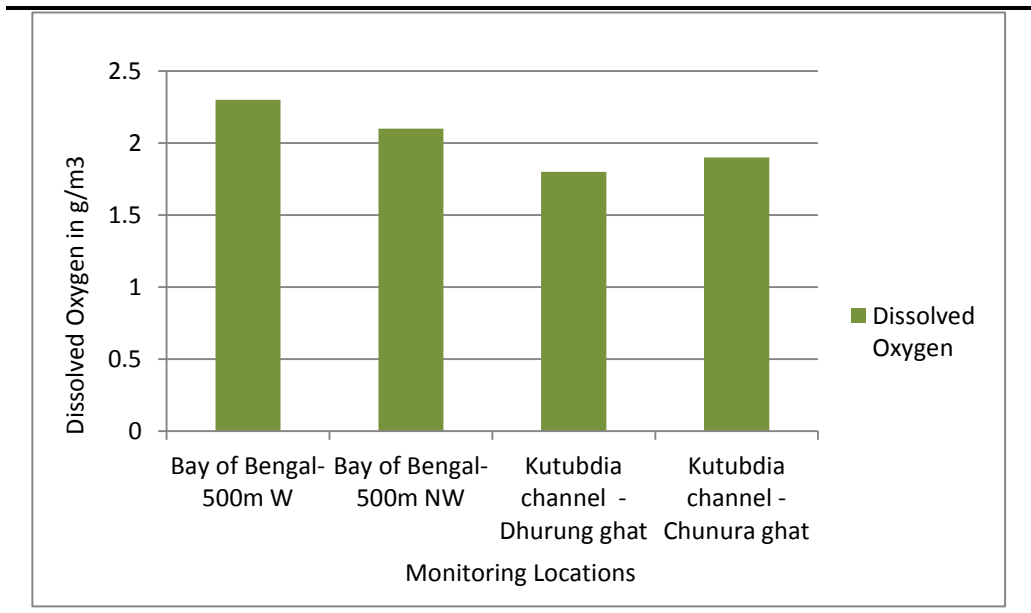


Dissolved Oxygen

Dissolved oxygen levels in marine sediment were measured by collecting a 1:10 extract (100 g sediment dissolved in 1000 mL bottle). Dissolved oxygen is an important indicator of biological potential of marine sediment and low

dissolved oxygen levels is indicative of poor benthic life. The dissolved oxygen content of the sediment samples varied between 1.9-2.3 g/m³ which reveal low dissolved oxygen content. Dissolved oxygen content of sediment samples are shown in *Figure 4.29*.

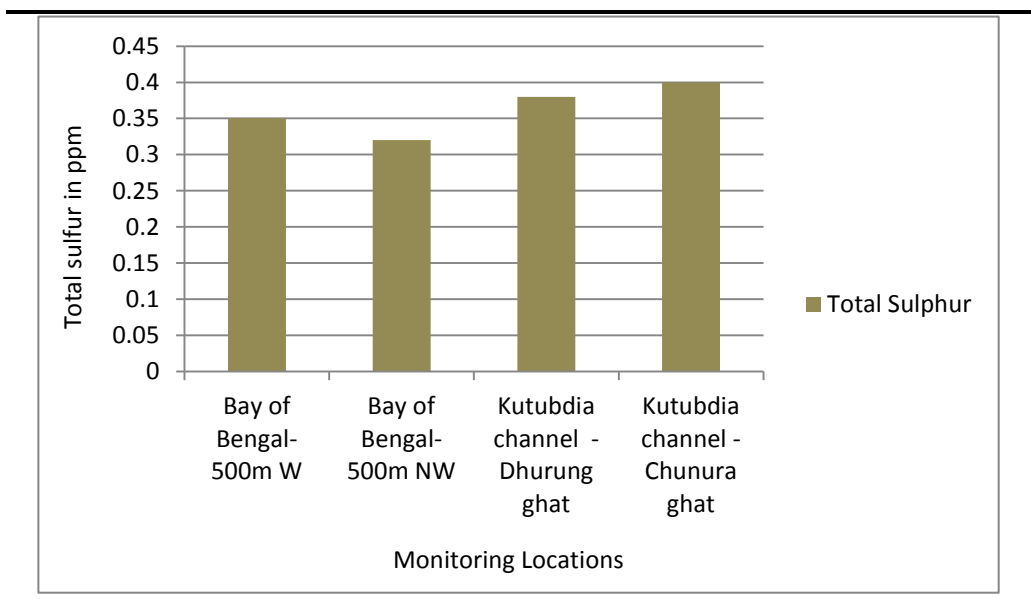
Figure 4.29 *Dissolved Oxygen Levels in Sediment Samples*



Total Sulphur

Sulphur content in the sediment samples is an important indicator of oil and gas pollution. Sulphur levels in sediment samples are presented in *Figure 4.30*. Sulphur contents of the samples varied between 0.35-0.40 ppm which represents low sulphur content in the samples.

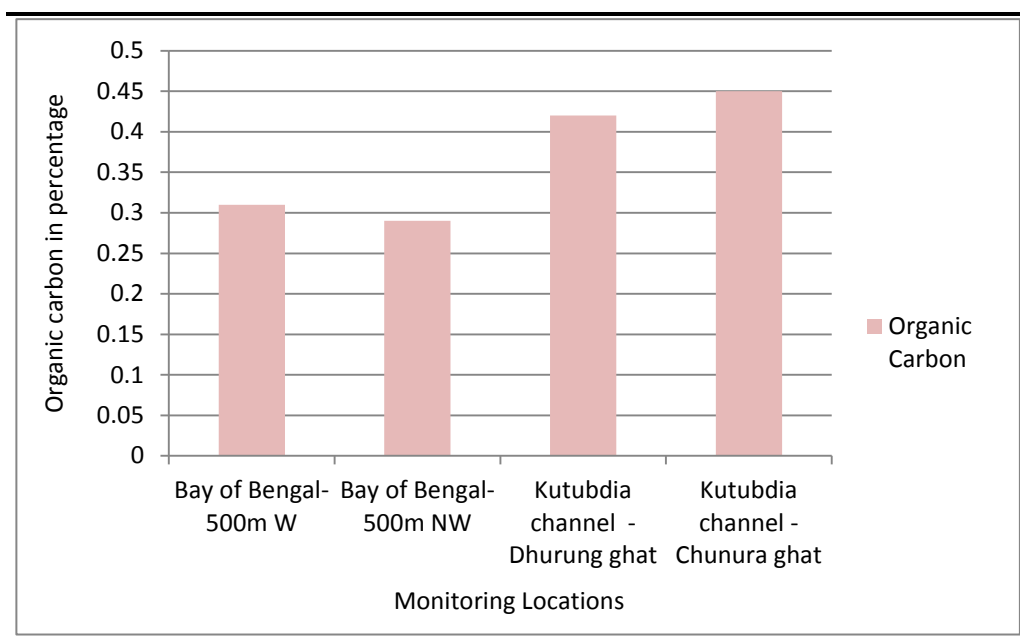
Figure 4.30 *Sulphur Levels in Sediment Samples*



Organic Carbon

Organic carbon levels in sediments are an important indicator of productivity of biogeochemical cycles of the marine environment. One of the measures of overall productivity of the marine environment is to understand the biological pump that measures the fixing of atmospheric carbon dioxide into photosynthetic organism and then transport it to the sediments as organic carbon. Organic carbon present in marine sediment due to natural conditions is normally around 0.5%. Organic carbon content of the sediment samples were found to be low varying between 0.31-0.45%. The organic carbon contents in the sediment samples are shown in *Figure 4.31*.

Figure 4.31 *Organic Carbon levels in Sediment Samples*



Heavy Metals

Concentration of Cr in the sediment samples varied from 0.01-1.6 mg/kg and concentration of Pb varied from 8.52-13.07 mg/kg. Concentrations of Cd for all the samples were below 0.05 mg/kg.

The primary analysis results for heavy metals were comparable to the sediment analysis results conducted by JICA (2013)¹ in Kutubdia channel near Matarbari Island (*Table 4.13*). The concentrations of Cr, Cd and Pb were low compared to Dutch intervention values.

ERL (Effects Range-Low) and ERM (Effects Range-Median) proposed by the NOAA (National Oceanic and Atmospheric Administration, U.S.) are accepted globally as the guidelines for concentration of heavy metal in sediment which affect benthic organisms. Concentration of heavy metals at the sediment samples were found to be low compared to the ERL values.

¹ JICA, 2013. Environmental Impact Assessment of Construction of Matarbari 600X2 MW Coal Fired Power Plant and Associated Facilities

The sediment analysis results indicate that the sediments are not contaminated with heavy metals. Sediment analysis results are presented in **Table 4.13**.

Table 4.13 Sediment Analysis Results

S. No.	Parameter	Unit	Sediment Quality				JICA EIA, 2013*	Dutch Intervention Values 2013**	Guideline of NOAA	
			SD1	SD2	SD3	SD4			ERL	ERM
1	Sand	%	52.5	53.1	30.3	31.4	-	-	-	-
2	Silt	%	30.8	29.4	51.0	50.8	-	-	-	-
3	Clay	%	16.7	17.5	18.7	17.8	-	-	-	-
4	Texture		Sandy loam	Sandy loam	Silt loam	Silt loam	-	-	-	-
5	Dissolved Oxygen	g/m ²	2.3	2.1	1.8	1.9	-	-	-	-
6	pH	-	7.20	7.15	7.23	7.30	-	-	-	-
7	Organic Carbon	%	0.31	0.29	0.42	0.45	-	-	-	-
8	Total Sulphur	ppm	0.35	0.32	0.38	0.40	-	-	-	-
9	Cadmium	mg/kg	<0.05	<0.05	<0.05	<0.05	0.032-0.05	13	1.2	9.6
10	Lead	mg/kg	8.52	10.21	12.25	13.07	3.39-11.6	530	46.7	218
11	Chromium	mg/kg	0.15	0.33	1.2	1.6	-	-	-	-
12	Zinc	mg/kg	21.1	30.9	21.8	27.0	20.2-63.7	720	410	410
13	Copper	mg/kg	9.98	11.83	8.78	7.10	3.75-23.8	190	34	270
14	Nickel	mg/kg	23.6	22.19	32.68	26.47	-	100	-	-

Source: Primary Monitoring, November 2016

*JICA, 2013. Environmental Impact Assessment of Construction of Matarbari 600X2 MW Coal Fired Power Plant and Associated Facilities

**Dutch Intervention Values (Soil Remediation Circular July 2013 Revision)

4.11 GROUND WATER RESOURCE AND QUALITY

Groundwater is abundant in Bangladesh and the aquifers are highly productive. However, the ground water resource in the Kutubdia Island is limited, as the Island is surrounded by saline water on all sides. The ground water level in the central and southern part of the Island is shallow and also fresh. The ground water is mostly tapped through shallow tube wells and used for agriculture as well as domestic purpose. The ground water level in northern part of the island is comparatively deeper and mostly saline. This water is suitable for agriculture, and the drinking water is mostly sourced from the lower aquifer.

Groundwater samples were collected from shallow tube wells in Dakshin Dhurung, Kaiyabil, Lemshikhali and Boroghop Unions of Kutubdia Island.

The samples were analysed for parameters covering physical, chemical and bacteriological characteristics. Parameters such as temperature, pH, Total Dissolved Solids (TDS), electrical conductivity (EC) and salinity were

measured onsite. Water samples were collected as grab water sample in a pre-washed 5-litre plastic jerry can and 250 ml sterilized clean PET bottle for complete physio-chemical and bacteriological tests respectively.

The samples were analysed as per standard procedure/method given in Standard Method for Examination of Water and Wastewater Edition 20, published by APHA.

Details of the sampling locations are presented in *Table 4.14* and the ground water sampling locations are shown in *Figure 4.2* and photographs of groundwater sample collection are shown in *Figure 4.32*.

Table 4.14 *Ground Water Sampling Locations*

S. No.	Sampling Location	Depth	Establishment	Code	Monitoring Date	Geographic Location
1	Ali Fakir Deil village, Dakshin Dhurung Union	200	2004	GW1	17.11.16	21°52'0.20"N 91°50'45.50"E
2	Baitul Sharif Madrasa Complex, Kaiyabil Union	800	2000	GW2	17.11.16	21°50'16.80"N 91°51'17.80"E
3	Darbar village, Lemshikhali Union	680	2011	GW3	17.11.16	21°51'12.29"N 91°52'28.64"E
4	Uttar Mogdil village, Boroghop Union	900	2002	GW4	17.11.16	21°48'46.30"N 91°51'12.10"E

Figure 4.32 *Photographs of Ground Water Sample Collection*





Discussion of Results

- pH of the groundwater samples were recorded in the range of 6.74-8.23 as against the ECR, 1997 standard of 6.5 to 8.5.
- Turbidity values of the groundwater samples ranged between 0.94-2.1 NTU and are in compliance to the ECR, 1997 standard of 10 NTU.
- The level of total dissolved solids (TDS) recorded in the groundwater samples varied from 0.15-1.70 ppt. In almost all the samples, the TDS levels were found to be in exceedance to the acceptable limit of 1 ppt. (samples collected from Ali Fakir Deil village, Baitul Sharif Madrasa Complex, Darbar village).
- Chloride concentrations were recorded from 172 mg/l to 184 mg/l in the groundwater samples. Sample collected from all the locations showed chloride concentration in compliance to the ECR, 1997 limits.
- Fluoride levels in the groundwater samples were found to be in the range 0.33-0.45 mg/l. Fluoride concentrations for all the samples were found to be in compliance to the ECR, 1997 limit of 1.0 mg/l.
- Sodium and potassium contents of the samples varied between 104-114 mg/l and 1.22-1.56 mg/l. The results were found to be in compliance to the standard values of sodium (200 mg/l) and potassium (12 mg/l)
- Arsenic concentration of the samples were found to be varying between 0.0-0.2 mg/; which were in compliance to the standard limit of 0.05 mg/l
- Iron concentration of all the samples (0.78-0.91 mg/l) were found to be in compliance to the ECR, 1997 limit of 1.0 mg/l
- Concentration of heavy metals viz. cadmium, lead, mercury, chromium, nickel, manganese, zinc, copper etc. were found to be in compliance to the ECR, 1997 limits.
- Faecal and total coliforms were not detected from the collected samples

In summary the groundwater analysis reveal that almost all the parameters are within the standard values of ECR, 97 (excepting TDS) and it can be assumed that the ground water quality was satisfactory for drinking within the Kutubdia Island.

Groundwater analysis results are presented in *Table 4.15*.

Table 4.15 *Ground Water Analysis Results*

S. No.	Parameter	Unit	Ground Water Quality				Standards ECR, 97
			GW1	GW2	GW3	GW4	
1	Temperature	°C	27.3	27.3	27.1	28.3	-
2	pH	-	7.04	7.09	6.74	8.23	6.5-8.5
3	TDS	Ppt	1.70	1.57	1.38	0.15	1
4	EC	mS/cm	3.43	5.16	2.75	0.31	-
5	Salinity	Ppt	1.55	2.41	1.20	0.10	-
6	Colour	Hazen	13	11	9	12	15
7	Odour	-	Odorless	Odorless	Odorless	Odorless	Odorless
8	Turbidity	NTU	2.1	1.5	0.94	1.7	10
9	Total Hardness (as CaCO ₃)	mg/l	219	227	196	205	-
10	Alkalinity (HCO ₃)	mg/l	213	241	216	228	-
11	Chloride (Cl)	mg/l	172	182	181	184	150-600
12	Sulphate	mg/l	233	210	217	215	400
13	Nitrate	mg/l	2.2	1.7	1.8	1.3	10
14	Fluoride (F)	mg/l	0.33	0.45	0.44	0.38	1.0
15	Sodium (Na)	mg/l	104	114	107	110	200
16	Potassium (K)	mg/l	1.56	1.23	1.33	1.22	12
17	Arsenic (As)	mg/l	0.01	0.01	Nil	0.02	0.05
18	Cadmium (Cd)	mg/l	<0.001	<0.001	<0.001	<0.001	0.005
19	Chromium (Cr)	mg/l	<0.01	<0.01	<0.01	<0.01	0.05
20	Mercury (Hg)	mg/l	<0.001	<0.001	<0.001	<0.001	0.001
21	Lead (Pb)	mg/l	<0.01	<0.01	<0.01	<0.01	0.05
22	Iron (Fe)	mg/l	0.8	0.78	0.84	0.91	0.3-1.0
23	Nickel (Ni)	mg/l	<0.01	<0.01	<0.01	<0.01	0.1
24	Manganese (Mn)	mg/l	<0.01	<0.01	<0.01	<0.01	0.1
25	Copper (Cu)	mg/l	0.02	0.01	0.02	0.02	1
26	Zinc (Zn)	mg/l	0.7	0.6	1.2	0.9	5
27	Boron (B)	mg/l	0.1	0.23	0.15	0.08	1.0
28	Fecal Coliform	n/100ml	0	0	0	0	0
29	Total Coliform	n/100ml	0	0	0	0	0

Source: Primary Monitoring, November 2016

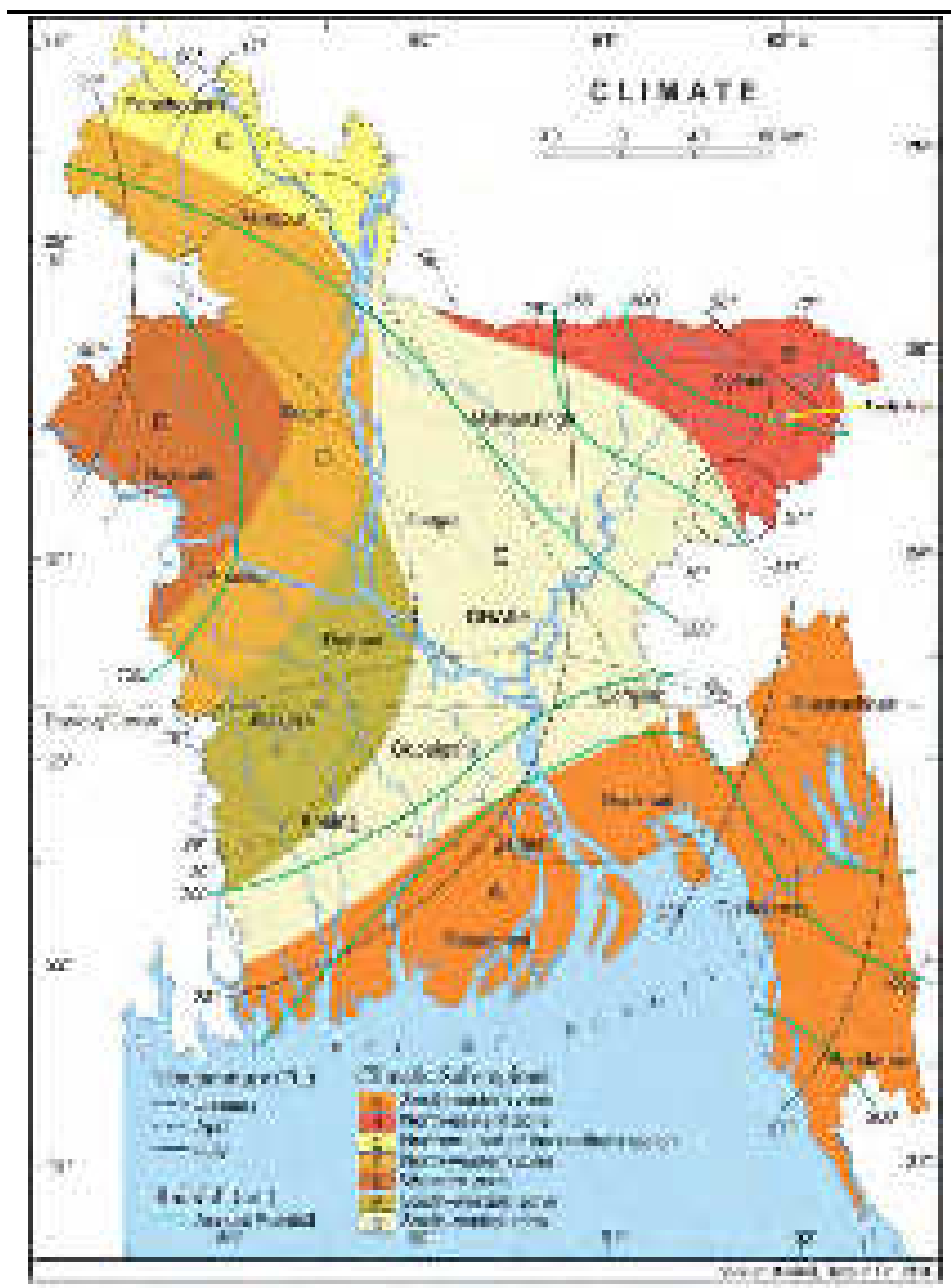
4.12 METEOROLOGY

4.12.1 Climate

The Kutubdia Island falls under the South-eastern zone as per climatic sub-regions of Bangladesh (*Figure 4.33*). From the climatic point of view, three distinct seasons can be recognised - the cool dry season from November through February, the pre-monsoon hot season from March through May, and the rainy monsoon season which lasts from June through September. The climatic data for the study area was obtained from the meteorological station

located in Kutubdia and maintained by the Bangladesh Meteorological Department (BMD).

Figure 4.33 Climatic Sub-regions of Bangladesh



Source: Maps of Bangladesh
[\[https://mapofbangladesh.blogspot.in/2012/01/climate-climatic-sub-regions.html\]](https://mapofbangladesh.blogspot.in/2012/01/climate-climatic-sub-regions.html)

Temperature

The average minimum temperature in Kutubdia area is recorded during November to February and varies generally from 6.2°C to 13.4°C; while the maximum temperature of 39.5°C is observed in May. *Table 4.16* shows the yearly average maximum and minimum temperature at Kutubdia Station for the last 10 years (2000 - 2010).

Table 4.16 Climatic Data of the Kutubdia Station

Year	Max Temp (°C)	Min Temp (°C)	Average Humidity (%)	Annual Rainfall (mm)	Average Wind Speed (m/s)
2000	34.8	13.2	89	3138	1.4
2001	34.8	11.5	89	2320	0.8
2002	34.5	10.2	90	2389	0.9
2003	36.4	10.5	89	2495	1.0
2004	35.8	12.5	86	2541	1.2
2005	37.5	13.4	88	2727	1.6
2006	34.6	6.2	86	2967	1.5
2007	34.7	12.2	87	3162	1.4
2008	34.7	11.7	87	3171	1.3
2009	35.7	12.2	86	2658	2.2
2010	35.3	12.7	84	2702	2.1

Source: Bangladesh Meteorological Department, Kutubdia Station

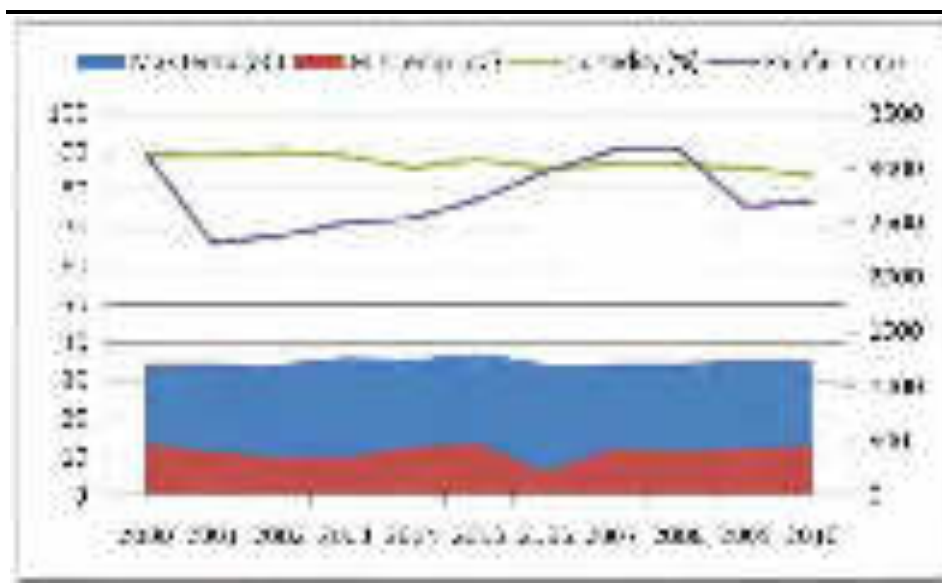
Humidity

As seen from **Table 4.16** the average annual humidity in the region varied from 84% to 90% as depicted in the 10 years data (years 2001 to 2010) . In general, the relative humidity of the study area is lowest between January to April and from May there is a steady increase until November and then again the humidity starts dipping in December and this trend continues till March / April.

Rainfall

The maximum annual rainfall in this region, recorded during the last decade (2000-2010), is about 3171 mm with about 80% of the total rainfall occurring during the monsoons. The peak one day highest rainfall is 360 mm and has been recorded in June 2008. However, July is the highest rainfall recorded month in a year when the average monthly rainfall is 925.17 mm. Subsequently, the rainfall gradually decreases as dry spell in a month increases. An insignificant amount of rainfall has also been recorded in winter.

Figure 4.34 Graphical Representation - Temperature, Humidity & Rainfall at Kutubdia



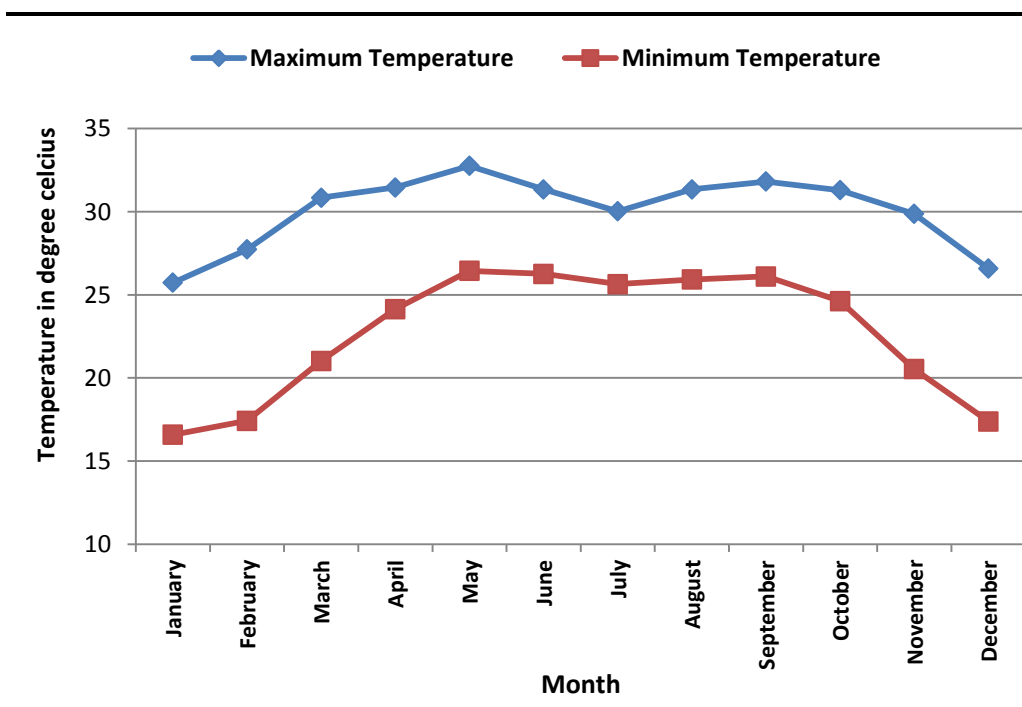
Source: Bangladesh Meteorological Department, Kutubdia Station

Monthly variation in meteorology was analyzed for the year 2015 from the data collected from the Meteorological Station at Kutubdia Island. The details are presented below.

Temperature

Monthly variation in maximum temperature fluctuated between 25.73^oC in January to 32.75 ^oC in May. Minimum temperature fluctuates between 16.59 ^oC in January and 26.44 ^oC in May. Monthly variation in maximum and minimum temperature levels are presented in *Figure 4.35*.

Figure 4.35 Monthly Variation of Maximum and Minimum Temperature- Kutubdia (2015)

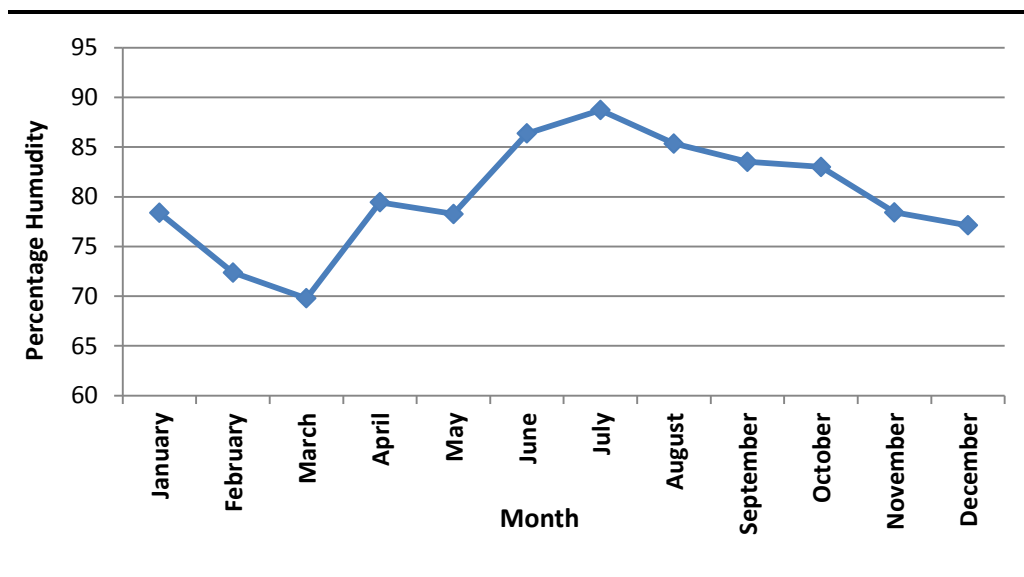


Source: Bangladesh Meteorological Department, Kutubdia Station

Humidity

Monthly average data of percentage humidity varied between 69.78% in March to 88.73% in July. Monthly variation in humidity levels is presented in *Figure 4.36*.

Figure 4.36 Monthly Variations in Humidity Levels- Kutubdia (2015)

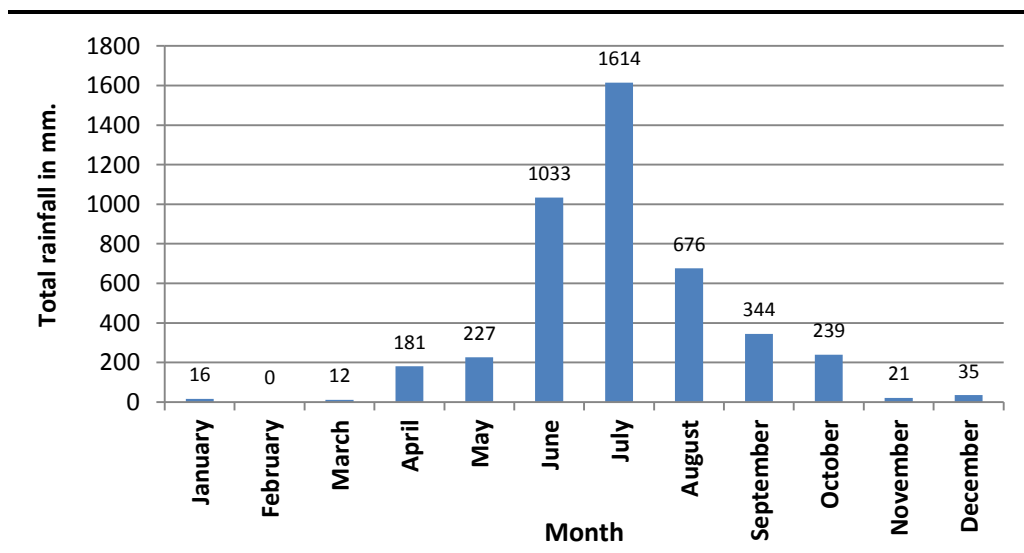


Source: Bangladesh Meteorological Department, Kutubdia Station

Rainfall

Rainfall primarily occurred from June to September (about 83% of the total rainfall) due to the influence of south-west monsoon. Moderate rainfall was also received during the months of April, May and October (181-239 mm.). November to March received very little rainfall. Monthly variation of total rainfall data is presented in Figure 4.37.

Figure 4.37 Monthly Total Rainfall- Kutubdia (2015)

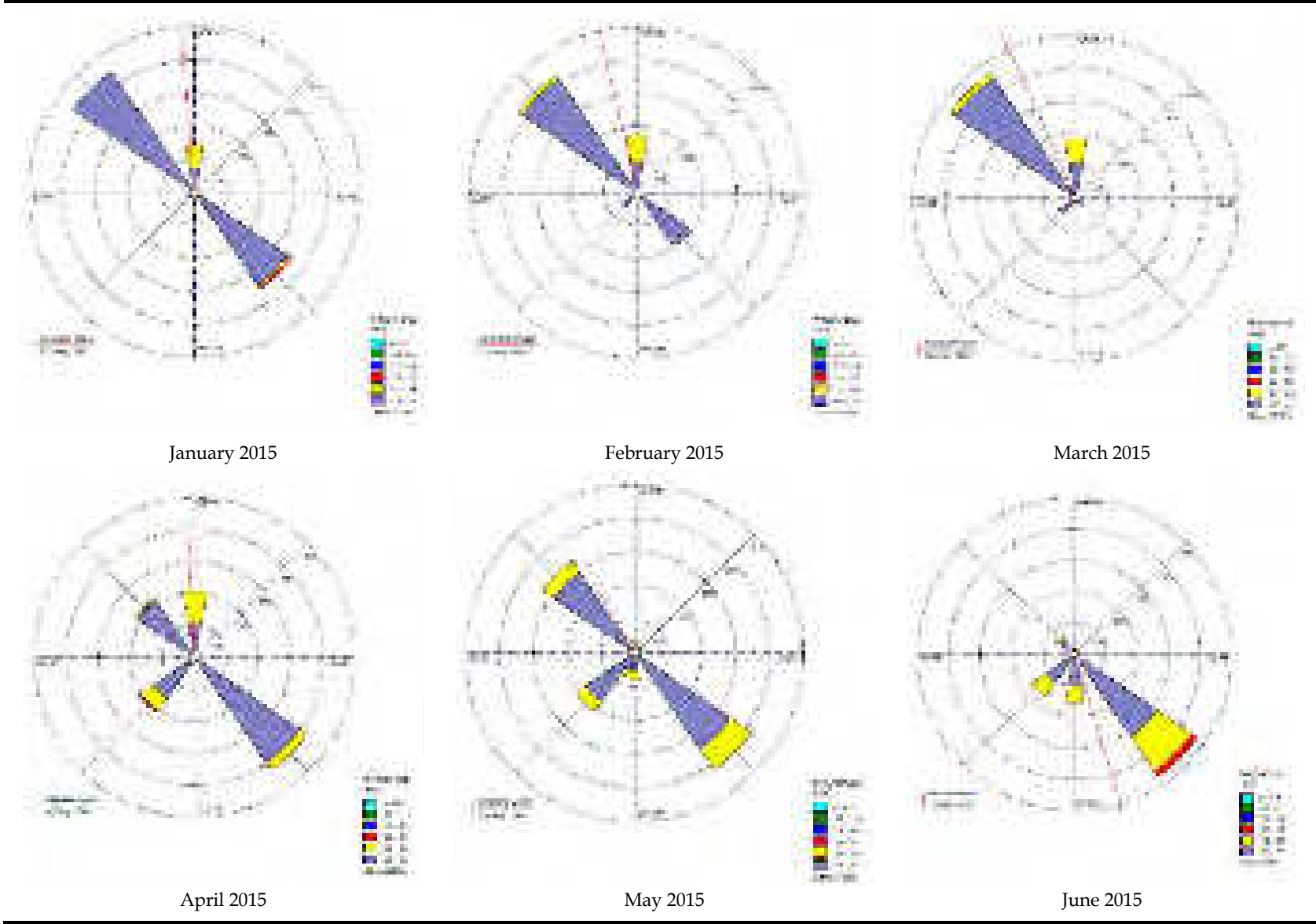


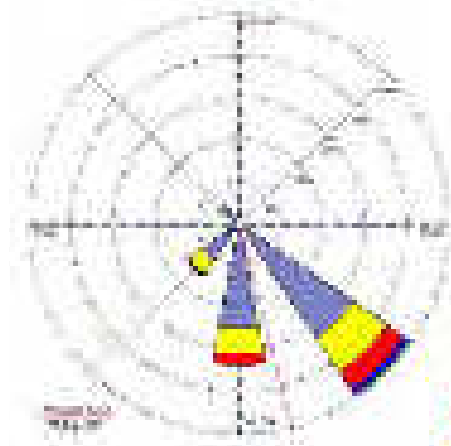
Source: Bangladesh Meteorological Department, Kutubdia Station

Wind Speed and Wind Direction

Wind direction was recorded from south-southeast during June-September. Average monthly wind speeds were also higher during June -September with the maximum wind speed of 1.68m/s recorded during the month of June. Wind direction was recorded from north-northwest for the rest of the months. Lowest wind speed was recorded during December (0.42 m/s). Monthly wind roses for 2015 are shown in Figure 4.38.

Figure 4.38 Monthly Wind Rose – Kutubdia Station (2015)





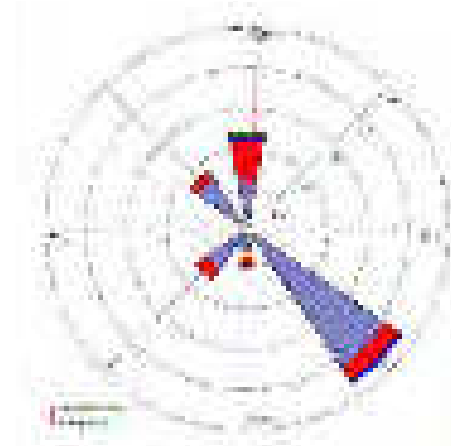
July 2015



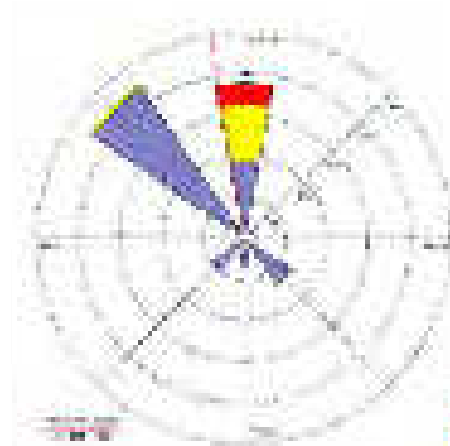
August 2015



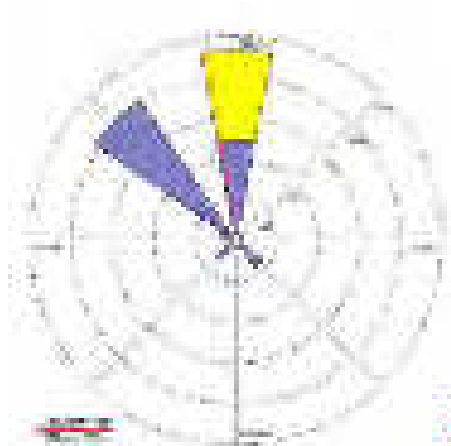
September 2015



October 2015



November 2015



December 2015

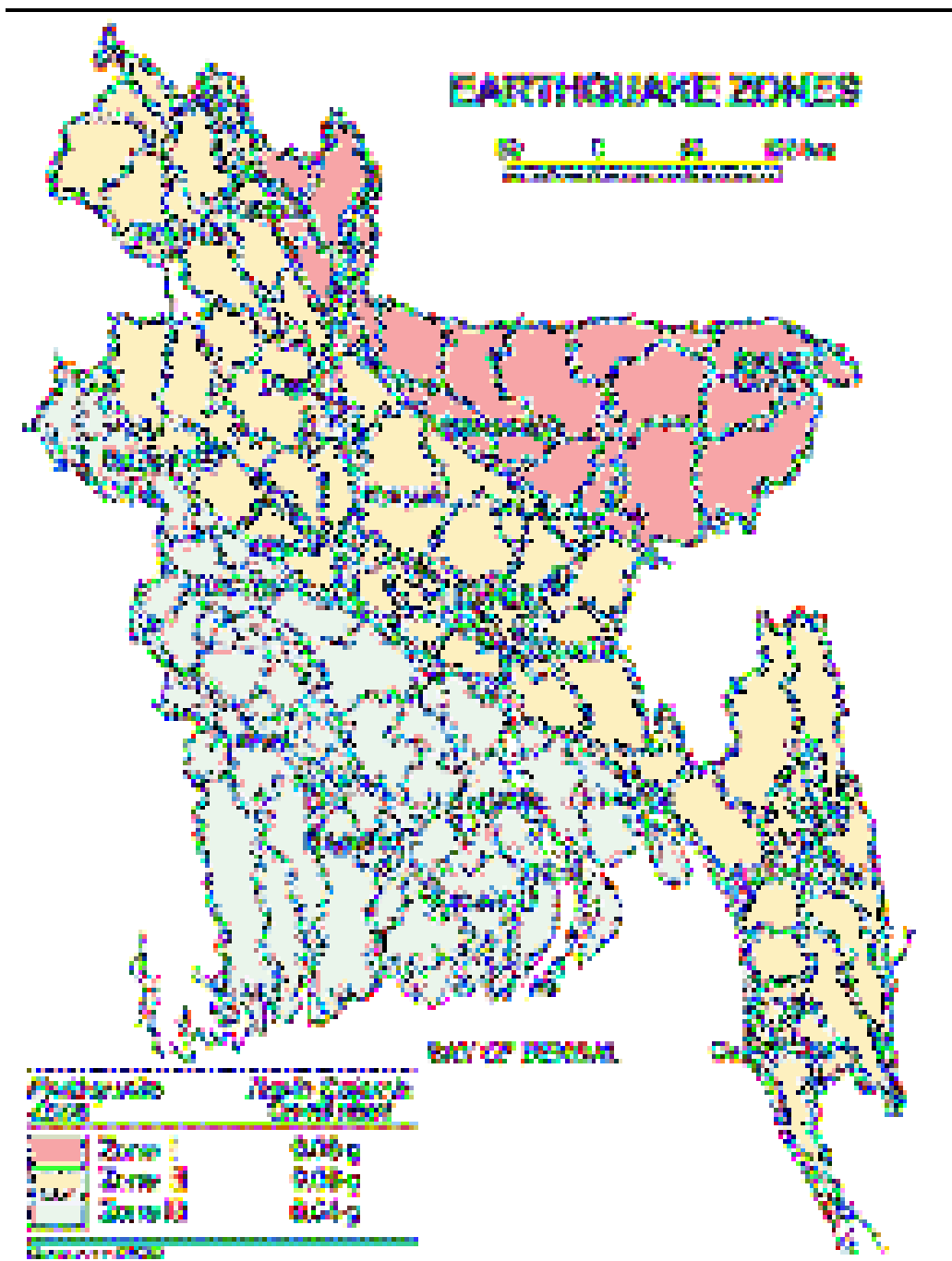
Source: Bangladesh Meteorological Department, Kutubdia Station

4.13 NATURAL HAZARDS

4.13.1 Earthquakes

As per the Seismic Zoning Map of Bangladesh, the country is divided into four seismic zones (*Figure 4.39*). The Project site is located in Zone -II, (same as *Chittagong*), where building design of moderate levels will be necessary.

Figure 4.39 Earthquake Zone Map of Bangladesh



Source: Geological Survey of Bangladesh

Maps of Bangladesh

<https://mapofbangladesh.blogspot.in/2011/10/bangladesh-seismic-earthquake-zones.html>

4.13.2 Cyclones

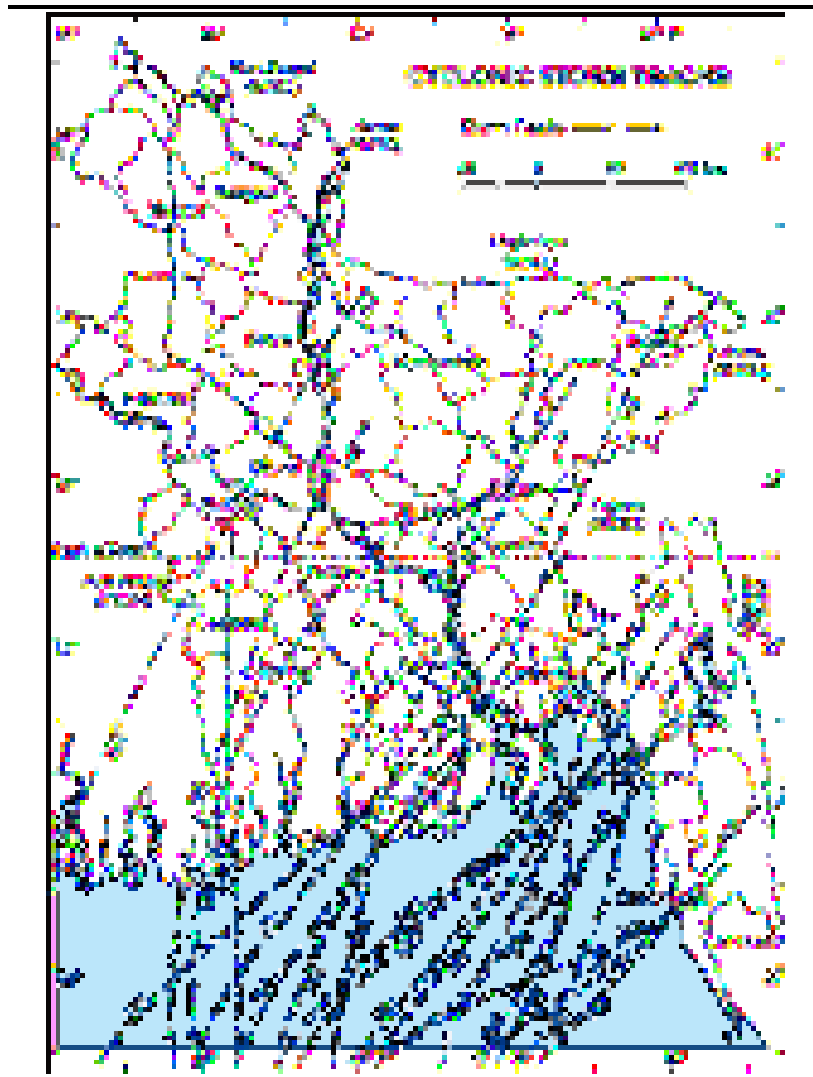
Bangladesh is one of the most cyclone prone areas on the earth. The South-western coastal zone (*Chittagong- Cox's Bazar*) is the most affected and is commonly considered as the most important cyclone prone zone of Bangladesh.

Devastating cyclones hit the coastal zones almost every year and are usually accompanied by high-speed winds, sometimes reaching 250 km/hr or more and with 3 m to 10m high waves, causing extensive damage to life, property and livestock. These cyclones usually occur in two seasons, April-May and October-November - i.e. before and after the monsoon season.

The Kutubdia Island is also adversely affected by cyclone almost every year. The worst ever cyclonic event was experienced on 29th April of 1991, when a severe cyclonic storm accompanied with a core of hurricane winds hit the *Chittagong* region. Wind speeds reached up to 225 km/hr or more and with surge height of 6 m to 8 m. This great cyclone of 1991 caused extensive damage to life, property and livestock on this island.

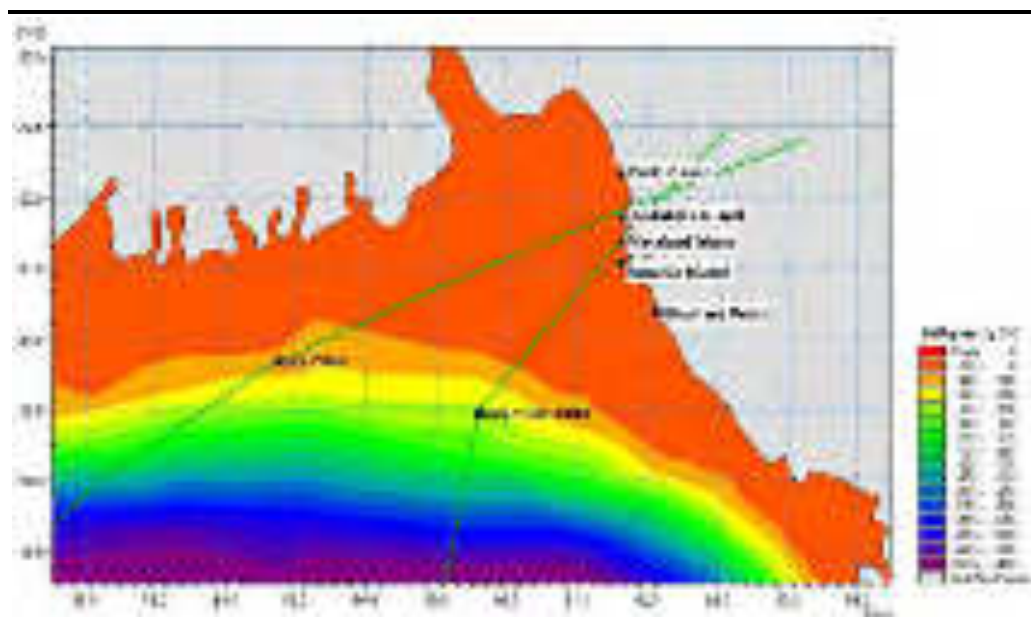
Key cyclonic storm tracks in Bangladesh has been mapped in *Figure 4.40* and severe cyclone track which have made an appearance very close to the proposed site at Kutubdia is provided in *Figure 4.41*.

Figure 4.40 Cyclonic Storm Tracks in Bangladesh



Source: Banglapedia [<http://en.banglapedia.org/index.php?title=Cyclone>]

Figure 4.41 Severe Cyclonic Storm Track in the vicinity of Kutubdia



Source: DHI, 2016 - Desktop Study for Site Screening in Chittagong and Moheshkhali Region

Key cyclonic storm tracks in Bangladesh have been mapped in *Figure 4.40* and list of major cyclones recorded in Chittagong-Cox's Bazar area in last 30 years is presented in *Box 4.1*.

Box 4.1

30 years cyclone records of Chittagong-Cox Bazaar Area

-
- 24–25 May 1985: A severe cyclone hit Chittagong, Cox's Bazar, Noakhali and coastal islands (Sandwip, Hatiya, and Urirchar). Maximum wind speed at Chittagong was 154 km/h, at Sandwip was 140 km/h, at Cox's Bazar was 100 km/h. The storm surge reached a height of 3.0–4.6 m. Casualty: 11,069 people, 135,033 cattle. Damages: 94,379 houses and 74 km of road, and embankments destroyed.
 - 29–30 April 1991: The diameter of the storm was close to 600 km. The maximum wind speed (observed at Sandwip) reached 225 km/h. At other places, the maximum wind speed was reported as follows: Chittagong 160 km/h, Khepupara (Kalapara) 180 km/h, Kutubdia 180 km/h, Cox's Bazar 185 km/h, and Bhola 178 km/h. The storm made landfall near the coast north of Chittagong port during the night of the 29th April. The maximum storm surge height reached about 5 to 8 m. Casualty: 150,000 people, 70,000 cattle. Damages: loss of property was estimated at about Tk 60 billion.
 - 29 April–3 May 1994: A severe cyclonic storm hit the coastal islands near Cox's Bazar. Maximum wind speed reached 210 km/h. Casualty: 400 people, 8,000 cattle.
 - 21–25 November 1995: A severe cyclonic storm hit the coastal islands near Cox's Bazar. The maximum wind speed was up to 210 km/h. Casualty: 650 people, 17,000 cattle.
 - 16–19 May 1997: May 1997 Bangladesh cyclone hit the coastal islands and chars near Chittagong, Cox's Bazar, Noakhali and Bhola districts. The maximum wind speed was 225 km/hour, and the storm surge reached 3.05 metres. Casualty: 126 people.
 - 25–27 September 1997: A severe cyclonic storm hit coastal islands near Chittagong, Cox's Bazar, Noakhali and Bhola. It had wind speeds of up to 150 km/hour, and a storm surge of 1.83 to 3.05 metres.
 - 16–20 May 1998: A severe cyclonic storm with windspeed of 150 km/hour struck coastal islands near Chittagong, Cox's Bazar, and Noakhali. The storm surge was from 1.83 to 2.44 metres.
 - 14–15 May 2007: Cyclone Akash struck about 115 km south of Chittagong with wind speeds up to 120 km/hour. 14 people were killed and damages amounted to US\$982 million.
 - 15 November 2007: Cyclone Sidr with wind speeds up to 260 km/hour, made landfall on southern Bangladesh, causing over 3,500 deaths and severe damage.
 - 16–17 May 2013: Cyclone Viyaru, formerly known as Cyclonic Storm Mahasen, hit near Chittagong with wind speeds up to 85 km/hour. 17 people died, and nearly 1.3 million were affected across the country. Losses to crops exceeded US\$5.14 million.
 - 29 July 2015: Cyclone Komen with wind speeds up to 75 km/hour, hit near Chittagong. About 510,000 houses in the country were damaged or

destroyed, and many residents lost their source of income as 667,221 acres (270,000 ha) of crop fields were damaged. The floods killed 132 people, of which at least 39 were directly related to Komen.

- 21 May 2016: Cyclone Roanu made landfall near Chittagong killing 26 people in Bangladesh. It had wind speeds up to 100 km/hour. Around 40,000 homesteads and business houses were damaged. Food storage, seasonal crops were damaged. Livestock, including fish and shrimp farms were swept away.

Source: http://teacher.buet.ac.bd/akmsaifulislam/reports/SIDR_report.pdf;
http://www.adpc.net/casita/case_studies/coastal%20hazard%20assessment/modelling%20cyclone%20hazard%20in%20bangladesh/background_information_on_the_storm_surge_modelling.pdf
https://en.wikipedia.org/wiki/List_of_Bangladesh_tropical_cyclones

4.13.3 Storm Surge

Storm surges are partly caused by pressure differences within a cyclonic storm and partly by high winds acting directly on the water. Their periods range from a few minutes to a few days, depending on atmospheric forces in the weather system

Kutubdia is affected by cyclone and storm surge almost every year. The cyclone affected areas of Bangladesh with corresponding surge heights have been indicated in *Figure 4.42*. From this figure, it can be observed that the Kutubdia Island is falling in a high risk area (where surge heights are above 1 m)

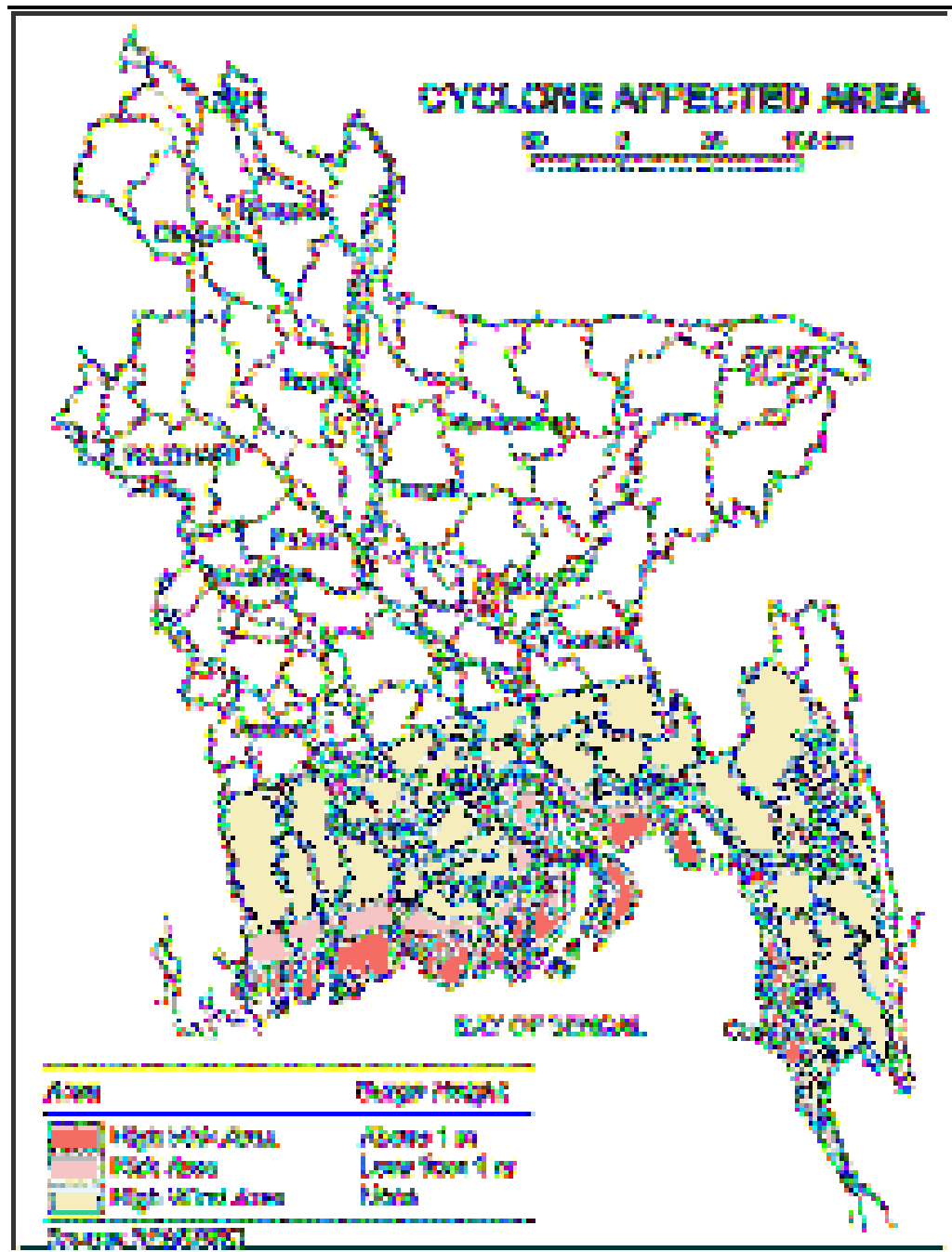
4.13.4 Inundation

There are six unions in the Kutubdia *Upazila*. After any cyclonic event and storm surge on the Island, the level of inundation is found to vary amongst different unions. This aspect has been specifically studied by Ahmed et al (2012)¹. The study brought out the fact that the southern part of the island (Boroghop and Ali Akbar Deil Unions) are most affected by inundation (3m to 4m), whereas the northern Unions are relatively at lesser risk, except for the coastal stretches.

A map showing inundation levels in Kutubdia Island is presented in *Figure 4.43*. The map also shows the available cyclone shelters.

¹ Musfique Ahmed and Rifat Anwar, 2012. Risk Assessment of Storm Surge of Kutubdia Island Using GIS; IACSIT Coimbatore Conferences IPCSIT vol. 28 (2012) © (2012) IACSIT Press, Singapore

Figure 4.42 Cyclone Affected Area Map of Bangladesh



Source: Bangladesh Space Research and Remote Sensing Organisation (SPARRSO)
 Maps of Bangladesh
[\[https://mapofbangladesh.blogspot.in/2011/10/cyclone-affected-area-bangladesh.html\]](https://mapofbangladesh.blogspot.in/2011/10/cyclone-affected-area-bangladesh.html)

Figure 4.43 Inundation Map of Kutubdia Island



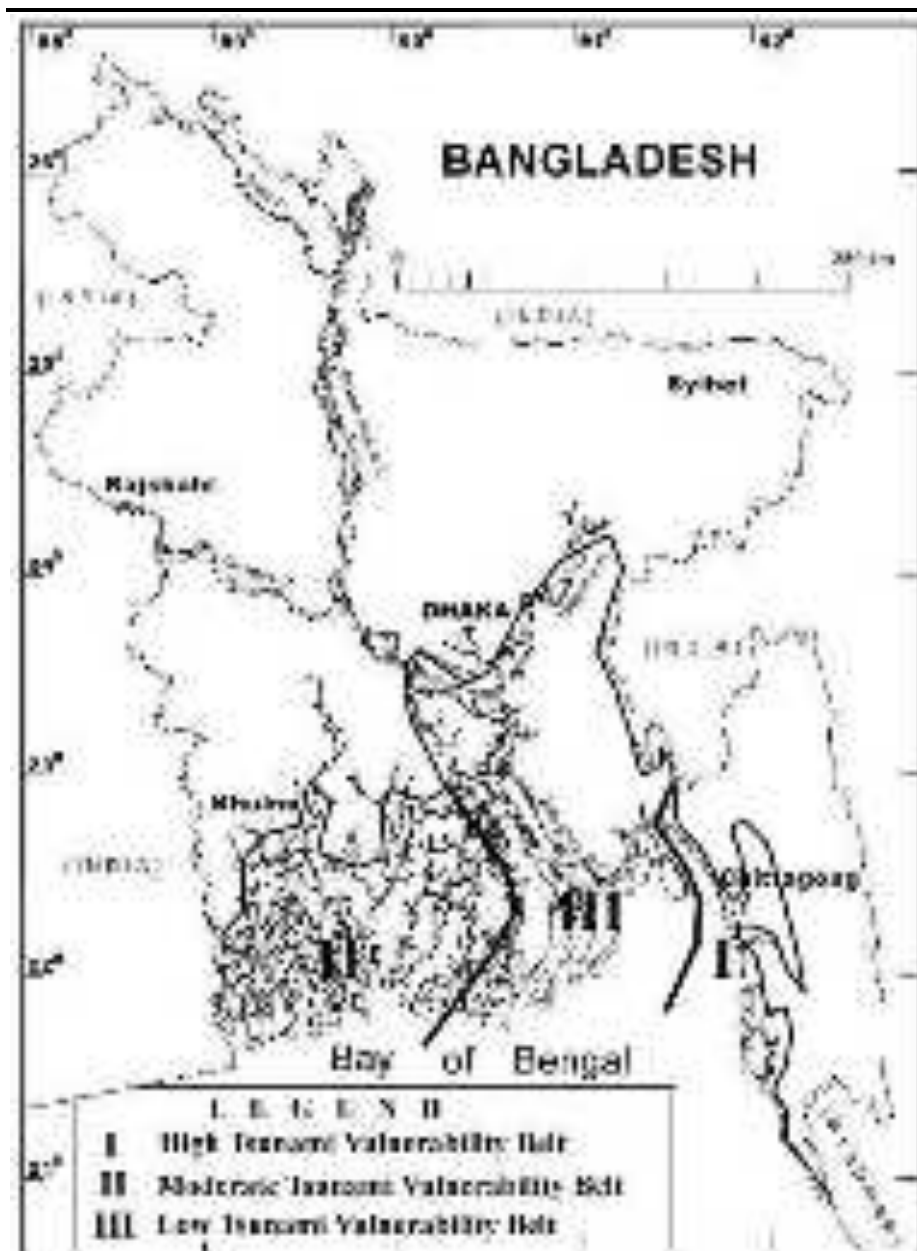
Source: Risk Assessment of Storm Surge of Kutubdia Island Using GIS; 2012 IACSIT Coimbatore Conferences IPCSIT vol. 28 (2012) © (2012) IACSIT Press, Singapore

4.13.5 Tsunami

Considering the state of tsunami vulnerability and potential seismic sources, the coastal belt is classified into three tsunami genic zones (Uddin, 2005¹) as shown in *Figure 4.44*. The Cox's Bazar coast falls within Zone-I, which is reportedly most vulnerable.

¹ Uddin, A.M. K. 2005. Tsunami: A Status Paper reflecting Bangladesh coast's exposure and vulnerability, Program Development Office for Integrated Coastal Zone Management Plan (PDO-ICZMP)

Figure 4.44 Tsunami Vulnerability Map



[Source: Uddin, A.M. K. 2005. Tsunami: A Status Paper reflecting Bangladesh coast's exposure and vulnerability, Program Development Office for Integrated Coastal Zone Management Plan (PDO-ICZMP)]

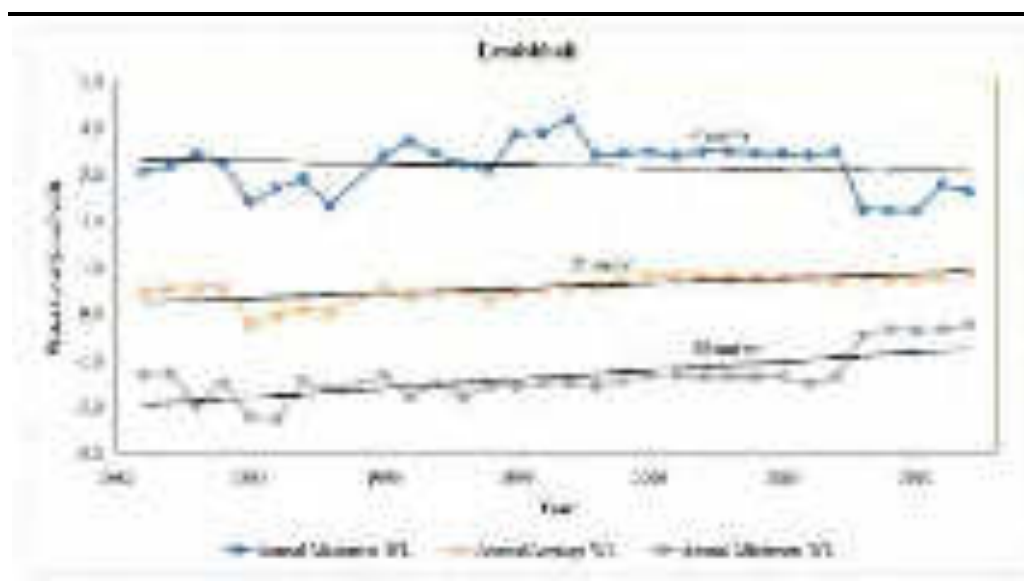
4.13.6 Climate Vulnerability

Coastal zone of Bangladesh is the vulnerable to climate change because of its location, flat topography, high population density, high levels of poverty, and reliance of many livelihoods on climate sensitive sectors particularly, agriculture, fisheries and water resources¹. The average elevation of the southwest coastal zone ranges from 1 to 2 m. Low elevation; active delta and dynamic morphology of the Bangladesh coastal area play a significant part in its vulnerability to sea level change.

¹ Assessment of Sea Level Rise on Bangladesh Coast through Trend Analysis. 2016. Climate Change Cell Department of Environment Ministry of Environment and Forests

The “Climate Change Cell” of the Department of Environment (DoE), initiated a study titled “Assessment of Sea Level Rise and Vulnerability in the Coastal Zone of Bangladesh through Trend Analysis”. The study revealed highest trend of sea level rise (SLR) in the Chittagong and Cox’s bazar region of Bangladesh coast compared to other two coastal sub-zone of the country (viz. Ganga and Meghna Subzones). Analysis of tidal water for 30 years (1981-2010) shows trends of water level in the Chittagong coastal plain areas is 11-21 mm/year. SLR at the Lemshikhali Substation (at the eastern bank of Kutubdia Island), closest to the proposed project site was found to be 21 mm/year based on trend analysis of 30 years data (1981-2012). SLR at the Lemshikhali substation is presented at the figure below.

Figure 4.45 Observed trend of Tidal Water Level at Lemshikhali over last 30 years



Source: Assessment of Sea Level Rise on Bangladesh Coast through Trend Analysis. 2016. Climate Change Cell Department of Environment Ministry of Environment and Forests

Sea level rise affects the coastal zone and its geometry in a number of ways including inundation, erosion and salt water intrusion into the water table etc. Climate Change vulnerability and climate resilient adaptation methods have been presented in the table below

Table 4.17 Climate Risk and Adaptation Strategy in Bangladesh

Sectors	Sector Impact & Vulnerability	Adaptation Options
Agriculture/ Food Security	Higher temperature, saline water intrusion, and changing monsoon rainfall patterns impacting crop production	Development and dissemination of climate-resilient crop varieties and cropping systems for water-logging and salinity-affected coastal areas Cultivation of vegetable crops in floating gardens and raised beds
	Prolonged drought may increase the need for inputs like irrigation and fertilizers	Research and dissemination of drought-tolerant crop varieties; better storage mechanisms, and crop diversification.
	Temperature increase would have severe impact on food production	Improve knowledge and agricultural extension services Sugar crops and other high value crops (HVC) improvement for adverse climate condition through biotechnology

Sectors	Sector Impact & Vulnerability	Adaptation Options
		Agronomic manipulations such as shifting planting dates, using short duration crop cultivation
Coastal Zones and Marine Ecosystems	Frequency and intensity of tropical cyclones and storm surge are increasing	Construction of Multi-purpose Cyclone Shelter Centers for people and of raised platforms
	Bay of Bengal more rough, making it difficult for fishermen and small craft to put to sea	Livelihood support and diversification to the coastal community Flood protection coastal defence structure Integrated project with promoting micro-finance in the vulnerable coastal areas; involvement of private sectors in the coastal areas through promoting micro-enterprise development
Water Resource Management	Too much water in wet season, too little water in dry season; untimely water and saline water are all experienced in the country	Modernization of existing irrigation schemes and demand management aimed at optimizing physical and economic efficiency in use of water resources and recycled water in water-stressed areas
	Frequency of intense rainfall in the country increasing, causing severe floods, water logging, landslides, and mud flows	Protection of groundwater resources and water catchment areas
	Sea Level Rise exacerbating drainage blockages & water logging; causes salt water intrusion	Rainwater harvesting, creation of water reservoir, low cost filter in salinity affected areas
	Shortages of fresh water for drinking becoming acute	Increasing surface water storage and restoring natural water courses
Health, Migration and Social Protection	Water, air, and vector-borne diseases and outbreaks of cholera, diarrhoea, and dengue increasing	Better irrigation water management to reduce mosquito breeding sites; improved diseases/vector surveillance and monitoring; education, training & awareness campaign on public health issues
	Children, women, elderly, and poor people suffering more from heat and cold waves	Improved housing and living condition in climate vulnerable zones
	People losing livelihood and getting displaced due to cyclone and storm surge, sea level rise, river erosion, etc. 'Climate migrants'	Livelihood protection in ecologically fragile areas and protection of vulnerable socio-economic groups Monitoring of internal and external migration and providing support for rehabilitation Improving the education and work skills of migrants and financing of resettlement costs and rehabilitation
Multi-sector		Mainstreaming climate change in national, sector and spatial development program Institutional strengthening and building of human resource capacity Improved capacity of Ministry of Environment and Forests (MOEF) to manage and coordinate investments in and knowledge on climate-resilient initiative

Source: Strategic Program for Climate Resilience: Bangladesh, 2010

Sea level rise near the proposed project area by analysis of 30 years trend was found to be approximately 21 mm/year. Considering the project life of 25 years (including construction period) a sea level rise of 0.5 m is expected in the area. However, as the ORF will be elevated to 8 metres, significant impact to the proposed project due to sea level rise is not anticipated.

4.14 AIR ENVIRONMENT

There are no air-polluting industries on the Kutubdia Island. A few brick kilns and a small diesel operated power plant of the Bangladesh Power Development Board is the prime source of air pollution on this island. The vehicles operating on the internal road are mostly battery operated rickshaw. Only a few fuel operated vehicles are found plying on the roads of the island. The only other source of air pollution in the study area includes domestic fuel combustion at the settlements.

4.14.1 Methodology of Air Quality Monitoring

Air monitoring was conducted at six locations within Kutubdia Island during post monsoon season (October-November), 2016. Parameters monitored were PM₁₀, PM_{2.5}, SO₂, NO_x and CO. All the parameters were monitored for 24 hours for six weeks taking one sample each week. CO was monitored for 8 hours for a day at each monitoring location.

Selection of sampling locations

The baseline status of the ambient air quality has been established through a scientifically designed ambient air quality monitoring network. The ambient air quality monitoring locations (**Figure 4.2**) were based on the following aspects covered in field survey plan developed prior to the field work:

- Meteorological conditions of the area based on information of BMD observatory at Kutubdia; and
- Location of sensitive receptors such as major settlements;

The particulate and gaseous samples collected during the monitoring have been analysed as per the procedures specified in **Table 4.18**. Details of the monitoring locations are presented in **Table 4.19** and the air monitoring locations are shown in **Figure 4.2**. Photographs of ambient air monitoring are presented in **Figure 4.46**.

Table 4.18 Methodology for Analysis of Ambient Air Quality

S. No.	Parameter	Analysis Procedure
1.	PM ₁₀	Gravimetric method
2.	PM _{2.5}	Gravimetric method
3.	SO ₂	Colorimetric method at 560nm using spectrophotometer (West-Gaeke method)
4.	NO _x	Colorimetric method at 540 nm using spectrophotometer (Jacob and Hochheiser method)
6.	CO	NDIR method

Table 4.19 Air Monitoring Locations

S.No.	Sampling location	Code	Monitoring date	Geographic location
1	Light House, Ali Fakir Deil	AQ1	02.10.16, 11.10.16, 16.10.16, 23.10.16, 29.10.16, 04.11.16	21°51'53.20"N 91°50'32.40"E

S.No.	Sampling location	Code	Monitoring date	Geographic location
2	Pachar Para, Dakshin Dhurung	AQ2	04.10.16, 11.10.16, 16.10.16, 23.10.16, 29.10.16, 04.11.16	21°52'1.20"N 91°51'21.90"E
3	Kata Para, Lemshikhali	AQ3	05.10.16, 12.10.16, 17.10.16, 25.10.16, 30.10.16, 05.11.16	21°52'40.70"N 91°53'33.20"E
4	Ismail Haji Para, Kaiyabil	AQ4	07.10.16, 12.10.16, 17.10.16, 25.10.16, 30.10.16, 05.11.16	21°51'1.30"N 91°51'17.10"E
5	Uttar Musjit Para, Uttar Dhurung	AQ5	08.10.16, 14.10.16, 21.10.16, 27.10.16, 01.11.16, 06.11.16	21°53'30.00"N 91°51'30.20"E
6	Uttar Mogdil Para, Boroghop	AQ6	10.10.16, 14.10.16, 21.10.16, 27.10.16, 01.11.16, 06.11.16	21°48'40.90"N 91°51'14.70"E

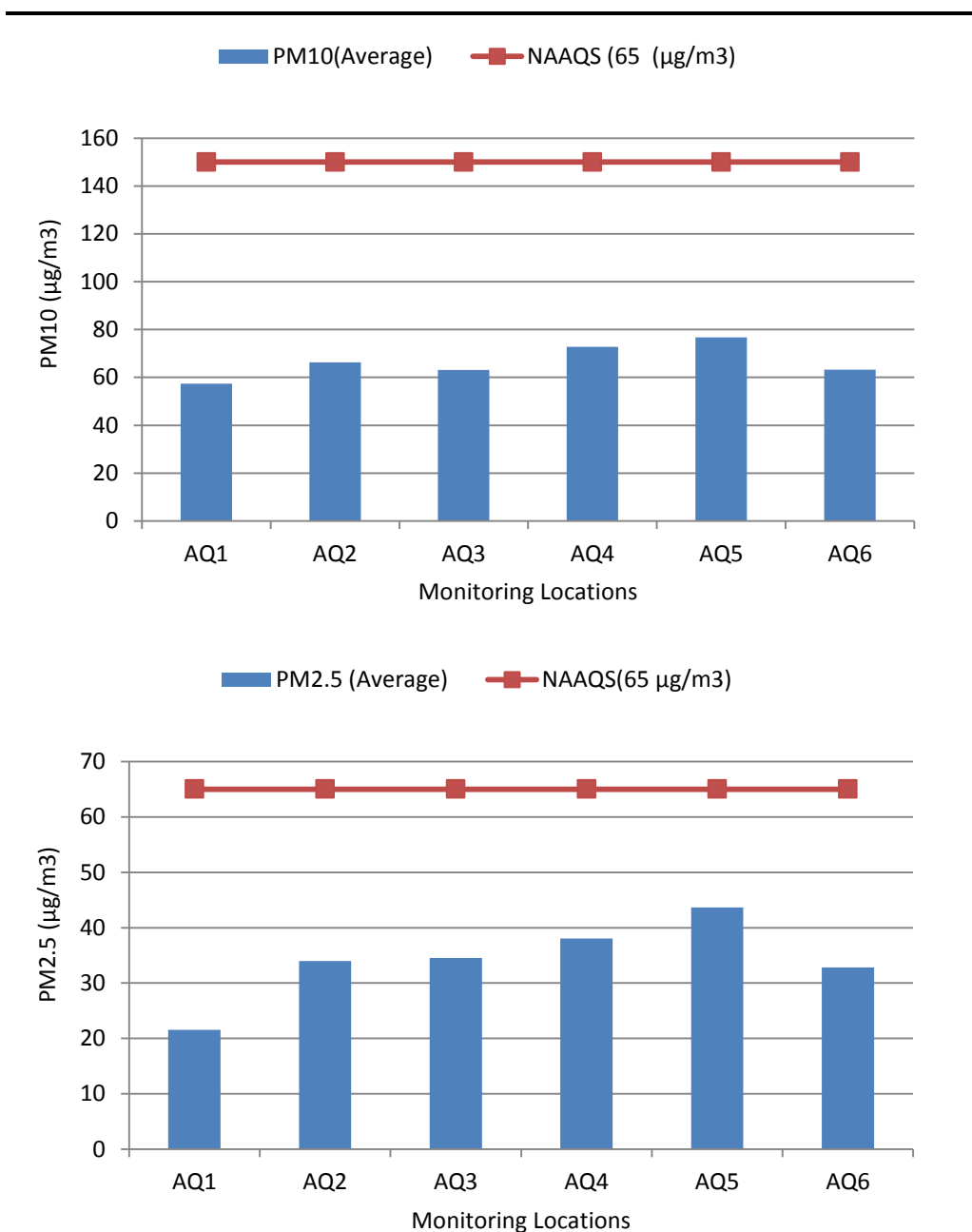
Figure 4.46 *Photographs of Ambient Air Quality Monitoring*



Concentration of Particulate matter (PM_{2.5} & PM₁₀)

The average and 98 percentile concentrations of PM_{2.5} in Kutubdia Island varied from 21.55-43.67 µg/m³ and 26.09-47.58 µg/m³ respectively. The average and 98 percentile concentrations of PM₁₀ in Kutubdia Island varied from 57.67-76.68 µg/m³ and 65.10-84.72 µg/m³ respectively. Station wise average PM concentration is presented in **Figure 4.47**. When the results are compared with the WHO guideline values for PM₁₀ and PM_{2.5}, it was noted that only the average and 98 percentile values for PM₁₀ and PM_{2.5} were exceeding the guideline values.

Figure 4.47 Station wise PM_{2.5} and PM₁₀ Concentrations in Kutubdia Island

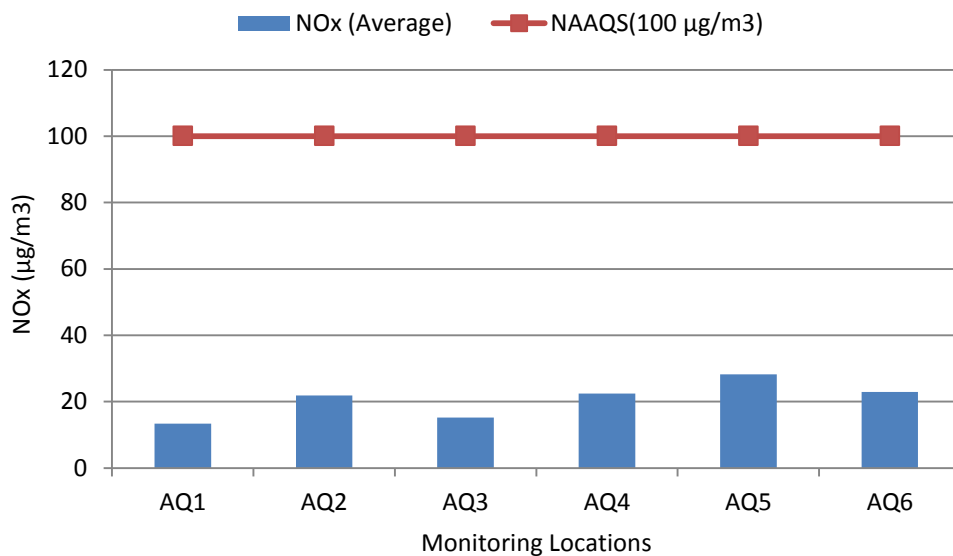


Source: Primary Monitoring, October- November 2016

Concentration of NO_x

The average and 98 percentile concentrations of NO_x in Kutubdia Island varied from 13.33-28.28 µg/m³ and 15.61-32.13 µg/m³ respectively. The NO_x concentrations were not exceeding the NAAQS, for all the locations. Location wise average NO_x concentrations are presented in *Figure 4.48*. The average and 98 percentile NO_x concentrations were found to be in compliance to WHO guideline values for NO_x.

Figure 4.48 Location wise NO_x Concentrations in Kutubdia Island



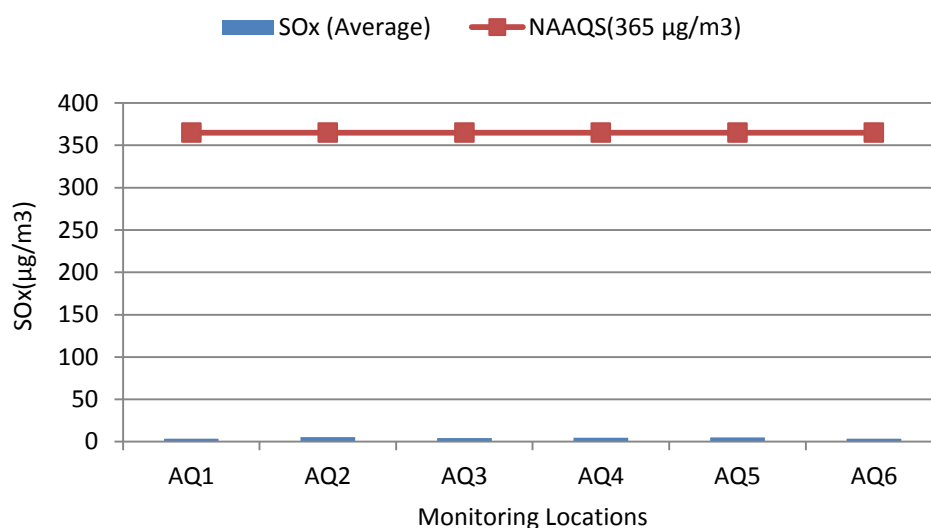
Source: Primary Monitoring, October- November 2016

Concentration of SO_x

The average and 98 percentile concentrations of SO_x at the monitoring locations varied from 3.64-5.12 µg/m³ and 4.19-5.71 µg/m³ respectively. The SO_x concentrations were in compliance to the NAAQS for all the locations. The average and 98 percentile SO_x concentrations were found to be in compliance to WHO guideline values for SO_x.

Station wise average SO_x concentration is presented in *Figure 4.49*.

Figure 4.49 Location wise SOx Concentrations in Kutubdia Island



Source: Primary Monitoring, October- November 2016

Concentration of Carbon Monoxide (CO)

Concentration of CO at the sampling locations varied between 0.57-0.85 ppm which is lower than the Bangladesh National Standard of 10,000 µg/m³ or 8.73 ppm.

Summary of ambient air quality results are presented in **Table 4.20**. Detailed results are provided in **Annex 3**

Table 4.20 Summary of Ambient Air Quality Results-Kutubdia Island

Location	Monitoring Date	Concentration (µg/m ³)				CO (ppm)*
		PM ₁₀	PM _{2.5}	SO _x	NO _x	
AQ 1(Light House, Ali Fakir Deil)	Maximum	65.62	26.41	4.2	15.72	0.63
	Minimum	52.19	18.67	3.02	10.42	
	Average	57.37	21.55	3.64	13.33	
	98 percentile	65.10	26.09	4.19	15.61	
AQ2 (Pachar Para, Dakshin Dhurung)	Maximum	76.31	39.42	5.97	24.76	0.57
	Minimum	60.12	30.55	4.9	18.25	
	Average	66.35	34.00	5.34	21.86	
	98 percentile	75.60	39.12	5.92	24.63	
AQ3 (Kata Para, Lemshikhali)	Maximum	70.54	39.66	4.53	18.41	0.68
	Minimum	57.34	28.35	3.26	12.53	
	Average	63.06	34.53	4.13	15.21	
	98 percentile	70.03	39.45	4.51	18.21	
AQ4 (Ismail Haji Para, Kaiyarbil)	Maximum	82.5	42.13	5.61	25.51	0.82
	Minimum	67.65	32.43	4.01	17.34	
	Average	72.77	38.07	4.83	22.41	
	98 percentile	81.67	42.01	5.57	25.49	
AQ5 (Uttar Masjid Para, Uttar Dhurung)	Maximum	85.43	47.71	5.75	32.34	0.85
	Minimum	70.45	39.54	4.67	23.56	
	Average	76.68	43.67	5.12	28.28	

Location	Monitoring Date	Concentration ($\mu\text{g}/\text{m}^3$)				CO (ppm)*
		PM ₁₀	PM _{2.5}	SO _x	NO _x	
	98 percentile	84.72	47.58	5.71	32.13	
AQ6 (Uttar Mogdil Para, Boroghop)	Maximum	68.34	35.76	4.24	26.32	0.67
	Minimum	56.74	28.43	3.11	18.54	
	Average	63.24	32.85	3.72	22.88	
	98 percentile	68.24	35.72	4.23	26.14	
National Standard**		150	65	365	100	10,000 $\mu\text{g}/\text{m}^3$ (or 9 ppm)
WHO Guidelines***		50	15	80	100	

Source: Primary Monitoring, October- November 2016

* CO was analyzed once at the monitoring locations

**The Bangladesh National Ambient Air Quality Standards have been taken from the Environmental Conservation Rules, 1997 which was amended on 19th July 2005 vide S.R.O. No. 220-Law/2005.

***WHO Ambient Air Quality Guideline Values (2005 and 2000), which are also being referred in the World Bank and IFC's General EHS Guidelines (2007)

4.15 NOISE ENVIRONMENT

There is no major noise generating industrial activities within the Island. The major source of noise is the vehicular movement on the internal roads and river traffic (motor boats, speed boats and trawlers) around the *ghats* in addition to anthropogenic sources of noise (human activities) on the island.

Noise monitoring was conducted at six locations within Kutubdia Island during post monsoon season (October), 2015. The purpose of ambient noise level measurement was to determine sound intensity at the monitoring locations. These locations are chosen in such a way that a representative data could be recorded all over the study area. The sound level is recorded in form of A-weighted equivalent continuous sound pressure level (Leq) values with the use of A-weighting filters in the noise measuring instrument.

Details of the monitoring locations are presented in *Table 4.21* and the noise monitoring locations are shown in *Figure 4.2*. Photographs of noise monitoring are presented in *Figure 4.50*.

Table 4.21 Noise Monitoring Locations

S No.	Sampling location	Category of Area/Receptor	Code	Monitoring Date	Geographic Location
1	Light House, Ali Fakir Deil	Residential	NL1	02.10.16 - 03.10.16	21°51'54.80"N 91°50'35.80"E
2	Dakshin Dhurung union complex, Pachar Para	Mixed	NL2	03.10.16 - 04.10.16	21°51'59.10"N 91°51'22.20"E
3	Nurul Hasan House, Kata Para, Lemshikhali	Residential	NL3	05.10.16 - 06.10.16	21°52'39.80"N 91°53'35.90"E

S No.	Sampling location	Category of Area/Receptor	Code	Monitoring Date	Geographic Location
4	Kamal Hossain House, Ismail Haji Para, Kaiyabil	Residential	NL4	07.10.16 - 08.10.16	21°50'59.51"N 91°51'14.72"E
5	Saju Mia House, Uttar Masjid Para, Uttar Dhurung	Residential	NL5	08.10.16 - 09.10.16	21°53'31.80"N 91°51'28.80"E
6	Kutubdia Upazila Health Complex	Silent Zone	NL6	09.10.16 - 10.10.16	21°49'6.20"N 91°51'11.30"E

Source: Primary Monitoring, October 2016

Figure 4.50 *Photographs of Noise Monitoring*



NL1 (Light house, Ali Fakir Deil)

NL2 (Dakshin Dhurung Union Complex, Pachar Para)



NL3 (Nurul Hasan House, Kata Para, Lemshikhali)



NL4 (Kamal Hossain House, Ismail Haji Para, Kaiyabil)



NL5 (Saju Mia House, Uttar Masjid Para, Uttar Dhurung)



NL6 (Kutubdia Upazila Health Complex)

Noise level monitoring was carried out for 24 hours during the monitoring period with 1-min equivalent sound pressure levels. At all the locations, measurement was taken at 1-min intervals over a 24 hour period. Further to that the equivalent noise levels have been converted to hourly equivalent noise levels. Finally, the measurements were done by dividing the 24 hours into two parts, i.e. daytime, which is considered from 0600 to 2100 hours and night from 2100 to 0600 hours. At each location, day time Leq has been computed from the hourly sound pressure level values measured between 0600 to 2100 hours and night time Leq has been computed from the hourly sound pressure level values measured between 2100 to 0600 hours.

Interpretation of Noise monitoring results

Four noise monitoring locations viz. Ali Fakir Deil, Lemshikhali, Kaiyabil and Uttar Dhurung are located in residential areas. Day time equivalent noise levels at these locations were found to be varying between 46.4 dB(A)-54.4 dB(A). Noise levels were found to be complying with the day time noise standards for residential area [55 dB(A)]. Night time equivalent noise levels at the stations were found to be varying between 43.2 dB(A)- 45.1 dB(A). Night time noise levels at all the stations were found to be conforming to night time noise standards for residential areas (45 dB(A)) for all locations except Kaiyabil which has indicate a slight exceedance.

Day time and night time equivalent noise levels at Dakshin Dhurung Union Complex was found to be 58.9 dB(A) and 45.8 dB(A) respectively. The noise levels were found to be in compliance to the daytime and night time noise standards (60 dB(A) and 50 dB(A) respectively) for mixed areas.

Day time and night time equivalent noise levels at the Kutubdia Upazila Health Complex were found to be 54.6 dB(A) and 44.7 dB(A) respectively. Both the day time and night time noise levels were found to be exceeding the day time and night time noise standards [50 dB(A) and 40 dB(A) respectively] for silent zone.

Equivalent noise levels at the sampling locations are presented in **Table 4.22**. Hourly noise levels at the sampling stations are presented in **Annex 4**.

Table 4.22 *Equivalent Noise Levels at Kutubdia Island*

S. No.	Locations	Category of Area/Receptor	Leq _{day} dB(A)	Leq _{night} dB(A)	Bangladesh Noise Standards	
					Day (dB(A))	Night (dB(A))
1	NL1	Residential	47.8	44.0	55	45
2	NL2	Mixed	58.9	45.8	60	50
3	NL3	Residential	49.6	45.0	55	45
4	NL4	Residential	54.4	45.1	55	45
5	NL5	Residential	46.4	43.2	55	45
6	NL6	Silent Zone	54.6	44.7	50	40

Source: Primary Monitoring, October 2016

4.16 ROAD AND RIVER TRAFFIC

Uttar Dhurung Road is the main road connecting the northern portion of the island and is also the access road to the site. Road connecting Ali Fakir Deil with the Uttar Dhurung Road is selected for the road traffic survey to understand the traffic load and emissions from the road way traffic. Kutubdia Channel is the important waterway for the proposed project site. Vessel traffic survey was also conducted at two locations viz. near Boroghop Ferry Ghat and Darbar Ghat in Kutubdia Channel (Refer *Figure 4.2* for survey location maps)

Road Traffic

The traffic survey was conducted continuously for 24 hours, one time during the study period at one location at the approach road to the proposed project. The traffic survey was conducted for both way movement of vehicles and categorized as medium vehicle (tractor/power tiller), light vehicle (private car, auto rickshaw, CNG, motor cycle) and non-motorized vehicle (rickshaw, cycle etc.).

Total no. of vehicles plying the road in 24 hours are 194 including 109 motorized vehicle and 85 non-motorized vehicle. Maximum traffic volume of 19 vehicles in an hour was recorded between 8-9 AM and during 2-3 AM no traffic was recorded. Frequency of light vehicle, small vehicle and non-motorized vehicles plying the road were 1.55%, 54.64% and 43.81% respectively.

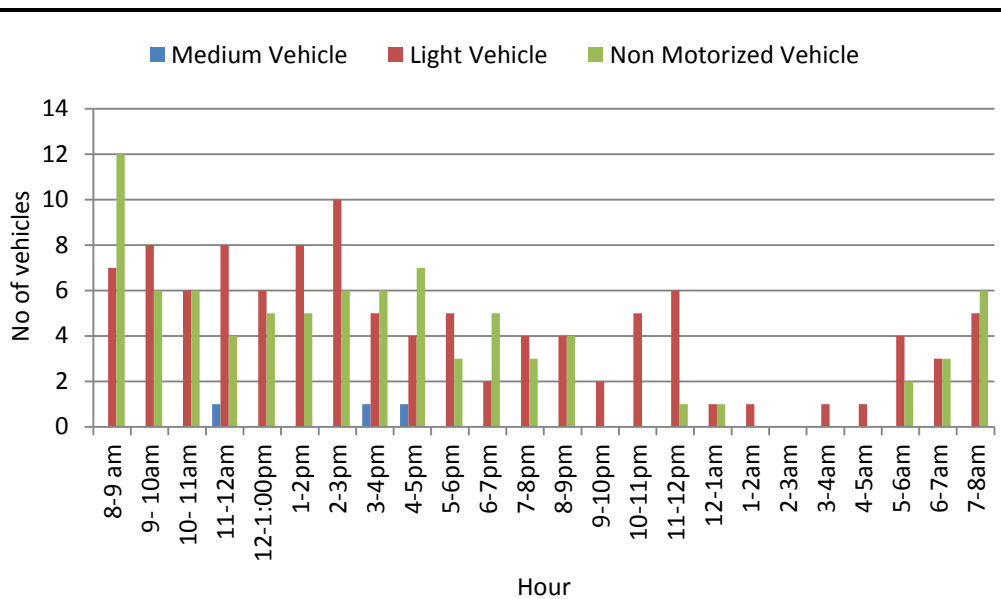
A summary of traffic survey results is presented in *Table 4.23* and hourly movement of vehicles is presented in *Figure 4.51*.

Table 4.23 *Status of Road Traffic*

S No.	Vehicle Type	Numbers/Time
1	Total traffic volume (Nos)/24 hr	194
2	Average traffic volume/hr	8
3	Max Traffic volume (Nos)/hr	19
4	Min traffic volume (Nos)/hr	0
5	Minimum traffic flow hours	8-9 AM
6	Maximum traffic flow hours	2-3 AM

Source: Primary Monitoring, October 2016

Figure 4.51 Hourly Traffic Load



Source: Primary Monitoring, October 2016

Movement of man, material and machinery to the site is expected during the construction and operation stages of the project. This is likely to result in an increase in traffic movement on the island. It is understood that plant and equipment can be transported to the site by sea route through all seasons of the year. Most of the heavy equipment is expected to be unloaded at Chittagong Port, and same will be transported to the Project site at Kutubdia Island via the sea route. So the incremental road traffic volume on the island will principally be resulting from movement of passenger vehicles carrying construction and operation personnel to/from site.

River Traffic

The river traffic survey was conducted continuously for 24 hours, one time during the study period at two locations in Kutubdia channel viz. Boroghop Ferry Ghat and Darbar Ghat. The river traffic survey was done for both way movement of vessels and categorized as fishing boat (motorized), trawler (goods carrying), Danish boat (passenger carrying), passenger service boat (large), speed boat, fishing boat (non motorized).

Total number of vessels recorded in Boroghop ferry Ghat was 394 compared to 380 nos. in Darbar Ghat. At Boroghop Ferry Ghat maximum vessel count of 35 nos. in an hour was recorded during 8-9 AM and minimum vessel count of 3 nos. was recorded during 2-3 AM. At Darbar Ghat maximum vessel count of 52 nos. in an hour was recorded during 1-2 PM and minimum vessel count of 3 nos. was recorded during 3-4 AM and 4-5 AM.

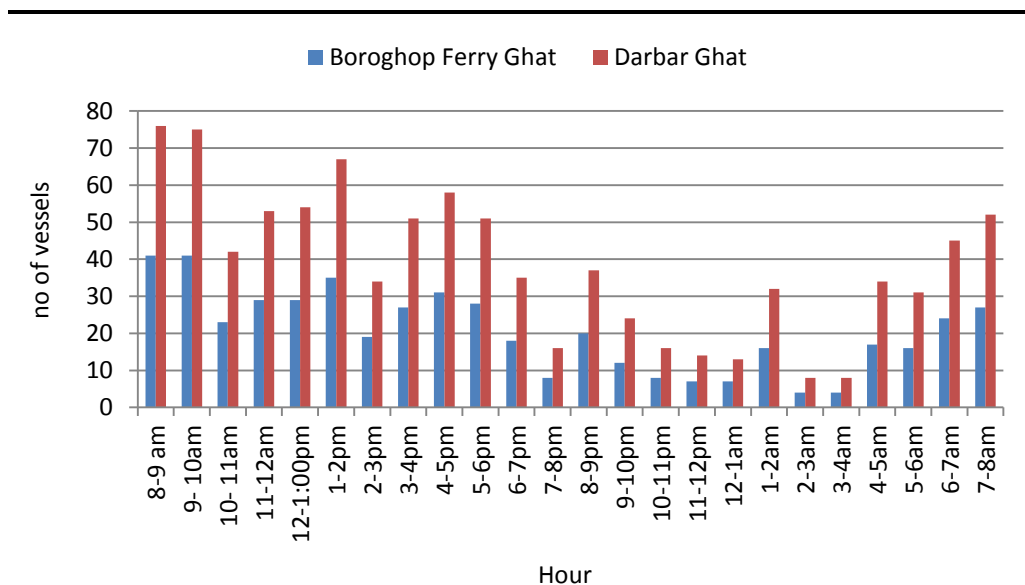
Summary of vessel survey results is presented in Table 4.24 and hourly movement of vessels is presented in Figure 4.52.

Table 4.24 Status of Vessel Traffic in Kutubdia Channel

S No.	Vehicle Type	Borohop Ferry Ghat	Darbar Ghat
1	Total Vessel count (Nos) in 24 hours	394	380
2	Average Vessel count/Hr	16	16
3	Max Vessel count (Nos)/Hr	35	52
4	Min Vessel count (Nos)/Hr	3	3
5	Minimum Vessel Movement Hours	2-3 AM	3-4 AM, 4-5 AM
6	Maximum Vessel Movement Hours	8-9 AM	1-2 PM

Source: Primary Monitoring, October 2016

Figure 4.52 Hourly Movement of Vessels



Source: Primary Monitoring, October 2016

During the construction phase of the current project, the sea traffic will comprise of barges and other vessels which will be used for shipment of plant and machinery to the site. It will also comprise of tugs used for supplying water as well as for bunkering purpose.

During the operation phase LNG Carriers (LNGCs) will bring in the LNG and offload it to the FSU through marine loading arms. It is understood that one LNGC is expect to arrive at the FSU every week for offloading of LNG. In addition the operation phase will also comprise of movements of tugs for supplying water as well as for bunkering.

4.17 ECOLOGY

4.17.1 Introduction

ERM team comprising of two (02) ecologist conducted six (06) day survey of the Kutubdia Island from 14th November to 20th November 2016. The survey was conducted with following objectives;

- Delineation of Study area based on project footprint.
- Identification of various habitats available within the Kutubdia Island;
- Enumeration of terrestrial and aquatic floral and faunal species within Kutubdia Island;
- Identification of floral and faunal species of conservational significance;
- Prediction of likely impacts due to projects activities;
- Suggesting mitigation measures and preparation of Biodiversity Management Plan for species of conservational significance.

4.17.2 Climatic Conditions

The climatic condition during the ecological survey was clear and sunny. The temperature ranged from maximum of 31°C to minimum of 19°C. No incremental weather such as rainfall and thunderstorms were experienced during the survey period.

4.17.3 Study area

The study area for ecological survey includes an area within 10 km from the proposed FSU location. 500 m buffer area on either side of the proposed pipeline route is also considered as study area for the ecology and biodiversity survey. The study area for ecological survey is presented in *Figure 4.1*.

As discussed in *Section 4.5.4: Land Use* major part of the study area (78.62%) falls in the Bay of Bengal. Predominant land use-land cover of the on-shore portion of the study area includes agricultural land (5.18%), salt pans (8.28%), and settlement (3.89%).

Land use of the pipeline corridor includes agricultural land (34.25%); Saltpan (29.27%), channel crossing (16.55%), sandy area (9.48%), block vegetation (7.46%).

The total land area of the Kutubdia Island is been divided in 2kmx 2 km grids for the biodiversity study. Among the 25 grids generated biodiversity study was conducted at 16 grids. Special consideration was undertaken to select the grids in proximity to the ORF and pipeline corridor. The grids selected for study of flora is presented in *Figure 4.57*.

The study area has been divided 2kmx 2 km grid. List of plants; habitat affinity of the floral species is provided.

4.17.4 Classification of Study Area-Bio-ecological Zone of Bangladesh

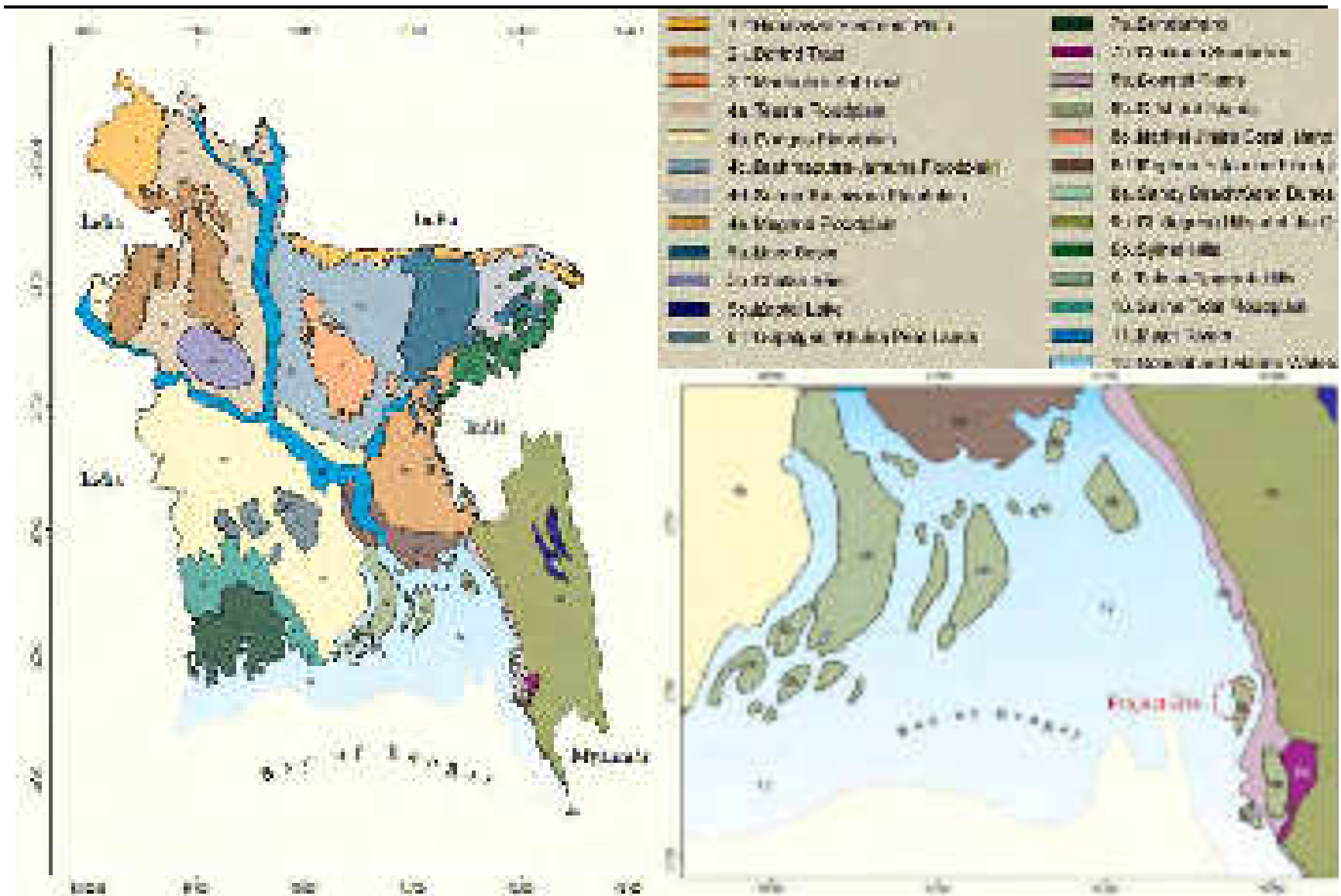
IUCN has classified Bangladesh into 25 Bio-ecological Zones in the context of physiographic and biological diversity. The Kutubdia Island falls under the bio-ecological zone of 'offshore islands (8b)' Details on this bioecological zone is presented in **Box 4.2** and **Figure 4.53**.

Box 4.2 Offshore Islands (8b)

Location	:	21°35'-22°45' N and 90°15'-92°05' E
Relevant Adm HQ	:	Cox's Bazar, Bhola, Patuakhali, Noakhali
Physiography	:	Young Meghna estuarine floodplain; Chittagong coastal plain
Soil	:	Calcareous alluvium (saline); Acid sulphate soils; Brown hill soils
Rainfall	:	2290-2790 mm
Temperature	:	Maximum 34° C, Minimum 12° C
Flooding depth	:	Medium Highland
Land use	:	Fallow-Fallow-T. aman (5b); Rabi-Aus-T. aman (2b); Planted Mangrove forest (15b)
Floral diversity:		
Trees		
Narikel (<i>Cocos nucifera</i>), Supari (<i>Areca catechu</i>), Rendi koroi/Rain tree (<i>Samanea saman</i>), Bhadi (<i>Lannea coromandelica</i>)		
Aquatic plants		
Topapana (<i>Pistia strateotes</i>), Kolmi (<i>Ipomoea aquatica</i>), Jhanji (<i>Utricularia exoleata</i>)		
Faunal diversity:		
Mammals		
Bengal fox (<i>Vulpes bengalensis</i>), Fishing cat (<i>Prionailurus viverrinus</i>), Common palm civet (<i>Paradoxurus hermaphroditus</i>), Ganges river dolphin (<i>Platanista gangetica</i>), Greater bandicoot rat (<i>Bandicota indica</i>)		
Birds		
Indian skimmer (<i>Rynchops albicollis</i>), Purple heron (<i>Ardea purpurea</i>), Painted stork (<i>Mycteria leucocephala</i>), Eurasian thick-knee (<i>Burhinus oedicnemus</i>)		
Reptiles		
River terrapin (<i>Batagur baska</i>), Glossy marsh snake (<i>Gerardia prevostianus</i>)		
Amphibians		
Boulenger's frog (<i>Rana alticola</i>), Common toad (<i>Bufo melanostictus</i>)		

Source: Nishat A. Haq, S.M. Imamul, Barua Shuvashish, P. Reza Ali, A.H.M., Khan, Moniruzzaman, A.S. (eds) 2002. Bio-ecological Zones of Bangladesh. IUCN Bangladesh Country office, Dhaka, Bangladesh. xii+131pp. Source: Bioecological Zones of Bangladesh, IUCN, 2002

Figure 4.53 Bio-ecological Zones of Bangladesh



Source: Nishat A. Haq, S.M. Imamul, Barua Shuvashish, P. Reza Ali, A.H.M., Khan, Moniruzzaman, A.S. (eds) 2002. Bio-ecological Zones of Bangladesh. IUCN Bangladesh Country office, Dhaka, Bangladesh. xii+131pp. Source: Bioecological Zones of Bangladesh, IUCN, 2002

4.17.5 Ecosystems within the Study Area

Available ecosystems within the study area are indicated below;

1. Terrestrial Ecosystem;
2. Coastal Ecosystem and
3. Aquatic Ecosystem
4. Marine Ecosystem

Vegetation in Terrestrial Ecosystem

Terrestrial ecosystem covers about 23% of the study area, which primarily includes agricultural lands, homestead plantation and strip plantation etc.

Agricultural lands

Agricultural land covers about 5% of the study area. Mono- cropping agricultural pattern of paddy is pre dominant in the area. Rabi crops cultivated are chilli, onion, vegetable, ladies finger, long yard bean, tomato, watermelon etc. Tree species observed near agricultural lands are *Mangifera indica*, *Samanea saman*, *Azadirachta indica*, *Cocos nucifera*, *Eucalyptus* sp., *Acacia auriculiformis*, *Phoenix sylvestris*, *Bambusa* sp., *Areca catechu*, *Borassus flabellifer* etc. It is envisaged that agricultural land would be falling within the ORF and also within the pipeline stretch (including both acquisition and requisition area).

Homestead Plantation

Homestead plantation was observed on marginal and fallow lands by the local villagers e.g. homestead, roads, embankment, canal banks and fallow agriculture land. Species observed are *Samanea saman*, *Acacia auriculiformis*, *Acacia manjiam*, *Azadirachta indica*, *Eucalyptus* sp., *Pongamia pinnata*, *Acacia nilotica*, *Ziziphus mauritiana*, *Leucaena leucocephala*, *Swietenia mahogani*, *Tectona grandis*, *Casia siamea*, *Gmelina arborea*, *Casuarina equisetifolia*, *Phoenix sylvestris*, *Bambusa* sp., *Cocos nucifera*, *Mangifera indica*, *Tamarindus indica*, *Areca catechu*, *Borassus flabellifer*, *Artocarpus heterophyllus* etc. It is envisaged that homestead plantation area would be falling within the ORF and within the pipeline stretch (including both acquisition and requisition area).

Strip Plantation

Afforestation program on participatory basis are being implemented along the roads, link road and embankment by the Forest Department under social forestry scheme to meet the demand of wood resources. Major species planted are *Samanea saman*, *Acacia auriculiformis*, *Swietenia mahogani*, *Tectona grandis*, *Artocarpus heterophyllus* etc.

Figure 4.54 Terrestrial Ecosystems in the Study Area



Homestead Plantation

Agricultural Land

Source: ERM Ecological Survey during 14th November to 20th November 2016

Vegetation in Coastal Ecosystem

Coastal ecosystems in the study area comprise of *Casuarina* plantation area, sandy beach areas and muddy areas

Casuarina Plantation

Casuarina (Jhau) plantation is undertaken by the forest department at about 26.5 ha at the western coast of the Kutubdia Island as a shelter belt. Union wise *Casuarina* plantation is presented below

- Dakshin Dhurung- 2.0 ha.
- Kaiyabil- 2.5 ha.
- Uttar Dhurung-15.0 ha
- Ali Akbar Deil- 4.0 ha.
- Boroghop- 10.0 ha.

Few stretches of *Casuarina* plantation is present within the proposed ORF.

Sandy Beaches

Sand beaches in the western coast of Kutubdia are mostly devoid of major floral species. Beach Morning Glory (*Ipomoea pes-caprae*) is the predominant natural vegetation at these sandy beaches. Some beach agriculture in small patches undertaken was also observed.

Figure 4.55 Coastal Ecosystems in the Study Area



Casuarina Plantation in Kaiyarbil

Sandy Beach area near Ali Fakir Deil

Ipomea pres-carpe vegetation on Sandy beach

Beach Vegetation in Western Coast Kutubdia

Source: ERM Ecological Survey during 14th November to 20th November 2016

Riparian vegetation

The unions are enriched with open water fisheries which are available in the rivers, canals and floodplain. Riparian vegetation are present along the sides of ponds, canals etc. Main type of plant species observed is *Syzygium cumini*, *Samanea saman*, *Cocos nucifera* etc.

Mangrove Plantation

Kutubdia Upazila is also an important place for mangrove plantation. Artificial mangrove plantation covered about 30.0 ha¹. Mangrove plantation in the island was undertaken by the Chittagong Coastal Forest Division. Mangrove plantation is present at the eastern coast near Kutubdia channel and also at the south eastern end of the Kutubdia Island. Species most widely used for plantation area *Avicennia officinalis*, *Avicennia marina*. It was reported by the forest department that they have tried planting species like *Sonneratia apetala* (Keowra) and *Excoecaria agallocha* (Geowra), however the same could not be sustained. No mangrove plantation is available within the ORF and pipeline stretch.

^{1&2} Land Use Zoning Report: Kutubdia Upazila, District Cox's Bazar, 2011

Salt Pans

Salt pans contribute to about 8.28% of the total study area for FSU and about 29% of the study area of the pipeline corridor. Salt pans are mostly devoid of any floral species.

Figure 4.56 *Inland Aquatic Ecosystems in the Study Area*



Mangrove Plantations near Lemshikhali Union Salt Pan area in Uttar Dhurung

Source: ERM Ecological Survey during 14th November to 20th November 2016

4.17.6 Terrestrial Ecosystem

Methodology for Survey of Terrestrial Floral species

The total land area of the Kutubdia Island is been divided in 2kmx 2 km grids for the biodiversity study. Among the 25 grids generated biodiversity study was conducted at 16 grids. Special consideration was undertaken to select the grids in proximity to the ORF and pipeline corridor. The grids selected for study of flora is presented in *Figure 4.57*.

At each grid floral survey was conducted at the predominant land use classes. Land use classes selected for floral survey includes

- Agricultural lands
- Homestead Plantation
- Salt pans
- Riparian Vegetation
- *Casuarina* Plantation
- Mangrove Plantation

Figure 4.57 Area Selected for Terrestrial Floral Survey

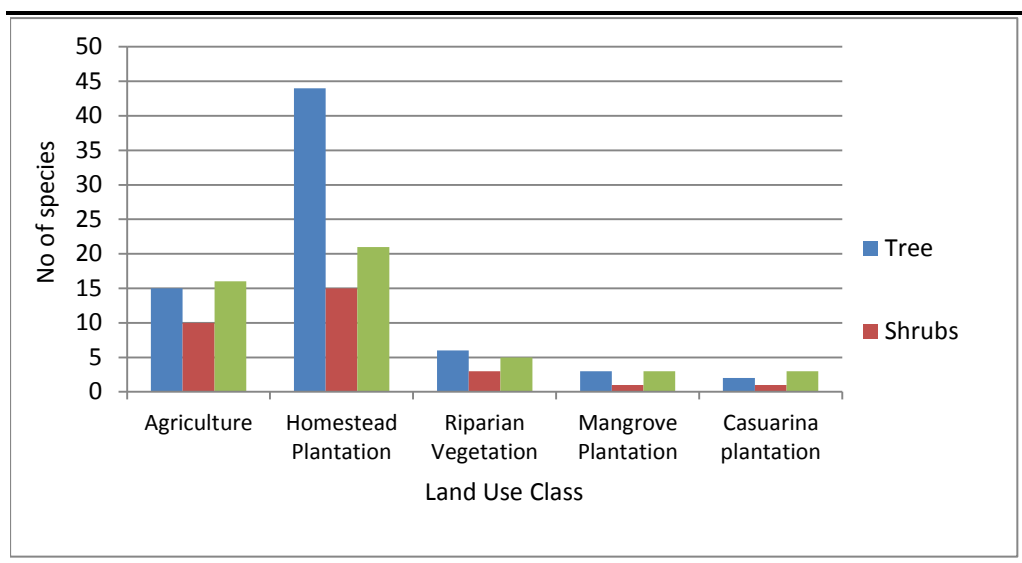


Terrestrial Floral Analysis

Total 87 terrestrial floral species were recorded from the study area which included 48 trees, 16 shrubs and 23 herbs and climbers. Detailed list of flora (including terrestrial and aquatic) is presented in **Annex 5**.

Among the land use classes maximum number of species were recoded from homestead plantation (80 species), followed by agricultural lands (41 species), riparian vegetation (14 species), mangrove plantation (7 species) and casuarina plantation (6 species). Number of species in each land use classes is presented in *Figure 4.58*.

Figure 4.58 *Terrestrial Floral Species in Different Land Use Classes in Kutubdia*



Summary of terrestrial floral analysis is presented in *Table 4.25* and grid wise record of floral species is presented in **Annex 6**.

Table 4.25 Terrestrial Floral Analysis -Summary

S. No	Land Use Types	Habitat Type	Trees	Shrubs	Herbs & Climbers
1	Agricultural	Modified	<i>Acacia auriculiformis</i> , <i>Acacia mangium</i> <i>Acacia nilotica</i> , <i>Albizia lebbeck</i> , <i>Alstonia scholaris</i> , <i>Areca catechu</i> , <i>Artocarpus heterophyllus</i> , <i>Bambusa vulgaris</i> , <i>Borassus flabellifer</i> , <i>Cocos nucifera</i> , <i>Dalbergia sissoo</i> , <i>Mangifera indica</i> , <i>Phoenix sylvestris</i> , <i>Samanea saman</i> , <i>Tamarindus indica</i> ,	<i>Calotropis gigantea</i> , <i>Calotropis procera</i> , <i>Carica papaya</i> , <i>Carissa carandas</i> , <i>Clerodendrum inerme</i> , <i>Rosa centifolia</i> , <i>Suaeda maritima</i> , <i>Vitex negundo</i> , <i>Rosa centifolia</i> , <i>Woodfordia fruticosa</i>	<i>Alternanthera sessilis</i> , <i>Alternanthera philoxeroides</i> , <i>Amaranthus spinosus</i> , <i>Bacopa monnieri</i> , <i>Celosia argentea</i> , <i>Centella asiatica</i> , <i>Colocasia esculenta</i> , <i>Cucurbita maxima</i> , <i>Cynodon dactylon</i> , <i>Cyperus rotandus</i> , <i>Eclipta prostrata</i> , <i>Mimosa pudica</i> , <i>Musa paradisiaca</i> , <i>Ocimum tenuiflorum</i> , <i>Phragmites karka</i>
2	Homestead plantation	Modified	<i>Acacia auriculiformis</i> , <i>Acacia mangium</i> <i>Acacia nilotica</i> , <i>Albizia lebbeck</i> , <i>Alstonia scholaris</i> , <i>Areca catechu</i> , <i>Artocarpus heterophyllus</i> , <i>Bambusa vulgaris</i> <i>Bombax ceiba</i> , <i>Borassus flabellifer</i> , <i>Calophyllum inophyllum</i> , <i>Casuarina equisetifolia</i> , <i>Citrus aurantifolia</i> , <i>Citrus limon</i> , <i>Cocos nucifera</i> , <i>Dalbergia sissoo</i> , <i>Delonix regia</i> , <i>Dillenia indica</i> , <i>Eucalyptus camaldulensis</i> , <i>Ficus benghalensis</i> , <i>Ficus religiosa</i> , <i>Gmelina arborea</i> , <i>Lepisanthes rubiginosa</i> , <i>Leucaena leucocephala</i> , <i>Magnolia champaca</i> , <i>Mangifera indica</i> , <i>Melia azedarach</i> , <i>Mimusops elengi</i> , <i>Phoenix sylvestris</i> , <i>Pithecellobium dulce</i> , <i>Pongamia pinnata</i> , <i>Saraca asoca</i> , <i>Cassia siamea</i> , <i>Samanea saman</i> , <i>Spondias pinnata</i> , <i>Sterculia foetida</i> , <i>Swietenia mahagoni</i> , <i>Syzygium cumini</i> , <i>Tamarindus indica</i> , <i>Terminalia arjuna</i> , <i>Terminalia catappa</i> , <i>Thespesia populnea</i> , <i>Ziziphus mauritiana</i>	<i>Bougainvillea spectabilis</i> , <i>Calotropis gigantea</i> , <i>Calotropis procera</i> , <i>Carica papaya</i> , <i>Carissa carandas</i> , <i>Clerodendrum inerme</i> , <i>Gardenia jesminoides</i> , <i>Hibiscus rosa-sinensis</i> , <i>Lantana camara</i> , <i>Lawsonia inermis</i> , <i>Pandanus foetidus</i> , <i>Ricinus communis</i> , <i>Rosa centifolia</i> , <i>Vitex negundo</i> , <i>Woodfordia fruticosa</i>	<i>Alternanthera sessilis</i> , <i>Alternanthera philoxeroides</i> , <i>Amaranthus spinosus</i> , <i>Bacopa monnieri</i> , <i>Boerhavia repens</i> , <i>Celosia argentea</i> , <i>Centella asiatica</i> , <i>Colocasia esculenta</i> , <i>Cucurbita maxima</i> , <i>Cynodon dactylon</i> , <i>Cyperus compressus</i> , <i>Cyperus rotandus</i> , <i>Eclipta prostrata</i> , <i>Enhydra fluctuans</i> , <i>Mimosa pudica</i> , <i>Musa paradisiaca</i> , <i>Ocimum basilicum</i> , <i>Ocimum tenuiflorum</i> , <i>Phragmites karka</i> , <i>Phyllanthus niruri</i> , <i>Alternanthera sessilis</i>
3	Riparian vegetation	Modified	<i>Samanea saman</i> , <i>Acacia auriculiformis</i> , <i>Alstonia scholaris</i> , <i>Syzygium cumini</i> , <i>Cocos nucifera</i> , <i>Dalbergia sissoo</i>	<i>Lantana camara</i> , <i>Ricinus communis</i> , <i>Suaeda maritima</i>	<i>Alternanthera sessilis</i> , <i>Alternanthera philoxeroides</i> , <i>Porteresia coarctata</i> , <i>Saccharum spontaneum</i> , <i>Sesuvium portulacastrum</i>
4	Mangrove Plantation	Modified	<i>Avicennia alba</i> , <i>Avicennia officinalis</i> , <i>Sonneratia apetala</i>	<i>Suaeda maritima</i>	<i>Porteresia coarctata</i> , <i>Saccharum spontaneum</i> , <i>Sesuvium portulacastrum</i>
5	<i>Casuarina</i> plantation	Modified	<i>Casuarina equisetifolia</i> , <i>Acacia auriculiformis</i>	<i>Calotropis procera</i>	<i>Ipomea pes-carpa</i> , <i>Celosia argentea</i> , <i>Cynodon dactylon</i> ,

Source: ERM Ecological Survey during 14th November to 20th November 2016

Terrestrial Faunal Species –Baseline Status

Herpetofauna

A total of 17 species of herpetofauna are reported from the study area. Green Frog (*Euphlyctis hexadactylus*) is reported endangered as per IUCN Red List v2016.3. Spotted Pond Turtle (*Geoclemys hamiltonii*) is reported Vulnerable as per IUCN Red List v2016.3. A list of herpetofaunal species is provided in **Table 4.26**.

Table 4.26 Herpetofaunal Species in the Study Area

S. No	Scientific Name	English Name	Local Name	Conservational Status		
				IUCN BD	IUCN Global	WLP A 2012
1	<i>Duttaphrynus melanostictus</i>	Southeast Asian toad	Kono bang	LC	LC	-
2	<i>Euphlyctis hexadactylus</i>	Green Frog	Kotkoti bang	LC	EN	Schedule I
3	<i>Fejervarya limnocharis</i>	Cricket frog		LC	LC	Schedule II
4	<i>Hoplobatrachus tigerinus</i>	Bull frog	Kola bang,	LC	LC	Schedule I
5	<i>Sylvirana leptoglossa</i>	Cope's Assam Frog	Koper Ashami Bang	LC	LC	Schedule II
6	<i>Rana temporalis</i>	Bronzed Frog	Gaso Bang	-	-	-
7	<i>Calotes versicolor</i>	Garden Lizard	Roktochusha	LC	Not Evaluated	Schedule II
8	<i>Mabuya mabuya</i>	Skink	Achil	-	-	-
9	<i>Gekko gekko</i>	Tokay Gecko	Tokkhak	LC	Not Evaluated	Schedule II
10	<i>Hemidactylus brookii</i>	House lizard	Guti Tiktiki	LC	Not Evaluated	Schedule II
11	<i>Hemidactylus frenatus</i>	House lizard	Pati Tiktiki	LC	LC	Schedule II
12	<i>Melanochelys trijuga</i>	Indian Black Turtle	Kalo Kossop	EN	NT	Schedule I
13	<i>Geoclemys hamiltonii</i>	Spotted Pond Turtle	Kalo Kasim	EN	VU	Schedule I
14	<i>Pangshura tentoria</i>	Median Roofed Turtle	Majhari Kaitta	NT	LC	Schedule I
15	<i>Xenochrophis piscator</i>	Checkered keel back	Dhora sap	LC	Not Evaluated	Schedule I
16	<i>Naja kaouthia</i>	Monocled Cobra	Jati Sap	NT	LC	Schedule II
17	<i>Enhydryis sieboldi</i>	Siebold's Smooth Water Snake	Sibolder Joloj Shap	Not Assessed	LC	Schedule I

Source: ERM Ecological Survey during 14th November to 20th November 2016

Avifaunal Species

A total of 91 species of Avifaunal species were observed in the study area. Black-headed Ibis (*Threskiornis melanocephalus*) is reported Vulnerable while Eurasian Curlew (*Numenius arquata*) is reported as Near Threatened as per IUCN Red List 2016.3. In addition to these 91 species one species Spoon-billed sandpiper (*Calidris pygmaea*) IUCN Red list Critically Endangered 2016.3 is

reported to be present in Matarbari and Sonadia Islands. As the Kutubdia Island present similar habitat values and is close by there is a likelihood of its presence and need further assessment during the month of January-February. A list of species is provided in *Table 4.27* and Photographic representation is provided in *Figure 4.59*.

Figure 4.59 *Avifaunal species in the Study Area*





Eurasian Curlew



Whimbrel



Terek Sandpiper



White Wagtail



Common Kingfisher



Lesser Sand Plover

Source: ERM Ecological Survey during 14th November to 20th November 2016

Table 4.27 Avifaunal Species in the Study Area

Sn.	Scientific Name	English Name	Local Name	Migratory Status	Conservational Status		
					IUCN BD	IUCN Global	WLPA 2012
1	<i>Threskiornis melanocephalus</i>	Black-headed Ibis	Kalamatha Kastechora	M	VU	NT	I
2	<i>Chroicocephalus brunnicephalus</i>	Brown headed Gull	Heugliner Gangchil	M	LC	LC	I
3	<i>Sterna sumatrana</i>	Black-naped Tern	Kalaghar Panchil	M	-	LC	I
4	<i>Larus ichthyaetus</i>	Great Black-headed Gull	Palasi Gangchil	M	LC	LC	I
5	<i>Larus brunnicephalus</i>	Brown-headed Gull	Khoiramatha Gangchil	M	LC	LC	I
6	<i>Charadrius mongolus</i>	Little Sand Plover	Choto Dhuljiria	M	LC	LC	I
7	<i>Charadrius leschenaultii</i>	Greater Sand Plover	Boro Dhuljiria	M	LC	LC	I
8	<i>Charadrius alexandrinus</i>	Kentish Plover	Kentish Jiria	M	LC	LC	I
9	<i>Pluvialis fulva</i>	Pacific Golden Plover	Proshanto Shonajiria	M	LC	LC	I
10	<i>Calidris temminckii</i>	Timminck's Stint	Timinker Chaha	M	LC	LC	I
11	<i>Calidris alba</i>	Sanderlin	Sanderlin	M	LC	LC	I
12	<i>Arenaria interpres</i>	Ruddy Turnstone	Lal Nuribatan	M	LC	LC	I
13	<i>Actitis hypoleucos</i>	Common Sandpiper	Pati Batan	M	LC	LC	II
14	<i>Tringa glareola</i>	Wood Sandpiper	Bon Batan	M	LC	LC	II
15	<i>Numenius phaeopus</i>	Whimbrel	Choto Gulinda	M	LC	LC	I
16	<i>Numenius arquata</i>	Eurasian Curlew	Eureshio Gulinda	M	NT	NT	I
17	<i>Gallinago stenura</i>	Pin-tailed Snipe	Lenja Chega	M	LC	LC	I
18	<i>Todiramplus chloris</i>	Collared Kingfisher	Dholaghar Machranga	M	LC	LC	I
19	<i>Tadorna ferruginea</i>	Ruddy Shelduck	Khoira Chokachoki	M	LC	LC	I
20	<i>Pandion haliaetus</i>	Osprey	Machmural	M	LC	LC	I
21	<i>Nycticorax nycticorax</i>	Black-crowned Night Heron	Kalamatha Nishibok	R	LC	LC	I
22	<i>Sterna albifrons</i>	Little Tern	Choto Panchil	R	LC	LC	I
23	<i>Ardea cinerea</i>	Grey Heron	Dhupni Bok	R	LC	LC	I
24	<i>Ardeola bacchus</i>	Chinese Pond Heron	China Kanibok	R	LC	LC	I
25	<i>Ardeola grayii</i>	Indian Pond Heron	Deshi Kanibok	R	LC	LC	I
26	<i>Bubulcus ibis</i>	Cattle Egret	Go Boga	R	LC	LC	II
27	<i>Casmerodias albus</i>	Great Egret	Boro Boga	R	LC	LC	II
28	<i>Egretta intermedia</i>	Intermediate Egret	Majhla Boga	R	LC	LC	I
29	<i>Egretta garzetta</i>	Little Egret	Choto Boga	R	LC	LC	II
30	<i>Phalacrocorax niger</i>	Little Cormorant	Choto Pankouri	R	LC	LC	II
31	<i>Caprimulgus macrurus</i>	Large-tailed Nightjar	Lenja Ratchora	R	LC	LC	I
32	<i>Athene brama</i>	Spotted Owlet	Khuruley Pencha	R	LC	LC	I
33	<i>Ketupa zeylonensis</i>	Broun Fish Owl	Khoira mechupacha	R	LC	LC	I
34	<i>Cypsiurus balasiensis</i>	Asian Palm Swift	Asio Talbatashi	R	LC	LC	I

Sn.	Scientific Name	English Name	Local Name	Migratory Status	Conservational Status		
					IUCN BD	IUCN Global	WLPA 2012
35	<i>Psittacula krameri</i>	Rose-ringed Parakeet	Shobuj Tia	R	LC	LC	II
36	<i>Psittacula alexandri</i>	Red-breasted Parakeet	Modna Tia	R	LC	NT	II
37	<i>Merops philippinus</i>	Blue-tailed Bee-eater	Neel-lej Shuichora	R	LC	LC	I
38	<i>Merops leschenaulti</i>	Chestnut-headed Bee-eater	Khoiramatha Shuichora	R	LC	LC	I
39	<i>Dinopium benghalense</i>	Lesser goldenback	Bangla kaththokra	R	LC	LC	I
40	<i>Upupa epops</i>	Eurasian Hoopoe	Pati Hoodhood	R	LC	LC	I
41	<i>Ceryle rudis</i>	Pied Kingfisher	Pakra Machranga	R	LC	LC	II
42	<i>Halcyon smyrnensis</i>	White-throated Kingfisher	Dholagoloa Machranga	R	LC	LC	II
43	<i>Alcedo atthis</i>	Common Kingfisher	Pati Machranga	R	LC	LC	II
44	<i>Rhipidura albicollis</i>	White-throated Fantail	Dholagola Chatighurani	R	LC	LC	I
45	<i>Dicrurus aeneus</i>	Bronzed Drongo	Fingey	R	LC	LC	I
46	<i>Dicrurus paradiseus</i>	Greater Racket-tailed Drongo	Boro Recket-Fingey	R	LC	LC	I
47	<i>Hypothymis azurea</i>	Black-naped Monarch	Kalaghar Rajon	R	LC	LC	I
48	<i>Aegithina tiphia</i>	Common Iora	Fatik Jal	R	LC	LC	II
49	<i>Ficedula albicilla</i>	Taiga Flycatcher	Taiga Chutki	R	LC	LC	I
50	<i>Prinia inornata</i>	Plain Prinia	Nirol Prina	R	LC	LC	II
51	<i>Zosterops palpebrosus</i>	Oriental White-eye	Udoi Dholachokh	R	LC	LC	I
52	<i>Pellorneum ruficeps</i>	Puff-throated Bbler	Golafola Satarey	R	LC	LC	I
53	<i>Anthus rufulus</i>	Paddyfield Pipit	Dhani Tulika	R	LC	LC	II
54	<i>Lonchura striata</i>	White-rumped Munia	Dholakomor Munia	R	LC	LC	I
55	<i>Lonchura punctulata</i>	Scaly-breasted Munia	Tila Munia	R	LC	LC	I
56	<i>Lonchura malacca</i>	Tricoloured Munia	Kalamatha Munia	R	LC	LC	I
57	<i>Lonchura malabarica</i>	Indian Silverbill	Deshi Chandithot	R	LC	LC	I
58	<i>Ploceus philippinus</i>	Baya Weaver	Deshi Babui/Baoi	R	LC	LC	I
59	<i>Arachnothera magna</i>	Streaked Spiderhunter	Dahi Makarmar	R	LC	LC	I
60	<i>Aethopyga siparaja</i>	Crimson Sunbird	Shidure Moutushi	R	LC	LC	I
61	<i>Cinnyris asiaticus</i>	Purple Sunbird	Beguni Moutushi	R	LC	LC	I
62	<i>Leptocoma zeylonica</i>	Purple-rumped Sunbird	Begunikomor Moutushi	R	LC	LC	I
63	<i>Chalcoparia singalensis</i>	Ruby-cheeked Sunbird	Chunimukhi Moutushi	R	LC	LC	I
64	<i>Dicaeum trigonostigma</i>	Orange-bellied Flowerpecker	Komlapet Fuljhur	R	LC	LC	I
65	<i>Dicaeum erythrorhynchos</i>	Pale-billed Flowerpecker	Metethot Fuljhuri	R	LC	LC	I
66	<i>Dicaeum cruentatum</i>	Scarlet-backet Flowerpecker	Lalpith Fuljhuri	R	LC	LC	I
67	<i>Dendrocitta vagabunda</i>	Rufous Treepie	KhoiraHarichacha	R	LC	LC	II
68	<i>Artamus fuscus</i>	Ashy Woodswallow	Metey Bonababil	R	LC	LC	II
69	<i>Oriolus xanthornus</i>	Black-hooded Oriole	Holdey Pakhi	R	LC	LC	II
70	<i>Corvus macrorhynchos</i>	Jungle Crow	Dar Kak	R	-	LC	-
71	<i>Corvus splendens</i>	House Crow	Pati Kak	R	LC	LC	-

Sn.	Scientific Name	English Name	Local Name	Migratory Status	Conservational Status		
					IUCN BD	IUCN Global	WLPA 2012
72	<i>Pycnonotus cafer</i>	Red-vented Bulbul	Bangla Bulbul	R	LC	LC	I
73	<i>Treron phoenicopterus</i>	Yellow-footed Green Pigeon	Holdepa Horial	R	LC	LC	I
74	<i>Streptopelia chinensis</i>	Spotted Dove	Tila Ghughu	R	LC	LC	I
75	<i>Streptopelia decaocto</i>	Eurasian Collared Dove	Raj Ghughu	R	LC	LC	I
76	<i>Treron bicintus</i>	Orange-breasted Green Pigeon	Horikol	R	LC	LC	I
77	<i>Columba livia</i>	Common Pigeon	Jalali Kabutor	R	LC	LC	I
78	<i>Orthotomus sutorius</i>	Common Tailorbird	Pati Tuntuni	R	LC	LC	-
79	<i>Copsychus saularis</i>	Oriental Magpie-Robin	Udoi Doel	R	LC	LC	II
80	<i>Acridotheres fuscus</i>	Jungle Myna	Jhuti Sahlik	R	LC	LC	II
81	<i>Acridotheres tristis</i>	Common Myna	Bhat Shalik	R	LC	LC	II
82	<i>Acridotheres cinereus</i>	Pale-bellied Myna	Dholatola Shalik	R	-	LC	I
83	<i>Sturnus malabaricus</i>	Chestnut-tailed Starling	Khoiralej Kathshalik	R	LC	LC	II
84	<i>Sturnus contra</i>	Pied Myna	Pakra Shalik	R	LC	LC	II
85	<i>Dicrurus macrocercus</i>	Black Drongo	Kala Fingey	R	LC	LC	II
86	<i>Passer domesticus</i>	House Sparrow	Pati Chorui	R	LC	LC	II
87	<i>Threskiornis melanocephalus</i>	Black-headed Ibis	Kalamatha Kastechora	M	VU	NT	I
88	<i>Calidris minuta</i>	Little Stint	Chhoto Chaha	M	LC	LC	I
89	<i>Xenus cinereus</i>	Terek Sandpiper	Terek Batash	M	LC	LC	I
90	<i>Motacilla alba</i>	White Wagtail	-	M	LC	LC	I
91	<i>Charadrius mongolus</i>	Lesser Sand Plover	Chhoto Dhuljiria	M	LC	LC	I

Source: ERM Ecological Survey during 14th November to 20th November 2016

Mammalian Species

A total 11 species of mammalian species were enumerated within the study area. The species were identified based on community consultation and direct sightings. Large Indian Civet (*Viverra zibetha*) and Common otter (*Lutra lutra*) are listed as Near Threatened as per IUCN Redlist 2016.3.

Table 4.28 *Mammalian Species within Study Area*

SN	Species Name	English Name	Local Name	BD IUCN Status	Global IUCN Status	WLPA 2012
1	<i>Pipistrellus coromandra</i>	Indian Pipistrelle	Chamchika	LC	LC	I
2	<i>Rousettus leschenaulti</i>	Leschenault's Rousette	Kola Badur	LC	LC	I
3	<i>Pteropus giganteus</i>	Indian Flying Fox	Baro badur	LC	LC	I
4	<i>Callosciurus pygerythrus</i>	Hoary-bellied Himalayan Squirrel	Kathbirali	LC	LC	I
5	<i>Rattus rattus</i>	House rat	Indur	LC	LC	III
6	<i>Bandicota indica</i>	Indian Mole rat	Indur	LC	LC	III
7	<i>Suncus murinus</i>	House shrew	Chika	LC	LC	-
8	<i>Viverra zibetha</i>	Large Indian Civet	Baghdas	NT	NT	I
9	<i>Lutra lutra</i>	Common otter	Ud biral	CR	NT	I
10	<i>Felis chaus</i>	Wild cat	Bon biral	NT	LC	I
11	<i>Herpestes edwardsii</i>	Indian grey mongoose	Bejji	LC	LC	I

Source: ERM Ecological Survey during 14th November to 20th November 2016

4.17.7 Aquatic Ecosystem

Marine Plankton Survey-Methodology

Survey of marine planktonic organisms was conducted at 6 locations, 4 locations at the Bay of Bengal and 2 locations at Kutubdia Channel. Locations for planktonic survey coincided with the marine water collection locations. Planktonic sample collection was conducted only from the surface (0.3-0.5 m from the surface) of Bay of Bengal and Kutubdia channel.

About 500 mL of water was collected from each station and preserved with Lugol's Iodine for phytoplanktonic analysis. About 50 L water was filtered through plankton net and preserved with buffered formalin for zooplanktonic sample collection. Details of the planktonic survey locations are shown in **Table 4.29** and shown in a map in **Figure 4.2** and photographic representation of collection of plankton samples are shown in **Figure 4.60**.

Table 4.29 *Plankton Survey Locations*

Sl.	Sampling location	Code	Monitoring Date	Geographic location
1	500 m west towards the sea from the proposed ORF	B1	16.11.16	21°51'50.09"N 91°50'5.85"E
2	3000 m west towards the sea from the proposed ORF	B2	16.11.16	21°51'33.90"N 91°48'42.55"E
3	1500 m South West towards the sea from the proposed ORF	B3	16.11.16	21°51'3.26"N 91°49'42.81"E
4	1500 m North West towards the sea from the proposed ORF	B4	16.11.16	21°52'28.49"N 91°49'46.05"E

Sl.	Sampling location	Code	Monitoring Date	Geographic location
5	300 m towards the Kutubdia channel from right bank near to the Dhurung ghat	B5	17.11.16	21°53'3.25"N 91°53'51.61"E
6	300 m towards the Kutubdia channel from left bank near to the Chunura ghat	B6	17.11.16	21°53'14.81"N 91°54'39.05"E

Source: ERM Ecological Survey during 14th November to 20th November 2016

Figure 4.60 Photographic representation of Plankton Sample Collection



Source: ERM Ecological Survey during 14th November to 20th November 2016

Phytoplankton Analysis

Total phytoplanktonic density was much higher at the samples collected from Kutubdia Channel (5642 & 7040 individuals/L) compared to the Bay of Bengal samples (586-1652 individuals/L). Phytoplankton community was represented by 17 genera. Among the phytoplanktonic genera *Nitzschia* sp. was the most dominant followed by *Navicula* sp. and *Synedra* sp. Phytoplankton community compositions at the monitored location are presented in **Table 4.30**.

Table 4.30 Phytoplankton Community Composition at the Monitored Locations

S No.	Phytoplankton Taxa/species	Number (individuals/L)					
		B1	B2	B3	B4	B5	B6
1	<i>Acanthes</i> sp.	32	40	7	25	94	74
2	<i>Amphipora</i> sp.	11	9	29	8	38	4
3	<i>Amphora</i> sp.	40	33	86	36	112	182
4	<i>Ceratium</i> sp.	29	-	25	17	309	104
5	<i>Chaetoceros</i> sp.	82	-	16	11	211	278
6	<i>Coscinodiscus</i> sp.	-	5	9	27	134	156

S No.	Phytoplankton Taxa/species	Number (individuals/L)					
		B1	B2	B3	B4	B5	B6
7	<i>Cyclotella sp.</i>	78	90	83	103	386	460
8	<i>Melosira sp.</i>	60	77	13	45	245	102
9	<i>Navicula sp.</i>	234	220	10	273	1219	1782
10	<i>Nitzschia sp.</i>	892	72	155	405	1510	2751
11	<i>Pleurosigma sp.</i>	12	19	32	44	98	41
12	<i>Rhizosolenia sp.</i>	-	2	13	-	43	24
13	<i>Skeletonema sp.</i>	70	182	72	204	564	321
14	<i>Synedra sp.</i>	103	-	25	-	412	567
15	<i>Thalassionema sp.</i>	-	2	9	14	187	24
16	<i>Thalassiosira sp.</i>	-	-	2	23	52	170
17	<i>Triceratium sp.</i>	9	4	-	-	28	-
	Total	1652	755	586	1235	5642	7040

Source: ERM Ecological Survey during 14th November to 20th November 2016

Zooplankton analysis

Similar to that of phytoplankton samples, total zooplankton densities were much higher at the samples collected from Kutubdia Channel (4513 & 2930 individuals/L) compared to the Bay of Bengal samples (716-1502 individuals/L). Zooplankton community was represented by 23 genera. Among the zooplanktonic genera Crab Zoea was most dominant followed by Copepod nauplii and *Penaus sp.* Zooplankton community compositions at the monitored locations are presented in **Table 4.31**.

Table 4.31 Zooplankton Community Composition at the Monitored Locations

S No.	Zooplankton Taxa/species	Number (individuals/L)					
		B1	B2	B3	B4	B5	B6
1	<i>Heliosoma sp.</i>	-	-	-	2	13	8
2	<i>Diphyes sp.</i>	2	6	1	3	22	14
3	<i>Lensia sp.</i>	18	11	-	-	32	21
4	<i>Cresis sp.</i>	5	7	5	8	25	16
5	<i>Notobranchaea</i>	11	10	-	3	37	24
6	<i>Haloptilus sp.</i>	10	-	-	-	12	8
7	<i>Centropages sp.</i>	11	9	-	-	26	17
8	<i>Euchaeta sp.</i>	2	5	4	11	27	14
9	<i>Calocalanus</i>	27	35	38	52	132	86
10	<i>Acetes indicus</i>	78	66	70	12	142	92
11	<i>Calanopia sp.</i>	92	106	89	21	119	77
12	<i>Calanus sp.</i>	135	108	71	99	410	267
13	<i>Evadues sp.</i>	101	139	29	128	288	187
14	<i>Lucifer sp.</i>	57	15	21	14	341	222
15	<i>Penaus sp.</i>	118	34	6	31	484	315
16	<i>Microsetella sp.</i>	48	110	73	101	228	148
17	<i>Oithona sp.</i>	20	15	31	34	176	114
18	<i>Sagitta sp.</i>	152	124	13	114	319	207
19	Polycheate larvae	28	37	18	24	352	229
20	Crab zoea	174	215	101	128	446	290
21	Barnacle nauplius	145	130	18	110	311	202
22	Bivalve larvae	78	70	23	64	144	94
23	Copepod nauplii	190	206	105	82	427	278
	Total	1502	1458	716	1041	4513	2930

Source: ERM Ecological Survey during 14th November to 20th November 2016

The plankton recorded from the study area is common in occurrence with respect to the aquatic ecosystems in Bangladesh and forms the primary producers and primary consumers in the aquatic ecosystem food chain.

Analyses of Marine Benthic Communities

Marine sediment samples collected for analyses of physicochemical characteristics were also analyzed for the benthic communities. Details of the sediment survey locations are shown in **Table 4.12** and shown in a map in **Figure 4.2**. Composition of benthic communities at the monitored location is presented in **Table 4.32**.

Sediment samples collected from Bay of Bengal revealed poor benthic community composition represented by only 1-2 individuals/m². Sediment samples collected from the Kutubdia channel revealed comparatively higher concentration of benthic organisms varying between 15-25 individuals/m², however the density of benthic organisms were still poor at the Kutubdia Channel. Low density of benthic organisms could be due to low levels of organic carbon (0.31-0.45%) in the sediment. Among the organisms higher concentration was recorded from Nematodes and Bivalves.

JICA(2013)¹ study conducted in Kutubdia Channel also represented low concentration of benthic organisms varying between 3-18 individuals/m². The composition of benthic organisms found in the JICA study involving Crustaceans, Polychaetes, Bivalves and Gastropods are comparable to the current study.

Table 4.32 *Composition of Benthic Communities at Monitored Locations*

S. No	Benthos Group/ species	Number (individuals/m ²)			
		SD1	SD2	SD3	SD4
1	Gastropoda				
2	<i>Macra sp.</i>	-	-	5	9
3	Polychete	-	-	3	1
4	<i>Duplex sp.</i>	1	-	2	1
5	<i>Nematode sp.</i>	-	1	3	11
6	<i>Lumbrineris sp.</i>	-	1	2	-
7	Bivalvia	-	-	-	11
8	Crustacea	-	-	-	2
	Total	1	2	15	35

Source: ERM Ecological Survey during 14th November to 20th November 2016

Vegetation in Aquatic Ecosystem

Aquatic vegetation from the village ponds in the study area includes species of *Eichhornia crassipes*, *Hydrilla verticillata*, *Hygrophila auriculata*, *Hygroryza aristata*, *Lemna perpusilla*, *Nymphaea nouchali*, *Ipoemea aquatica*, *Pistia stratiotes*, *Spirodela polyrhiza* and *Centrostachys aquatic*.

¹ JICA, 2013. Environmental Impact Assessment of Construction of Matarbari 600X2 MW Coal Fired Power Plant and Associated Facilities

Fishery survey was undertaken during November 2016. Survey indicated that around 400 numbers of ponds were present in Kutubdia and among them 20 ponds were used for commercial aquaculture. Major fish species cultured were Pangas (*Pangasius pangasius*), Tilapia and Rui (*Labeo rohita*). As most of the marine fishes caught were not available sold in local fish market of Kutubdia, people of Kutubdia depend on these freshwater fishes for consumption. The yearly production of these freshwater fishes is approximately 30 tons. Tilapia was the highly priced among the freshwater cultured fishes. Common fish species in inland are Rui (*Labeo rohita*), Catla (*Catla catla*), Mrigal (*Cirrhina mrigala*) and exotic fishes Tilapia (*Tilapia nilotica*), Grass Carp (*Ctenopharyngodon idella*), Silver Carp (*Hypophthalmichthys molitrix*), Big Head (*Hypophthalmichthys nobilis*), Anabas (*Anabas testudineus*) (Koi), Clarias (*Clarias batrachus*) (Magur), *Heteropneustes fossilis* (Sing), *Channa punctatus* (Taki), *Mystus tengra* (Tengra), *Glossogobius giuris* (Baila), *Gadusia chapra* (Chapila), *Chanda ranga* (Chanda), *Colisa sp.* (Kholisha), *Chana striatus* (Shoal), *Salmostoma phulo* (Chela), *Amblypharyngodon mola* (Mola) and small indigenous fish like *P. sarana* (raj punti), *Mastacembalus spp.* (Baim), *M. gulio* (Gulsha), *Nadus nandus* (Raina), *Ailia coila* (Bashpata), *Xenentodon cancila* (Kakila) etc.

Marine Fauna (inclusive of Kutubdia Channel)

A 5 day survey was undertaken by 2 local fishery experts to Kutubdia Island. The information presented is the outcome of their survey.

Fisheries Resources of Kutubdia

There were two different kinds of fishing activities on Kutubdia Island, (i) deep sea fishing; the fishermen who went to deep sea with mechanized larger boats and stayed 5-10 days or even more depending on the distance fishermen cross for a single trip with a group of 7 to 14 or more and (ii) Estuarine and near shore fishing; the fishermen who fish near shore and went on a daily basis and used smaller boats or non-mechanized boats that usually carry 1 to 10 fishermen on board. The fishermen who fish near shore mostly fish all the year round. But the fishermen who fish at deep sea mainly considered October to March as peak fishing season whereas; April to mid-September as a lean fishing season.

Deep Sea Fishing

Fishermen of Kutubdia usually catch fishes all the year. A total of 57 fish species were enumerated based on fisherman consultation in two seasons mentioned by them as Summer and Rainy season (April –September) and Winter season (October-March) which have been listed in the table 1. Two price categories could be identified as more than 400 tk/kg and less than 400 tk/kg.

Out of 57 fish species, 24 species were of highly priced and others were low priced. All the fishes had commercial values but Indian Salmon fish was the highest priced fish followed by Triple tailed fish, Silver pomfret, Lady fish and Spotted sickle fish. It may be mentionable that a 30 kg Indian Salmon fish used to sell to the agents of Pharmaceuticals Company for 2-3 lac BDT whereas 20-30 kg Triple tailed fish used to sell at 40,000 to 60,000 BDT. Price of Silver pomfret, Lady fish and Spotted sickle fish varied according to the demand and seasonality. The list of deep sea fishes are given in *Table 4.33*

Near shore and Channel Fishing

A total 32 species of fishes were found in Nearshore and Channel of Kutubdia. List of Nearshore and Channel fishes with their seasonal availability and values are given in *Table 4.34*.

Figure 4.61 *Fishery Resources in Study Area*



Fishes caught from Kutubdia channel

Fishes caught offshore of Kutubdia

Mechanized fishing boats in Kutubdia

Fishing Net (Matiya & Undara jal)

Open auction in the boat before landing

Fish Market in Kutubdia

Source: Fishery Survey Report on Kutubdia, EQMS, Dec 2016

Table 4.33 List of Deep Sea Fishes Caught by Fishermen of Kutubdia

S No.	Local Name	English Name	Scientific Name	Fishing Season	IUCN Conservation Status	Value (High/low)
1.	Aila	Black banded trevally	<i>Seriolina nigrofasciata</i>	October-March	Least Concern	Low
2.	Bata	Gold-spot mullet	<i>Liza parsia</i>	October-March	Not Assessed	Low
3.	Koral bata	Flathead grey mullet	<i>Mugil cephalus</i>	October-March	Least Concern	Low
4.	Chowkha	Big-eye ilish	<i>Ilish filligera</i>	October-March	Not Assessed	High
5.	Pan mach	Spotted sickle fish	<i>Drepane punctata</i>	April-September	Least Concern	High
6.	Pan mach	Spotted sickle fish	<i>Drepane longimanna</i>	April-September	Least Concern	High
7.	Poysha mach	Deep pugnose pony fish	<i>Scutor ruconius</i>	October-March	Not Assessed	Low
8.	Futki chapa	Talang quenfish	<i>Scomberoides commersonianus</i>	April-September	Not Assessed	Low
9.	Faissa/dati faissa	Long jaw thryssa	<i>Thryssa setirostris</i>	October-March	Not Assessed	Low
10.	Sada datina	Silver grunter	<i>Pomadasys hasta</i>	April-September	Least Concern	High
11.	Ram chowkkhya	Elongati ilish	<i>Ilisha elongate</i>	October-March	Not Assessed	High
12.	Chowkkhya faissa	Jewelled shad	<i>Ilisha megaloptera</i>	October-March	Not Assessed	High
13.	Kata gogut	Catfish	<i>Arius nenga</i>	October-March	Not Assessed	High
14.	Hatir kan	Spade fish	<i>Ephippus orbis</i>	April-September	Not Assessed	High
15.	Toli	Tolishad	<i>Hilsa toli</i>	October-March	Not Assessed	High
16.	Ilish	Hilsha shad	<i>Tenualosa ilisha</i>	October-March	Least Concern	High
17.	Kamila	Indian Pike conger	<i>Congresox talabonoides</i>	October-March	Not Assessed	High
18.	Ram kata	Catfish	<i>Arius maculates</i>	October-March	Not Assessed	High
19.	Kaua mach	Hard tail scad	<i>Megalaspis cordyla</i>	October-March	Least Concern	High
20.	Khoilla	Grey mullet	<i>Mugil corsula</i>	October-March	Least Concern	Low
21.	Gang koi	Triple tailed fish	<i>Lobotes surinamensis</i>	October-March	Least Concern	High
22.	Koral	Giant seaperch	<i>Lates calcarifer</i>	October-March	Not Assessed	Low
23.	Korati chela	Tenpounders	<i>Elops machnate</i>	April-September	Not Assessed	Low
24.	Kuichcha	White spotted moray	<i>Gymnothorax punctatus</i>	April-September	Not Assessed	Low
25.	Laukka	Indian salmon	<i>Polynemus indicus</i>	October-March	Not Assessed	High
26.	Olua	Neglected grenadier anchovy	<i>Coilia neglecta</i>	October-March	Least Concern	Low
27.	Mur baila	Flathead fish	<i>Platycephalus indicus</i>	October-March	Data Deficient	Low
28.	Mouri	Shrimp scad	<i>Alepes djeddaba</i>	October-March	Not Assessed	High

S No.	Local Name	English Name	Scientific Name	Fishing Season	IUCN Conservation Status	Value (High/low)
29.	Pekhom mouri	Indian thread fin	<i>Alectis indicus</i>	April-September	Not Assessed	High
30.	Malabar mouri	Malabar cavalla	<i>Carangoides malabaricus</i>	April-September	Least Concern	High
31.	Chowkhkha	Yellow striae scad	<i>Selaroides leptoplepis</i>	October-March	Not Assessed	Low
32.	Samudrik pangas	Fatty catfish	<i>Pangasius pangasius</i>	October-March	Not Assessed	Low
33.	Hail chanda	Black pomfret	<i>Parastromateus niger</i>	April-September	Not Assessed	High
34.	Tobolchi	Ox-eyed scad	<i>Selar boops</i>	April-September	Least Concern	High
35.	Takia	Fringe scale sardine	<i>Sardinella fimbriata</i>	April-September	Not Assessed	Low
36.	Ram gojar/shol	Cobia	<i>Rachycentron canadus</i>	October-March	Not Assessed	Low
37.	Nilambori	Short fin scad	<i>Decapterus macrosoma</i>	October-March	Least Concern	Low
38.	Sada datina	Silver grunter	<i>Pomadasys hasta</i>	April-September	Least Concern	High
39.	Taila faisla	Hair fin anchovy	<i>Setipinna taty</i>	October-March	Not Assessed	Low
40.	Tailla	Fourfinger threadfin	<i>Eleutheronema tetradactylum</i>	October-March	Not Assessed	Low
41.	Roissa	Paradise threadfin	<i>Polynemus paradiseus</i>	October-March	Not Assessed	High
42.	Tek chanda	Jacks	<i>Atropus atropus</i>	April-September	Not Assessed	Low
43.	Tengra	Bagrid catfish	<i>Mystus gulio</i>	October-March	Least Concern	Low
44.	Thuitta	Red cornet fish	<i>Fistularia villosa</i>	April-September	Least Concern	Low
45.	Hichchiri	White sardine	<i>Escualosa thoracata</i>	October-March	Not Assessed	Low
46.	Rupali Chanda	Silver pomfret	<i>Pampus argentius</i>	April-September	Not Assessed	High
47.	Undora	Lady fish	<i>Sillago domina</i>	October-March	Not Assessed	Low
48.	Lal poa	Silver jew	<i>Johnius argentius</i>	October-March	Not Assessed	Low
49.	Churi	Ribbon fish	<i>Trichiurus savala</i>	October-March	Not Assessed	Low
50.	Cheowa	Torpedo trevally	<i>Taenoides anguillaris</i>	October-March	Not Assessed	Low
51.	Loitta	Bombay duck	<i>Harpodon nehereus</i>	October-March	Not Assessed	Low
52.	Maitya	Jack and pompanos	<i>Cybium guttatum</i>	April-September	Data Deficient	High
53.	Pata mach	Sole	<i>Cynoglossus mactostomus</i>	October-March	Not Assessed	Low
54.	Bom maitya	Tuna	<i>Euthynnus affinis</i>	April-September	Least Concern	Low
55.	Bata	Bata	<i>Mugil cephalus</i>	October-March	Least Concern	Low
56.	Potka	Potka	<i>Chelonodon patoca</i>	October-March	Least Concern	Low
57.	Chiring	Gobi	<i>Apocryptes bato</i>	October-March	Not Assessed	Low

Source: Fishery Survey Report on Kurubdia, EQMS, Dec 2016

Notes: High=>400 tk/kg, Low =<400 tk/kg

Table 4.34 *List of Nearshore and Channel fishes in Kutubdia*

S No.	Local Name	English Name	Scientific Name	Seasonal Availability	Commercial Value (High/ Low)	Source of Data
1.	Poysha mach	Deep pugnose pony fish	<i>Scutor ruconius</i>	October-March	Low	Boat survey
2.	Faissa/dati faissa	Long jaw thryssa	<i>Thryssa setirostris</i>	October-March	Low	Boat survey
3.	Chowkkhya faissa	Jewelled shad	<i>Ilisha megaloptera</i>	October-March	High	Boat survey
4.	Roissa	Paradise threadfin	<i>Polunemus paradiseus</i>	October-March	High	Boat survey/ FGD
5.	Toli	Tolishad	<i>Hilsa toil</i>	October-March	High	FGD
6.	Ilish	Hilsha shad	<i>Tenualosa ilisha</i>	October-March	High	FGD
7.	Kamila	Indian Pike conger	<i>Congresox talabonoides</i>	October-March	High	Boat survey
8.	Ram kata	Catfish	<i>Arius maculates</i>	October-March	High	FGD
9.	Kaua mach	Hard tail scad	<i>Megalaspis cordyla</i>	October-March	High	FGD
10.	Khoilla	Grey mullet	<i>Mugil corsula</i>	October-March	Low	FGD
11.	Korati chela	Tenpounders	<i>Elops machnate</i>	April-September	Low	Boat survey
12.	Kuichcha	White spotted moray	<i>Gymnothorax punctatus</i>	April-September	Low	Boat survey
13.	Olua	Neglected grenadier anchovy	<i>Coilia neglecta</i>	October-March	Low	Boat survey
14.	Chowkhkha	Yellow stripe scad	<i>Selaroides leptoplepis</i>	October-March	Low	FGD
15.	Tobolchi	Ox-eyed scad	<i>Selar boops</i>	April-September	High	FGD
16.	Takia	Fringe scale sardine	<i>Sardinella fimbriata</i>	April-September	Low	Boat survey
17.	Taila faisla	Hair fin anchovy	<i>Setipinna taty</i>	October-March	Low	Boat survey
18.	Tailla	Fourfinger threadfin	<i>Eleutheronema tetradactylum</i>	October-March	Low	Boat survey
19.	Roissa	Paradise threadfin	<i>Polunemus paradiseus</i>	October-March	High	Boat survey
20.	Tengra	Bagrid catfish	<i>Mystus gulio</i>	October-March	Low	Boat survey
21.	Hichchiri	White sardine	<i>Escualosa thoracata</i>	October-March	Low	Boat survey
22.	Undora	Lady fish	<i>Sillago domina</i>	October-March	Low	FGD
23.	Lal poa	Silver jew	<i>Johnius argentius</i>	October-March	Low	FGD
24.	Churi	Ribbon fish	<i>Trichiurus savala</i>	October-March	Low	Boat survey
25.	Cheowa	Torpedo trevally	<i>Taenoides anguillaris</i>	October-March	Low	FGD
26.	Loitta	Bombay duck	<i>Harpodon nehereus</i>	October-March	Low	Boat survey

S No.	Local Name	English Name	Scientific Name	Seasonal Availability	Commercial Value (High/ Low)	Source of Data
27.	Bata	Bata	<i>Mugil cephalus</i>	October-March	Low	Boat survey
28.	Potka	Potka	<i>Chelonodon patoca</i>	October-March	Low	Boat survey
29.	Chiring	Gobi	<i>Apocryptes bato</i>	October-March	Low	Boat survey
30.	Sada chingri	White shrimp	<i>Penaeus indicus</i>	All the year	High	Boat survey
31.	Horina chingri	Brown shrimp	<i>Metapenaeus monoceros</i>	All the year	High	Boat survey
32.	Chali chingri	Yellow shrimp	<i>Metapenaeus brevicornis</i>	All the year	High	Boat survey

Source: Fishery Survey Report on Kurubdia, EQMS, Dec 2016

Notes: High=>400 tk/kg, Low =<400 tk/kg

Hilsha (*Tenualosa ilisha*) fishing becomes intense during the months of May to October and in November and December. All types of mechanized boats usually engaged in Nearshore to deep sea Hilsha fishing. Unfortunately this year Hilsha was drastically reduced in the month of November and the fishermen informed that it was due to the synchronization failure of ban on Hilsha fishing and Hilsha breeding time. Local fishermen informed that, once some fishermen made pen in salt production area of Kutubdia to encircle a school of Hilsha fish and tried to nurse/rear them but this type of activities were not found during the survey.

Threatened fish species: Based on the fishery survey and FGD, it was found that only two species of fishes were threatened and these were Korat mach (*Anoxypristis cuspidata* is listed as Endangered as per IUCN Red List v 2016-3.) and Koiputi (*Anodontostoma chacunda*) is now a rare locally.

Fishing Boats: Mainly two types of boats were used by the fishermen *i.e.* Mechanized and Non-mechanized. The characteristics of these boats with CPUE are presented in **Table 4.35**. The CPUE were always variable as mentioned in the table.

Table 4.35 Boats used by the fishermen of Kutubdia

S No.	Types of boat	Subcategory (SC)	Engine power (hp) and freeze chamber	Number of fishermen in operation	Fishing area (Offshore / Nearshore / Channel)	CPUE (Kg/Haul)
1.	Mechanized	SC-1	18-22	5-7	Nearshore and Channel	5-50
		SC-2	45-65 with two freeze chamber	7-10	Offshore	20-200
		SC-3	70-110 with three freeze chamber	9-14	Offshore	50-300
2	Non-mechanized			Channel	0.5-10	1-2

Fishing Gear: Different types of gears are being used by the fishermen of Kutubdia, which are listed in the table below. Most fishermen used Ilish jal, Maitya jal and Undara jal for deep sea fishing while Behundi jal for Nearshore fishing. Details on the gears are listed on **Table 4.36**

Table 4.36 Types of gears used for catching fish in Kutubdia region

S No.	Local name	Common name	Approx. Price	Major types of fishes caught
1.	Ilish jal	Gillnet for Hilsha	3-4 lacs	Hilsha
2.	Maitya jal	Large Mesh Drift Gill net	1-1.5 lacs	Indian salmon, Surma, Gang koi and other deep sea fishes
3.	Behundi jal	Set bag net for jewfish	0.6-0.8 lac	Deep sea fishes
4.	Undara jal	Set bag net for jewfish	1.5-2 lacs	Lady fish (Undara) and other deep sea fishes
5.	Behundi jal	Estuarine set bag net	0.2-0.4 lac	Shrimp, Crabs, Hicchir

Fish Market Survey

Only one very small sized fish market was observed at Boroghop area of Kutubdia. Only few species of fishes were sold in that market. Of them Pangas (*Pangasius pangasius*), Tilapia and Rui (*Labeo rohita*) are mentionable. The sellers used to sell fish whenever the Paikers delivers the fishes to the market. Two types of Paikers were found within the fish marketing system of Kutubdia. One type of Paikers had their own mechanized boats and competed in the open auction whenever any mechanized boat arrived at shore and bought the fishes and then sailed for Chittagong or Cox'sbazar landing center. Second type of Paikers usually participated in the open auction in the smaller sized boats and bought the fishes and brought them to the fish market.

Nearshore areas of Kutubdia were fishing grounds of Loitta, Churi, Olua Kamila and Ramkata. Other fishes listed in table 1 were mostly caught in offshore areas (Deep Sea) of Kutubdia and local people informed that those deep sea areas were also their breeding grounds. Also, according to local people, Kutubdia channel seemed to be both breeding and fishing ground of Icha, Hicchir, Chiring and Chewa.

Migratory Route of Hilsa

During the local consultation with fisherman and fishery department it was known that before 2000s, Hilsha were found in the Kutubdia channel but now-a-days due to the presence of high anthropogenic activities and local fishing Hilsha population changed the route of migration. Hilsha seemed to migrate from deep sea to north of 150-200 km offshore of Kutubdia and then the Hilsha school crosses eastern Nearshore of Kutubdia and aggregate near Bashkhali at Gandamara point where they breed and then the school begin its journey to enter into Meghna river system. This information also supported by Dewan et al. (2014) where the authors also mentioned that Gandamara point of Kutubdia was the breeding ground of Hilsha and this Gandamara point is located at the 7 km North of the Kutubdia Island.

The breeding areas of Hilsa fish and identified Hilsa migration routes in Meghna and Padma River system are given in *Figure 4.62*. The project site and study area fall in moderately suitable habitat for Hilsa breeding.

Figure 4.62 Hilsa Breeding Map in Bangladesh and Major Hilsa migration routes in Meghna and Padma River System



Source: DoF (2008). Fisheries Statistical Yearbook of Bangladesh 2006-07. Bangladesh: Department of Fisheries, MoFL.

IUCN Publication: Migration, Spawning Patterns and Conservation of Hilsa Shad (*Tenualosa ilisha*) in Bangladesh and India by Dewan Ali Ahsan, M Niamul Naser, Utpal Bhaumik, Sugata Hazra and Subhra Bikash Bhattacharya http://cmsdata.iucn.org/downloads/iucn_hilsa_study.pdf

Marine Herpetofauna

The marine herpetofauna reported during community consultation and stakeholder consultations such as Forest Range officer of Chittagong Coastal Forest Division and Marine Life Alliance, a NGO working for Turtle Conservation in the Cox's Bazar area. The predominant reptile known for using Western coast of Kutubdia Islands for egg nesting is Olive Ridley's Turtle (*Lepidochelys olivacea*) IUCN listed Vulnerable 2016.3 and locally listed as Vulnerable. Primary survey was also conducted during the coastline Survey from Bargop Bazar area to Miyarkata village in north of Kutubdia Island. No direct evidences of Olive ridley nesting sites can be identified during the survey due to non nesting season. Nesting in the Island is reported from (December to February/March) however, possible Olive ridley turtle nesting sites along with the turtle number annually was consulted with the local villagers. Visual identification of species was assisted with the help of field guides. The photographic representation is presentation in *Figure 4.63* and *Figure 4.64*

Figure 4.63 *Community Consultation during coastline survey for Turtle Nesting Site*



Source: ERM Ecological Survey during 14th November to 20th November 2016

Figure 4.64 Stakeholder Consultation for Turtle Nesting Site



With Range Officer, Kutubdia Range Officer

With Marine life Alliance NGO working on Turtle Conservation

Source: ERM Ecological Survey during 14th November to 20th November 2016

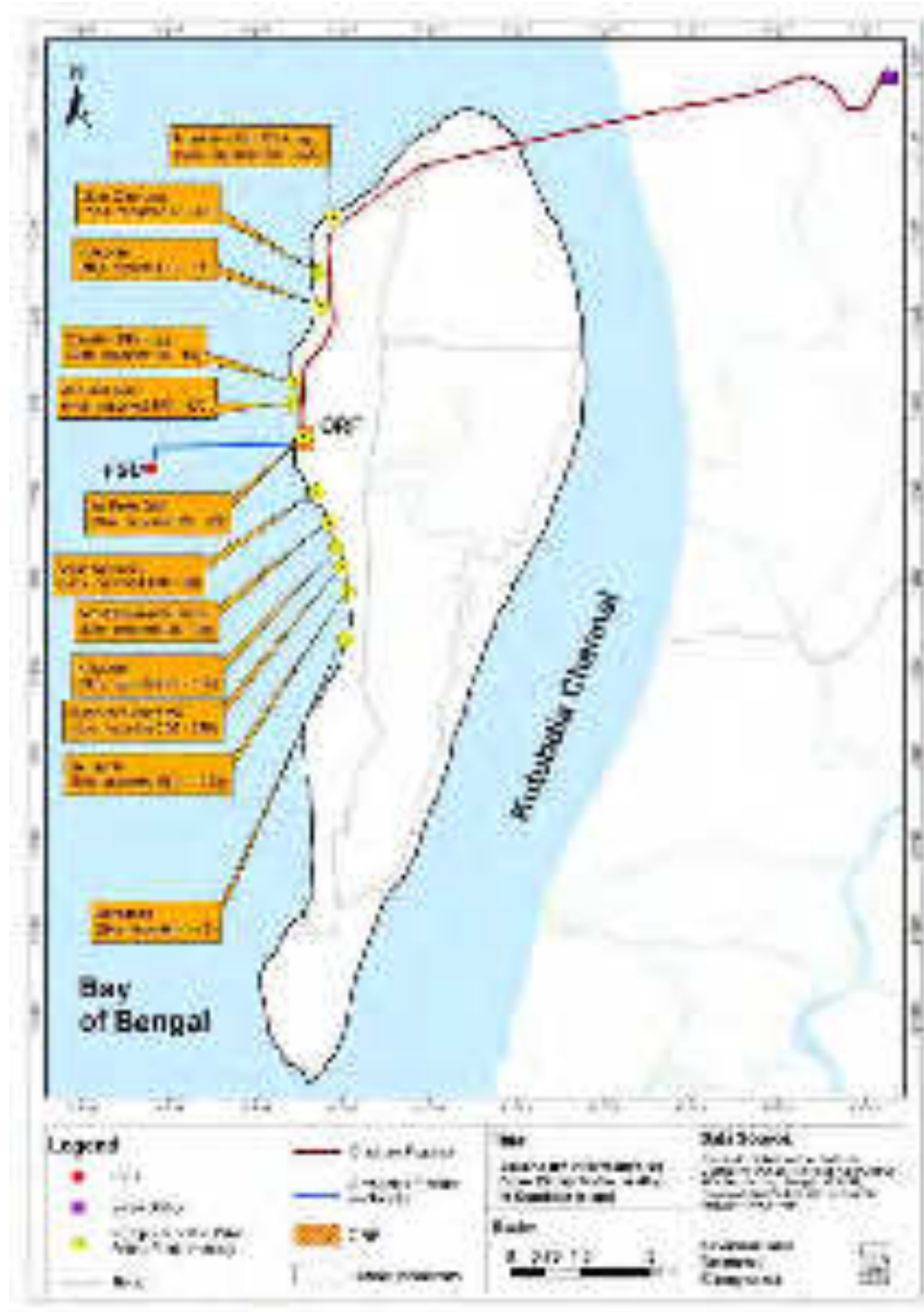
Isolated Olive turtle nesting is reported all along the west coast of Kutubdia Island. These nesting are very sporadic and cannot be identified as mass nesting sites such as in notified ecologically critical areas such as Sonadia Islands in the southern part of Moheshkali Island. As indicated above the nesting season is from December to February/March, it is suggested to survey the western coastline of the Island during the nesting season to identify the impacts of project activity on the turtle nesting.

In addition to Olive ridley turtles Green Sea Turtle (*Chelonia mydas*) IUCN listed Endangered v. 2016.3 and Hawksbill Turtle (*Eretmochelys imbricate*) IUCN listed Critically Endangered v 2016.3 also nest in the west coast of entire Cox's bazar district and their nesting is reported ^{(1) (2)} in close by sandy beaches of Sonadia Island and Matarbari Island. There is a strong likelihood of these species nesting in Kutubdia Island and there is a requirement to undertake a primary survey to confirm their presence. Map showing the nesting sites based on community consultation is given in **Figure 4.65**.

(1) Hossain,MA; Miah,MI; Hasan,KR; Bornali,JJ; Shahjahan, M (2013) Present status of conservation and management of sea turtle in Cox's Bazar district of Bangladesh. Bang. J. Anim. Sci. 42 (2): 131- 138

(2) Rashid-S.M.A.-M.Z.-Islam.-2006.-Status-and-conservation-of-marine-turtles-in-Bangladesh.-In-Marine-turtles-of-the-Indian-subcontinent-Pp.-200-216

Figure 4.65 Olive Ridley Turtle Nesting Reported in Community Consultation during the Coastline Survey



Source: ERM Ecological Survey during 14th November to 20th November 2016

Note: It is to be noted that the figure denotes the number and presence of Olive Ridley Turtles as reported by villagers of Kutubdia Island during the coastline surveys. However, no authentic survey findings or verifiable literature (research papers, forest department reports etc.) is available to confirm the presence and numbers as has been reported during the aforementioned consultation with villagers.

Marine Mammals

Four (04) marine Dolphin species were reported by the local fishermen (Both Near Shore and Deep Sea) to be present within 5 km area of Kutubdia Island. The species list is given in *Table 4.37*.

Table 4.37 *Marine Mammal Species Reported within the Study Area*

S No.	Common Name	Scientific Name	Local Name	IUCN BD	IUCN Global	WLPA 2012
1.	Indo-pacific Humpback Dolphin	<i>Sousa chinensis</i>	Golapi Dolphin	Least Concern	Near Threatened	Sch-I
2.	Indo-Pacific Bottlenose Dolphin	<i>Tursiops aduncus</i>	Botolnaak Samudrik Shishu	Data Deficient	Least Concern	Sch-I
3.	Irrawaddy Dolphin	<i>Orcaella brevirostris</i>	Iraboti	Vulnerable	Near Threatened	Sch-I
4.	Indo-Pacific Finless Porpoise	<i>Neophocaena phocaenoides</i>	Paknahin Choto Shishu	Near Threatened	Vulnerable	Sch-I

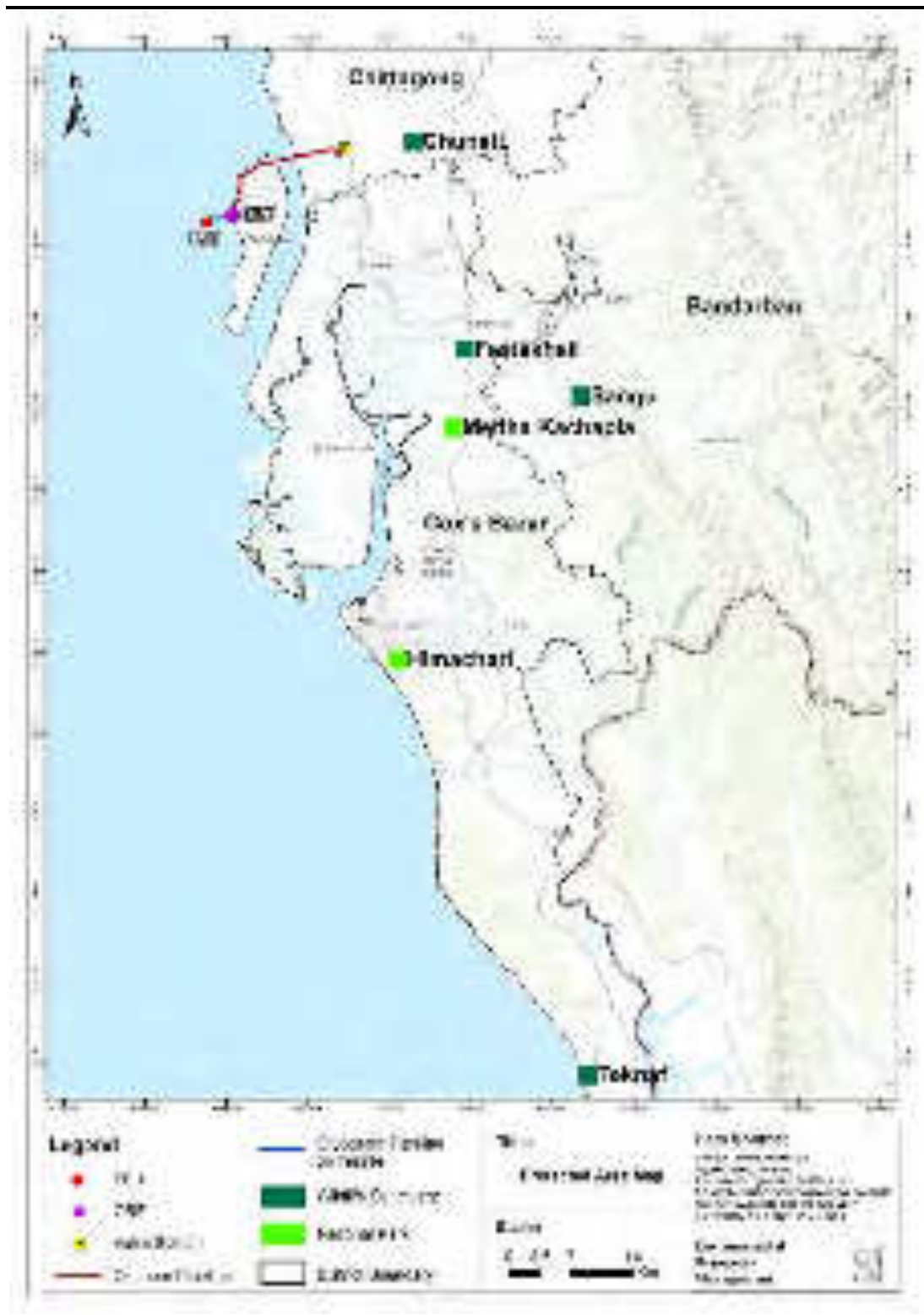
Source: ERM Ecological Survey during 14th November to 20th November 2016

4.17.8 Protected Area

There are no protected areas like National Park, Wildlife Sanctuary, etc. within the study area of 10 km radius from FSU location. The nearest protected area is Chunati Wildlife Sanctuary, which is approximately 21 km from the Project site for the land based facility.

The protected areas in the south-eastern part of Bangladesh (*Chittagong – Cox's Bazar* region) are presented in *Figure 4.66*.

Figure 4.66 Protected Areas of Bangladesh



Source Fifth National Report to the Convention on Biological Diversity (Biodiversity National Assessment 2015), DoE, Nov 2015

4.17.9 Ecologically Critical Areas (ECAs)

Based on significance and ecological sensitivity, Department of Environment (DoE) has declared a number of areas as Ecologically Critical Areas (ECAs). There is no ECAs within the study area. The nearest ECA is at *Sonadia* about 36 km far from the proposed project site. The ECAs in the south-eastern part of Bangladesh are presented in *Figure 4.67*

4.17.10 Other Sensitivities

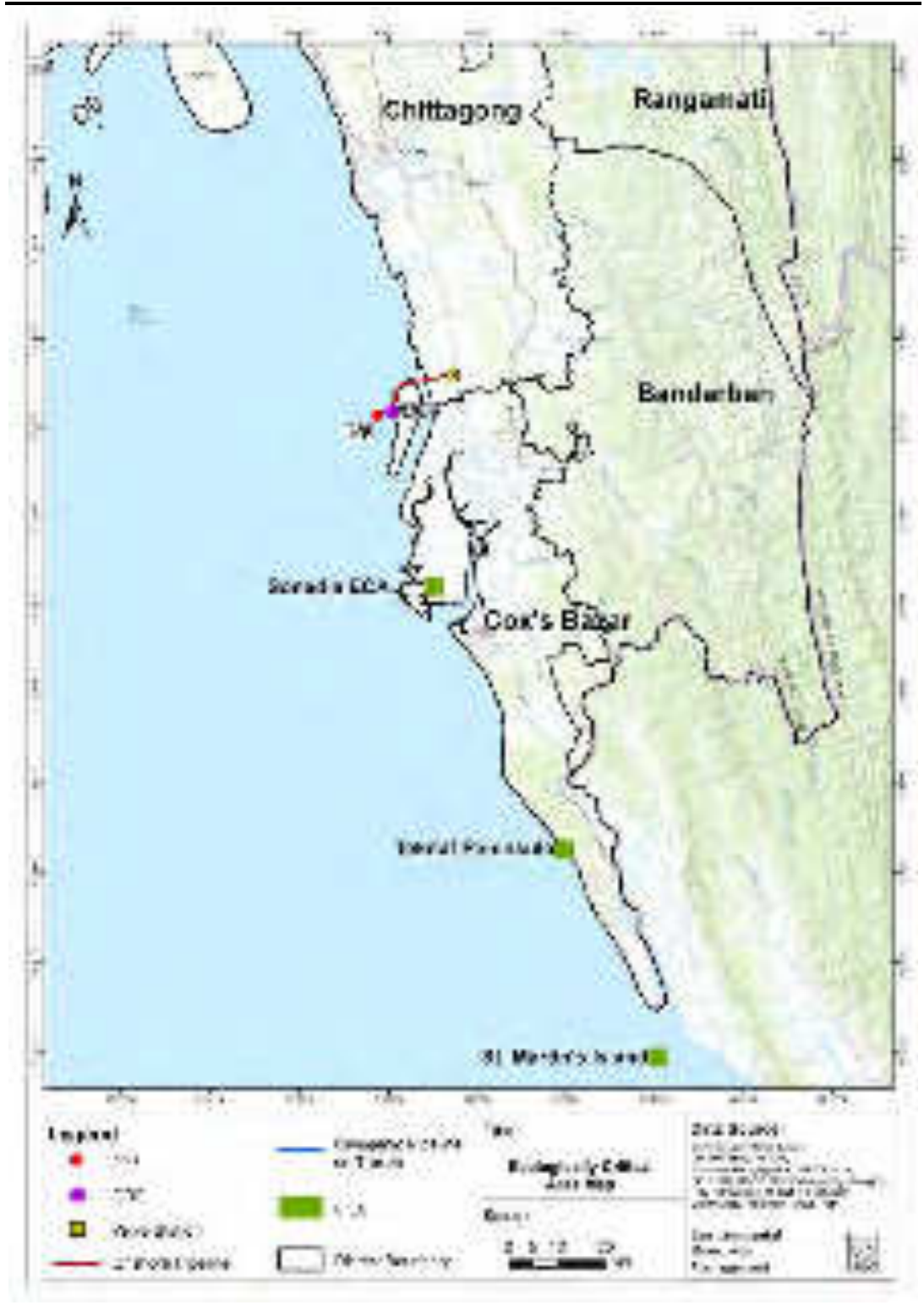
Mangrove vegetation has been recorded from the south-eastern part of the Kutubdia Island, especially around the *Boroghop Ghat*. This patch of mangrove vegetation has been artificially established by the Forest Department. The species of mangrove primarily planted includes *Keora (Sonneratia apetala)* and *Byne (Avicennia sp.)*.

The nearest coral reef to the Project site is at the St. Martin's Island approximately 148 km South of Kutubdia. The region around St. Martin's Island is rich in biodiversity and has coral reefs and sea grass bed or seaweed bed. It's also declared as an Ecologically Critical Area by the Department of Environment.

Sonadia Island situated at the southern tip of Moheshkali Island is known site for mass turtle nesting and wintering ground for Critically Endangered Spoonbilled Sandpiper.

No Sea grass habitat is reported to be within 10 km area of the project site.

Figure 4.67 Ecologically Critical Area of Bangladesh



Source: Fifth National Report to the Convention on Biological Diversity (Biodiversity National Assessment 2015), DoE, Nov 2015

4.18 SOCIO-ECONOMIC PROFILE

The Project site is located in Dakshin Dhurung and Kaiyabil Union Parishads of Kutubdia Upazila (Sub-district) in the Cox’s Bazar District and an associated onshore gas pipeline from project site to GTCL terminal at Napura-Valve station No.2 at Puichhari Union of Banshkahli Upazila in Chittagong district has also been proposed. Based on the assessment of the project, its surroundings and its environmental & social influence, a 10 kilometre radius for the study area around the FSU and additionally 500 meter buffer on either side along the proposed pipeline route is considered as the study area. The study area for Land Based Facility falls entirely within Kutubdia Upazila while study area for the pipeline falls in Kutubdia Upazila as well as Chhanua and Puichhari Unions in Banshkhali Upazila. **Table 4.38** indicates the location of project activity across Unions, Upazila and Districts. The socio-economic features of the Kutubdia Upazila and Chhanua and Puichhari Union of Banshkhali Upazila in Chitagong district are discussed in this section.

Table 4.38 Study Area

Project Activity	Location		
	Union Parishad	Upazila	District
Land Based Facility	Dakshin Dhurung	Kutubdia Upazila	Cox’s Bazar District
	Kaiyabil	Kutubdia Upazila	Cox’s Bazar District
Onshore Pipeline	Uttar Dhurung	Kutubdia Upazila	Cox’s Bazar District
	Chhanua	Banshkhali Upazila	Chittagong District
	Puichhari		

4.18.1 Administrative Structure

Cox’s Bazar District:

The Cox’s Bazar District is bounded by the Chittagong District on the North, Bay of Bengal on the South and West and the Bandarban District on the East. This district also shares an international boundary with Myanmar on the East. The total area of the district is 2491.85 sq. km. Cox’s Bazar District; it was formerly a sub-division of Chittagong District. It was constituted as a sub-division in 1854 and comprised of Cox's Bazar Sadar, Chakoria, Moheshkhali and Teknaf Thanas. Subsequently three new Thanas were added under this subdivision namely Ukhia, Kutubdia and Ramu. Under the decentralization scheme these Thanas were transformed into Upazilas and the Cox's Bazar subdivision was promoted to a district in 1984. Presently, this district consists of 8 Upazilas, 71 Unions, 182 Mauzas, 989 villages, 4 Paurashavas, 39 wards and 164 Mahallas. The Upazilas are Chakoria, Cox’s Bazar Sadar, Teknaf, Kutubdia, Moheshkhali, Pekua, Ramu and Ukhia.

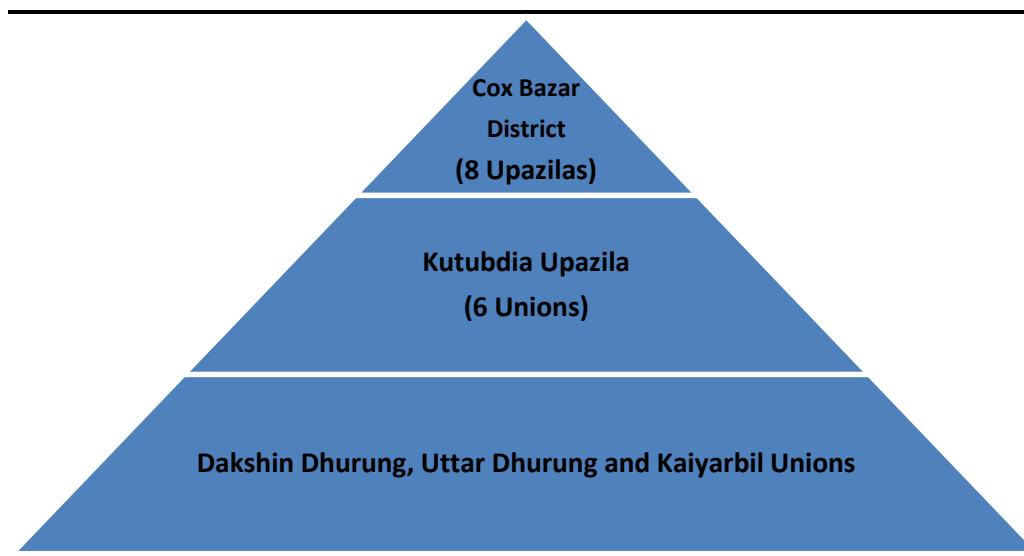
Kutubdia Upazila: The Kutubdia Upazila is located between 21°43’ and 21°56’ north latitudes and between 91°50’ and 91°54’ east longitudes and occupies an area of 215.79 sq. km. This Upazila is an island of Bay of Bengal and is further divided into 6 Unions, 9 Mouzas and 55 villages.

Dakshin Dhurung Union: The Dakshin Dhurung Union is located between 21°43' and 21°56' north latitudes and between 91°50' and 91°54' east longitudes and occupies an area of 6.01 sq. km.

Kaiyarbil Union: The Kaiyarbil Union is located between 21°51' and 21°48' north latitudes and between 91°50' and 91°51' east longitudes and occupies an area of 3.6 sq. km.

Uttar Dhurung Union: The Dakshin Dhurung Union is located between 21°53' and 21°55' north latitudes and between 91°50' and 91°53' east longitudes and occupies an area of 11.49 sq. km.

Figure 4.68 *Administrative Set up of the Study Area*



Source: Population and Housing Census of Cox's Bazar District, 2011

Chittagong District

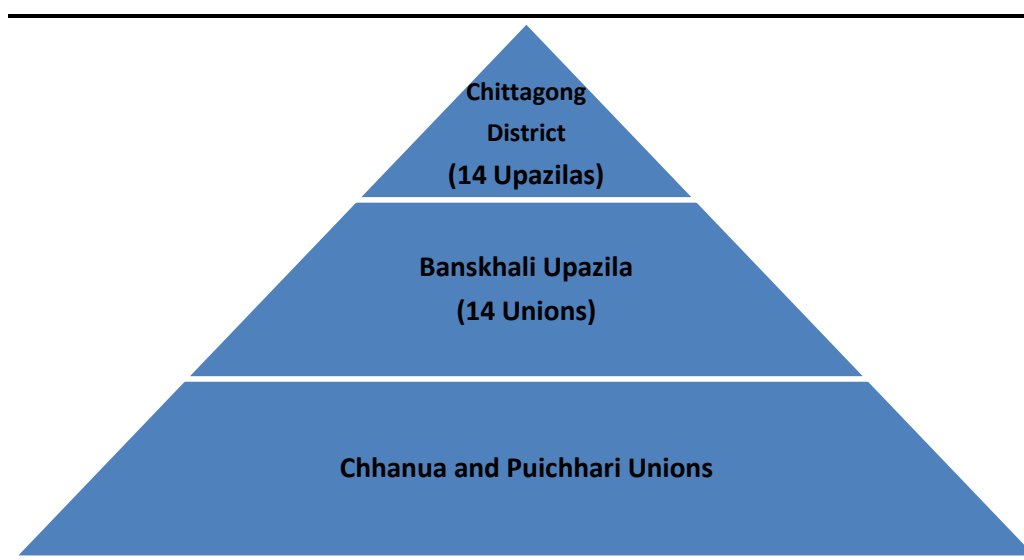
Chittagong is bounded on the north by Feni and Khagrachhari district and Tripura state of India, east by Khagrachhari, Rangamati and Bandarban district, on the south by Cox's Bazar district and on the west by the Bay of Bengal and Noakhali district. The total area of the district is 5282.92 sq. km. (2039.74 sq. miles) of which 1700 sq. km. (456.37 sq. miles) including coastal area is under forest. It lies between 21°54' and 22°59' north latitude and between 91°17' and 92°13' east longitude. The district consists of 14 Upazilas, 11 metropolitan thanas, 194 unions, 890 populated mauzas and 1288 villages. It has one city corporation comprising of 41 wards and 237 mahallas. It has also 10 paurashavas having 90 wards and 199 mahallas. The upazilas are Anowara, Banskhali, Boalkhali, Chandanaish, Fatikchhari, Hathazari, Lohagara, Mirsharai, Patiya, Rangunia, Raozan, Sandwip, Satkania and Sitakunda. The metropolitan thanas are Bakalia, Bayejid Bostami, Chandgaon, Bandar (Chittagong Port), Double Mooring, Haliashar, Khulshi, Kotwali, Pahartali, Panchlaish and Patenga.

Banskahli Upazila: The upazila occupies an area of 376.90 sq. km. including 85.80 sq. km. forest area. It is located in between 21°53' and 22°11' north latitudes and in between 91°51' and 92°03' east longitudes. The upazila is bounded on the north by Sangu River and Anowara upazila, on the east by Satkania and Lohagara upazilas, on the south by Pekua and Chakaria upazilas of Cox's Bazar zila and on the west by the Bay of Bengal. The upazila consists of 1 paurashava, 9 wards, and 38 mahallas, 14 unions, 70 populated mauzas and 81 villages.

Chhanua Union: The Chhanua Union is located between 21°55' and 21°56' north latitudes and between 91°54' and 91°55' east longitudes and occupies an area of 20.19 sq. km.

Puichhari Union: The Puichhari Union is located between 21°54' and 21°56' north latitudes and between 91°55' and 91°58' east longitudes and occupies an area of 43.75 sq. km.

Figure 4.69 *Administrative Set up of the Study Area*



Source: Population and Housing Census of Chittagong District, 2011

4.18.2 *Demography of Project Area*

As per the Census of Bangladesh (2011), the total population of Cox's Bazar District and Chittagong District is 2,289,990 (comprising of 415,954 households) and 7,616,352 (comprising of 1,532,014 households) respectively. The average annual increase in population since 2001 has been estimated at 2.55 percent in Cox's Bazar district and 1.40 in Chittagong district. The **Table 4.39** provides an overview on the population trends of Cox's Bazar and Chittagong Districts over a period of 10 years from 2001 to 2011.

Table 4.39 Population Trends of the Districts

Index	Population Details of Cox's Bazar District		Population Details of Chittagong District	
	2011	2001	2011	2001
Total Households	415,954	296,109	1,532,014	1,240,537
Total Population	2,289,990	1,773,709	7,616,352	6,612,140
Change in Population	516,281	354,449	1004212	1,316,013
Average Annual Increase	51,628	35,445	100421	131601
Annual Rate of Growth over a Period of 10 years (percent)	2.55	2.25	1.40	2.24
Average Household (HH) size	5.45	5.99	4.92	5.35

Source: Population and Housing Census 2011, Bangladesh Bureau of Statistics (BBS), 2011

The population of Kutubdia Upazila and Banskhali Upazila is 125,279 and 431,162 as per the 2011 census and constitutes approximately 5.47 percent and 5.66 percent of the total population of Cox's Bazar and Chittagong District. The population density of Kutubdia and Banskhali upazila is 581 persons and 1144 persons per square kilometre respectively, which is lower than the average population density of Cox's Bazar District (919) and Chittagong District (1442). Gender ratio of Kutubdia Upazila has increased from 91 to 95 over the last decade while gender ratio of Banskhali upazila has decreased from 111 to 97. The *Table 4.40* accounts for the key demographic indicators of Kutubdia and Banskhali Upazilas.

Table 4.40 Population Trends of Kutubdia Upazila

Upazila	Index	2011	2001	Percent of District (2011 Census)
Kutubdia	Total Households	22,587	18,368	6.99
	Total Population	125,279	107,221	5.47
	Population Density	581	494	-
	Sex Ratio ¹	105	91	-
	Change in Population	18,058	12,166	-
	Average Annual Increase	1806	1217	-
	Annual rate of Growth over period of 10 years (percent)	1.54	1,21	-
	Average Household Size	5.54	5.83	-
Banskhali	Total Households	84,216	71,229	5.49
	Total Population	4,31,162	3,91,320	5.66
	Population Density	1144	1038	-
	Sex Ratio	97	111	-
	Change in Population	39842	70981	-
	Average Annual Increase	3984	7098	-
	Annual rate of Growth over period of 10 years (percent)	0.96	2.02	-
	Average Household Size	5.11	5.45	-

Source: Population and Housing Census 2011, Bangladesh Bureau of Statistics (BBS), 2011

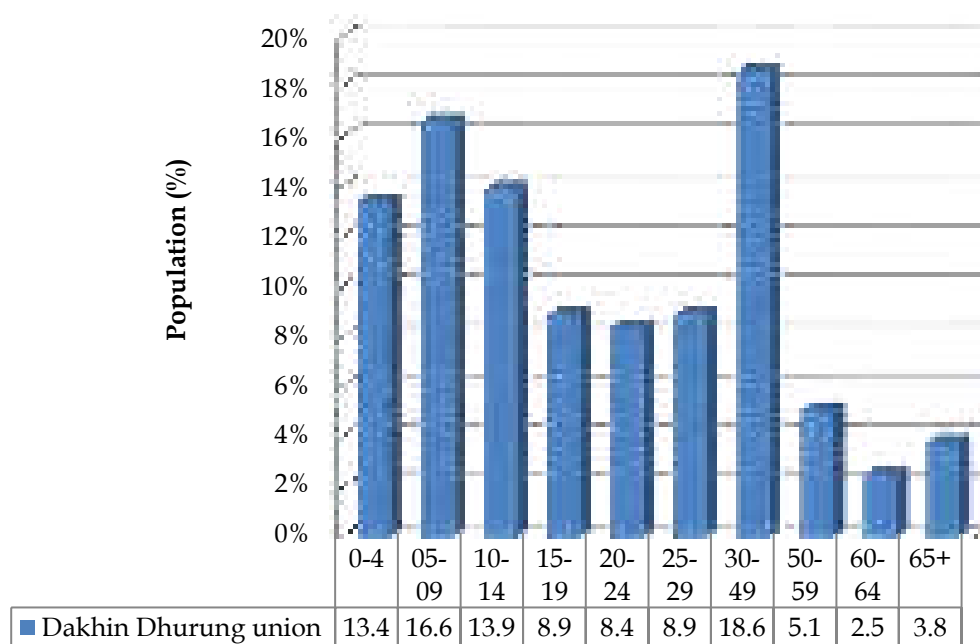
¹ Sex ratio per hundred male

Dakshin Dhurung Union

Census of Bangladesh (2011) shows that Dakshin Dhurung union has 17,279 population residing in 2942 household and constitutes approximately 13.79 percent of the total population of Kutubdia. The population density of Dakshin Dhurung union is 2873 persons per square kilometre, which is higher than the average population density of Kutubdia Upazila (581) and Cox's Bazar District (919). Gender ratio of this Union is 105 which is similar to the Upazila.

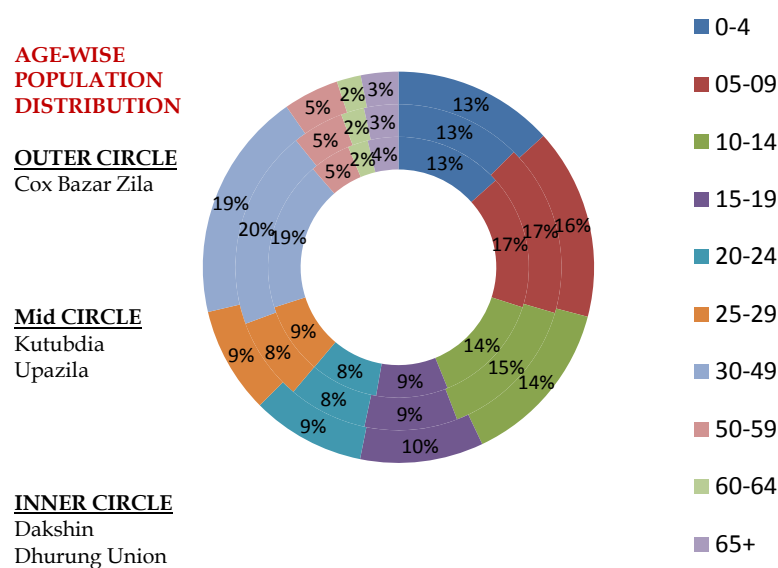
The census of Bangladesh divides the population age groups into ten (10) categories. These being, those below the age of 4, between 5 and 9, 10 to 14, 15 to 19, 20 to 24, 25 to 29, 30 to 49, 50 to 59, 60 to 64 and those above the age of 64 respectively. *Figure 4.70* highlights the age-wise distribution of population in Dakshin Dhurung Union whereas *Figure 4.71* presents a comparative trend in the age-wise population distribution in Dakshin Dhurung Union with that of the overall Upazila and district.

Figure 4.70 Age-Wise Distribution of Population in Dakshin Dhurung Union



Source: Population and Housing Census 2011, Bangladesh Bureau of Statistics (BBS), 2011

Figure 4.71 Comparison of Age-wise Population Distribution of Dakshin Dhurung Union with Kutubdia Upazila and Cox's Bazar District



Source: Population and Housing Census 2011, Bangladesh Bureau of Statistics (BBS), 2011

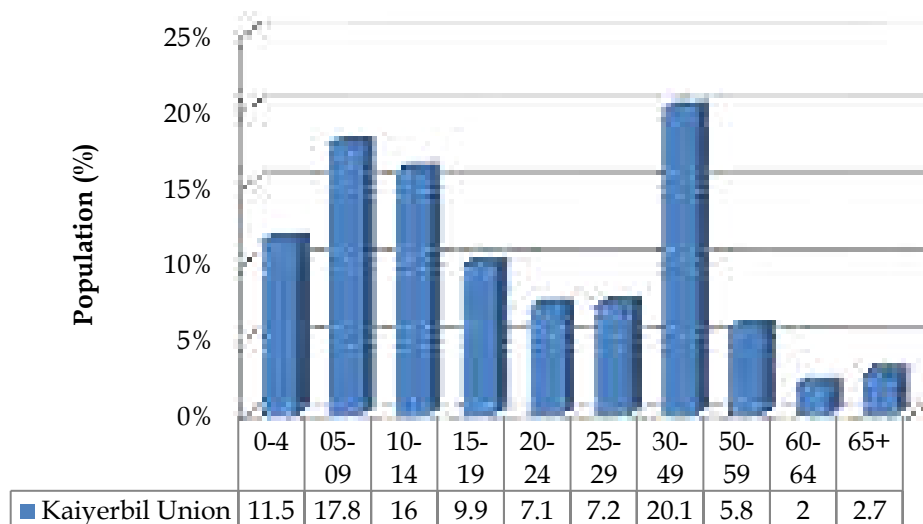
It can be observed from the above figure that a large percentage of the population (19 percent) in Dakshin Dhurung Union falls within the age group of 30 to 49 years followed by population within the age group of 05 to 09 years (17 percent) and 10-14 years (14 percent) respectively. The trend is quite similar for the Kutubdia Upazila and Cox's Bazar District where the largest percentage of the population falls within the age group of 30 to 49 years.

Thus 50 percent of the population in Dakshin Dhurung Union falls within an economically active age group (15-59 years), while rest 50 percent of the population is understood to be dependent. Similar trends are visible in Kutubdia and Cox's Bazar District where 52 percent of the population falls within the economically active age group.

Kaiyabil Union

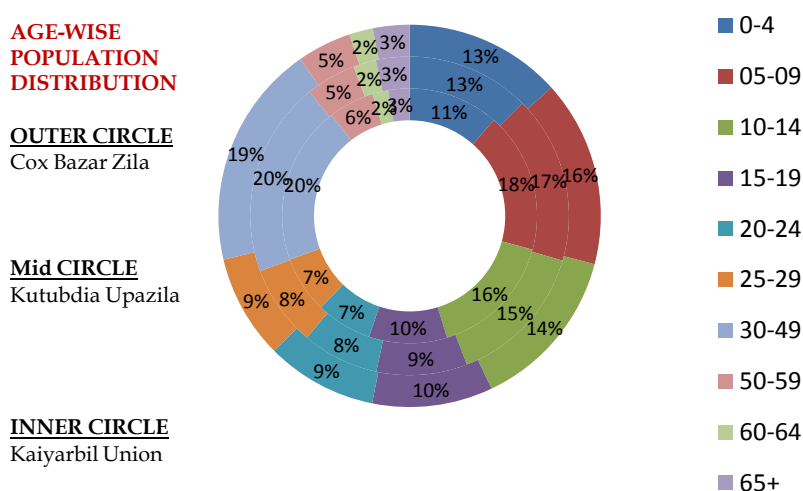
As per Census of Bangladesh (2011), Kaiyabil union has a population of 12,945 residing in 2423 households and constitutes approximately 12.07 percent of the total population of Kutubdia Island. The population density of Kaiyabil Union is 3595 persons per square kilometre, which is higher than the average population density of Kutubdia Upazila (581) and Cox's Bazar District (919). Gender ratio of this Union is 98 which is lower than that of the Kutubdia Upazila. **Figure 4.72** highlights the age-wise distribution of population in Kaiyabil Union whereas **Figure 4.73** presents a comparative trend in the age-wise population distribution in Kaiyabil Union with that of the overall Upazila and district.

Figure 4.72 Age-Wise Distribution of Population in Kaiyar Union



Source: Population and Housing Census 2011, Bangladesh Bureau of Statistics (BBS), 2011

Figure 4.73 Comparison of Age-wise Population Distribution of Kaiyarbil Union with Kutubdia Upazila and Cox's Bazar District



Source: Population and Housing Census 2011, Bangladesh Bureau of Statistics (BBS), 2011

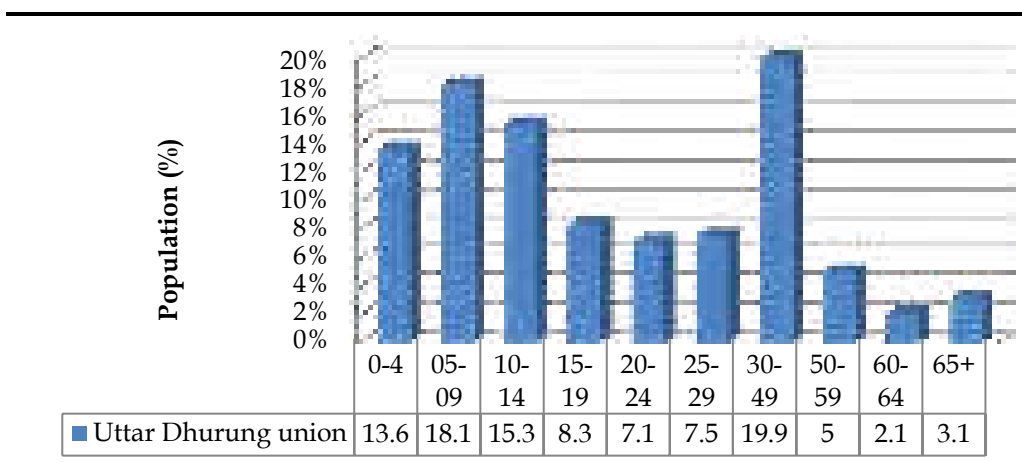
It can be observed from the above figure that a large percentage of the population (19 percent) in Kaiyarbil Union falls within the age group of 30 to 49 years followed by population within the age group of 05 to 09 years (17 percent) and 10-14 years (14 percent) respectively. The trend is quite similar for the Kutubdia Upazila and Cox's Bazar District where the largest percentage of the population falls within the age group of 30 to 49 years.

Thus 50 percent of the population in Kaiyarbil Union falls within an economically active age group (15-59 years), while rest 50 percent of the population is understood to be dependent. Similar trends are visible in Kutubdia Upazila and Cox's Bazar District where 52 percent of the population falls within the economically active age group.

Uttar Dhurung Union

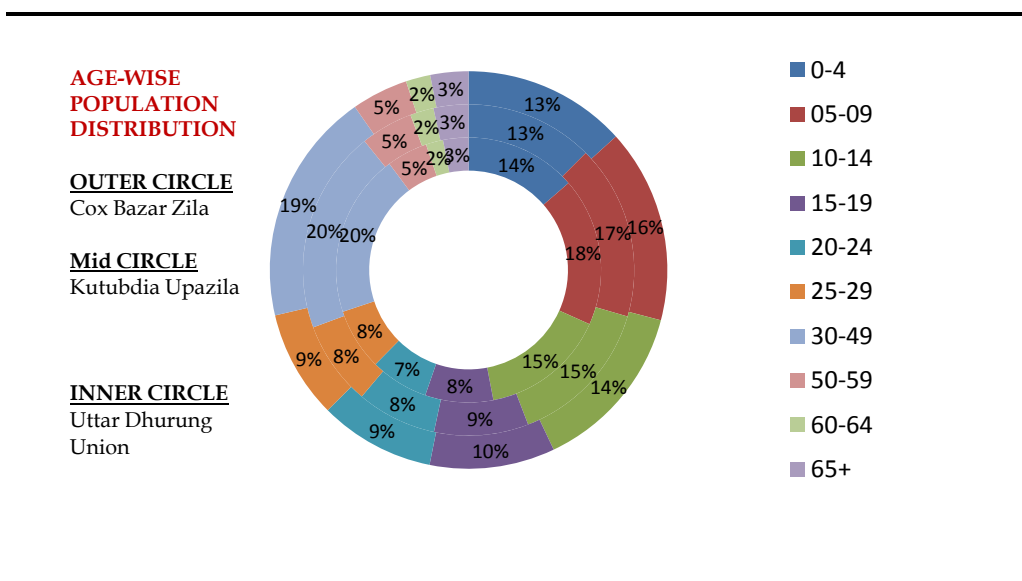
Census of Bangladesh (2011) shows that Uttar Dhurung union has 28035 population residing in 4889 household and constitutes approximately 28.09 percent of the total population of Kutubdia. The population density of Uttar Dhurung Union is 2431 persons per square kilometre, which is higher than the average population density of Kutubdia Upazila (581) and Cox’s Bazar District (919). Gender ratio of this Union is 96 which is lower than that of the Upazila. *Figure 4.74* highlights the age-wise distribution of population in Uttar Dhurung Union whereas *Figure 4.75* presents a comparative trend in the age-wise population distribution in Uttar Dhurung Union with that of the overall Upazila and district.

Figure 4.74 Age-Wise Distribution of Population in Uttar Dhurung Union



Source: Population and Housing Census 2011, Bangladesh Bureau of Statistics (BBS), 2011

Figure 4.75 Comparison of Age-wise Population Distribution of Uttar Dhurung union with Kutubdia Upazila and Cox’s Bazar District



Source: Population and Housing Census 2011, Bangladesh Bureau of Statistics (BBS), 2011

It can be observed from the above figure that a large percentage of the population (20 percent in Uttar Dhurung Union) falls within the age group of 30 to 49 years followed by population within the age group of 05 to 09 years (17percent) and 10-14 years (14 percent) respectively. The trend is quite similar for the Kutubdia Upazila and Cox’s Bazar District where the largest percentage of the population falls within the age group of 30 to 49 years.

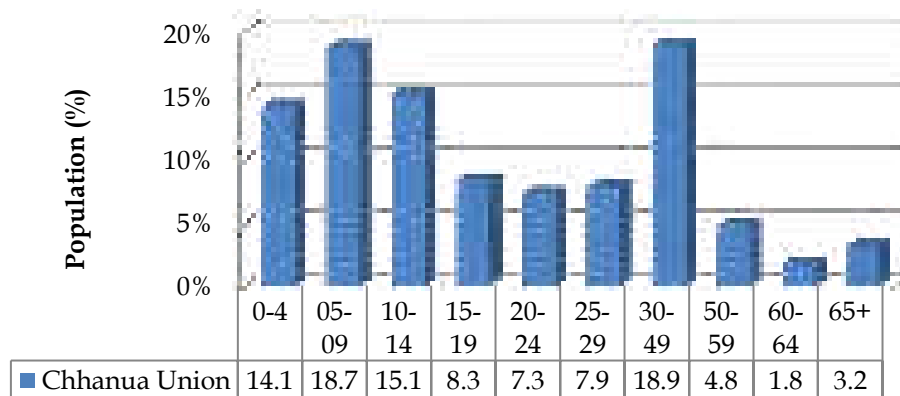
Thus 50 percent of the population in Uttar Dhurung Union falls within an economically active age group (15-59 years), while rest 50 percent of the population is understood to be dependent. Similar trends are visible in Kutubdia Upazila and Cox’s Bazar District where 52 percent of the population falls within the economically active age group.

Overall it is noticed that 25-30 percent of the population falls in the age bracket of 15 to 30 years, which can be considered as the potential population which looks for livelihood diversification. It is also important to note that around 18 percent of the total population constitute infants and elderly population, whose sensitivity to health needs to be considered during impact assessment study.

Chhanua Union

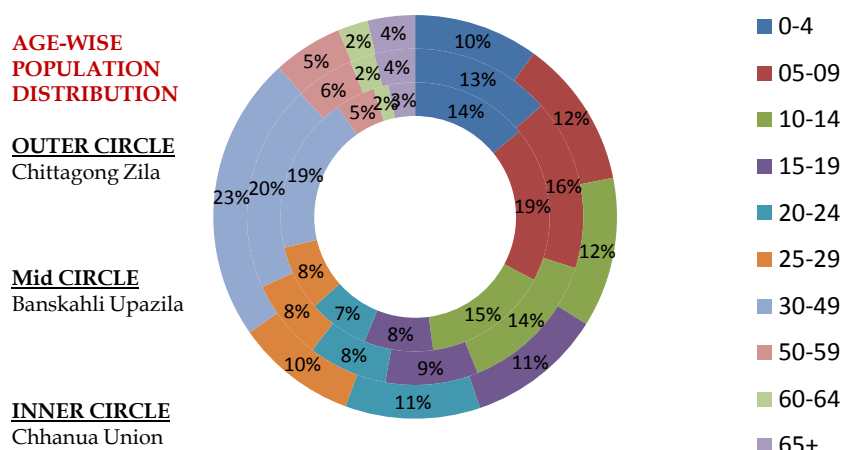
Census of Bangladesh (2011) shows that Chhanua union has a population of 28,748 residing in 5586 households, and constitutes approximately 6.66percent of the total population of Banshkhali Upazila. The population density of Chhanua Union is 1424 persons per square kilometre, which is higher than the average population density of Banshkhali Upazila (1144) but lower than the Chittagong District (1442). Gender ratio of this Union is 97 which are lower than the Upazila. *Figure 4.76* highlights the age-wise distribution of population in Chhanua Union whereas *Figure 4.77* presents a comparative trend in the age-wise population distribution in Chhanua Union with that of the overall Upazila and district.

Figure 4.76 Age-Wise Distribution of Population in Chhanua Union



Source: Population and Housing Census 2011, Bangladesh Bureau of Statistics (BBS), 2011

Figure 4.77 Comparison of Age-wise Population Distribution in Chhanua Union with Banskhali Upazila and Chittagong District

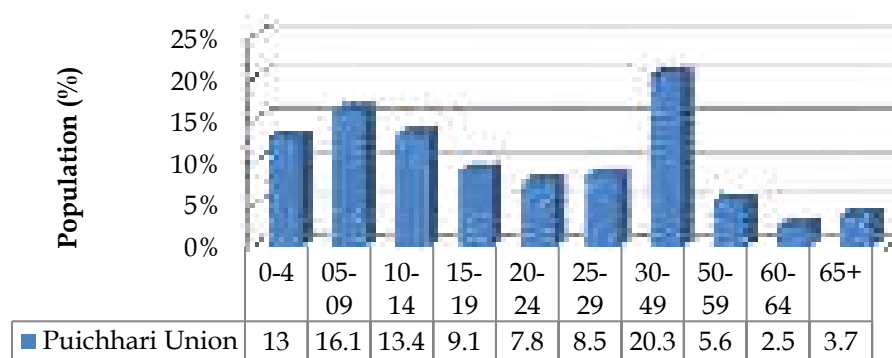


Source: Population and Housing Census 2011, Bangladesh Bureau of Statistics (BBS), 2011

Puichhari Union

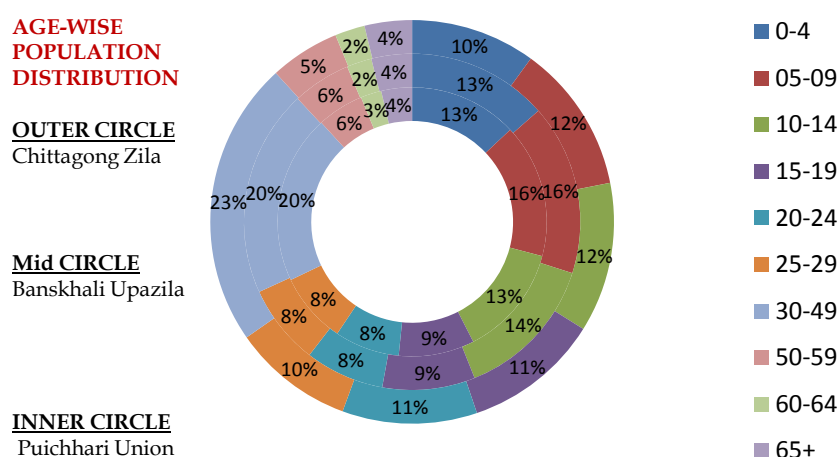
Puichhari Union has a population of 34,224 residing in 6849 households and constitutes approximately 7.93 percent of the total population of Bansshkhali Upazila. The population density of this union is 782 persons per square kilometre, which is lower than the average population density of Bansshkhali Upazila (1144) and the Chittagong District (1442). Gender ratio of this Union is 103 which are higher than the Upazila. **Figure 4.78** highlights the age-wise distribution of population in Puichhari Union whereas **Figure 4.79** presents a comparative trend in the age-wise population distribution in Puichhari Union with that of the overall Upazila and district.

Figure 4.78 Age-Wise Distribution of Population in Puichhari Union



Source: Population and Housing Census 2011, Bangladesh Bureau of Statistics (BBS), 2011

Figure 4.79 Comparison of Age-wise Population Distribution in Puichhari with Banskhali Upazila and Chittagong District



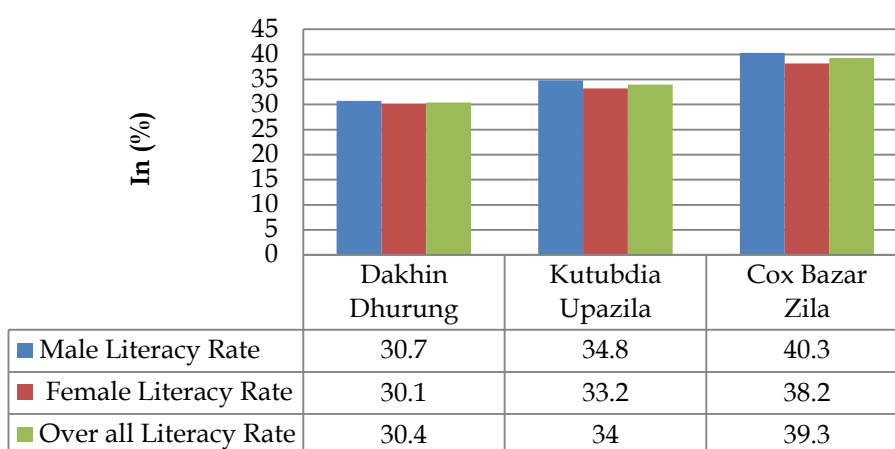
Source: Population and Housing Census 2011, Bangladesh Bureau of Statistics (BBS), 2011

4.18.3 Literacy Profile

Dakshin Dhurung

Population Census of Bangladesh, 2011 shows that literacy rate in Dakshin Dhurung Union has been indicated at 30.4 percent, which is lower than the national literacy rate of 56.75percent. The overall literacy rate for the Kutubdia and Cox’s Bazar district stands at 34 percent and 39.3 percent respectively. Male and female literacy rate is 30.4 percentage and 31.1 percentage respectively. The graphical representation of literacy indicators are shown in *Figure 4.80*

Figure 4.80 Literacy Profile of Dakshin Dhurung Union

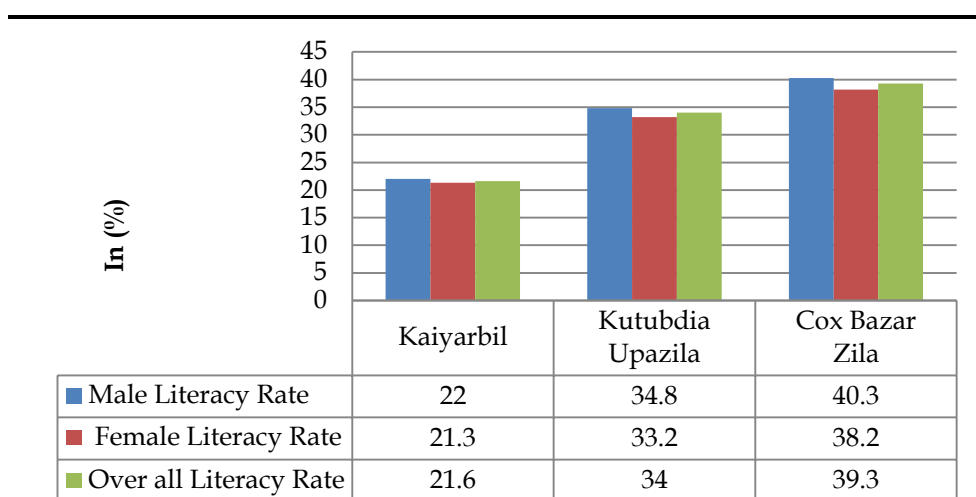


Source: Population and Housing Census 2011, Bangladesh Bureau of Statistics (BBS), 2011

Kaiyarbil Union

As per Population and Housing Census, 2011 literacy rate in Kaiyarbil Union is 21.6 percent, which is lower than the literacy rate for the Kutubdia Upazila and Cox's Bazar district which stands at 34 percent and 39.3 percent respectively. Male and female literacy rate is 21.3 percentage and 21.6 percentage respectively. The graphical representation of literacy indicators are shown in *Figure 4.81*.

Figure 4.81 Literacy Profile of Kaiyarbil Union

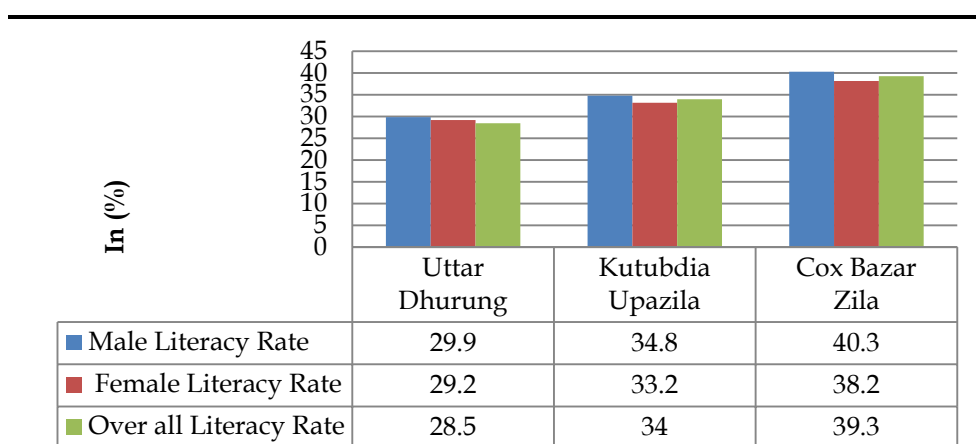


Source: Population and Housing Census 2011, Bangladesh Bureau of Statistics (BBS), 2011

Uttar Dhurung

Population and Housing Census data shows that Literacy Rate of Uttar Dhurung Union is 30.4 percent which is lower than the literacy rate of Kutubdia Upazila and Cox's Bazar district which stands at 34 percent and 39.3 percent respectively. Male and female literacy rate is 29.9 percentage and 29.2 percentage respectively. The graphical representation of literacy indicators are shown in *Figure 4.82*.

Figure 4.82 Literacy Profile of Uttar Dhurung Union



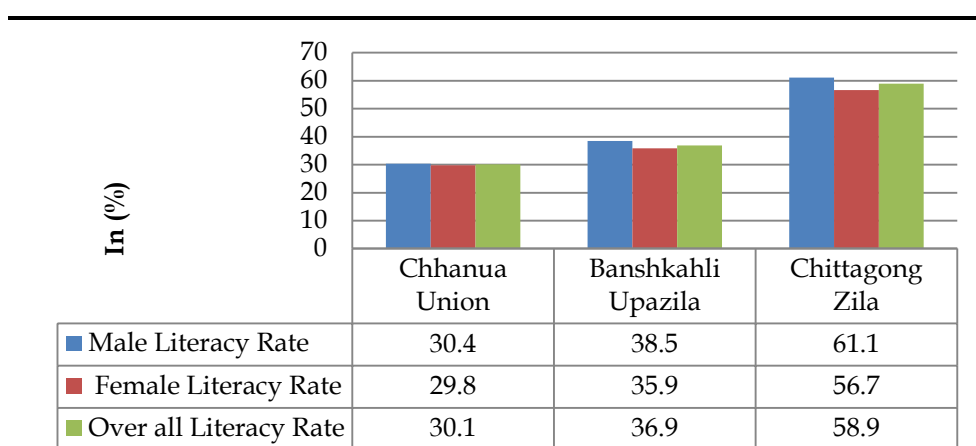
Source: Population and Housing Census 2011, Bangladesh Bureau of Statistics (BBS), 2011

With respect to individual literacy trends amongst males and females, it can be observed that literacy amongst women is higher than their male counterparts. The difference registered was higher in Cox’s Bazar District (2.1 percent) than in the Union and Upazila.

Chhanua Union

Population Census of Bangladesh shows that the literacy rate in Chhanua Union is 30.1percent, which is lower than the national literacy rate of 56.75percent. The overall literacy rate for the Banshkahli Upazila and Chittagong district stands at 36.9 percent and 58.9 percent respectively. Male and female literacy rate is 30.4 percentage and 29.8 percentage respectively. The graphical representation of literacy indicators are shown in **Figure 4.83**.

Figure 4.83 *Literacy Profile of Chhanua Union*

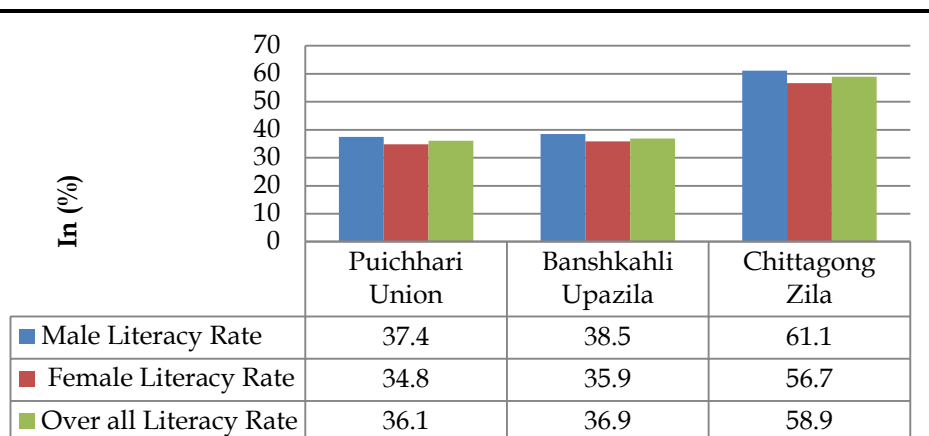


Source: Population and Housing Census 2011, Bangladesh Bureau of Statistics (BBS), 2011

Puichhari Union

As per Census, 2011 Puichhari Union has a literacy rate of 36.1 percent, which is lower than the national literacy rate of 56.75 percent. The overall literacy rate for the Banshkahli Upazila and Cox’s Bazar district stands at 36.9 percent and 58.9 percent respectively. Male and female literacy rate is 34.8 percentage and 36.1 percentage respectively. The graphical representation of literacy indicators are shown in **Figure 4.84**.

Figure 4.84 Literacy Profile of Puichhari Union



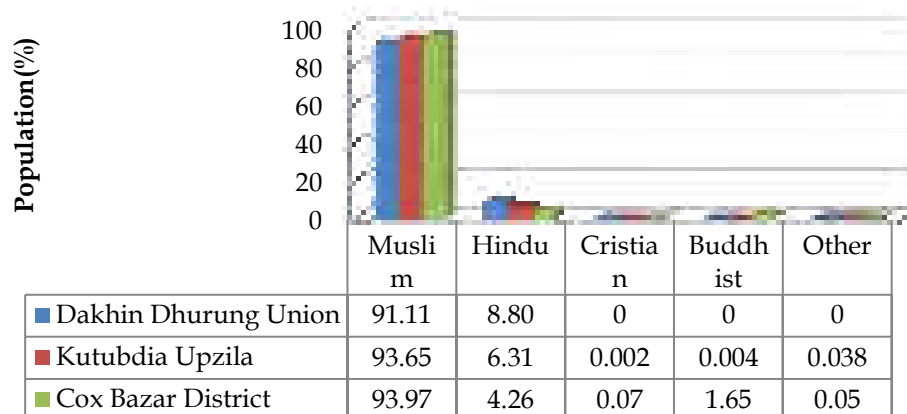
Source: Population and Housing Census 2011, Bangladesh Bureau of Statistics (BBS), 2011
 With respect to individual literacy trends amongst males and females, it can be observed that literacy amongst women is lower than their male counterparts. The difference registered was higher in Chittagong District (4.4 percent) than in the Union and Upazila.

4.18.4 Religion and Ethnic Composition

Dakshin Dhurung Union

Resident of Dakshin Dhurung Union mostly comprises of people following Islam. Census of Bangladesh shows that only 8.80 percent of the population in Dakshin Dhurung Union is following other faith, while 91.11 percent comprises of Muslim population.

Figure 4.85 Religious Composition of Dakshin Dhurung Union



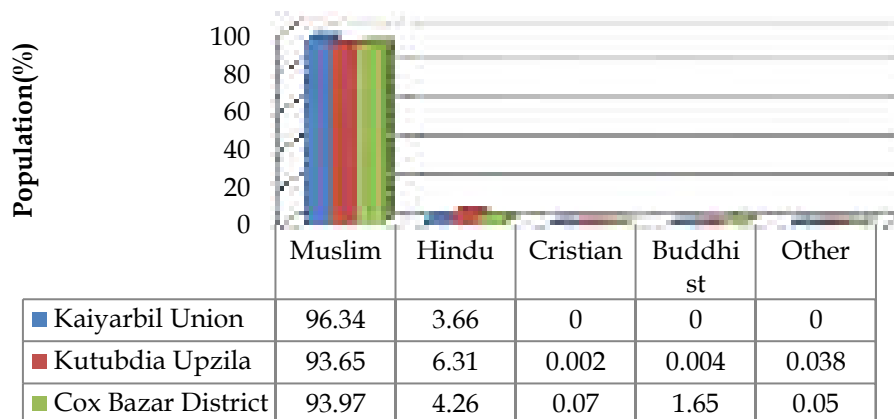
Source: Population and Housing Census 2011, Bangladesh Bureau of Statistics (BBS), 2011

Kaiyarbil Union

Resident of Kaiyarbil Union mostly comprises of people following Islam. Figure 4.86 shows that only 3.66 percent of the population in Kaiyarbil Union

is following Hindu religion, while 96.34 percent comprises of Muslim population.

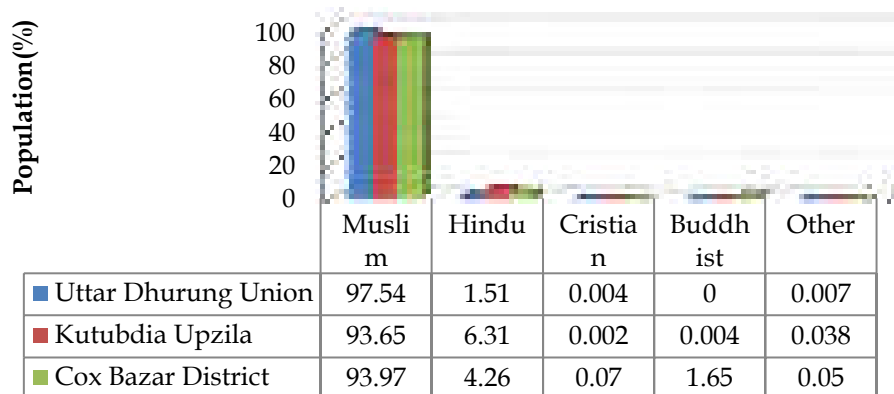
Figure 4.86 Religious Composition of Dakshin Dhurung



Source: Population and Housing Census 2011, Bangladesh Bureau of Statistics (BBS), 2011
Uttar Dhurung Union

Resident of Uttar Dhurung Union mostly comprises of people following Islam. Census of Bangladesh, 2011 depicted that only 2.5 percent of the population in Uttar Dhurung Union is following other faith, while 97.54 percent comprises of Muslim population.

Figure 4.87 Religious Composition of Uttar Dhurung



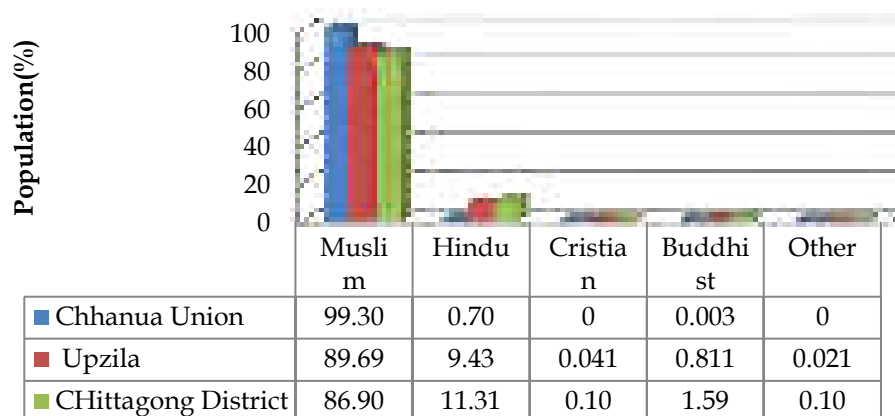
Source: Population and Housing Census 2011, Bangladesh Bureau of Statistics (BBS), 2011

The population belonging to other ethnic minorities is quite negligible. Kutubdia has only 0.015 percent ethnic minority population. There are only 5 ethnic households in the entire Upazila with total population of 19.

Chhanua Union

Resident of Chhanua Union mostly comprises of people following Islam. It can be seen from the below figure that only 1 percent of the population in Chhanua Union is following other faith, while 99.30 percent comprises of Muslim population.

Figure 4.88 Religious Composition of Chhanua Union

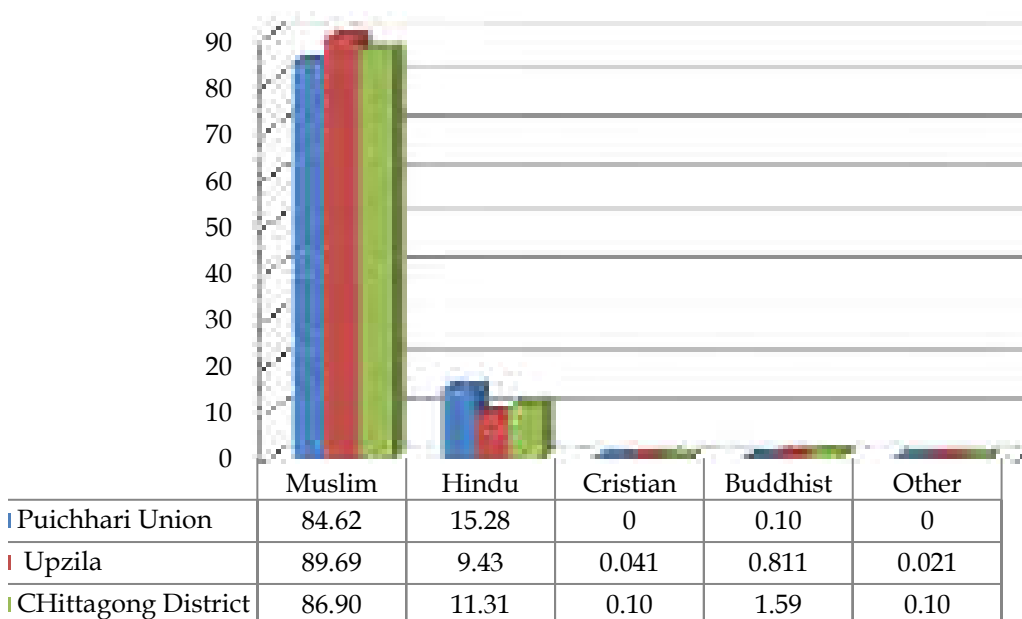


Source: Population and Housing Census 2011, Bangladesh Bureau of Statistics (BBS), 2011

Puichhari Union

Resident of Puichhari Union mostly comprises of people following Islam. It can be observed from the figure mention below that only 15 percent of the population in Puichhari Union is following other faith, while 84.62 percent comprises of Muslim population.

Figure 4.89 Religious Composition of Puichhari Union



Source: Population and Housing Census 2011, Bangladesh Bureau of Statistics (BBS), 2011

As per population and housing census, 2011 there is no ethnic minorities' population residing in the two above referred unions.

4.18.5 Vulnerability

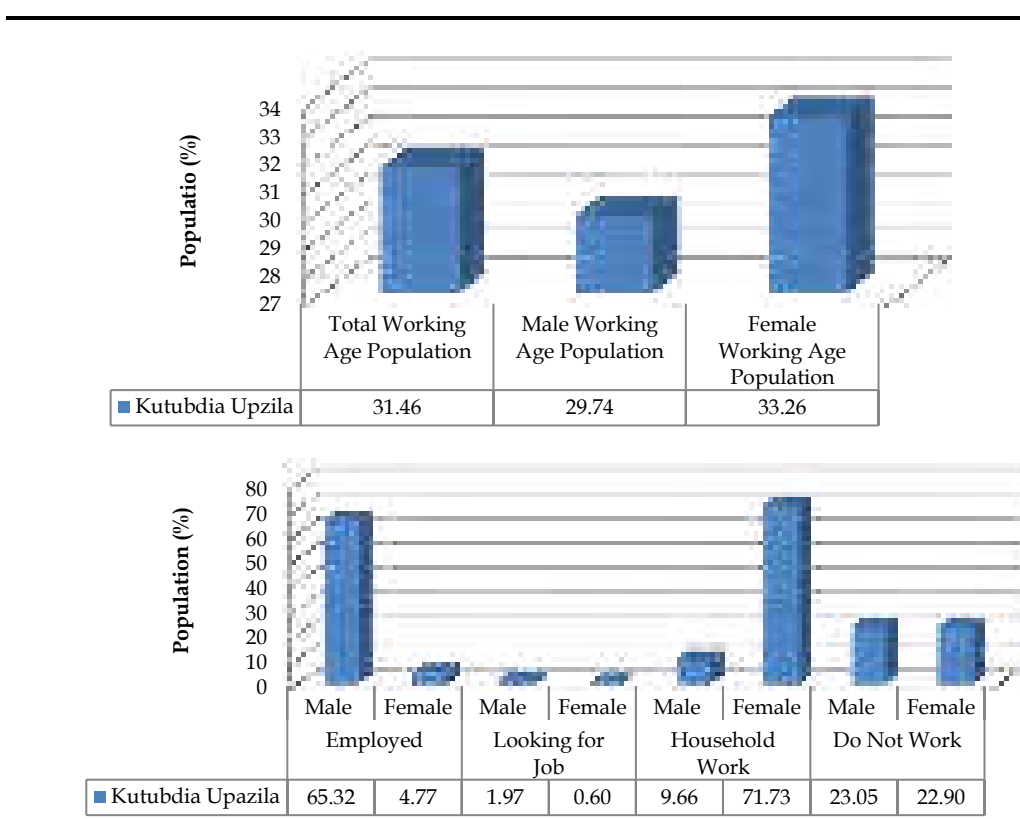
In addition to the infant and elderly age group, widows/separated population and disabled/differently abled population are considered as vulnerable population. The disabled or differently abled population constitutes 2percent of the total population.

4.18.6 Local Economy and Employment

Kutubdia Upazila

As per the Population and Housing Census of Cox Bazar District, 2011 employed population in Kutubdia Upazila is only 70 percent of the working age population (15-65 years), however female working population is quite low (only 4.77 percent) in this Upazila. Female population is mainly engaged in household work. Hence, the employment situation of female population looks quite grim in study area.

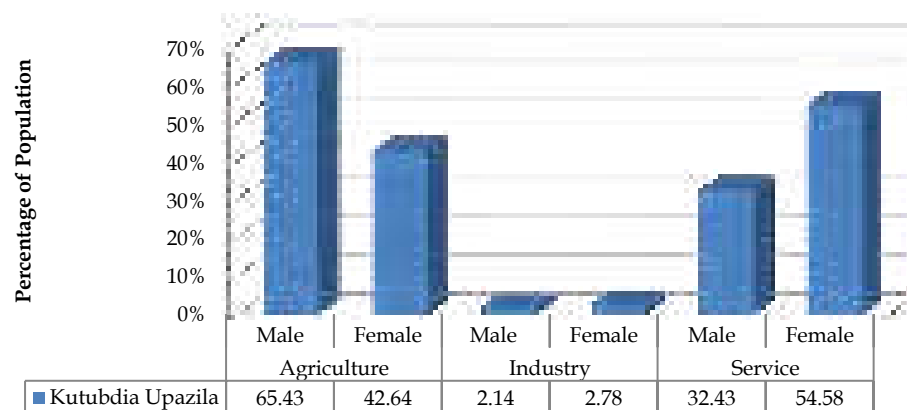
Figure 4.90 Employment Status of Kutubdia Upazila



Source: Population and Housing Census 2011, Bangladesh Bureau of Statistics (BBS), 2011

It can be observed from population census data that the main source of livelihood for a majority of the population is agriculture and related activities. Other than that salt production, fishing and dry fish production also plays a vital role in case of livelihood generation in this Upazila.

Figure 4.91 Sector Wise Employment of Kutubdia Upazila



Source: Population and Housing Census 2011, Bangladesh Bureau of Statistics (BBS), 2011

Dakshin Dhurung Union

The workforce participation rate in the Dakshin Dhurung Union is 78 percent as per the population and housing Census data of Cox Bazar District. Community consultation reveals that majority of inhabitants in Dakshin Dhurung union are involved in fishing and salt pan activity. Cultivators comprise the second most important work category of the total workforce.

Kaiyarbil Union

Population Census of Cox Bazar District, 2011 shows that workforce participation rate in the Kaiyarbil Union is 78.25 percent. Community consultation reveals that majority of inhabitants in Kaiyarbil union are involved in agricultural activity. Fishing comprises the second most important work category of the total workforce.

Uttar Dhurung Union

As per Bangladesh Census, 2011 the workforce participation rate in Uttar Dhurung Union is 79.51 percent. Community consultation reveals that majority of inhabitants in this union are employed as fisherman and salt pan workers and cultivators are very low in number.

Banshkhali Upazila

Census data of Cox's Bazar district shows that The employed population in Banskhali Upazila is only 72 percent of the working age population, however female working population is quite low (only 5.2 percent) in this Upazila. Female population is mainly engaged in household work.

Chhanua Union

It can be observed from population census data that the workforce participation rate in the Chhanua Union is 76.35 percent. Community

consultation reveals that majority of inhabitants are involved in fishing and salt pan activity. Cultivators comprise the second most important work category of the total workforce.

Puichhari Union

The workforce participation rate in the Puichhari Union is 77.27 percent. Community consultation reveals that agriculture is main economic activity in this union and majority of inhabitants are involved in agricultural practices. Few people are also involved in other activities like fishing and small business.

4.18.7 Major Livelihood Activities of Kutubdia Island

It has been observed during site visits that agriculture, salt cultivation and fishing are three major livelihood earning activities observed in Kutubdia Island. Community consultation also revealed that most of the community people are engaged in these activities and all other livelihood activity like small business, boat making and maintenance, salt and dry fish marketing all are directly and indirectly dependent on these activities. Therefore the present study is also considering agriculture, salt cultivation and fishing as its point of focus for studying livelihood dependence for the population of the Kutubdia Island.

Agriculture

The main profession of the habitants of Kutubdia Upazila is agriculture; 56 percent of the total population is dependent on agriculture. People of Ali Akbar Deil, Boroghob, Kaiyabil, Dakshin Dhurung and Uttar Dhurung are mostly involved in agriculture and cultivation of seasonal vegetables. The following table gives an insight to total arable land available in the six Union Parishads of the Kutubdia Upazila.

Table 4.41 Union Based Total Arable Land and its Use

Name of Union	Total Arable Land (Acres)	Utilization of Land in Acres		
		Single Crop	Double Crop	Triple Crop
Uttar Dhurung	2890	124	2025	741
Dakshin Dhurung	2297	172	1309	815
Lemshikhali	1828	148	963	716
Kaiyabil	1530	172	741	617
Boroghob	2321	124	840	1358
Ali Akbar Deil	2630	124	1729	778
Total	13496	864	7607	5025

Source: Disaster Management Plan for Kutubdia Upazila

Agriculture had been the primary source of income for the inhabitants of the island Upazila, but frequent cyclonic events and sea water surge has made the cultivable land of Kutubdia infertile due to salinity. More agricultural land was converted to salt fields. Cultivation is mostly done for selling and self-consumption.

Box 4.3**Agriculture in Kutubdia Upazila**

- 5465 hector of land is under cultivation in Kutubdia Upazila
- Some of the regions on the Upazila are tripled cropped – Rabi, Karif I (Aaush) and Karif II (Amon) crops are grown
- Farmers are being given identity cards – Krishi Upakaran Sahayata Card
- There are 13740 farmers in Kutubdia



Source: Upazila Agriculture Office, Kutubdia Upazila

Salt Cultivation

Salt production is quite an ancient industry in the coastal zones of Bangladesh, especially in Chittagong and Cox's bazar areas. Salt is produced seasonally from December to mid-May and the preparation starts from October-November. Traditionally salt was produced by evaporating water by boiling the seawater. From 2000-2001 salt was produced in a different way known popularly as polythene process, in which salt production per acre is much higher than old method. In traditional method, per acre production of salt was 17.25 m ton, while in the new method per acre production of salt has been 21 m ton and furthermore, production per acre and the quality of salt is very standard. Moreover the market price of this salt produced in this new method has doubled and cultivators earn good profit.

Hundreds of person from the different Upazilas of Cox's Bazar District are involved into salt harvesting including Kutubdia Upazila. Cox's Bazar is the only region in Bangladesh where salt harvesting is done. In Kutubdia Upazila, salt harvesting is one of the primary livelihood options of the island population and also done as a secondary seasonal source of income. It is mainly done at the central part of the island on both sides of the Filate Kata Khal. Due to frequent cyclonic events and sea water surge, more and more agricultural lands are becoming infertile and getting converted for salt harvesting. *Table 4.42* provides Union wise land under salt cultivation in Kutubdia Upazila and number of salt cultivators.

Table 4.42 *Union Parishad wise Area under Salt Cultivation and Salt Cultivators in 2015-16*

Name of Union	Land Area (Acres)	Number of Cultivators
Uttar Dhurung	1770	1180
Dakshin Dhurung	475	340
Kaiyarbil	820	550
Lemshikhali	2525	1700
Boroghop	450	300
Ali Akbar Deil	960	530
Total	7000	4600

Source: Bangladesh Small & Cottage Industries Corporation (BSCIC) Office, Cox's Bazar

- In Kutubdia Upazila 7000 acres of land is under salt cultivation
- There are 4600 salt cultivators in the whole Upazila
- The number of salt cultivators is not the same every year; it increases by 10 percent if the yield is good in the current year
- In Kutubdia all the salt cultivators are from the island itself



Source: Bangladesh Small & Cottage Industries Corporation (BSCIC) Office, Cox's Bazar

Fishing

In Bangladesh the Fisheries sector plays a significant role in providing income opportunities, earning foreign exchange, alleviating protein shortage and socio-economic development of the population. The fisheries sector contributes 4.43 percent to the national GDP ¹and 22.21 percent to the total agricultural GDP as per Department of Fisheries (DoF), 2011. Fisheries are the second largest export sector in Bangladesh. An estimated 1.4 million people are engaged fulltime and approximately 12 million people as part time in the fisheries sector². Majority of these people are concentrated in the coastal areas of Bangladesh.

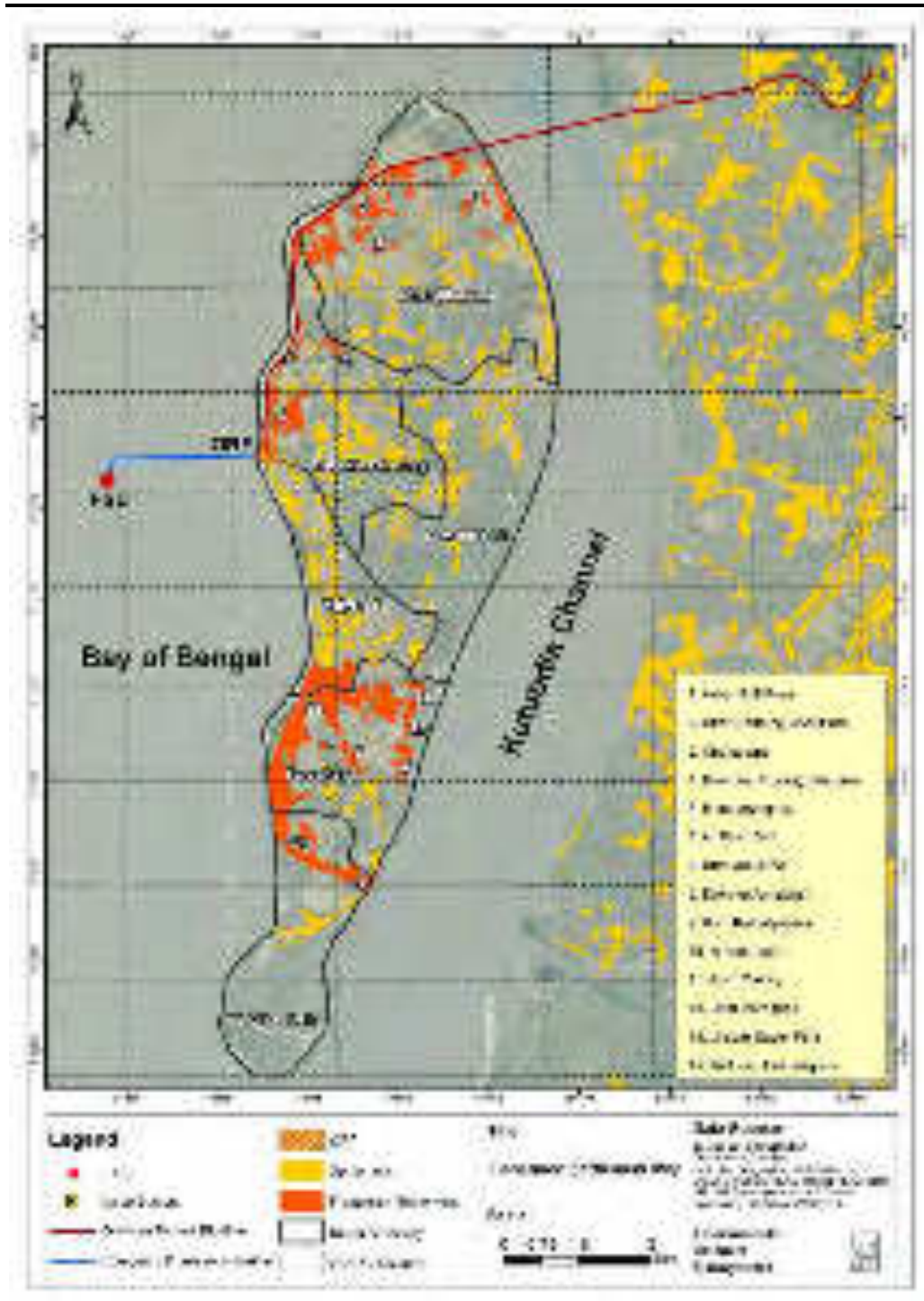
Kutubdia Upazila, an island in itself, is home to several such fishermen whose primary livelihood is fishing. One of the key stakeholders of this project is the fishermen community of Kutubdia Island and especially those who are residing adjacent to the project footprint area.

As an approach towards the Fishermen Study, in order to avoid randomness, the island was delineated interposing a uniform grid (2km x 2km), following which the fishermen settlements were mapped based on the information obtained from the District Fisheries Office, Cox's Bazar and key informant interview with elderly fishermen (*Figure 4.92*). Focus Group Discussions (FGDs) and key informant interviews were conducted with the fishermen from these identified fishermen settlements across all the six Union Parishads of Kutubdia Upazila.

¹ Haq N. Bangladesh Tackles Poverty and Hunger with Fish Farming

² Ahmed, Halim and Sultana 2012

Figure 4.92 Fishermen Settlement



Source: Key Informant Interviews

Fishermen in Kutubdia Upazila

It was informed by the District Fisheries Officer (DFO), District Fisheries Department, Cox's Bazar that number of registered fishermen with the department as on 30th June, 2016 is 7116 in Kutubdia Upazila (Table 4.43). According to DFO there may be additional 20 percent more fishermen in the island upazila those who have not been registered due to various reasons. Therefore it can be estimated that there are approximately 8500 fishermen in

Kutubdia Upazila. Following *Table 4.43* provides the ward wise number of registered fishermen in the respective six Union Parishads.

Table 4.43 *List of Registered Fishermen in Kutubdia Upazila as on 30th June, 2016*

Union	Ward 1	Ward 2	Ward 3	Ward 4	Ward 5	Ward 6	Ward 7	Ward 8	Ward 9	Total
Boroghop	148	76	93	466	199	142	345	24	51	1588
Dakshin Dhurung	192	168	118	122	76	24	53	186	190	1120
Uttar Dhurung	406	134	472	165	209	79	194	101	138	1912
Kaiyabil	23	40	20	24	82	14	90	59	65	391
Ali Akbar Deil	214	188	255	82	146	459	250	207	00	1739
Lemshikhali	14	39	44	29	70	79	56	52	63	410
TOTAL										7116

Source: District Fisheries Office, Cox's Bazar

As indicated in **Table 4.43**, the predominance of fishermen communities are more in Uttar Dhurung, Ali Akbar Deil and Boroghop Unions followed by Dakshin Dhurung. This has been reflected in the fishermen settlement map. In Lemshikhali and Kaiyabil Unions there is no fishermen settlement in particular and fishermen are scattered all over the union.

The highlighted cells in *Table 4.43* indicate the ward 2 and ward 1 under the Dakshin Dhurung and Kaiyabil Union Parishads respectively, which are adjacent to the project foot print. There are 191 registered fishermen (as on 30th June, 2016) residing near the project area; approximately around 230 fishermen¹ is expected to reside in this region in these two wards.

Fishing Communities & Fishing as Occupation

Focus Group Discussions (FGDs) and interview of the key informant revealed that in Kutubdia, traditionally fishing was practiced by the minority fishing community – *jeles* (*Hindu community*), who had been residing in this island for all most four generations, 200 years approximately. Fishing was predominantly their occupation. The Muslim population of the island adopted fishing as occupation in the last 20-25 years. The Muslim population of the island were traditionally into agriculture, livestock rearing and practiced fishing in small scale (aquaculture). Repeated cyclonic surge had reduced agricultural activity in the island over the years and people opted for alternate occupations. The Muslim population learnt the art of deep sea fishing and fishing in sea using different types of nets from the *jeles* (minority fishermen community).

¹ There may be additional 20 percent more fishermen in the island upazila those who have not been registered due to various reasons as per DFO.

Table 4.44 *Minority (Hindu) Fishing Settlements in Kutubdia*

Union Parishad	Name of Settlement	No. of Fishermen (Approx.)
Dakshin Dhurung	Dakshin Dhurung Jelepara	300
Boroghop	Boro Kaibatypara	450
Ali Akbar Deil	Ali Akbar Deil Jelepara	300

Source: Key Informant Interview held on 15th Nov. 2016 at Boroghop with an elderly fishermen referred by District Fisheries Officer

Type of Fishing

Types of fishing practiced by the fishermen in Kutubdia can be classified into:

- Deep-sea fishing
- Daily fishing
- Foot fishing/ Shore line fishing

Discussions with the fishermen during FGDs across all the Unions revealed that, all the fishermen practice all types of fishing; they cannot be classified into any one category.

Deep-Sea Fishing

From the onset of monsoon till spring (July/ August to March/ April), for a period of 9-10 months – fishermen go for deep-sea fishing. Trawlers are used for deep-sea fishing and they usually goes upto India boarder in the west and southwest for fishing (ranging from 70 to 300 km). The fishermen fish for 12 to 15 days in each trip; in a month’s time they can complete two trips. The deep-sea fishing is based on the lunar calendar and the cycle revolves round the new moon cycle and full moon cycle. Fish catch is usually more during the full moon (*‘Purnima’*) and new moon (*‘Amavashya’*). In each fishing trawler about 25 – 32/35 fishermen goes for fishing in deep sea. For deep sea fishing, boats with engine capacity of around 50-70 HP are used. The most common fish net used are *Behundi* (marine setback net) and Hilsa net.

Daily Fishing

Daily fishing can be categorized into two types as mentioned by the fishermen during the focus group discussions:

- (i) Daily fishing in sea for about 24-30 hours, where 7-8 fishermen goes together for fishing on sea. Fishing is usually done 25-50 km from the west coastline.
- (ii) Daily fishing with ice – where the fishing boats fish for 4-5 days with 8-12 fishermen on sea. Fishing is usually done 50-75 km from the west coastline.

For daily fishing boats with engine capacity less than 30 HP and non-motorised boats are used and most common fish net is *Behundi* (marine setback net).

Foot Fishing / Shoreline Fishing

Use of any type of motorized and non-motorized boat is not required for this type of fishing. Foot fishing can be done standing on the coast line or at the bank of the water body or at less depth water near the coast line. Fishermen of Kutubdia use push net and shrimp net to catch shrimps and shrimp fry during their lean fishing periods.

Shoreline Fishing

It was reported during the focus group discussions that nearshore foot fishing is done, especially by the elderly fishermen and young boys using push net and shrimp net both in Kutubdia Channel and along the shore line. It was also observed during the site visits and reported by the fishermen during FGDs that the fishermen have fixed *Behundi jal* (Estuarine set bag net) near the western coastline and it is usually fixed upto 1.5 km where depth of sea is less. **Figure 4.93 Shoreline Fishing using Pushnet and Estuarine Setbag Net**



Katha Fishing

Katha fishing is done by piling of tree branches, bushes or water hyacinth set on the river or beel bottom. Fish are usually attracted into the katha by the shelter provided and by the increased food supply. During the dry season, fish can become densely amassed in a katha and thus becomes easier to catch once they have taken refuge there. To harvest a katha zone, blocking nets is set around the katha, the branches are removed and blocking net is closed up. Final harvest may be with a beach seine or castnet inside the blocking net. However, this type of fishing is not in practice in Kutubdia Upazila; Kutubdia channel is mostly used for navigation purpose.

Fishing Ground

The hydrological conditions of Bay of Bengal make it favourable for a variety of shrimps and fishes. Although fishes remain scattered in the Bay of Bengal in some places they get concentrated and constitute important fishing grounds. Four fishing grounds have been identified in the exclusive economic zones – South Patches, South of South Patches, Middle Ground, Swatch of no Ground.

South patches located at 91.30'E to 92.10' E and 20.55'S to 21.52'S, having a total area of 3662 sq km, with its depth ranging from 10m to 100m, however 90 percent of the total area is less than 40 m deep. Nearest distance of the ground from Chittagong and Cox's Bazar is 40 km and 10 km respectively.

South of south patches located at 91.30'E to 92.20'E and 20.15'S to 20.50'S, having a total area of 2538 sq. km, with depth ranging from 10m to 100m. Depth of 75 percent of the area is more than 40 m deep. This area is about 5 km from Teknaf.

Middle ground located at 90.20'E and 91.30'E and 20.25'S to 21.20'S, having a total area of about 4600 sq. km., with 70 percent of the total area is more than 40m deep. The nearest distance from the Cox's Bazar is about 65 km.

*Swatch of no Ground*¹ located at 89.35'E to 90.10'E and 20.55'S to 21.55'S, having a total area of about 3800 sq. km., with 70 percent of the total area is more than 40m deep. The overall depth ranges between 10 m to 100 m. The region is about 30 km away from Dublarchar and 40 km from Sonarchar.

The following figure shows the fishing zones as identified in Bay of Bengal.

Figure 4.94 Fishing Zones in Bay of Bengal



Source: Department of Fisheries, Cox's Bazar

¹ Announced on October 27, 2014, the Swatch of No Ground (SoNG-MPA) is Bangladesh's first marine protected area. It is located in the Bay of Bengal at the head of a submarine canyon. It spans approximately 672 square miles (1,738 square kilometers) and is more than 900 kilometers in depth in some locations. The area is a key breeding and spawning ground for dolphins, whales, sharks and turtles. The marine protected area was established for the long-term protection of cetaceans that inhabit waters offshore of Bangladesh. - <http://www.mpatlas.org/mpa/sites/60009462/>

All these fishing grounds are potential reserves for various species of fish and shrimps. The fishermen mapped the fishing grounds on Bay of Bengal where they usually go for daily fishing and deep-sea fishing using motorized boats and trawlers, during the focus group discussions. **Figure 4.95** points out the fishing grounds and fishing zones as pointed out by the fishermen.

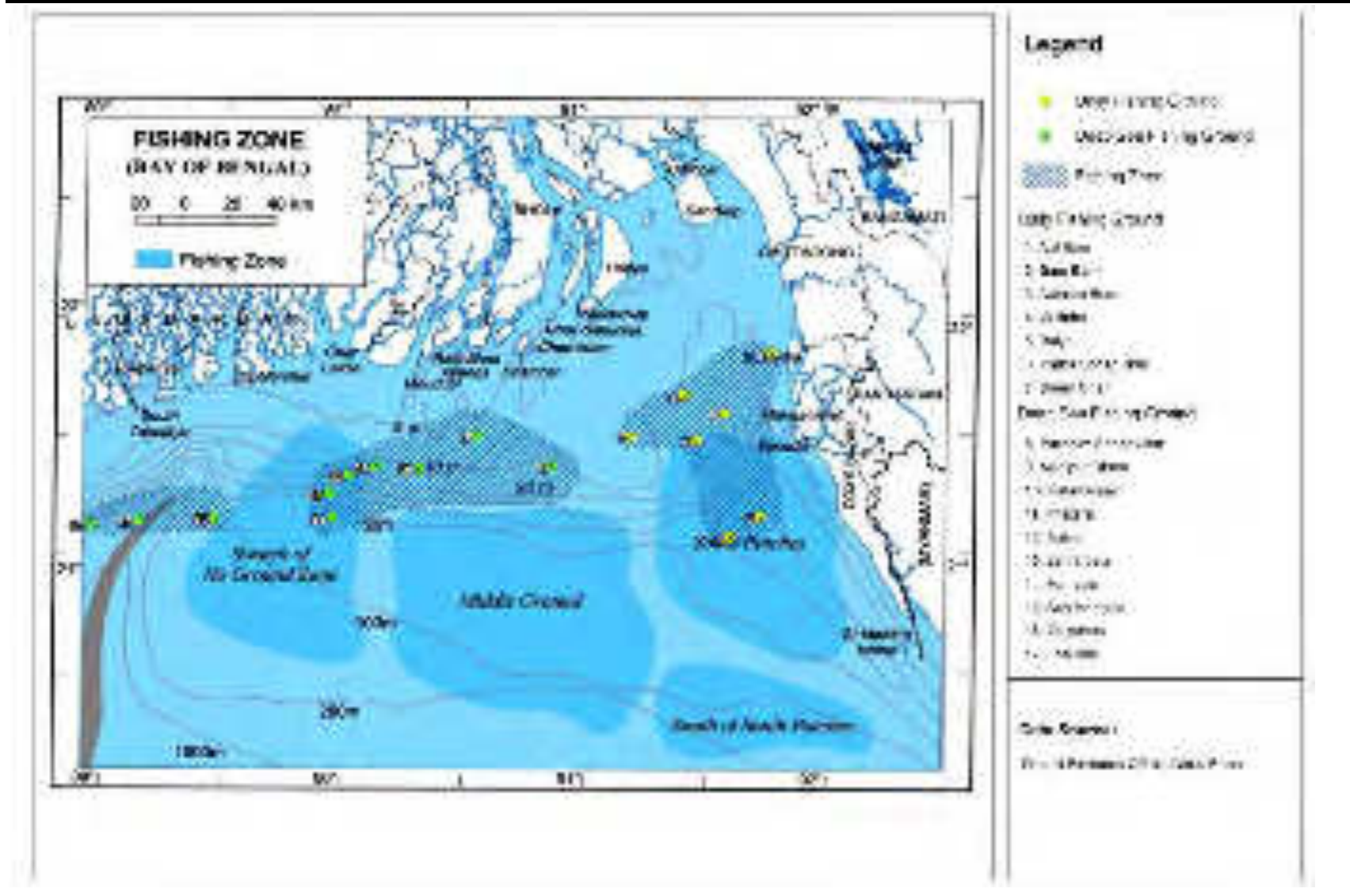
Box 4.5

Mapping of Fishing Grounds

Fishermen from three settlements of Dakshin Dhurung Union Parishad – *Dakshin Dhurung Jelepara, Madanyerpara and Ali Fakir Deil* were present for the FGD held at the Union Office. The group contributed some important information related to fishing practices, fish catch, fishing grounds and also participated in mapping of fishing grounds.



Figure 4.95 Fishing Zones as Demarcated by Fishermen



Source: District Fisheries Office, Cox's Bazar and FGDs with fishermen community

Fish Catch

In 2014 the estimated total fish catch in the country of Bangladesh was about 35.5 lakh Metric Ton ¹in which Marine Fisheries contributed 5.95 lakh Metric Ton of the total fish production of the country. It has been reported that over the last five years the 'capture fishery production' is decreasing at an average rate of 2.2 percent². The FRSS data reveals that in 2012-13 marine capture fish production was 5.88 lakh Metric Ton which is 17.3 percent of share and in 2013 -14 it reduced to 16.8 percent of the share. This has been further confirmed by the participating fishermen during the discussions. They were of the opinion that overall fish availability and fish catch has reduced in the recent years due to environmental changes. Discussions revealed that fish catch on sea varies with seasonality. A specific study on the 'Environmental and Social Vulnerabilities and Livelihoods of Fishing Communities of Kutubdia Island Bangladesh' ³ indicates that - the health of fisheries along the coast of Bangladesh has always been sensitive to changes in marine environment in Bay of Bengal. Sea surface temperatures have increased, slow sea level rise, cyclonic activities and increase in magnitude of both cyclones and storm surges have affected the coastal communities, specially those who are heavily dependent on fisheries for their livelihood are particularly vulnerable to these changes. A survey conducted during the study shows that 40 percent of the fishermen respondents said *Hilsa* fish (*Tenualosailisha*) catch has reduced followed by Shrimp (*Metapenaeusmonoceros*), *Loitta* (*Harpadonnehereus*), *Bhetki* (*Latescalcarifer*), etc. Overfishing has been cited as the prime reason for decrease in fish catch. However due to use of sophisticated fishing nets, climatic shift and catching fish fry are considered as the major causes behind fewer fish catch in Bay of Bengal.

Deep-sea Fishing

Fishermen venturing for deep-sea fishing sails as far as 300 km in winter and monsoon season for fishing, while in summer they try to fish closer to the coast (150 km approx.) due to frequent cyclonic whether conditions.

Table 4.45 *Fish Catch Based on Seasonality*

Season	Fish Catch Per Trip	
	kg	Metric Ton
Winter	10,000 - 12,000	10 - 12
Summer	4,000 - 6,000	4 - 6
Monsoon	10,000 - 12,000	10 - 12
Hilsa (during monsoon)	8,000	8

Source: Focus Group Discussion with Fishing community

¹ Source: FRSS, 2013-14

² Source: FRSS, 2013-14

³ Environmental and Social Vulnerabilities and Livelihoods of Fishing Communities of Kutubdia Island, Bangladesh, Dissertation Paper to Kent State University by Munshi Khaedur Rahman

As reported by the fishermen during the Fish Survey report the fishermen catch nearly 60-61 varieties of fish during deep-sea fishing out of which about 33 types of fishes are of low value and the rest are of high value

Daily Fishing

Small motorized boats and non-motorized boats are used for daily fishing; fish catch also depends on the availability of refrigerating arrangements in the boats. The small motorized boats usually have facilities of preserving fish catch with ice for 4-5 days. It was reported during the discussions with the fishermen that fish catch by small motorized boats with ices preservation varies between 30-40 kgs. While those fishermen who do daily fishing using non-motorized boats makes three trips a day; they sail out during the high tide - and in each trip they catch fish upto 15 kgs.

As reported by the fishermen during the Fish Survey report the fishermen catch nearly 30-31 varieties of fish during daily fishing in sea and Kutubdia Channel out of which about 20 types of fishes are of low value and the rest are of high value.

Figure 4.96 *Boats Returning with its Catch after Daily Fishing*



Foot Fishing

It is reported by key informant that foot fishing is mainly done using two types of fishing nets - push net and choto (small) Behundi jal. Push net is used to catch small shrimps during low tide; quantity of fish catch is very less and it is not meant for sell. This shrimp catch is for own family consumption. Choto Behundi jal is set along the shoreline to catch different kinds of small fish. The nets are set two time a day at the starting of high tide; fish catch is around 20-30 kgs.

The areas typically used for foot fishing / shoreline fishing is presented in **Figure 4.97**

Figure 4.97 Areas Typically used for Foot Fishing / Shoreline Fishing



Use of Nets

Fishing gears used by the fishermen of Bangladesh are depicted in the following figures that have been sourced from the Department of Fisheries. Interviews with the local fishermen revealed that they use push nets, and shrimp nets in Kutubdia Channel for catching shrimps and Grillnet for Hilsha (Ilish jal), Large Mesh Drift Gillnet (Maitya jal), different types of Setbag nets (Behundi jal, Undara jal, Choto Behundi jal) for different types of fish catch. Fishermen have also mentioned about using 'Chai jal' for catching crabs in Kutubdia Channel and 'Banrshi jal' (Long Line) for catching fish like Macarel in deep sea.

The different fishing nets are shown in Figure 4.98.

Figure 4.98 Fishing Nets



Source: Department of Fisheries, Bangladesh

Figure 4.99 Use of Fishing Gears



Consultation with fishermen at Ali Fakir Deil village regarding use of nets

Income from Fishing

Discussions with the fishermen during FGDs divulged that in winter season income from fish sell is higher than in summer and monsoon. In monsoon the income majorly depends and varies on Hilsa catch (*Table 4.46*).

Table 4.46 *Fish-sell Income*

Season	Income from Fish -sell (Tk) per trip
Deep-sea Fishing	
Winter	7-8 lakhs
Summer	2-2.5 lakhs
Monsoon	4-5 lakhs (depending on Hilsa catch)
Daily Fishing	
In all seasons (using motorized boats)	40,000 - 60,000
Daily fishing with non-motorized boats	500 - 600
Foot Fishing	
Foot fishing using <i>choto</i> Behundi jal	1000 - 1500

It was reported by the fishermen that the expenditure cost for undertaking one trip for deep-sea fishing is about 2 - 2.5 lakh Tk (Taka) in winter and 1.5 - 2 lakh Tk in summer and monsoon. This expenditure is incurred by owner of the trawlers. The owners of the trawlers for contractual fishing are either from Kutubdia island or they are from adjacent Upazilas, and district - Moheshkhali, Chittagong, etc. The boat owners do not go for deepsea fishing but hires all the first boat man (*majhi*), second boat man, Engine Driver, Master/Supervisor (*Garariya*) along with the fishermen. The entire deep sea fishing trips is financed by the boat owners.

The yearly income of a fisherman varies between 1.30 - 1.50 lakh Tk that includes all types of fishing. Contractual fishing involves people in different capacities and different role - first boat man (*majhi*), second boat man, Engine Driver, Master/Supervisor (*Garariya*) along with the fishermen.

Table 4.47 *Income from Contractual Fishing*

Person	Income per Year (Tk)
First Boatman	3-4 lakh
Second Boatman	1.5 - 2 lakh
Engine Driver	1 - 1.5
Master/Supervisor	1 - 1.5
Fisherman	80,000 - 90,000

Fish Selling Market

In Kutubdia there is no fish landing point; fish catch is usually sold on high-sea. As there is no electricity supply in the island preserving fish catch without ice or refrigeration is a major problem faced by the fishermen, and hence they sell their catch on sea. Trawlers and big boats come daily from Chittagong port region to purchase fish. There are three markets on high-sea where the fishermen sell their catch - *near Chittagong, near Cox's Bazar, Banskhali Bangla Bazar*. Apart from this there is another market on mainland *Chuarphari* near Pekua Bazar where fish catch from daily fishing is also sold by the fishermen.

Fishing Route

Fishing routes as followed by the fishermen when they venture into sea generally depends on the location of the settlement, where the fishermen reside and where the boats and trawlers are anchored. The routes followed by the fishing trawlers and boats from the respective unions are as follows:

Daksin Dhurung Union: Fishermen sail from the shoreline west of the union and sail west or south-west into deep sea for fishing. Same route if followed for daily fishing also.

Uttar Dhurung: The fishermen residing towards the western side of the union usually follow the same route - they start sailing from the western shoreline and they sail west or south-west to Bay of Bengal. During monsoon the fishermen of Uttar Dhurung sail through Kutubdia Channel to reach Bay of Bengal.

Boroghop: The union is located at south-east part of the Island Upazila. The fishermen from this union usually sail south through Kutubdia Channel and reach Bay of Bengal; in winter they use the western coastline for sailing into the sea for fishing.

Ali Akbar Deil: The union is at the southern part of the island and the fishermen use the eastern side, i.e. they sail through Kutubdia Channel to Bay of Bengal. The union has faced server erosions on south and south-western parts.

Anchorage

There are several anchorage points along the west coast, northern coastal line and on the north-eastern side of the island in Kutubdia Channel. There are several anchorage points along the eastern side near Boroghop. It was reported by the fishermen that during summer and monsoon the fishermen anchor their boats in Kutubdia Channel to avoid destruction from the frequent tropical cyclonic surges. It was observed during the side visits that there are several anchorage points along the west coastline of Dakshin Dhurung and Uttar Dhurung Union where boats and fishing nets are repaired.

Figure 4.100 demarcates the fishing routes whereas *Figure 4.101* marks the anchors points.

Figure 4.100 Fishing Routes as Used by the Kutubdia Fishermen



Figure 4.101 Anchorage Points as Used by the Kutubdia Fishermen



Figure 4.102 Anchorage Points in Kutubdia



Anchorage - Boroghop

Anchorage - Lemshikhali

Aquaculture

Aquaculture (shrimp cultivation) is also practiced in Kutubdia Island. During site visit it was observed in Uttar Dhurung and Dakshin Dhurung Union. Few families are involved in this activity as their secondary source of livelihood. Community Consultation revealed that 7 to 8 families from a group and take lease 20 to 22 gonda low laying land near the extended sea shore for Tk 10000 per season for 7 to 8 months and fill that land with saline water channelized from sea. They also invest 20000 to 25000 Tk for purchasing 80000-100000 shrimplets (seeds), among which 20000 to 25000 shrimplets die. Remaining seeds grow to the size of 100-120 gram in 3 to 4 month time. They sell that to mobile assembler, who is known as mahajan at 500 to 600 Tk/kg. For one season income of the group is 7 lakhs to 8 lakhs Tk.

Figure 4.103 *Aquaculture Practices in Kutubdia*



Fish Drying

Dried fish, typically known as '*sutki*' in Bangladesh, is an important component of the daily diet in Bangladesh and it has good domestic market. It was observed during site visit that many people all around Kutubdia Island are involved in fish drying activity. Fish drying generally starts in October and ends in March. Dry fish processor purchase fresh fish from the fishermen - major species of fish used for drying are *Loittya*, *Poa*, *Parse*, *Phasa*, *Taposi*, *Chhuri*, *Boiragi*, *Fatra*, *Rupchanda*, *Pama*. Fish drying is done under sun. There are two techniques of sun drying i.e. Horizontal drying, Vertical drying.

Horizontal drying: The main bulk of the catch consists of small fish which are dried on horizontal wooden racks raised about one meter above the ground. The fish are placed on mats and turned occasionally to prevent sticking to the mat

Vertical Drying: Big fishes like *Loittya*, *Chhuri*, *Bol* and Indian salmon are typically dried hanging from vertical wooden racks. Some small stingrays are

sliced into longitudinal strips which remain attached to the tail base, and the whole ray is hung by the tail from a vertical rack to dry.

A typical fish drying yard (locally named as *Shutki Mahal*) consists of a fenced area with a small house at one end which is used as store room. Dimension of yards varies widely. The fencing is made of bamboo poles and it is use both for demarcation line and vertical drying racks. Certain fish species dry much faster when hung vertically than when dried on horizontal racks. Bombay duck has high water content. It takes 12 days to dry on a horizontal rack, but only 6 days on a vertical rack. About 75-90 percent of a drying yard is covered by fish drying in a horizontal position. Typically the fish are dried on mats which are either placed to horizontal racks or directly on the ground.

The processors having their own drying houses (*Sutki Mahal*) earn 100,000 Tk to 200,000 Tk per season and laborers earn 3000 Tk. per month. About, 5-6 laborers work in each *Sutki Mahal*. Local processors sell their dried fish to mobile assembler, who known as mahajan.

Figure 4.104 *Fish Drying in Kutubdia*



4.18.8 Housing and Sanitation

As per the census data, majority (95percent) of the population with in study area lives in kuchcha structures. The material used for construction of houses

includes mud, bamboo, GI sheets, of which the most commonly used material is GI sheets.

With respect to ownership pattern, majority of the houses are self-owned in comparison to houses being rented out or under rent-free occupation.

As per the census information, the sanitation facilities with in study area comprises mostly of sanitary hardware with dry disposal mechanism. The facility was observed to be prevalent in more than 50percent of the households.

A smaller fraction (29.2percent) of the households was observed to be using sanitation facilities with water sealed latrines. Pit latrines with dry disposal without any sanitary hardware were observed only in 16.7percent of the households. Open defecation or absence of any form of sanitation facilities was observed in 4.6percent of the households.

4.18.9 Water and Power Supply

Most of the households are dependent on tube-well for drinking water supply. 95.2percent of households source their drinking water from tube-well and only 0.7percent depends on tap-water supply.

Only 8.6percent of the households in Kutubdia Island have electricity connection and almost 13.5percent household in Chhanua and Puichhari union has electricity connection.

4.18.10 Education Facility

As per district statistics, 2011, there are 32 government primary school, 24 registered primary school, 1 Government secondary school, 8 non-government secondary school, 1 non-government college is present in Kutubdia Upazila. In addition 7 madrasah, 4 kawmi madrasah and 14 ebte dayee madrasah also present in this Upazila.

Consultation with Upazila Education Department during social reconnaissance visit indicated that there are several educational institutions within the island Upazila – apart from general education madrasa education system is also followed. Although the education department has tried to align itself with the Millennium Development Goal (MDG) of 100 percent enrolment, which they have succeeded, however on the contrary the dropout rate is also high. Most of the boys drop out to earn from drying fish. The *Table 4.48* describes availability of educational institutional in Kutubdia Upazila.

Table 4.48 *Educational Infrastructure Available in Kutubdia Island*

SN	Educational Infrastructure	Number
1.	Govt. Primary School	59
2.	Private KG School	41
3.	Learning Centres for Dropouts	118
4.	Nimnya Madhyamik (Upper Primary level)	1
5.	High School (Secondary level)	8
6.	College (10+2 level)	2
7.	Primary level Madrasa schools	11
8.	Madhyamik level Madrasa (Secondary level)	7
9.	Higher Secondary level Madrasa	1
10.	Degree level Madrasa	1
11.	Vocational College	1

Source: Upazila Education Office

At least one primary school and madrasa is present within the union boundary

4.18.11 Health Facility

The health facilities of the Kutubdia Upazila include:

- Upazila Health Complex – 1 No.
- Union Health Centre – 6 Nos. and
- Private Clinic- 1 No.

4.18.12 Financial Institutions

The Kutubdia Upazila has 4 Nationalised Banks

4.18.13 Cultural Heritage

Birth of Saint Hazrat Abdul Malek Shah makes the Kutubdia Island famous. There are certain cultural and religious sites - Ek Hatia Fakirer Masjid, Kalarma Masjid, Maharaja Kazir Masjid, Tomb of Qutb Auliya in Kutubdia. These places are of local cultural importance but are not having any regional / national importance or archaeological significance. The island is also famous for its Lighthouse that was built during the British period in 1896 and much later eroded by the sea.

A private graveyard has been identified during the site visit west of the present lighthouse on the sand beach portion. The graveyard along with portion on the western part of Dakshin Dhurung union was subject to sea erosion due to cyclonic surge; part of the graveyard was reclaimed later and was demarcated by wooden poles by the villagers, where they often visit to seek blessings from their late forefathers.

Figure 4.105 Cultural Heritage Sites on Kutubdia Island



Ek Hatia Mosque - Located on the Way to the Site



Tomb of Kutub Aulia (Ali Akbar Deil)



Kalarma Mosque (Uttar Dhurung)



Graveyard located north of the proposed site

This section identifies and assesses the potential impacts in the environment that could be expected from the proposed LNG project at Kutubdia Island in Bangladesh. The impacts due to the Project activities across different phases have been identified and assessed. The Project activities will impact the physical, social and ecological environment in two distinct phases:

- a. Construction¹
- b. Operation

Impacts are identified and predicted based on the analysis of the information collected from the following:

- Project information (as outlined in *Section 3*);
- Baseline information (as outlined in *Section 4*).

The identification of likely impacts during construction and operation phases has been carried out based on likely activities having their impact on environmental and socio-economic parameters. The details of the activities and their impacts have been worked out in the following sections.

The next section discusses in detail the impact assessment methodology adopted as part of ESIA process for the proposed LNG Project.

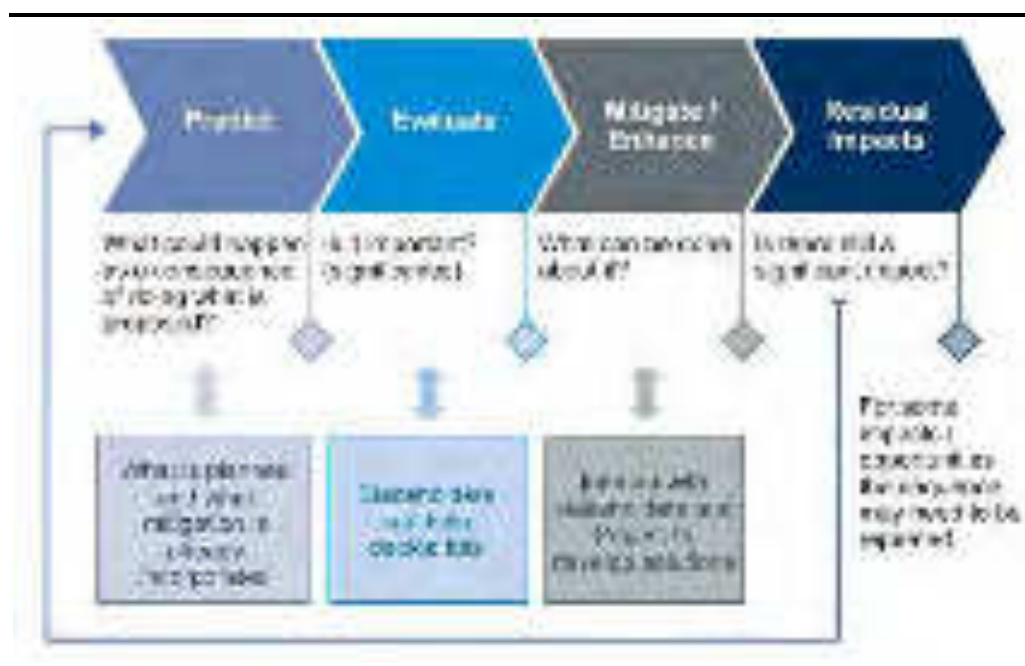
5.1 *IMPACT ASSESSMENT METHODOLOGY AND APPROACH*

Impact identification and assessment starts with scoping and continues through the remainder of the impact assessment process (IAP). The principal impact assessment (IA) steps are summarized in *Figure 5.1* and comprise:

- **Impact prediction:** to determine what could potentially happen to resources/receptors as a consequence of the Project and its associated activities;
- **Impact evaluation:** to evaluate the significance of the predicted impacts by considering their magnitude and likelihood of occurrence, and the sensitivity, value and/or importance of the affected resource/receptor;
- **Mitigation and enhancement:** to identify appropriate and justified measures to mitigate negative impacts and enhance positive impacts;
- **Residual impact evaluation:** to evaluate the significance of impacts assuming effective implementation of mitigation and enhancement.

¹ Social impacts associated with the pre-construction phase of the Project have also been covered under the construction phase.

Figure 5.1 Impact Assessment Process



Prediction of Impacts

Prediction of impacts is essentially an objective exercise to determine what could potentially happen to the environment as a consequence of the project and its associated activities. This is essentially a repeat of the process undertaken in scoping, whereby the potential interactions between the project and the baseline environment are identified. From these potential interactions, the potential impacts to the various resources/receptors are identified, and are elaborated to the extent possible. The diverse range of potential impacts considered in the IA process typically results in a wide range of prediction methods being used including quantitative, semi-quantitative and qualitative techniques. The nature and types of impacts that has been addressed in this EIA is defined in the **Box 5.1** below.

Box 5.1 Nature and types impacts considered for impact assessment

- **Negative**, when impact is considered to represent adverse change from the baseline or introduced a new undesirable factor; and
- **Positive or beneficial**, when impact is considered to represent improvement to baseline or introduced a new desirable factor;
- **Direct**, impacts that result from a direct interaction between the project and a resource/ receptor;
- **Indirect**, impacts that follow on from the direct interactions between the project and its environment as a result of subsequent interactions within the environment; and
- **Induced**, impacts that result from other activities (which are not part of the project) that happen as a consequence of the project.

Evaluation of Impacts

In assessing the significance of impact, the following impact characteristics are taken into consideration:

Determining Magnitude of an impact

Magnitude, i.e. severity of an impact or degree of change caused by a project activity is a function of one or more of the following characteristics:

- *Scale*: Degree of damage that may be caused to the environmental components concerned;
- *Extent*: The extent refers to spatial or geographical extent of impact due to proposed project and related activities;
- *Duration*: The temporal scale of the impact in terms of how long it is expected to last.

Criteria have been defined for each of these key elements and classified based on the level of impacts (low, medium and high) on the environmental component, presented in *Table 5.1* below:

Table 5.1 Prediction Criteria

Impact Elements	Criteria	Ranking
Scale	• Irreversible damage to natural environment and/or likely difficult or may not to revert back to earlier stage with mitigation;	High
	• Major changes in comparison to baseline conditions and / or likely to regularly or continually exceed the standard;	Medium
	• Reversible damage to natural environment but likely to easily revert back to earlier stage with mitigation;	
	• Perceptible change from baseline conditions but well within acceptable norms.	Low
	• Effect is within the normal range of natural variation;	
	• No perceptible or readily measurable change from baseline conditions;	
Extent	• Project site and the entire study area (10.0 km from FSU, ORF & pipeline)	National
	• Project site & its surroundings (2.0 km from FSU, ORF & pipeline)	Regional
	• Project site & its immediate vicinity (0.5 km from FSU, ORF & Pipeline)	Local
Duration	• Spread beyond the lifecycle of the project	Long term
	• Spread across several phases of the project lifecycle	Medium term
	• Only during particular activities or phase of the project lifecycle	Short term

Magnitude essentially describes the intensity of the change that is predicted to occur in the resource/receptor as a result of the impact. The magnitude combines the impact characteristics of Extent, Duration and Scale and is a multiplicative factor of these three criteria set. Based on the above understanding magnitude of impact is assessed as per the *Table 5.2*.

Table 5.2 Assessing Magnitude of Impact

Extent	Duration	Scale	Magnitude
Local	Short Term	Low	Negligible
Regional	Short Term	Low	Small
Local	Medium term	Low	Small
Local	Short Term	Medium	Small
National	Short Term	Low	Small
Local	Long term	Low	Small
Local	Short Term	High	Small
Regional	Medium term	Low	Small
Regional	Short Term	Medium	Small
Local	Medium term	Medium	Small
National	Medium term	Low	Medium
National	Short Term	Medium	Medium
Regional	Long term	Low	Medium
Regional	Short Term	High	Medium
Local	Long term	Medium	Medium
Local	Medium term	High	Medium
Regional	Medium term	Medium	Medium
National	Long term	Low	Medium
National	Short Term	High	Medium
Local	Long term	High	Medium
National	Medium term	Medium	Large
Regional	Long term	Medium	Large
Regional	Medium term	High	Large
National	Long term	Medium	Large
National	Medium term	High	Large
Regional	Long term	High	Large
National	Long term	High	Large

Magnitude of impact is assessed as negligible only when no discernible impact is assessed.

Determining Sensitivity/ Importance/ Vulnerability of Receptor

In addition to characterising the magnitude of impact, the other principal step necessary to assign significance for an impact is to define the sensitivity/ vulnerability/ importance of the impacted resources/ receptor. There are a range of factors to be taken into account when defining the sensitivity/ vulnerability/ importance of the resource/ receptor, which may be physical, biological, cultural or human as per the following understanding:

- Where the resource is physical (for example, fresh water body) its quality, sensitivity to change and importance (on a local, regional, national importance) are considered;
- Where the resources/ receptor is biological or cultural (for example, sea turtle habitat and nesting site), its importance (for example local, regional or national importance) and its sensitivity to the specific type of impact are considered;
- Where the receptor is human, the vulnerability of the individual, community or wider societal group is considered.

Definition as defined in *Table 5.3* has been adopted to determine sensitivity/ importance/ vulnerability of environmental resources or receptor.

Table 5.3 *Sensitivity/Importance/ Vulnerability Criteria*

Sensitivity Criteria	Contributing Criteria
High	<ul style="list-style-type: none"> Existing physical environment quality is already under stress; Ecologically sensitive/ protected area, provides habitat for globally protected species; Profound or multiple levels of vulnerability that undermine the ability to adapt to changes brought by the project. Human receptors/ vulnerable community are located within the project footprint and directly affected by the project Resource exclusive for community use
Medium	<ul style="list-style-type: none"> Existing physical environment quality shows some sign of stress; which is sensitive to change in quality or physical disturbance; Natural habitat provides habitat for wildlife, which are protected under National regulations; Some, but few areas of vulnerability; still retaining an ability to at least in part adapt to change brought by the project. Human receptors/ vulnerable community are located adjacent the project site and likely to be affected by the project Alternative resource available with community
Low	<ul style="list-style-type: none"> Existing physical environment quality is good; Modified habitat provides habitat for common species; Human receptors are located away and are not likely to be affected due to the project related activities

Evaluating Significance of Impacts

Once magnitude of impact and sensitivity/ vulnerability/ importance of resource/ receptor have been characterised, the significance was assigned for each impact. Impact significance is designated using the matrix shown in *Figure 5.2*

Figure 5.2 *Assessing Significance of Impact due to Proposed Project Related Activities*

		Sensitivity /Vulnerability / Important Resource / Receptor		
		Low	Medium	High
Magnitude of Impact	Negligible	Negligible	Negligible	Negligible
	Small	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Major
	Large	Moderate	Major	Major

The matrix applies universally to all resources/receptors, and all impacts to these resources/receptors, as the resource/receptor-specific considerations are factored into the assignment of magnitude and sensitivity/vulnerability/ importance designations that enter into the matrix *Box 5.2* provides a context for what the various impact significance ratings signify.

An impact of **negligible** significance is one where a resource/receptor (including people) will essentially not be affected in any way by a particular activity or the predicted effect is deemed to be 'imperceptible' or is indistinguishable from natural background variations.

An impact of **minor** significance is one where a resource/receptor will experience a noticeable effect, but the impact magnitude is sufficiently small (with or without mitigation) and/or the resource/receptor is of low sensitivity/ vulnerability/ importance. In either case, the magnitude should be well within applicable standards.

An impact of **moderate** significance has an impact magnitude that is within applicable standards, but falls somewhere in the range from a threshold below which the impact is minor, up to a level that might be just short of breaching a legal limit. Clearly, to design an activity so that its effects only just avoid breaking a law and/or cause a major impact is not best practice. The emphasis for moderate impacts is therefore on demonstrating that the impact has been reduced to a level that is as low as reasonably practicable (ALARP). This does not necessarily mean that impacts of moderate significance have to be reduced to minor, but that moderate impacts are being managed effectively and efficiently.

An impact of **major** significance is one where an accepted limit or standard may be exceeded, or large magnitude impacts occur to highly valued/sensitive resource/receptors. An aim of IA is to get to a position where the Project does not have any major residual impacts, certainly not ones that would endure into the long-term or extend over a large area. However, for some aspects there may be major residual impacts after all practicable mitigation options have been exhausted (i.e. ALARP has been applied). An example might be the visual impact of a facility. It is then the function of regulators and stakeholders to weigh such negative factors against the positive ones, such as employment, in coming to a decision on the Project.

Identification

Identification of Mitigation and Enhancement Measures

Once the significance of an impact has been characterised, the next step is to evaluate what mitigation and enhancement measures are warranted. For the purposes of this IA, ERM has adopted the following Mitigation Hierarchy:

- **Avoid at Source;** Reduce at Source: avoiding or reducing at source through the design of the project;
- **Abate on Site:** add something to the design to abate the impact;
- **Abate at Receptor:** if an impact cannot be abated on-site then control measures can be implemented off-site;
- **Repair or Remedy:** some impacts involve unavoidable damage to a resource and these impacts can be addressed through repair, restoration or reinstatement measures;
- **Compensate in Kind, compensate through other means:** where other mitigation approaches are not possible or fully effective, then compensation for loss, damage and disturbance might be appropriate.

The priority in mitigation is to first apply mitigation measures to the source of the impact (i.e., to avoid or reduce the magnitude of the impact from the associated Project activity), and then to address the resultant effect to the resource/receptor via abatement or compensatory measures or offsets (i.e., to reduce the significance of the effect once all reasonably practicable mitigations have been applied to reduce the impact magnitude).

Residual Impact Evaluation

Once mitigation and enhancement measures are declared, the next step in the IA 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 declared mitigation and enhancement measures.

Management and Monitoring

The final stage in the IA Process is definition of the management and monitoring measures that are needed to identify whether: a) impacts or their associated Project components remain in conformance with applicable standards; and b) mitigation measures are effectively addressing impacts and compensatory measures and offsets are reducing effects to the extent predicted.

A Environmental Management Plan, which is a summary of all actions which the Project Proponent has committed to executing with respect to environmental/social/health performance for the Project, is also included as part of the EIA report. The Environmental Management Plan includes mitigation measures, compensatory measures and offsets and management and monitoring activities.

5.2 IDENTIFICATION OF POTENTIAL IMPACTS

The potential impacts have been identified through a systematic process whereby the activities (both planned and unplanned) associated with the Project have been considered with respect to their potential to interact with environmental and social resources or receptors.

The interaction matrix enables a methodical identification of the potential interactions each Project activity may have on the range of resources/receptors within the Area of Influence i.e. the study area for the Project.

Table 5.4 Impact Identification Matrix for FSRU Project

Project Activity/ Hazards																							
	Environmental Resources											Ecological Resource			Social-Economic Resources								
	Aesthetic & Visual Impact	Land Use	Soil/ Sediment Quality	Air Quality	Noise & Vibration	Topography & Drainage	Surface water resource	Surface water quality	Ground water resource	Ground water quality	Traffic (road & river)	Terrestrial Flora & Fauna	Aquatic Flora (Inland & Marine)	Aquatic Fauna (Inland & Marine)	Migratory Route/ Corridor	Job & economic opportunity	Economy & Livelihoods	Social & Cultural Structures	Land Use (Economic Displacement)	Infrastructure & Services	Cultural Resources	Community Health & Safety	Occupational health & safety
Construction Phase																							
Construction of FSU																							
Setting up of FSU including initial discharge of ballast water																							
Construction of land based facilities																							
Land Purchase/ Acquisition																							
Site Clearing																							
Filling of land																							
Building of structures including temporary structures																							
Laying on Onshore pipeline and testing																							
Construction of trestle																							
Associate Activities																							
Heavy equipment operations																							
Storage, handling and disposal of waste																							
Generation of sewage and discharge																							
Influx of construction workers																							
Transportation of manpower, equipment & materials over water or by road																							
Storage and handling of chemicals (unplanned release)																							

Project Activity/ Hazards																							
	Environmental Resources											Ecological Resource				Social-Economic Resources							
	Aesthetic & Visual Impact	Land Use	Soil/ Sediment Quality	Air Quality	Noise & Vibration	Topography & Drainage	Surface water resource	Surface water quality	Ground water resource	Ground water quality	Traffic (road & river)	Terrestrial Flora & Fauna	Aquatic Flora (Inland & Marine)	Aquatic Fauna (Inland & Marine)	Migratory Route/ Corridor	Job & economic opportunity	Economy & Livelihoods	Social & Cultural Structures	Land Use (Economic Displacement)	Infrastructure & Services	Cultural Resources	Community Health & Safety	Occupational health & safety
Operation Phase																							
Fugitive emission from FSU & LNG Terminal																							
Emission from captive power plant																							
Emission from LNG carrier ship																							
Illumination from ORF, Trestle and FSU																							
Physical presence of FSU (Safety zone) and trestle																							
Noise generation due to operation of plant and auxiliaries																							
Generation and discharge of cooling water Captive Power Plant																							
Generation and discharge of Ballast & Bilge water from FSU/ LNG Carrier ship																							
Generation of domestic waste water and discharge from FSU, onshore facility																							
Industrial and domestic water demand for operation of facilities																							
Wastewater discharge/ disposal																							
Wastes - domestic waste and other non-hazardous wastes handling, storage																							
Hazardous material and waste storages																							

- = Represents "no" interactions is reasonably expected
- = Represents interactions reasonably possible but none of the outcome will lead to significant impact impacts
- = Represents interactions reasonably possible with one of the outcomes may lead to potential significant impact

5.3 POTENTIAL IMPACT

5.3.1 Potential Impact on Aesthetics and Visual Quality

Construction Phase

Source of Impact: The sources aesthetics and visual impacts can result from:

- Raising of land – ORF;
- Storage of construction materials;
- Storage and disposal of construction waste, municipal waste;
- Physical presence of labour camp;
- Earth work along the pipeline route;
- Dust deposition in the nearby property/ vegetation;
- Disposal of HDD cut material generated from pipeline lying.

Embedded Control Measures: The project embedded control measures are as follows:

- Storage facility for construction materials will be provided within the proposed project site;
- Labour camp will be set up in within the proposed project site with sanitation facility, solid waste collection facilities.

Assessment of Impact: The construction materials will be stored in covered sheds as well as in open stockpiles; these will be visible from nearby settlements like Ali Fakir Deil, Kaiyabil etc. It is understood that the material would be sourced from maintenance dredging activity of Chittagong Port. It is proposed that the labour camp for the proposed project will be setup within the proposed site, which is presently open and can be visible from nearby localities; this may causes visual and aesthetic impact on the nearby villages.

Large volume of fill materials (white sand) will be unloaded from vessels and same will be used for filling of land. Handling of such large volume of fill materials will generate fugitive dust and same will be deposited in the nearby vegetation and property, this will create visual and aesthetic impact of the locality.

The villages near the project site have no solid waste disposal site; as a practice most of the organic waste is disposed within the homestead land for manure and the other wastes are either recycled or disposed in their own premises. It is estimated that, 15 kg/day of MSW will be generated from the labour camp/ construction site. The disposal of MSW in open area around the village can create nuisance.

Earth work (excavation and stacking of soil) for laying of pipeline and well as stacking of pipeline in the staging areas will also create visual impacts along the proposed pipeline. It is also proposed to use the HDD technology to lay the pipeline across the Kutubdia Channel; this is expected to generate large volume of cuttings. It is likely to be disposed on the land. Therefore, disposal of HDD cutting is also expected to cause visual and aesthetic impacts.

The environmental setting of the area reveals that the Kutubdia Island has a typical rural setting with flat terrain (agricultural land and salt pans) with small settlements and homestead plantation. The people have never experienced large scale industrial / developmental activity on the island. The above mentioned activities will create measurable changes of the environmental setting. The construction activity will be a short term activity. Its impact may be limited 1 km around the ORF facility and 0.5 km area along the pipeline route. The aesthetics and visual impact is assessed to be moderate.

Mitigation Measures: The mitigation measures to minimise the above mentioned impacts are as follows:

- Entire ORF facility will be fenced with bamboo mat or tin sheet;
- All the construction activities will be restricted within the designated site;
- Fugitive dust will be suppressed with periodic water sprinkling;
- On completion of work all temporary structures, surplus materials and wastes will be completely removed from site and disposed at a designated area;
- Construction wastes and municipal solid waste temporarily stored at the sites will be transported to the designated disposal site/facility at regular intervals.

Impact	Aesthetic and visual impact due to construction activity			
Impact Nature	Negative		Positive	Neutral
Impact Type	Direct		Indirect	Induced
Impact Duration	Short Term		Medium Term	Long Term
Impact Extent	Local		Regional	National
Impact Scale	Low		Medium	High
Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low		Medium	High
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered Moderate			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations)	Significance of impact is considered Minor .			

Residual Impact: Considering the implementation of above mentioned mitigations measures the residual impact is assessed to be **minor**.

Operational Phase

Source of impact: The sources of aesthetics and visual impacts can result from:

- Physical presence of the ORF;
- Physical presence of 2.4 km long Trestle with Cryogenic Pipeline (10 -12m height);
- Illumination from the LNG facility.

Embedded Control Measures: Project embedded control measures include:

- Development of greenbelt at the periphery of the ORF

Assessment of Impact: It is proposed that the land will be elevated to eight meter for the ORF facility. Onshore gas receiving facility, control building, gas based captive power plant with 43 m height stack, admin building, jetty will be constructed within the area demarcated for land based facilities. It is also proposed to construct 2.4 km long trestle with cryogenic pipeline from ORF to the FSU, which is located in the sea. The physical presence of the ORF, pipeline, FSU can be visible from 2-3 Km distance from the proposed facilities.

All the project facilities will have bright illumination arrangements. The study area typically represents a rural setting with no industrial presence – more so the settlements close to the site like Ali Akbar Deil, Bindapara have no power supply. The illumination in the project facilities is likely to cause major changes of environmental settings of the area. The physical presence of such facilities as well as illumination can be noticed from quite some distance (2-3 km) throughout the lifecycle of the project. The impact of aesthetics and visual quality is assessed to be **moderate**.

Mitigation Measures: The mitigation measures to minimise the above mentioned impacts are as follows:

- Appropriate shading of lights to prevent scattering.

Impact	Aesthetic and visual impact due to operational phase activities			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Short Term	Medium Term	Long Term	
Impact Extent	Local	Regional	National	
Impact Scale	Low	Medium	High	
Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High	
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered Moderate			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations)	Significance of impact is considered Moderate .			

Residual Impact: Considering the implementation above mentioned mitigations measures the residual impact is assessed to be **moderate**.

5.3.2 Potential Impact on Land Use

Source of impact: The land use impacts can result from:

- Procurement of land for ORF (agricultural/ saltpans/ sea beach);

- Temporary loss of agricultural / saltpan activity during laying of pipeline;
- Restriction of land use along the pipeline corridor.

Assessment of Impact: The total land requirement for the ORF facility is 40 acres. The project site land use data reveals that (Refer: Section 3.7.3) agricultural land, salt pans, sea-beach land and possibly homestead land will be permanently converted into industrial land for the purposes of this project. This will result in permanent change in land use.

The total length of onshore pipeline is 17 km. The total land required for the pipeline is estimated to be 34 acres. The land use data along the pipeline corridor reveals that a total of 27.6 acres of private land (6.6 acres of agricultural land, 9 acres of salt pan land and 12 acres of sandy beach and other land) will be permanently acquired for laying the onshore pipeline. The Govt. land required is 6 acres. During this period the existing uses of the land like agriculture, salt production, etc. may get restricted. It is expected to be a temporary change in land use and the land can be utilised for its original use after the pipeline laying process has been completed. The impact of land use changes is assessed to be **minor**.

The impact on land use will primarily be with associated socio-economic impacts on the land loser, and is discussed later in the report in Section 5.3.11.

Mitigation Measures: The mitigation measures to minimise the above mentioned impacts are as follows:

- Immediate restoration of land to original state after completion of pipeline laying activity along with complete removal of all construction material and waste

Impact	Land use impact due to ORF and Pipeline			
Impact Nature	Negative		Positive	Neutral
Impact Type	Direct		Indirect	Induced
Impact Duration	Short Term		Medium Term	Long Term
Impact Extent	Local		Regional	National
Impact Scale	Low		Medium	High
Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low		Medium	High
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered Minor			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations)	Significance of impact is considered Minor			

Residual Impact: Considering the implementation of above mentioned mitigations measures the residual impact is assessed to be **minor**.

5.3.3 *Potential Impact on Soil Quality*

Construction phase

Source of Impact: The impacts on soil quality can result from:

- Removal of top soil from the ORF area and pipeline route;
- Disposal of construction waste/ MSW/ HDD cutting;
- Spillage of chemical/ oil on open soil.

Embedded Control Measures: The project embedded control measures are as follows:

- Construction waste will be utilised for filling of project site;
- Municipal solid waste generated from the labour camp and construction site will be transferred to the disposal site in consultation with the Union Parishad;
- Fuel, chemical and lubricant will be stored in paved storage areas.

Assessment of Impact: The project site (ORF facility and onshore pipeline) land use data shows that agricultural land will be utilised for the project. Before construction activity, the top soil of the agricultural land if not properly stripped and stored for future use, the entire volume of top soil will be permanently lost with expected change in fertility/soil characteristics.

Fuels, lubricant, paints, etc., would be stored at designated paved areas. Thus the contamination of soil can happen only due to accidental spillage of fuel, lubricants and paints from storage areas and during transfer of fuels and chemicals. However, in case of a spill, the restoration of top soil is usually difficult and a time taking activity.

The primary monitoring results of soil quality results shows that there was no contamination of heavy metals and other soil contaminants in the nearby agricultural land (*Refer Section 4.5.5*). The above mentioned soil quality impacts will be localised within the project site or in the immediate vicinity. The potential impact on soil quality is assessed to be **minor**.

Mitigation Measures: The mitigation measures to minimise the above mentioned impacts are as follows:

- Properly stripping of top soil and conserve it for future use (greenbelt development or reclaim the agricultural land along the pipeline);
- Restrict project and associated activities within acquired land;
- The drainage system at site is to be provided with sedimentation tank and oily-water separator to prevent contaminants, especially oil and grease, from being carried off by surface runoff;
- Manage spills of contaminants on soil using standard engineering practices.

Impact	Soil quality impact due to construction activities			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Short Term	Medium Term	Long Term	
Impact Extent	Local	Regional	National	
Impact Scale	Low	Medium	High	
Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High	
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered Minor			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations)	Significance of impact is considered Negligible .			

Residual Impact: Considering the implementation of above mentioned mitigation measures, impact on soil quality is assessed to be **negligible**.

Operational Phase

Source of Impact: Potential impact on soil quality can arise due to:

- Accidental spillage of fuel & lubricant from storage facility or from transport vehicles;
- Improper storage and disposal of STP sludge, hazardous waste;
- Surface runoff from spillage area into nearby agricultural fields and or open land;

Embedded Controls: The project embedded control measures are as follows:

- The sludge generated from the STP will be temporarily stored in pits within the ORF and periodically transferred to the waste disposal facility of Chittagong Port;
- Impervious storage area, especially for storage of fuel & lubricant, hazardous waste, etc. will be prepared;
- Storm water drainage system to capture the surface runoff through properly graded garland drains and finally channelize the runoff into the sea. The drainage system will be designed with sedimentation tank to arrest silt load.

Assessment of Impact: The fuels, lubricant, chemical, etc., would be stored at a designated area within the facility which is paved. Thus the contamination of soil can happen only due to accidental spillage of fuel, lubricants and chemicals from storage areas and during the transfer of fuels and chemicals. The surface runoff from spillage site to nearby agricultural land or open land can lead to contamination of soil.

The sludge generated from the STP, cleaning of LNG storage tank will be stored in pits with impervious liners and same will be periodically transferred to the disposal facility of the Chittagong port. Improper handling and mixing with surface runoff water can lead to contamination of soil in nearby areas. The primary soil quality monitoring results shows that, nearby soils were not contaminated (*Refer: Section 4.5.5*) with heavy metals and other contaminants. The soil contamination from the above mentioned activities can affect the soil quality of nearby areas. Such contamination (if they occur) may have long term effect on the soil quality. Considering project embedded control measures, contamination of soil can happen only during accidental cases or in case of improper management. The potential impact on soil quality is thus assessed to be **Minor**.

Mitigation Measures: The following mitigation measures will be implemented:

- Ensure proper spill control and management at site;
- Monitor and detect any contamination on soil & ground water;
- Good housekeeping to prevent spillage and runoff from site;
- Ensure the disposal of waste into designated storage and disposal area.

Impact	Soil quality impact due to operational activities			
Impact Nature	Negative		Positive	Neutral
Impact Type	Direct		Indirect	Induced
Impact Duration	Short Term		Medium Term	Long Term
Impact Extent	Local		Regional	National
Impact Scale	Low		Medium	High
Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low		Medium	High
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered Minor			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations)	Significance of impact is considered Minor .			

Residual Impact: Considering the implementation of above mentioned mitigation measures, impact on soil quality is assessed to be **Minor**.

5.3.4 Potential Impact on Physiography & Drainage

Construction Phase

Source of Impact: The potential impact on physiography and local drainage may arise due to:

- Raising of land for ORF up to 8 m;
- Laying of pipeline along the agricultural land; crossing of drainage channels/ nalas (minor streams), etc.

Embedded control Measures: The project embedded control measures are as follows:

- Storm water drainage structure will be provided to drain all the surface runoff into the sea.

Assessment of Impact: The propose ORF facility is situated on both side of the existing earthen embankment. The height of the flood protection embankment is approximately 3.0m. The topography of the main island indicates low lying flat terrain with general slope towards the Pilat Katakhal. Areas on the western side of the coastal embankment drain towards the sea.

Construction of the ORF site will entail the raising of the existing ground level by 8.0 from existing ground level. This will result in considerable change in the existing local physiography, given the fact that the area being considered for the project is flat agricultural land now with a gradual slope towards the west. The excess runoff water from the agricultural fields drains through lower surfaces along the embankment and finally discharges into the Pilat Katakhal through micro-drainage channels. The raising of land for ORF may disturb the low laying areas and its drainage slope towards west.

It is also proposed to lay 17 km onshore buried pipeline. During laying of pipeline, earth work (excavation and stacking of cut material) may block the micro-drainage channels. After, completion of pipeline laying, if the earth materials are not properly cleared, micro-drainage of the area may be disturbed. Physical presence of ORF facility would be for the entire life cycle of the project (long term). The impact on topography and drainage assessed to be **Moderate**.

Mitigation Measures: The proposed mitigation measures are as follows:

- Provide drainage system for the eastern side of the ORF to maintain the micro-drainage of area;
- Reclaim the site after completion of the pipeline laying;
- Maintain the cross drainage structure along the pipeline route.

Impact	Physiography & drainage impact due to physical presence ORF			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Short Term	Medium Term	Long Term	
Impact Extent	Local	Regional	National	
Impact Scale	Low	Medium	High	
Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High	
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered Moderate			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations)	Significance of impact is considered Minor			

Residual Impact: Considering the implementation of above mentioned mitigation measures, impact on topography and micro drainage is assessed to be **minor**.

5.3.5 *Potential Impact on Air Quality*

Construction Phase

Source of Impact: Potential impact on ambient quality could arise due to:

- Site development;
- Operation of vehicles and construction machinery;
- Construction material transport, storage, handling and construction waste disposal;
- Operation of diesel generator (DG) sets.

Embedded Control Measures: project embedded control measures are as follows:

- Vehicle, equipment and machinery used for construction would conform to applicable emission norms.

Assessment of Impact:

As discussed under Section 3 on Description of the Project, the land where the ORF is proposed comprises of predominantly agricultural land along with salt pans, sandy beach area, etc. For site development the entire area will be raised above the HFL. Silver sand will be utilised for filling up the land. It is also proposed to strip the top soil before site development. Stripping of top soil and filling of land will require operation of earth moving equipment like loaders, poclains, dumpers etc. and will result in emission of sufficient amount of dust and particulate matter. The generation and dispersion of fugitive dust from construction site will depend upon prevailing wind conditions and is likely to get aggravated during the dry season.

Power required for construction activities will be sourced from DG sets. The operation of back up DG sets will generate the PM, NO₂ and SO₂. Exhaust emission from operation of machinery and vehicles are likely to contribute to air pollutant load (primarily particulate matter (PM), NO_x, SO₂, CO etc.). The pollutants, especially particulate matter, will be settled in areas surrounding proposed project site and this activity will be continuing along the entire duration of the construction phase. The major part of the construction material, i.e. fill material will be transported through water ways. Therefore, fugitive emission due to operation of vehicle will be lower compared to transport of entire construction material through roadways. The dispersion of these air pollutants may affect receptors viz. village settlements located in near vicinity like Ali Fakir Deil, Bindapara, etc.

The baseline air quality monitoring results shows that concentration of PM, SO₂, NO₂ was well within the National Ambient Air Quality Standards (NAAQS) indicating that the environment is not stressed (*Refer Section 4.14*). The generation of PM, SO₂, NO₂ from the above mention activities will not

cause significant changes to baseline conditions or result in exceedance NAAQS. The duration of the construction activity will be medium term (24-36 months). The fugitive emissions are likely to be dispersed locally. The potential impact on air quality is assessed to be **minor**.

Mitigation Measures: The proposed mitigation measures are as follows:

- The construction materials will be stored away from nearby human settlement (particularly Ali Fakir Deil) so that the maximum possible distance between the stock yard and receptors is maintained. Further efforts will be made to maintain the stockpile against a wall or obstruction so that it works as a windbreak and fugitive emissions during strong winds can be avoided;
- During construction, the approach /access road will be kept clean, free from mud and slurry to prevent any entrainment of dust;
- Waste from construction site will not be burned;
- Location of construction material stockpiles will be sufficiently away from nearby worker's camps;
- All loading and unloading activities to be carried out as close as possible to the storage facilities;
- Proper handling of materials to ensure minimal emission of dust.

Impact	Air quality impact due to construction activities			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Short Term	Medium Term	Long Term	
Impact Extent	Local	Regional	National	
Impact Scale	Low	Medium	High	
Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High	
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered Minor			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations)	Significance of impact is considered Negligible .			

Residual Impact: Considering the implementation of above mentioned mitigation measures, the residual impact on ambient air quality is assessed to be **negligible**.

Operational Phase

Source of Emission: Main source of air pollution from proposed project will be from the power generation facility at the onshore terminal. It is proposed to have a 20 MW captive power generation facility at site with natural gas as primary fuel and HSD as a secondary fuel. The emissions from the captive power plant will be primarily oxides of nitrogen (NO_x), particulate matter

(PM) and carbon monoxide (CO), considering that the plant will run with natural gas. Natural gas based Power Plant projects are the least GHG emitting plants and release lower quantities of carbon dioxide, the major greenhouse gas.

Embedded Control Measures: The project embedded control measures are as follows:

- For operation of power plant, cleaner fuel (natural gas) will be utilised and adequate stack height will be provided.

Assessment of Impact: The stack characteristics and emission data of captive power generation facility are presented in *Table 5.5*.

Table 5.5 *Emission Estimation (Point Sources) with Stack Characteristics*

Source	Source ID	Release Height (m)	Gas Exit Velocity (m/s)	Gas Exit Temperature (K)	Stack Inside Diameter (m)	Emission Rate for NO _x (ppm)*
CPP-1 (10 MW)	STCK 1	43	21	433	1.6	30
CPP-2 (10 MW)	STCK 2	43	21	433	1.6	30

Source: Reliance Power

Note: * In absence of data on project emission rate for NO_x, the applicable national regulatory standard of 30 PPM has been considered and the emission rates have been derived from the same.

Prediction of Impacts

Impacts due to the operation of onshore facility of the project were assessed by modelling projected emission rates (Refer *Table 5.5*) of the proposed project. The assessment was performed by modelling projected emission rates in AERMOD. The terrain pre-processor of ISC-AERMOD View 9.2.0 model was used for preparation of Digital Elevation Model (DEM) for the entire study area. The output file consists of the x, y locations of each receptors, mean sea level (MSL) elevation.

ISC-AERMOD View 9.2.0 model directly reads the output files created by the pre-processing programs and along with source information and predicts ambient air concentrations for a variety of pollutants and averaging periods ranging from 1-hour to annual.

Meteorological Data: Surface meteorological data recorded from the Kutubdia Station of Bangladesh Meteorology Department (BMD) for year 2015 was used for the modelling exercise. The details of the same are presented in the baseline section. In order to develop the meteorological data for the model, AERMET pre-processor of AERMOD was used.

Receptors: The receptor grid or network, defines the locations of predicted air concentrations used to assess compliance with the relevant standards or guidelines.

The following comprehensive fine and coarse receptor network was used for this analysis:

- 100 m x 100 m grid receptors of the entire project study area of 10 km radial zone from project centre; and
- 6 Discrete Cartesian receptors located within the study area, where baseline monitoring was carried out during the study period.

This network used Cartesian (X, Y) receptors with UTM coordinates. Base elevation of all the receptors were found using terrain elevations interpolated from SRTM (~30 m) Digital Elevation Model (DEM) data. The 6 discrete Cartesian receptor locations considered in this study are shown in **Figure 5.3**. All these receptors are located within Kutubdia Island.

Figure 5.3 Emission Sources and Receptors



Predicted maximum criteria pollutant concentrations (incremental) due to the proposed project in the study area have been presented in **Table 5.6**. Ground level concentration isopleths of NO_x are presented from **Figure 5.4** and **Figure 5.7** for short-term and long-term averaging periods.

Table 5.6 Predicted Incremental Ground Level Concentrations

S. No	Receptor	Incremental Short-term Max. Concentration (µg/m ³) NO _x (1-hourly)	Incremental Short-term Max. Concentration (µg/m ³) NO _x (24-hourly)	Incremental Long-term Max. Concentration (µg/m ³) NO _x (Annual)
1	AQ1	7.95	1.24	0.25
2	AQ2	8.70	1.05	0.19
3	AQ3	6.94	0.43	0.03
4	AQ4	5.54	0.87	0.13
5	AQ5	3.93	0.46	0.06
6	AQ6	5.49	0.41	0.04
7	Max. GLC	14.21	3.42	0.59

For criteria pollutant (NO_x), maximum predicted concentration is defined as:

- NO_x short-term averaging (1-hour) – the highest concentration for each receptor and study area;
- NO_x short-term averaging (24-hour) – the highest concentration for each receptor and study area;
- NO_x -term averaging (annual) – annual average of ground level concentrations at the receptors and study area.

Table 5.7 Resultant Air Quality

S. No	Receptor	Baseline Air Quality of NO _x (µg/m ³)	Incremental Short-term Max. Concentration of NO _x (24-hourly) (µg/m ³)	Resultant Air Quality of NO _x (µg/m ³)
1	AQ1	13.33	1.24	14.57
2	AQ2	21.86	1.05	22.91
3	AQ3	15.21	0.43	15.64
4	AQ4	22.41	0.87	23.28
5	AQ5	28.28	0.46	28.74
6	AQ6	22.88	0.41	23.29
Applicable Standard*				
AAQ Standards Bangladesh (2005)				-
WHO AQ Guidelines (2005)				-

Note: Bangladesh is not having any 24 hourly standards for NO_x. Only averaging period covered in the Ambient Air Quality Standard of Bangladesh is annual average, and the standard for NO_x is 100 µg/m³. Also, WHO AQ Guidelines for annual average is 40 µg/m³.

It is evident from **Table 5.8** that resultant short term air quality for 24 hours averaging period will be well within the applicable standard, as the resultant impact is much lesser than the annual average of 100 µg/m³.

Therefore, it is evident that due to the proposed project there will not be any significant adverse impact on air quality and the impact magnitude will be **minor**.

Mitigation Measures: The proposed mitigation measures are as follows:

- The Project will adopt Dual Fuel (Gas and HSD) Gas Turbine system for captive power generation which has a relatively high energy-efficiency and low polluting per unit of power produced compared to other thermal power plants;
- Two air emission stacks –42m height will be included - to disperse the air pollutants such that ground level concentration of air pollutants do not exceed the background concentration and meets GOB/DOE norms;
- Monitor ambient air quality in and around the Project site as per the Environment Monitoring Program formulated for the Project which will comply with National Regulatory requirements.

Impact	Change in air quality due to the project operations			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional	International	
Impact Scale	Maximum impact will be observed close to project site with 1 km radial zone.			
Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High	
	Residential areas of Ali Fakir Deil are located in close proximity of the site.			
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered Minor .			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations)	Significance of impact is considered Minor .			

Residual Impact: Considering the implementation of above mentioned mitigation measures, the residual impact on ambient air quality is assessed to be **minor**.

Figure 5.4 NOx - 1 Hourly Maximum Ground Level Concentration Isoleths

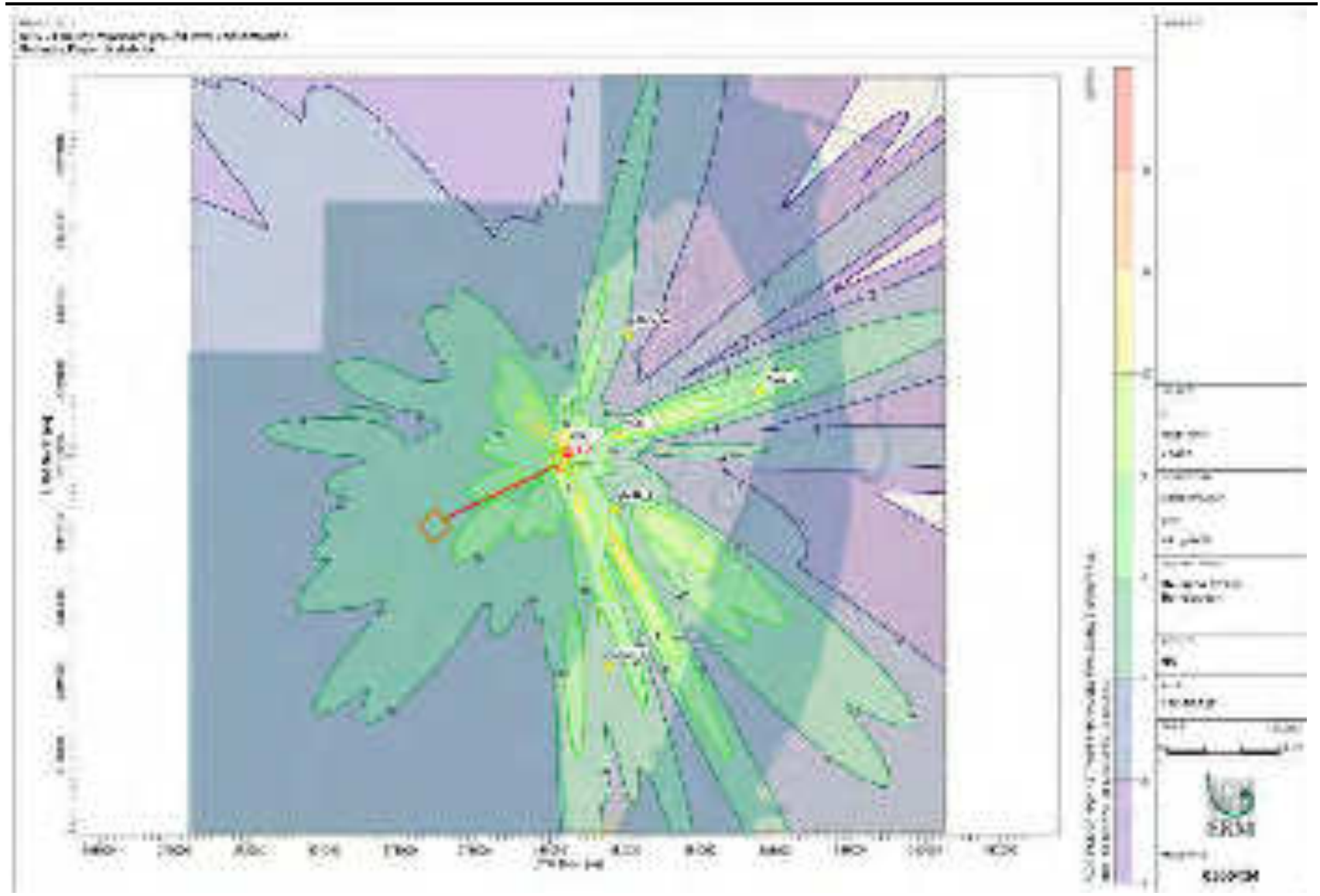


Figure 5.5 NOx - 1 Hourly Maximum Ground Level Concentration Isopleths

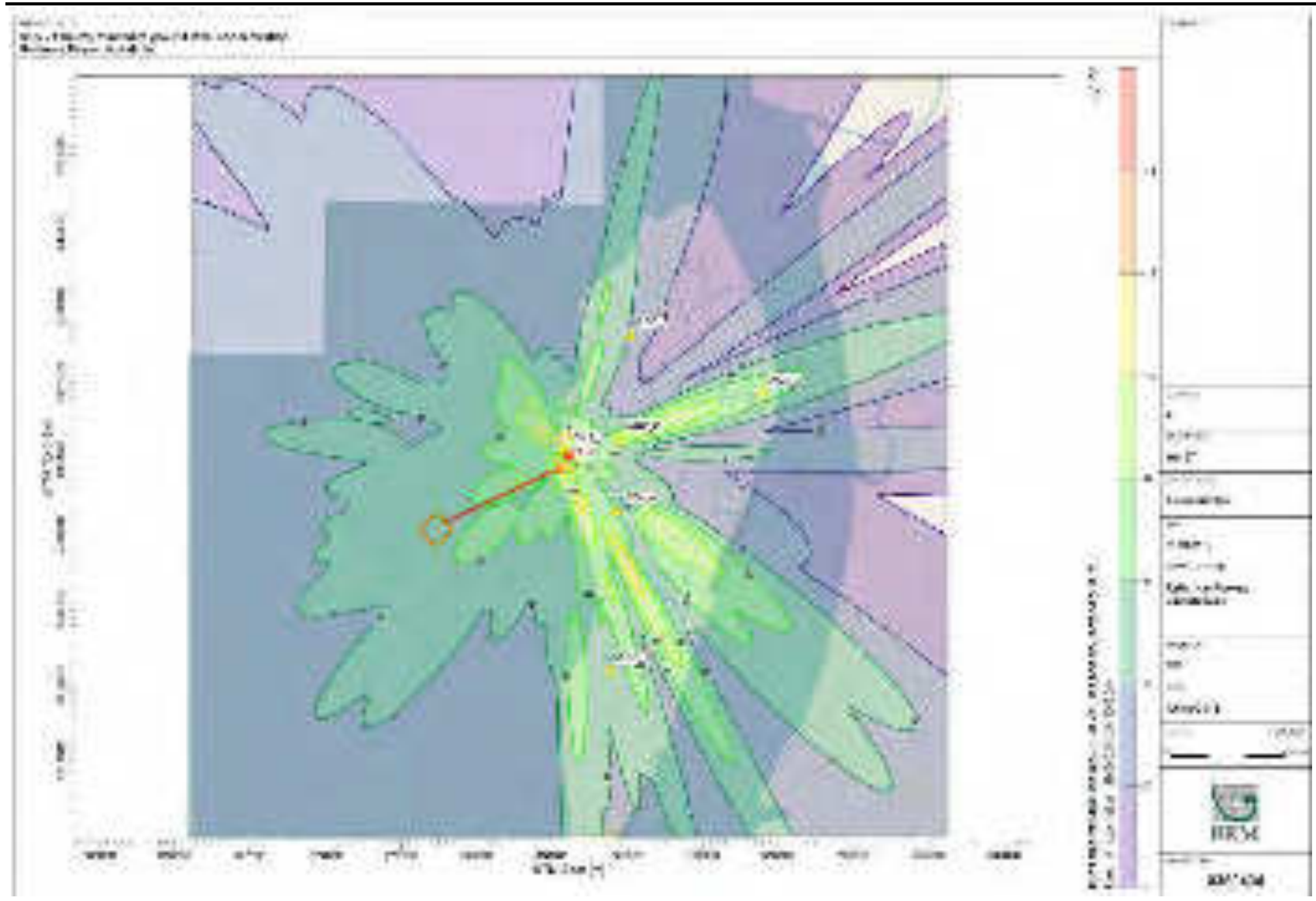


Figure 5.6 NOx - 24 Hourly Maximum Ground Level Concentration Isoleths

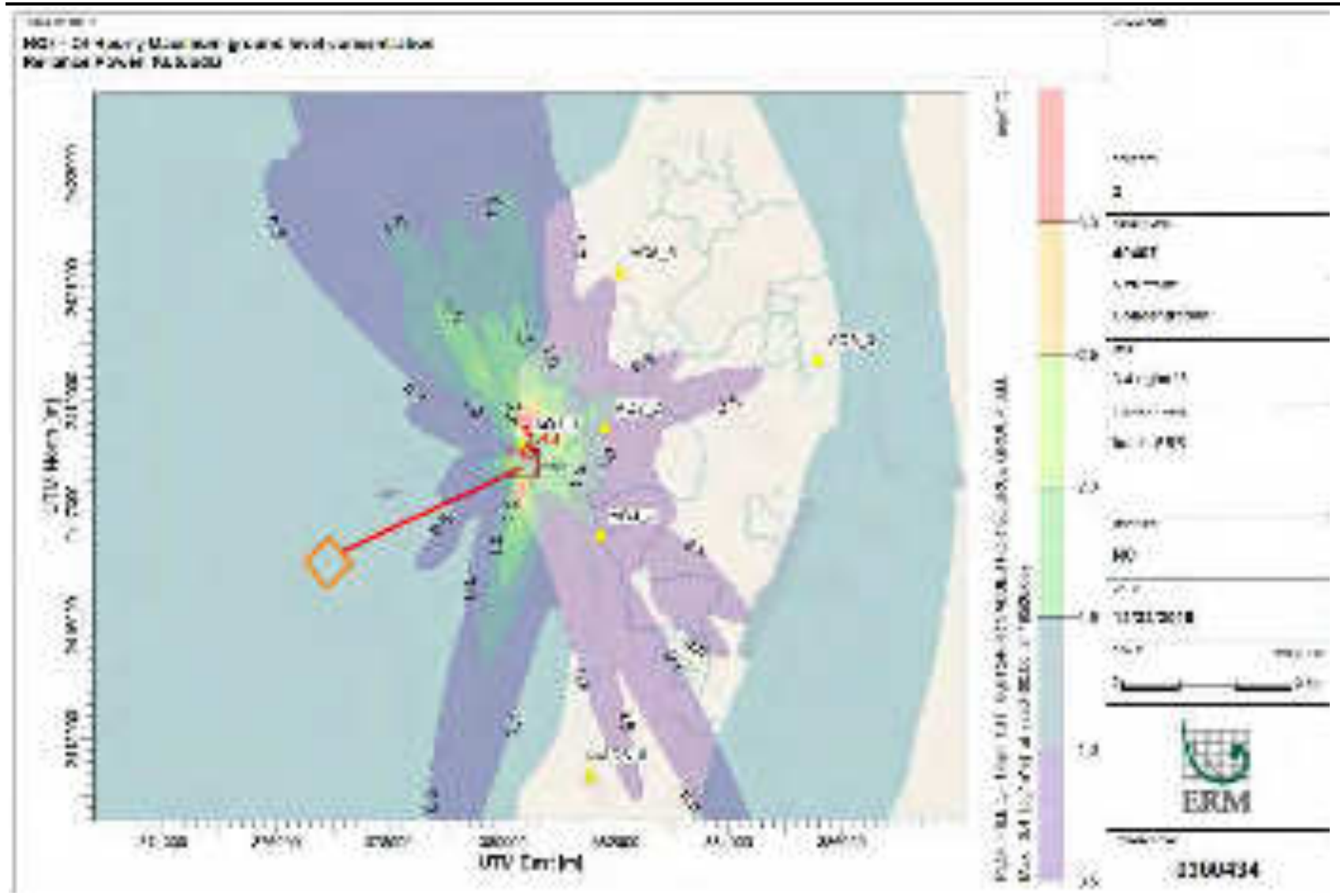
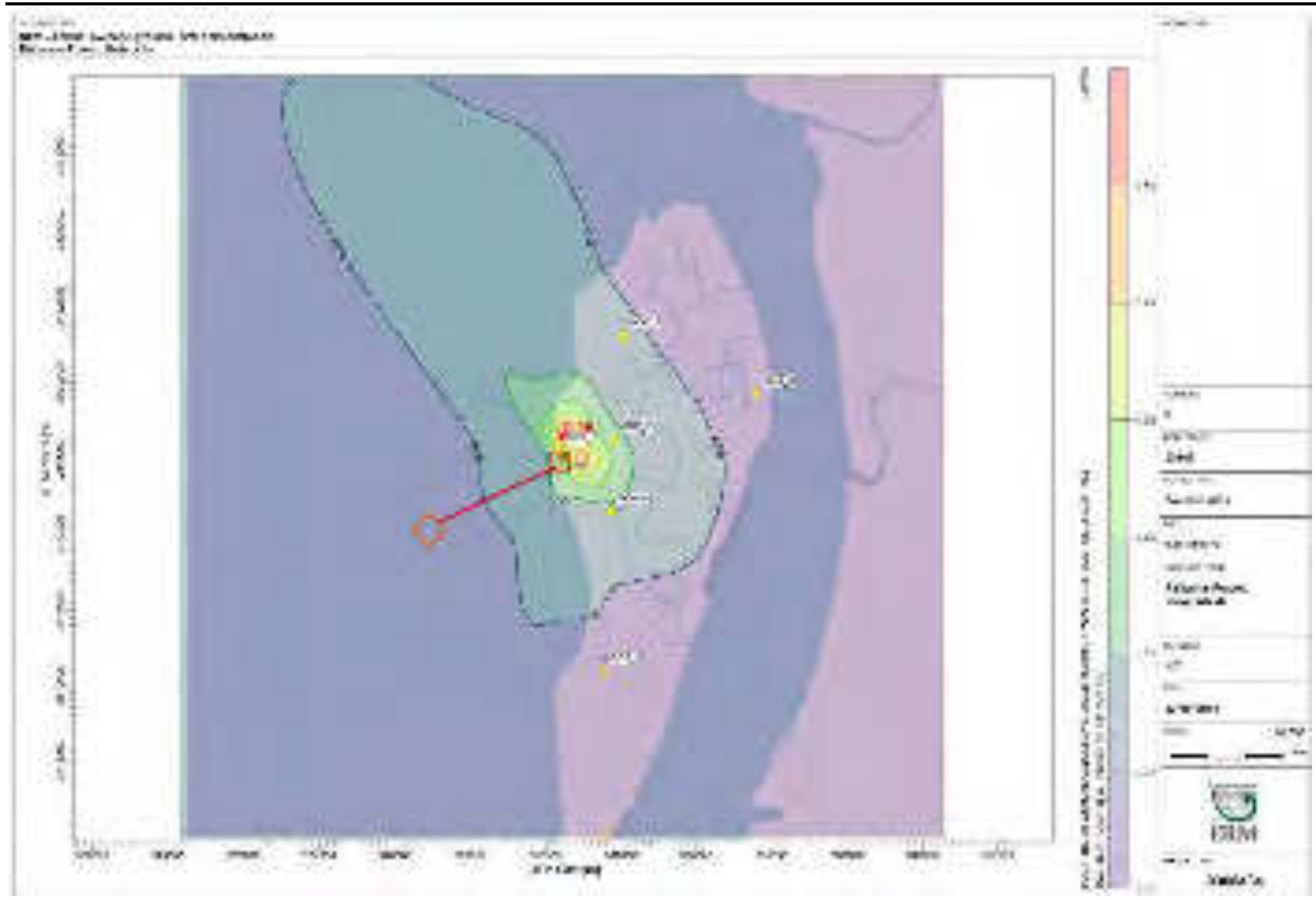


Figure 5.7 NOx - Annual Average Ground Level Concentrations Isoleths



5.3.6 Potential Impact on Noise quality

Construction Phase

Source of Impact: The potential impacts on noise quality may arise out of the following:

- Machineries and equipment;
- Vehicular traffic;
- Backup DG set.

Embedded Control Measures: Project embedded control measures are as follows:

- Vehicle, equipment and machinery used for construction activities would conform to applicable noise norms.

Assessment of Impact: The construction activities such as transportation of raw materials for civil works, operation of heavy equipment and construction machinery are likely to cause increase in the ambient noise levels in and around the project site.

The ambient noise level in and around the plant was well within the ambient noise standard. The noise generated from the above mentioned activities likely to be attenuated within 500m from the construction site. This may cause discomfort to the construction workers onsite and nearby receptor (nearby villagers). The construction activity is a medium term activity, i.e. 24/36 months. The potential impact on noise quality due to above mentioned construction activities is assessed to be **minor**.

Mitigation Measures: The proposed mitigation measures are as follows:

- Maintenance of vehicles and machineries to maintain the noise level;
- Silent DG set will be utilised;
- Night time construction activities will be restricted;
- PPE will be provided to the construction workers.

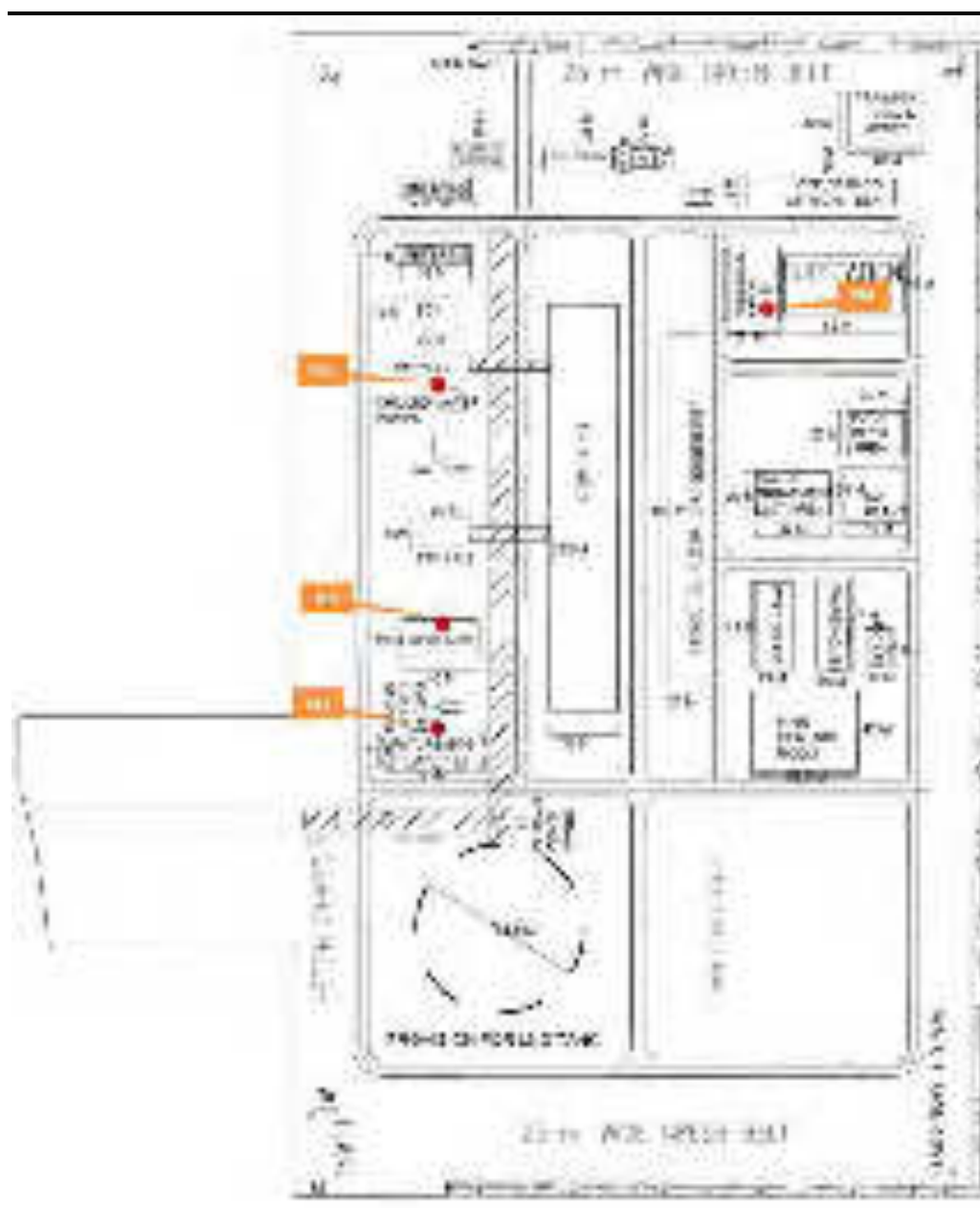
Impact	Noise quality impact due to construction activities			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Short Term	Medium Term	Long Term	
Impact Extent	Local	Regional	National	
Impact Scale	Low	Medium	High	
Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High	
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered Minor			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations)	Significance of impact is considered Negligible .			

Residual Impact: Considering the implementation of above mentioned mitigation measures, the residual impact on noise quality is assessed to be **negligible**.

Operational Phase

Source of Noise: The noise generation during operational phase would be restricted at source itself through different measures such as inspection, operation and maintenance at regular intervals. All equipments will be designed for < 80 dB sound level at 1 meter. Mainly noise will be generated from captive power generation, chilled water pumps, HP pumps and compressors and the noise levels from all these facilities will be about 80 dB(A) at 1 m from source. Location of the noise sources considered for the modelling exercise is shown in *Figure 5.8*.

Figure 5.8 *Noise Sources in the Onshore LNG Facility*



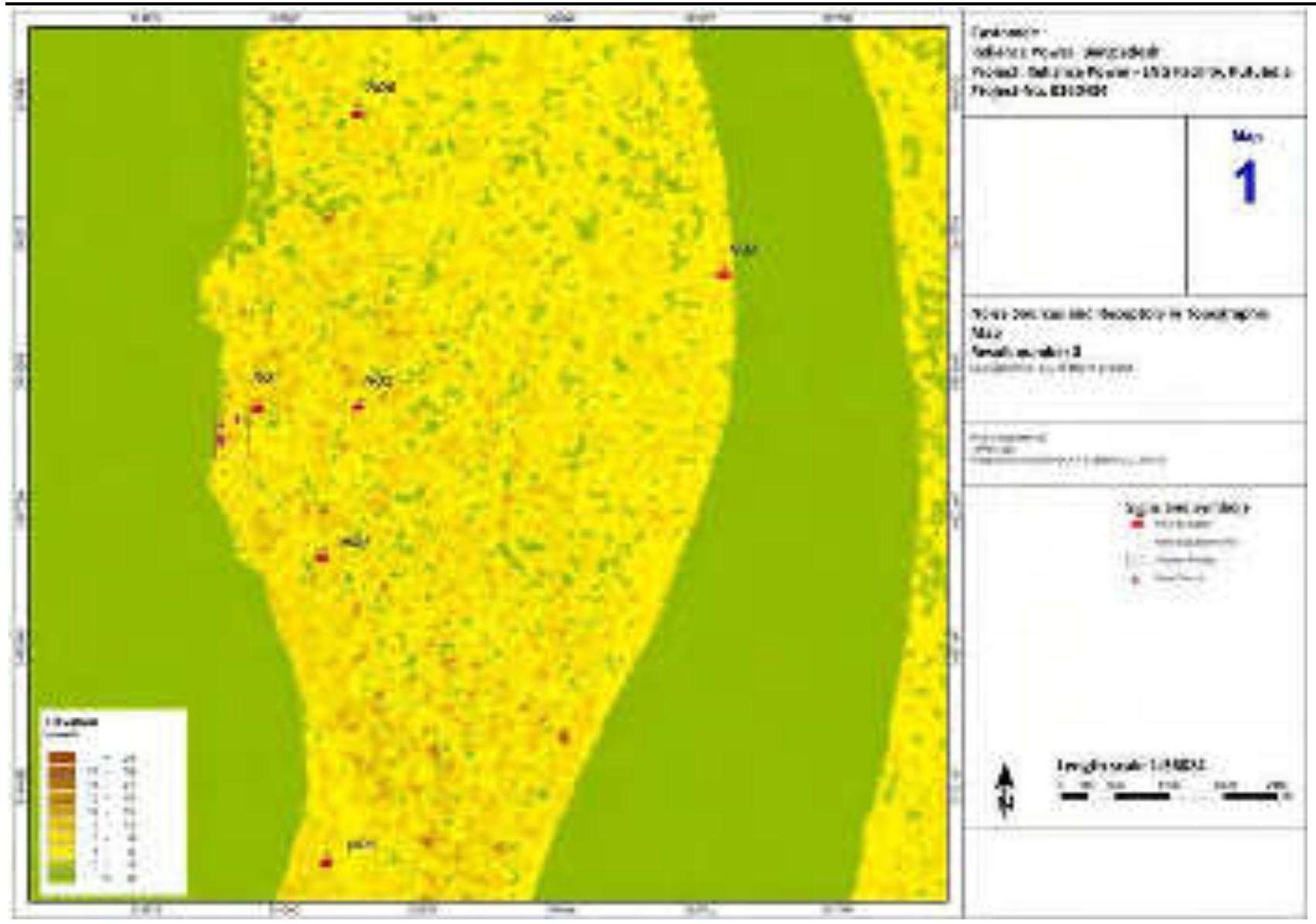
Embedded Control Measures: Noise and vibration from the Project will be mitigated through engineering control and wherever possible high noise equipment will be enclosed in noise-proofed buildings that effectively contain the noise. It is planned that the Project will meet the noise emission criteria specified in the GOB ECR, 1997 as presented **Table 5.8**

Table 5.8 *Noise Emission Criteria*

Location	Noise Level Limit (dB(A))	
	Daytime (0600 - 2100 hrs)	Night-time (2100 - 0600 hrs)
Industrial Area	75	70
Residential Area	55	45

Receptors: The onshore LNG terminal is to be located near Ali Fakir Deli village in Dakshin Dhurung Union. Ambient noise baseline monitoring was carried out at 6 locations. The noise monitoring locations with respect to the project on the topographic map has been presented in **Figure 5.9** Since, all the receptors are residential and hence the receptor sensitivity is considered to be **medium**.

Figure 5.9 Noise Sources and Receptors in Topographic Map



Prediction of Impact

Methodology: The environmental noise prediction model SoundPLAN 7.2 was used for modelling noise emissions from key noise generating equipment of the onshore LNG facility. It has been assumed that all the plant equipment will adhere to the equipment noise emission criteria of 85 dB(A) noise level at a distance of 1 m from the source. Operation of equipment with 100% usage scenario was modelled to cover the operation phase of the Project. As a conservative approach to the assessment, atmospheric absorption during sound transmission was not included in the assessment. In addition, to represent a worst-case scenario for the assessment, all equipment was assumed to be operating simultaneously. Noise reflection/ barrier due to the structures, buildings within the LNG terminal and boundary wall have also not been taken into consideration.

Predicted Noise Levels at Receptors: Predicted noise levels at six receptors (where baseline noise levels were also monitored) have been presented in **Table 5.9**.

Table 5.9 Predicted Noise Levels at Noise Receptors during Operation Phase

Recp. Code	Category of Area / Receptor	Distance from LNG Terminal Boundary (km)	Baseline Sound Pressure Levels at Receptors, Leq (dBA) ⁽¹⁾		Incremental Sound Pressure Levels due to Project at Receptors, Leq (dBA) ⁽²⁾		Overall Sound Pressure Levels at Receptors, Leq (dBA) ⁽³⁾ (Baseline + Incremental)		Applicable Standard (dB(A)) ⁽³⁾ as per Landuse	
			Leq _d	Leq _n	Leq _d	Leq _n	Leq _d	Leq _n	Day	Night
			NQ1	Residential	0.12	47.8	44.0	24.6	24.6	47.8
NQ2	Mixed	1.20	58.9	45.8	6.6	6.6	58.9	45.8	60	50
NQ3	Residential	5.60	49.6	45.0	-	-	49.6	45.0	55	45
NQ4	Residential	1.50	54.4	45.1	4.8	4.8	54.4	45.1	55	45
NQ5	Residential	3.90	46.4	43.2	-	-	46.4	43.2	55	45
NQ6	Silent Zone	4.90	54.6	44.7	-	-	54.6	44.7	50	40

⁽¹⁾ Ambient noise levels as monitored during the baseline survey

⁽²⁾ All operations have been considered as continuous and hence there is no change in the day and night time prediction results.

⁽³⁾ Environmental Conservation Rules, 1997 (Schedule 4) amended September 7, 2006

It is evident from the noise modelling results (**Table 5.9**) predicted noise levels at any of the receptor considered in the study will be well within the applicable standard for day and night time. Furthermore, there will be no change in the resultant noise levels at each receptor due to the Project. The impact magnitude is considered to be **minor**.

Mitigation Measures: The proposed mitigation measures are as follows:

- Install noise attenuation provisions such as air intake silencers and acoustic insulation around noisy equipment.

- Comply with the noise emission criteria as per the Schedule 4 of ECR, 1997; Noise Pollution (Control) Rules, 2006 and noise guidelines prescribed in the General EHS guidelines of the IFC;
- Monitor ambient noise levels in and around the Project site as per the Environment Monitoring Program formulated for the project which will comply with National Regulatory requirements.

Impact	Change in ambient noise levels due to the project operations				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional		International	
Impact Scale	Maximum impact will be observed close to boundary.				
Impact Magnitude	Negligible	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium		High	
	Residential areas of Ali Fakir Deil village in Dakshin Dhurung Union located within 500 m from the project boundary.				
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major	
	Significance of impact is considered Minor				
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large	
Impact Significance (With Mitigations)	Significance of impact is considered Minor .				

Residual Impact: Considering the implementation of above mentioned mitigation measures, the residual impact on noise quality is assessed to be **minor**.

5.3.7 Potential Impacts on Ground Water Quality

Construction Phase

Source of Impact

The spillage and seepage of chemical, oil and lubricants from storage area, waste handling area and generation of domestic waste/wastewater from construction labour camp area may adversely affect ground water quality in the area.

Embedded Control Measures:

- Provision of septic tank and soak pit to treat waste water from labour camp.

Assessment of Impacts: The existing groundwater quality analysis does not reveal any existing contamination or pollution of groundwater. The contamination of subsurface groundwater may happen due to accidental spillage of fuel, lubricants and chemicals from storage areas at the ORF. Contamination of subsurface groundwater can also occur in case of frequent accidental discharges on open soil or unpaved areas. The same is also valid for

the disposal of hazardous waste in site storage area/ disposal facility. The geographical extent of potential impact due to above activity is anticipated to be local and impact duration is expected to be short term. The sensitivity is high, as the water is unpolluted and provides services as drinking water, domestic uses (washing, bathing) for the region. The impact on ground water quality assessed to be **moderate**.

Mitigation Measures

- Ensure proper spill control and management at site;
- Ensure storage of hazardous material and waste in proper manner and disposed the waste in Hazardous waste Landfill site;
- Monitor groundwater from time to time to detect any contamination.

Impact	Impact on groundwater quality due to runoff and spillage from chemical and oil storage site				
Impact Nature	Negative	Positive	Neutral		
Impact Type	Direct	Indirect	Induced		
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional		International	
Impact Scale	Low	Medium		High	
Impact Magnitude	Negligible	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low		Medium	High	
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major	
	Significance of impact is considered Moderate				
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large	
Impact Significance (With Mitigations)	Significance of impact is considered Moderate				

Residual Impact

The residual impact after implementation of mitigation measures will be of **moderate** significance.

Operational Phase

Ground water may be contaminated from the operational area due to spillage of oil & lubricant or hazardous waste. The impact will be same as in construction phase.

5.3.8 Potential Impact on Surface Water Quality

Construction Phase

Source of Impact: Potential impact on surface water quality could arise due to:

- Surface runoff from construction site;
- Generation and disposal of domestic waste water from construction camp;

- Pilling activities;
- Use of biocides;
- Discharge of hydro-testing water.

Embedded Control Measures: The embedded control measures are as follows:

- Provision of septic tank and soak pit to treat waste water from labour camp.

Assessment of Impact: Surface run offs from construction material storage area, construction waste storage areas, hazardous waste (waste oil, used oil etc.) and chemical storage areas may lead to pollution of receiving natural drainage channels etc. As the slope of the area is towards Bay of Bengal, these surface run offs are likely to reach the Bay of Bengal. It is also proposed to lay 17 km onshore pipeline; during this process earth work (excavation and stacking of soil) will be required; the surface runoff from disturbed sites may lead to pollution of receiving water bodies. This situation is likely to be more pronounced considering high rainfall received in these areas. The surface run offs may contain the high sediment load, oil residues, organic wastes, etc. This may adverse impact on water quality, which ultimately leads to impacts on aquatic ecology.

During construction phase, RBLTL will provide sanitation facilities for workers at the construction site. The domestic wastewater will be treated through septic tank and soak pit. Therefore, sewage will not be disposed in the sea or nearby surface water body.

Construction of jetty near FSU and the trestle will require excavation of seabed material near shore and will involve piling work. The excavation activities and pilling work in the seabed will generate fine sediments and will also result in resuspension of sediments in water. This is expected to increase the turbidity of water and thus have an adverse impact on surface water quality. The turbid water may have impact on aquatic ecology; thus affecting primary productivity. The leakage and spillage of oil and lubricants from machineries and equipment may also cause adverse impact on water quality. Drilling / excavation work on the bed of the Kutubdia Channel (crossing of onshore pipeline) also has potential adverse impact on benthic habitat. The impact on aquatic ecology and benthos has been discussed in the ecological impact assessment section.

Approximately, 17 km onshore pipeline and which included 3 km stretch of Kutubdia Channel (where subsea pipeline is proposed) is proposed for this project. During the pipeline laying, hydro-testing will be required. Hydro-testing water if directly discharged into the Kutubdia Channel or nearshore will affect the water quality. Hydro-testing water generally characterized by high pH, turbidity, metals, oxygen scavengers like ammonium or sodium bisulphite etc, biocide residue etc.); this will ultimately affect the aquatic ecology as well as benthic ecosystem.

The Kutubdia Channel and near shore of Kutubdia Island is an ecological sensitive area in terms of fish habitat, breeding and nursing ground for fishes and also habitat Olive Ridley Sea Turtle. The water quality of the river is fit for fishing (ECR 97 Use Class D) and also no major contamination was recorded (*Refer Section 4.8*) from the baseline monitoring conducted. The surface runoff from construction site, generation of suspended solid during piling, discharge hydro-testing water, spillage & leakage of oil and lubricate, etc., may cause perceptible changes in the existing baseline condition (by affecting TDS, TSS, BOD level, etc). The impact will be temporary in nature. The potential impact on surface water quality due to construction activities is assessed to be **moderate**.

Mitigation Measures: The mitigation measures are as follows:

- Restrict the earth work activities during monsoon season;
- Channelize all surface runoff from the construction site through storm water drainage system and provide adequate size double chambered sedimentation tank;
- Prevent & mitigate spill of paint/fuel within the construction site;
- Treat the hydro-testing water before discharge into the sea/ channel.

Impact	Surface water quality impact due to construction activities			
Impact Nature	Negative		Positive	Neutral
Impact Type	Direct		Indirect	Induced
Impact Duration	Short Term		Medium Term	Long Term
Impact Extent	Local		Regional	National
Impact Scale	Low		Medium	High
Impact Magnitude	Positive	Small	Medium	Large
Resource/ Receptor Sensitivity	Low		Medium	High
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered Moderate			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations)	Significance of impact is considered Minor			

Residual Impact: Considering the implementation of above mentioned mitigation measures, the residual impact on surface water quality during construction phase is assessed to be **minor**.

Operational Phase

Source of Impact

- Generation & discharge of grey & black water from the FSU;
- Discharge of ballast water and bilge water from LNG carrier;
- Surface runoff from ORF;
- Generation and disposal of domestic waste water from ORF.

Embedded Control Measures: The control measures are as follows:

- Grey water and black water from FSU will be discharged as per MARPOL standard;
- The ballast water and bilge water from LNG carrier will be disposed in the Chittagong port;
- Domestic waste water from ORF facilities will be treated through septic tank & soak pit or a mobile STP.

Assessment of Impact: Surface run off from oil storage waste handling unit (waste oil, used oil, etc.) may lead to the pollution of receiving water bodies. The surface run off may contain oil and lubricant, in case there is spillage from above mentioned areas. However, taking into account the provision of onsite drainage system with sedimentation tank, oil filters, etc., the pollution load is not expected to be significant.

The sewage generated from the residential facilities or office area of the ORF will be treated through septic tank and soak pit / mobile STP and the treated effluent will be reused for maintaining greenbelts; therefore, any direct discharge is not envisaged.

The grey water, black water, ballast water and bilge water will be discharged into the Chittagong Port facility. There will be no direct discharge into the sea. The impact on surface water quality is assessed to be *minor*.

Mitigation Measures: The mitigation measures are as follows:

Channelize all surface runoff from through storm water drainage system and provide adequate size double chambered sedimentation tank

Impact	Surface water quality impact due to operational activities			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Short Term	Medium Term	Long Term	
Impact Extent	Local	Regional	National	
Impact Scale	Low	Medium	High	
Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High	
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered Minor			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations)	Significance of impact is considered Minor .			

Residual Impact: Considering the implementation of above mentioned mitigation measures, the residual impact on surface water quality during operation phase is assessed to be **minor**.

5.3.9 Potential Impact Terrestrial Habitat (Flora & Fauna)

Construction phase

Source of Impact

- Vegetation clearance;
- Fugitive emission and deposition on vegetation; and
- Noise and vibration.

Embedded Control Measures: The control measures are as follows:

- Vegetation removal to be minimal and limited to the ORF;
- Water sprinkling for dust suppression; and
- Provision of dust curtains to reduce the dust emission.

Assessment of Impacts

The vegetation at the ORF is primarily included under homestead plantation, shelterbelt areas (*Casuarina* plantation) and agricultural land. The vegetation removal will cause loss of vegetation cover, habitat loss to the faunal species living within the project area and will also cause habitat disturbances to the faunal species to the nearby areas. In addition vegetation clearance is expected to take place at the RoW of onshore pipeline from ORF to Napura valve station. No floral species was identified to be under threatened category. Mammalian species of concern in the area are Indian Grey Mongoose, Large Indian Civet both listed Near Threatened as per IUCN Red List 2016.v3. Among avifauna Red-breasted Parakeet listed Near Threatened as per IUCN Red List 2016.v3. Among reptiles Spotted Pond Turtle (Vulnerable as per IUCN Red List 2016.v3) and Indian Black Turtle (Near Threatened as per IUCN Red List 2016.v3) were also reported from the area. The nature of the impact is negative and direct. The construction period is of 24-36 months hence the impact duration can be assigned as medium term. The impact will be mainly on the immediate project area thus of extent would be local. The vegetation clearance will be within the project area hence local in extent. Thus the impact magnitude on terrestrial flora and fauna is small. Receptors sensitivity is medium because the species likely to be impacted are Near Threatened to Vulnerable as per the IUCN classification. Based on the table below the impact of vegetation clearance on terrestrial flora and fauna is assessed as **minor**.

Mitigation Measures: The mitigation measures are as follows:

- Plantation of local species for stabilization of the filled in material and plantation in surrounding areas; and
- Additional plantation at other identified areas such as inland pipeline line corridor.

Impact	Impact on Terrestrial Habitat due to construction activities			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Short Term	Medium Term	Long Term	
Impact Extent	Local	Regional	National	
Impact Scale	Low	Medium	High	
Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High	
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered Minor			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations)	Significance of impact is considered Minor			

Residual Impact: Considering the implementation of above mentioned mitigation measures, the residual impact on terrestrial habitat, flora and fauna is assessed to be **minor**.

Impact on shelterbelt has been assessed in detail in *Section 5.3.17 Impact on Social Forestry*.

Operational Phase

Source of Impact

- Emission from operational plant
- Illumination, noise and vibration at site

Embedded Control

- A thick green belt of 15-20 m within and outside the project boundary will help in reducing the impacts from air emissions and noise and vibration impacts

Assessment of Impacts

Emission from the operational plant, illumination, noise and vibration from the ORF site may cause disturbance to the local fauna. As mentioned in the construction phase impacts the floral species located near the ORF and pipeline corridor are not threatened in nature. However, the faunal species are represented by few threatened and near threatened species viz. Indian Grey Mongoose, Large Indian Civet (Near Threatened; IUCN Red List 2016.v3), Red-breasted Parakeet (Near Threatened; IUCN Red List 2016.v3), Spotted Pond Turtle (Vulnerable; IUCN Red List 2016.v3), Indian Black Turtle (Near Threatened; IUCN Red List 2016.v3) may experience the impact. The nature of the impact is negative and direct. The impact can happen during the entire life cycle of the project and can be assigned as long term. The impact will be mainly on the immediate project area thus of extent would be local. Thus the impact magnitude on terrestrial flora and fauna is small. Receptors sensitivity

is medium because the species likely to be impacted are Near Threatened to Vulnerable as per the IUCN classification. Based on the table below the impact of on terrestrial flora and fauna during operational phase of the project is assessed as **minor**.

Mitigation Measures: The mitigation measures are as follows:

Preparation of Green Belt Management Plan and its strict implementation within the project site and immediate surrounding areas;

Impact	Impact on Terrestrial Habitat due to operational activities			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Short Term	Medium Term	Long Term	
Impact Extent	Local	Regional	National	
Impact Scale	Low	Medium	High	
Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High	
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered Minor			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations)	Significance of impact is considered Minor			

Residual Impact: Considering the implementation of above mentioned mitigation measures, the residual impact on terrestrial habitat, flora and fauna is assessed to be **minor**.

5.3.10 Impact on Aquatic Habitat

Construction Phase

Source of Impact

- Surface runoff from construction site, discharge of hydro-testing water, spillage & leakage of oil and lubricate, from construction site;
- Construction of onshore facility on sea beach;
- Noise and vibration due to piling activities in the sea;
- Move of ship and vessels and
- Illumination.

Assessment of Impacts

The impacts are assessed based on following receptor species;

- Olive Ridley's Turtle (*Lepidochelys olivacea*) IUCN listed Vulnerable 2016.3

Olive Ridley turtles have been reported nesting in the western coast of Kutubdia Islands. The ORF project site is one of the turtle nesting sites as reported by the locals and reports 20-30 individuals of Olive Ridley's which used the project area annually. Apart from the ORF the pipeline is also passing through northern end of the west coast of Kutubdia Island which also reportedly has turtle nesting sites with a potential of 180 individuals of turtles nesting annually.

- Dolphin species:

One species (Irrawaddy Dolphin- *Orcaella brevirostris*-IUCN Vulnerable 2016.v3) and two Dolphin species namely Indo-pacific Humpback Dolphin (*Sousa chinensis*) and Indo-Pacific Finless Porpoise (*Neophocaena phocaenoides*) listed IUCN Near Threatened ver (2016.v3) are reported within the FSU and ORF facility from 500 m of the coastline to 5 km in the area.

These species are likely to get impacted due to various construction activities of the project such as preparation of berths for docking of the vessel, construction of offshore cryogenic pipeline on trestle from FSU to ORF and pipeline from ORF to valve station crossing the Kutubdia channel. The surface runoff from construction site, generation of suspended solid during piling, discharge of hydro-testing water, spillage & leakage of oil and lubricate, etc., may cause perceptible changes in water quality and also can affect the aquatic habitat and fauna.

There is further requirement to establish the nesting frequency and sites of Olive Ridley Turtle on the west coast line of the Kutubdia Island. The Olive ridley nesting takes place from December to February in the region. There is likelihood of turtle and dolphin mortality/injury during construction period due to boat and vessel movement in sea and channel area. Turtle nest can be poached by the working labour force, and left out waste of the worker camps can increase the dog population in the area.

The impact extent is local as impact on aquatic fauna would potentially happen in proximity to the project footprint. The impact duration in medium term as the construction activity will be carried out for 24-36 months. Impact scale will be medium as the impact will be reversible and likely to have minor change over baseline in due course of time. Impact magnitude thus assessed is medium and the receptor sensitivities are medium as species affected are of IUCN Vulnerable 2016.v3 hence bear conservational significance. Based on the table below the impact on aquatic habitat is assessed as **moderate**.

Mitigation Measures: The mitigation measures are as follows:

- Survey of turtle nesting habitats at the project location and pipeline route prior to start of the activity;

- Minimum illumination at the coastal side as they may disrupt the hatchling movement;
- Minimize the vessel movement during the egg nesting months of December to March;
- Prohibition under contractual condition for poaching of turtle eggs by the construction workers;
- Implementation of air and noise (above water and under water) control measures as suggested under air and noise impact sections.

Impact	Impact on aquatic habitat due to construction activities			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Short Term	Medium Term	Long Term	
Impact Extent	Local	Regional	National	
Impact Scale	Low	Medium	High	
Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High	
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered Moderate			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations)	Significance of impact is considered Minor			

Residual Impact: Considering the implementation of above mentioned mitigation measures, the residual impact on aquatic habitat is assessed to be **minor**.

Operational Phase

Source of Impact

- Spillage & leakage of fuel & lubricant;
- Move of ship and vessels and
- Illumination.

Embedded Control

- Positioning of illumination lights land ward side and not sea side;
- Restricted and limited movement of vessels during the nesting period.

Assessment of Impacts

As mentioned in the impact on aquatic habitat during construction phase the concerned species that are likely to get impacted even during operation phase are Olive Ridley's Turtle (IUCN listed Vulnerable 2016.3), Irrawaddy Dolphin (IUCN Vulnerable 2016.v3), Indo-pacific Humpback Dolphin & Indo-Pacific Finless Porpoise (listed IUCN Near Threatened ver (2016.v3). These species are likely to get impacted due to spillage/ leakage of

fuel and lubricant from the FSU/ORF, movement of ships and vessels and illumination from FSU and ORF. There is likelihood of turtle and dolphin mortality/injury during operation period due to boat and vessel movement in sea and channel area.

The impact extent is local as the as the impacts are likely to happen near the project footprint. The impact duration in long term, impact scale will be medium as the impact will be reversible and likely to have minor change over baseline in due course of time. Impact magnitude thus assessed is medium and the receptor sensitivities are medium as species affected are of IUCN Vulnerable 2016.v3 hence bear conservational significance. Based on the table below the impact on aquatic habitat is assessed as **moderate**.

Mitigation Measures

- Establishment of Turtle Nesting locations through Forest Department and Local NGO's;
- Support Local Forest Department and Local NGOs for in situ turtle nesting activities;
- Support government initiatives in terms of research and monitoring for Dolphin studies in the region.

Impact	Impact on aquatic habitat due to operational activities			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Short Term	Medium Term	Long Term	
Impact Extent	Local	Regional	National	
Impact Scale	Low	Medium	High	
Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High	
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered Moderate			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations)	Significance of impact is considered Minor			

Residual Impact: Considering the implementation of above mentioned mitigation measures, the residual impact on aquatic habitat is assessed to be **minor**.

5.3.11 Potential Impact due to Land Acquisition

Impacts associated with land acquisition prior to start of civil works for the project is described below.

Construction Phase

Land Loss

Based on the present information available from the Reliance Power the following land requirement is anticipated that will be acquired through land acquisition.

Land Based Facility: According to the information presently available the current land requirement for the Land Based Facility is 40 acres, which is a mix of both government and private land. The land area covers about 240 plots in two mouzas - Dakshin Dhurung and Kaiyabil. The private land parcels (87% of the total site area) may potentially go for land acquisition. The land owners of the plots are the potentially impacted persons who will lose their land parcels and livelihoods from that land. Number of impacted land owners who will potentially loss their land may be less or more than the number of plots. The exact number of affected persons (APs) will be ascertained after finalization of the project foot print and after determining the ownership details as per records maintained by the Land Department. The government land will be transferred on lease or issuance of 'No Objection Certificate' through the Deputy Commissioner of the district to the Project Proponent. It is currently not known who could potentially be deriving livelihood from the government land, if at all. The RP process will also identify non-titleholders impacted by the land acquisition/transfer.

On the basis of satellite imagery interpretation and considering the current project footprint that has been made available by Reliance Power, it also appears that few residential plots might be acquired for the Land Based Facility. This is an irreversible impact causing physical displacement but compensation can reduce the magnitude of that impact. However this needs to be confirmed through subsequent field surveys.

Onshore pipeline: The 17 km proposed alignment of the onshore gas pipeline, connecting Onshore Regasification Facility (ORF) to the main gas grid of GTCL at Banskhali, passes through Uttar Dhurung, Chhanua and Puichhari Union Parishads of Kutubdia and Banskhali Upazila respectively. The required land for laying the gas pipeline will be a mix of both government land (5.96 acres across a total stretch of around 3 Km) and private land (27.64 acres across a total stretch of 14 Km). Based on the information provided by RBLTLit is envisaged that the required Right of Way width will be 8 m along the stretch of 17 km. Land acquisition process for the 14 km private land of the pipeline will have to be undertaken impacting land loss by families. The government land will be transferred to the Project Proponent

Terminal Station at Napura: Land will be acquired for the terminal station at Napura adjacent to existing MLV station along GTCL pipeline in Banshkhali. For the terminal station a land parcel of 75m x 75m or 75m x 100m will be acquired, which is about 1.4 acres or 1.85 acres.

The land parcels that will potentially go for acquisition are primarily agricultural fields, salt pans. It is anticipated that during the construction phase the land owners will lose land due to land acquisition. It will be determined and accordingly APs will be identified once the project foot print is finalised. The impact due to loss of land is permanent. Magnitude of impact due to land acquisition can be ascertained during the RP survey depending on the amount of land loss by the land owners and the number of land owners impacted.

Mitigation Measure:

As a mitigation measure the land owners will be appropriately compensated as detailed out in Entitlement Matrix in the Resettlement Framework.

- Prepare a Resettlement Plan (RP) based on the principles and entitlements defined in the Resettlement Framework (RF)
- Provide compensation as defined in the RF
- Provide alternate housing and resettlement support as per the RF and RP
- Consult the PAFS through the process and ensure that are able to participate in a free, prior and informed way.
- Provide access to an efficient and efficient/effective grievance redressal process
- The land owners those who will be losing land will receive cash compensation under the law (CCL) which is Mouza Rate additionally with 50 percent of it as premium as per ARIPO; and
- Cash grant to cover the difference between cash compensation under law (CCL) and the replacement cost¹.

Impact	Loss of Land Ownership for Land Based Facility, Onshore Gas Pipeline, Terminal Station at Valve 2			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional	International	

¹ **Replacement cost** is the actual cost to replace an item or structure at its pre-loss condition. This may not be the "market value" of the item, and is typically distinguished from the "actual cash value" payment which includes a deduction for depreciation.

Impact Scale	Total land area available for agriculture and salt cultivation in Dakshin Dhurung and Kaiyabil Union is 5122 acres ¹ ; only 0.78 percent (40 acres for land based facility). For onshore gas pipeline 27.64 acres of private land which is mostly under agriculture and salt cultivation may be acquired but will be returned to the owner after construction followed by restoration for resuming previous livelihood activity.			
Frequency	During construction phase of the project			
Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High	
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered Moderate			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations)	Significance of impact is considered Minor			

Residual Impact: Considering the implementation of above mentioned mitigation measures, the residual impact is assessed to be **minor**.

Change in Land use

The establishment of the project will result in permanent change in land use of the project site for the sub components areas (like land based facility and terminal station at valve 2) from agricultural and salt pan to industrial. At a broader level, the project development is likely to also result in land use change of some areas in the near vicinity (for commercial usage or residential purposes).

The direct resultant impact (adverse) of land use change in the project area (and the other planned components) is the reduction in land area available for agriculture and salt cultivation and resultant livelihood impacts on land owners, sharecroppers and salt pan workers; however the magnitude of impact in terms of change in land use would be small in comparison to the total arable land and salt cultivation land available in Dhakshin Dhurung and Kaiyabil Unions [total land area available for agriculture and salt cultivation in Dakshin Dhurung and Kaiyabil Union is 5122 acres²; only 0.78 percent (40 acres for land based facility) of this land will change land use from agricultural to industrial]. Industrialisation in the region will also have a positive impact in terms of increase in employment and allied opportunities, better infrastructure and amenities, etc. whose benefits are not only restricted at the local site level but also at the Upazila level.

¹ As mentioned in Baseline Section in Dakshin Dhurung Union 2297 acres and 475 acres land is under agriculture and salt cultivation respectively; in Kaiyabil Union 1530 acres and 820 acres land is under agriculture and salt cultivation.

² As mentioned in Baseline Section in Dakshin Dhurung Union 2297 acres and 475 acres land is under agriculture and salt cultivation respectively; in Kaiyabil Union 1530 acres and 820 acres land is under agriculture and salt cultivation.

It is envisaged that the laying of the pipeline (33.6 acres) will not significantly impact in the change of land use along the corridor. It is reported that once the construction is complete, Reliance Power might return the land back to the land losers for redevelopment including growing crops, grazing, salt cultivation, etc. However, no structural development would be permitted on the same. Hence, it will be possible to restore land use (like agriculture, salt cultivation, grazing) once construction is complete.

Mitigation Measure:

- Mitigation measures as outlined in the immediately preceding section on Land Loss to be followed.

Impact	Change in Land-Use for Land Based Facility & Terminal Station at Napura			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect		Induced
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional		International
Impact Scale	Total land area available for agriculture and salt cultivation in Dakshin Dhurung and Kaiyarbil Union is 5122 acres ¹ ; only 0.74 percent (40 acres for land based facility will be taken up. For onshore gas pipeline 27.64 acres of private land which is mostly under agriculture and salt cultivation may be acquired but will be returned to the owner after construction followed by restoration for resuming previous livelihood activity.			
Frequency	During construction phase of the project			
Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium		High
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered Moderate			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations)	Significance of impact is considered Minor			

Residual Impact: Considering the implementation of above mentioned mitigation measures, the residual impact is assessed to be **minor**.

Fragmentation of Land

Parcels of land along the proposed RoW for gas pipeline may get fragmented due to the linear acquisition associated with the route of the gas pipeline. This may either lead to partial loss of cultivable land and salt pans or even creation of orphan lands which may be rendered too small or unviable for cultivation both for agriculture or salt. Alternatively, associated facilities would require

¹ As mentioned in Baseline Section in Dakshin Dhurung Union 2297 acres and 475 acres land is under agriculture and salt cultivation respectively; in Kaiyarbil Union 1530 acres and 820 acres land is under agriculture and salt cultivation.

access routes for maintenance purposes and these may impact adjacent parcels of land or crops.

Impact	Fragmentation of Land for Onshore pipeline			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect		Induced
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional		International
Impact Scale	27.64 acres land will be temporarily acquired for gas pipeline and it will be returned for agriculture and salt cultivation purpose			
Frequency	During the construction phase			
Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low		Medium	High
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered Negligible			

5.3.12 Potential Livelihood Impacts

The land parcels that will potentially go for land acquisition during the construction phase are agricultural lands and salt cultivation fields as assessed from satellite imagery and from the Reconnaissance Survey Report for the LNG Terminal and associated pipeline. The impacts on different stakeholder groups, as envisaged are as follows:

Livelihood of Land Owners

As described earlier the proposed land for the land based facility is single cropped and agricultural activities are primarily dependent on monsoon due to lack of irrigation infrastructure in the area. Paddy is the main crop while certain vegetables are also grown as a second crop purely for self-consumption purposes. Even though agriculture is the primary source of income, due to the constraints in irrigation facilities, land owners are not entirely dependent on land for livelihood and amount of land which will be acquired for the project is very less in comparison to the total available land in the island for agriculture. Project effected people (land owners) can also invest the compensation money for buying land in other place.

Though the salt cultivation is profitable livelihood option, local people who are engaged in salt cultivation, are also not entirely dependent on salt cultivation as this activity is restricted only for six months in a year.

Significant adverse impact from loss of land for the RoW for the gas pipeline is not envisaged because of the temporary nature of acquisition. However, there

would be short term losses primarily resulting from disruption or severance of access to farm land during the construction phase of the pipeline¹..

Mitigation Measure:

- Project effected people (land owners) to be compensated as detailed out in Entitlement Matrix in the Resettlement Framework. The land owners will be compensated for their standing crops and trees as per the entitlements detailed out in the Resettlement Framework;
- Land owners along the pipeline corridor to receive compensation in accordance with the duration of disruption, i.e.rental fees may be paid for the period of using the land and crop compensation in case of agricultural land

Impact	Impact on Livelihood of Land Owners			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional	International	
Impact Scale	Proposed land for the land based facility is single cropped and agricultural activities are primarily dependent on monsoon due to lack of irrigation infrastructure in the area. Paddy is the main crop while certain vegetables are also grown as a second crop purely for self-consumption purposes. Even though agriculture is the primary source of income, due to the constraints in irrigation facilities, land owners are not entirely dependent on land for livelihood and amount of land which will be acquired for the project is very less in comparison to the total available land in the island for agriculture. Project effected people (land owners) can also invest the compensation money for buying land in other place.			
Frequency	Construction Phase			
Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High	
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered Minor			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations)	Significance of impact is considered Minor .			

Residual Impact: Considering the implementation of above mentioned mitigation measures, the residual impact is assessed to be **minor**.

¹ As per the Project Activity Schedule provided by the Projec Proponent complete laying of gas pipeline will take 12 months and an additional 3 months will be required for restoring the site and removing construction materials, which is about 15 months on whole. And the laying of the onshore pipeline will be done in sections.

Livelihood of Sharecroppers, Lessee Farmers and Salt Pan Workers

Due to establishment of the project, the sharecroppers and lessee farmers (if any) cultivating within the project area would have to discontinue their practice in the project area once the construction activities start. The project will influence the sharecroppers to search for other land parcels in the vicinity in order to continue their practice. Restriction on use of land in project area may lead to impact their livelihood and income. This impact may be temporary i.e. loss of income during the transition phase and could be mitigated once the sharecropper, lessee farmers finds a new site for cultivation and renews his sharecropping practice. However, the impacts could also be long term and in some instances lead to change in occupational pattern (like cultivator to agricultural or wage labour, contract worker etc.) if any sharecropping family is unable to find alternate land.

Similar impacts, as in case of the sharecroppers, are envisaged for the salt pan owners (usually the salt pan owners take land on lease from the land owners for salt cultivation) and its labourers. Restriction on use of land parcels due to acquisition (for land based facility) may lead to impact livelihood and income of the salt pan workers/ labourers. However this impact may be temporary, till the salt pan owners find other parcel of land to take on lease and the workers find salt cultivation work at other salt pans in neighbouring areas. The impacts could also be long term and in some instances lead to change in occupational pattern if any labourers working in salt pans is unable to find alternate place of work or land.

Considering the sensitivity matrix, since both magnitude and sensitivity are both medium, the impact of the livelihood of the project is considered to be moderate.

At this point of time no cumulative impact is assessed as no further projects have been proposed in the island upazila, however there may be cumulative impacts in the regions in case of any further infrastructural and industrial development in the region.

Mitigation Measures:

- As a mitigation measure the share croppers, lessee farmers and the salt pan workers will be appropriately compensated as detailed out in Entitlement Matrix in the Resettlement Framework. The land owners will be compensated for their standing crops and trees as per the entitlements detailed out in the Resettlement Framework;
- For lease holders and sharecroppers using the land parcel at least 60 days advance notice will be served so that they can harvest standing seasonal crops and collect the salts. If harvest is not possible they will be equivalently compensated;
- Unskilled labour during the project construction phase should be sourced from the local community;

- Training should be provided to the local people for their skill enhancement and their provisions as it will be provided in the Resettlement Plan.

Impact	Livelihood Impact on Share Croppers, Lessee Farmers and Salt pan Workers			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional	International	
Impact Scale	Nearby project area			
Frequency	During entire life of the project			
Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High	
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered Moderate			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations)	Significance of impact is considered Minor			

Residual Impact: Considering the implementation of above mentioned mitigation measures, the residual impact is assessed to be **minor**.

5.3.13

Impact on Fishing Activity

Fishing is one of the primary livelihood options for the population of Kutubdia Island Upazila. The Kutubdia Island Upazila has 7,116 (as on 30th June 2016) registered fishermen and there may be additional 20% more unregistered fishermen according to the District Fisheries Officer; it makes the estimated amount of 8,500 fishermen in the island. The fishermen practice deep sea fishing (fishing during 15 to 20 days per trip), daily fishing (i.e. fishing during 24 -30 hours per trip) and foot fishing /shoreline fishing. Potential impacts on fishing activities are localized envisaged due to the Project all through its lifecycle starting from construction period.

Construction Phase

Impact on Shoreline and Foot Fishing

Land Based Facility: Land for the onshore regasification facility falls under Ali Fakir Deil (Ward no. 2) village in Dakshin Dhurung Union and Bindapara (Ward no. 1)¹ village in Kaiyabil Union. Fishermen of Ali Fakir Deil village

¹ Based on the baseline information there are 168 and 23 registered fishermen in Dakshin Dhurung and Kaiyabil Unions respectively. Additional 20 percent unregistered fishermen may be present in the area as per the District Fisheries Officer, Cox's Bazar.

(168 government registered fishermen) and Bindapara village (23 government registered fishermen), which is about 2.68% of the total registered fishermen in the island, use the sea shore for various activities like anchoring fishing boat, drying of fishing net, making and maintenance of boat and fishing gear.

It is also observed during the site visits that people practice foot fishing or shoreline fishing using push nets and estuarine set bag net to catch fish. This is commonly done by the fishermen residing adjacent to the seaside. During consultations with the fishermen it was mentioned by them that usually the elderly or youth members of the fishermen family go for foot fishing or shoreline fishing.

The proposed land requirement for the ORF, will be partly on the sand beach portion (i.e. left side of the embankment) and partly on the right side of the embankment. Shoreline fishing has been observed in this region which is primarily practised by the fishermen from Ali Akbar Deil and Bindapara villages. As the land based facility is proposed here, this will potentially impact the shoreline fishing and foot fishing by preventing the fishermen from setting up small setback nets near the coast line. It is expected that most of these fishermen would be able to continue this practice, albeit not specifically at the same location.

However, it must be noted that the bathymetry map indicates a steep sea floor with 10 m contour reaching within 1 km from the Kutubdia Island on the west, thus restricting shoreline fishing very close to the coast.

The anticipated impact on income may be reduced if the fishermen find an alternate fishing ground for foot fishing or shoreline fishing and start earning; however there may be a chance of conflict between the affected fishermen and the existing fishermen who are already into shoreline fishing or foot fishing in that region surrounding the Project site. The impact will be localized and long term in nature. However, the number of fishermen getting involved in foot fishing and shoreline fishing is a small proportion of the fishing community living and operating in the island, and the level of impact can only be established through further consultations at Resettlement Planning stage just before the construction activities commence. The expected fishermen of 2.68% will be impacted, which is very less in comparison to the total fishermen in the island.

Impact on Deep-Sea Fishing Access Route

It has been reported during the fishermen consultations and indicated in the fishing Route Map in Figure 4.100 that the contractual fishermen going for deep-sea fishing, especially from the Dakshin Dhurung Union and some from Kaiyabil Union start their journey from the coastal area north of the proposed site from an anchorage point and they travel south-west towards the deep-sea fishing grounds.

The access route taken by the fishermen could be restricted during construction of the trestle and twin berthing facility. Although this will not stop the deep sea fishing access of the fishermen of Dakshin Dhurung union, it could potentially increase their fuel cost and time. The impact will be localised and long term in nature.

Impact of Daily Fishing

The fishermen of Ali Fakir Deil and Bindapara (from Dakshin Dhurung) and Kaiyarbil Union from doing daily fishing except from near the Project site which will be impacted due to the trestle construction as they will not be allowed to fish in the exclusion zone (300 m either side along trestle). It is difficult to establish which fishermen exclusively use the area under the exclusion zone, if at all. However, such fishermen may have to take a slightly longer route to reach the daily fishing grounds or alter their starting location. The extent of impact will be minimal as the daily fishing ground starts from 5 km from the shoreline and the FSU will be at a distance of 2.4 km from the ORF. Impact may be localised, especially for those fishermen of Ali Fakir Deil and Bindapara villages fishing up to 4 km and it will be long term in nature. However, it is not expected to significantly impact their income; the fishermen of these villages can continue daily fishing taking either longer routes or altering their starting location with respect to ORF and deeper grounds as discussed during the community consultations; the impacts were accordingly assessed.

Impact of Daily Fishing Access Route

The FSU and the exclusion zone of it will not majorly impact daily fishing conducted within that zone. The daily fishing zone is beyond the exclusion zone – the first fishing ground as mentioned by the fishermen, 'Aat Bam', is at a distance of 5 km from the shoreline. Fishermen will be restricted to fish in the exclusion zone. They may have to sail further west or south-west for conducting daily fishing.

Onshore Gas Pipeline - The onshore gas pipeline will cross the Kutubdia Channel from the north-east part of the island. The gas pipeline will be laid sub-sea buried at a depth of 1-2 m below the bed of the Kutubdia Channel. This may not directly impact the fishing activity, this may potentially impact temporary disruption in navigation of the fishing trawlers and boats during construction phase of the gas pipeline that will cross the Channel.

The overall extent of impact on fishing activity related to income from foot fishing and shoreline fishing is assessed to be small, localised and long term for the fishing settlements near the Project site near land based facility of the LNG Terminal. There will be access related impacts but it will be localised for the 2.68% of fishermen residing in the settlements adjacent to the project site. However, the impact can be quantified in terms of profile of the fishermen, fish yield and seasonality based of the detailed survey to be undertaken for Resettlement Action Plan.

The human receptors/ vulnerable community likely to be affected by the Project being located adjacent the Project site away from the shore, the receptors sensitivity is considered to be medium.

Mitigation Measures:

- Fishermen will be informed about the Project construction and their feedback to be taken on seasonality and routes during construction. The Project will try and avoid disrupting peak fishing activities to the extent feasible;
- A monitoring study with GPS may be undertaken by the Project proponent that will monitor and assess the actual fishing routes, fishing zones and fish catch of the local fishermen that may potentially get impacted due to the project activities. This GPS route map should be referred to when developing RAP before construction;
- Fishermen claiming any damage or loss of livelihood may approach the grievance redressal mechanism to be established by the project and seek redressal or compensation;
- Any livelihood disruption, permanent or temporary for near shore fishermen will be compensated as defined in the RF and RP;
- Fishermen proven to be impacted will be provided access to alternate livelihood options;
- Any damage to boats or fishing gear, or for assets that need to be removed will be compensated at replacement value and determined by the grievance process;
- Fishermen will be provided prior information about the exclusion zone and the movement of LNG Carrier ;
- The work for the gas pipeline laying along the Kutubdia Channel may be conducted in sections such that traffic movement on the channel is not restricted.

Impact	Impact on Fishing Activity related to Income and Access			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional	International	
Impact Scale	Fishermen nearby project area from Ali Fakir Deil and Bindapara, which is about 2.68 percent of the total fishermen in Kutubdia island.			
Frequency	During entire life of the project			
Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High	
Impact Significance (Without Mitigation)	Negligible	Minor	Moderate	Major
	Significance of impact is considered Moderate			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations)	Significance of impact is considered Minor			

Residual Impact: Considering the above mentioned mitigation measures the residual impact significance will reduce to Minor.

Operation Phase

Impact on Fishing due to Restriction of Movement in the Exclusion Zone

During operation phase the twin berthing for FSU and LNG carrier together with cryogenic pipeline of ~2.4 km on a trestle will result in an exclusion zone of 500 m around twin berthing and 300 m either side of the trestle.

Ali Fakir Deil (Ward no. 2) village in Dakshin Dhurung Union and Bindapara (Ward no. 1) village in Kaiyabil is the location for the ORF, using the push nets and small set bag nets (*choto behundi jal*) and the fishermen doing daily fishing not very far from the coastline. There are 168 and 23 registered fishermen (as on 30th June 2016) in Ali Fakir Deil (ward no. 2) and Bindapara villages (ward no. 1) respectively. Once Project is operational, there will be restriction on movement of fishing community in the exclusion zone of about 300 m on either side of the trestle and 500 m around the twin berthing for security and safety reasons. Any shoreline fishing that may have been impacted by the construction and development of the land based facility, should have been assessed and compensated before as well as during the construction phase. The restriction of movement in the exclusion zone along the trestle near the coast will cause marginal impact on daily fishing (shrimp catch) through push nets.

There could also be impact on the fishermen residing in these villages going for deep sea fishing who usually start their journey from the coastal area near the site may have to take a longer route or alter their starting location either from north of ORF to access to north-western region or from south of the ORF to access to south-western sea region.

The impact magnitude for the near shore fishing and deep sea fishing is expected to be medium to small while the sensitivities of receptors (fishing community) is considered as medium, the impact significance on their livelihood of the project is considered to be **moderate**.

Mitigation Measures:

- Those fishermen who may get affected due to the operation of the Project activity during operation phase, on approaching to Project Proponent, should be assisted in shifting their starting location either from north of ORF to access to north-western region or from south of the ORF to access to south-western sea region.
- Fishermen be provided regular information about the movement of the FSU and about the restrictions in their boat movement. Regular engagement with fishermen be conducted through a stakeholder engagement plan.
- Any damage to fishing boats, gear and nets should be communicated through the grievance redressal process, and get the company will

address those through either replacement of gear or compensation at replacement value.

- Seasonal monitoring of fish catch be conducted by an independent agency to check trends in quantity or fish diversity for at least 5 years post start of operation. This data will help assess and verify any claims on loss of livelihood.
- Focus on generating more diversified local livelihoods through CSR/local social investment programmes.

Impact	Impact on livelihood due to restricted movement in sea shore and Sea during Operation			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional	International	
Impact Scale	Nearby project area Fishermen nearby project area from Ali Fakir Deil and Bindapara, which is about 2.68 percent of the total fishermen in Kutubdia island.			
Frequency	During entire life of the project			
Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High	
Impact Significance (Without Mitigation)	Negligible	Minor	Moderate	Major
	Significance of impact is considered Moderate			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations)	Significance of impact is considered Minor			

Residual Impact: Considering the above mentioned mitigation measures the residual impact significance will reduce to **Minor**.

5.3.14

Conflict with Local People

Consultations in the neighbouring villages indicate that the people in the area look forward to new employment to be generated by the project. Even though RBLTL/its contractors would endeavour to provide maximum employment to the local people, there would be constraints due to the lack of required technical skills and expertise in the local population. So, certain percentage of semi-skilled and highly skilled migrant labour would be used by contractors for manning these activities. It is anticipated that occasional conflicts would arise with the local community over the recruitment of migrant workers. Conflicts with the local population are also likely due to the cultural difference between migrant workers and nuisance caused by workers due to improper sanitation facilities etc. However these may be managed with good labour practices. Since the conflicts can cause temporary disruption in work, the impact is considered to be of **minor** significance.

Mitigation Measures

- Communication in the affected villages during the construction phase and the installation of an effective grievance redressal mechanism;
- Migrant labours would be provided training on local culture and traditions.

Impact	Conflict with local people			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional	International	
Impact Scale	Nearby project area			
Frequency	During construction phase			
Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High	
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered Minor			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations)	Significance of impact is considered Minor			

Residual Impact: Considering the above mentioned mitigation measures the residual impact will remain same, i.e. **minor**.

5.3.15 *Increment in Cost of Living*

The economic growth and the overall development of the region would also have some drawbacks especially on the quality of life. The employment generation would result in increase of expendable income in the areas. The resultant increased money flows in the area would increase the cost of living in the area which would have some negative impacts. However, the economic development in the area would also increase the purchasing power of the people in the area hence the negative impacts of incremental cost of living would be of **minor** significance.

Impact	Increment in cost of living			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional	International	
Impact Scale	Nearby project area			
Frequency	Entire operational phase			

Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium		High
Impact Significance (Without Mitigations)	Negligible	Minor	Minor	Major

5.3.16 *Community Health and Safety*

The community health and safety impacts may arise due changes in environmental quality, influx of non-resident workers to the area and additional river traffic movement.

Construction Phase

Possible sources of impacts to community health and safety during the construction phase are:

Dust and Noise Discomfort

Proposed project site and access road is surrounded by several rural settlements. Inhabitants residing close to site and access roads will get affected due to noise and dust generated from vehicular movements, site preparation operation of machineries, construction activities. Water sprinkling on the access roads and at the construction sites would reduce dust emissions considerably. To reduce noise related impacts, project vehicles should not blow horns near settlements and the night time movement of vehicles and construction activities will also be restricted.

Mitigation Measures

- Water sprinkler system should be installed for dust suppression;
- High noise generating construction should be suspended during night hours.

Impact	Impact on community health & safety due to dust and noise generation			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional	International	
Impact Scale	Around the project site			
Frequency	During construction phase			
Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High	
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered Minor			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations)	Significance of impact is considered Negligible			

Residual Impact: Considering the implementation of above mentioned mitigation measures, the residual impact on community health and safety is assessed to be **negligible**.

Transmission of Infectious Diseases

Approximate 900 workers will be employed during the construction phase of the project and it is anticipated that about 25% of the workers would be non-locals. The influx of workers to the community may cause impacts to public health, especially an increase in prevalence of diseases. Influx of migrant labours during construction can cause mixing of the migrant workforce with the local people. This mixing of the groups may cause some adverse impacts to public health in the neighbouring villages with the potential for spread of infectious diseases like as AIDS.

Improper sanitation facilities and disposal of municipal solid waste in the construction labour camps can also trigger vector borne diseases. Measures such as proper collection, storage and disposal of wastes, construction of septic tanks to prevent contamination of water resources from sanitary effluents generated from labour camps will be implemented. Taking these measures into account, the impact to public health and safety is evaluated to be of **minor** significance.

Mitigation Measures

- Labour Camp should be separated from the village
- Restricted access of local villagers in the labour Camp
- Movement of migrant labourer with in the villages should be restricted
- Waste generated from labour camp should not dump with in the villages
- Waste water generated from labour camp should not discharged within the village

Impact	Impact on Community health & safety due to transmission of infectious diseases			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional	International	
Impact Scale	Around the project site			
Frequency	During construction phase			
Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High	
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered Minor			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations)	Significance of impact is considered Negligible			

Residual Impact: Considering the implementation of above mentioned mitigation measures, the residual impact on community health and safety is assessed to be **negligible**.

Traffic Movement in Newly Constructed Site Approach Road

An increase in traffic during the peak construction activities and may create public safety issues for local residents, especially along the newly constructed site approach road. Potential impacts may include blocking access, congestion and traffic accidents along the approach road. With mitigation measures as speed control in place the impact to communities from heavy vehicular movement is assessed to be of **moderate** significance during the construction phase.

Mitigation Measures

The following mitigation measures will be put in place to reduce impacts to community to as low as reasonably practicable:

- Emphasizing safety aspects among drivers, particularly with regard to safe driving speeds;
- Ensuring that only licensed drivers are employed by the Project;
- Avoiding peak hours for heavy vehicles movement where possible;
- Regular maintenance of vehicles and use of manufacturer approved parts to minimize potentially serious accidents caused by equipment malfunction or premature failure;
- Collaboration with local communities and responsible authorities to improve signage, visibility and awareness of traffic and pedestrian safety.

Impact	Impact on Community health & safety due to traffic movement on village road			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional	International	
Impact Scale	Around the project site			
Frequency	During construction phase			
Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High	
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered Minor			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations)	Significance of impact is considered Negligible			

Residual Impact: Considering the above mentioned mitigation measures, the residual impact on community health and safety is assessed to be **Negligible**.

Operational Phase

The operation phase will be owned and operated by RBLTL. The operations phase will include day to day operations and management of the plant. Maintenance will include minor and major maintenance overhauls in order to maintain output of the industry.

Traffic Movement

During the operation phase of the Project, the regular traffic and transportation will be limited to the movement of plant personnel and contracted workers during their working shifts. Considering these factors, the impact due to traffic movement during operation phase will be **minor**.

Mitigation Measures

In order to avoid road accidents and fatalities to community following mitigation measures are proposed:

- Awareness campaign among the community residing adjacent to the road;
- Maintaining healthy relationship with community through CSR activity.

Impact	Impact on Community health & safety due to traffic movement on village road			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional	International	
Impact Scale	Around the project site			
Frequency	During operational phase			
Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High	
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered Minor			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations)	Significance of impact is considered Minor			

Residual Impact: Considering the above mentioned mitigation measures, the residual impact on community health and safety is assessed to be **minor**.

5.3.17

Impact on Social Forestry

Construction Phase

Potentially there are shelter belts around the land based facility site that are under social forestry scheme. The trees are planted by the Forest department and are taken care and maintained by the group of community people for a period of 10 years. When the trees are mature they are cut and sold by the Forest Department through auction. The total sale amount is distributed as the following:

- Community members (group) - 45 percent of the total sale amount;
- Forest Department - 45 percent;
- Refunding - 10 percent.

The small patch of shelter belt (social forestry) may potentially get impacted near the land based facility during the construction phase, and it is assumed that the community people of the adjacent settlement are the stakeholders of the forestry. Permission is to be availed from the Forest Department and DC (being the owner of the land). The trees will be valued by the Forest Department which is usually decided based on the age of the trees and compensation would be 1.5 times the value.

Mitigation Measure:

- Permission is to be availed from the Forest Department and DC (being the owner of the land);
- Compensation for the trees to be paid at market value and as assessed by the Forest Department;
- More trees to be planted by the project proponent apart from Green belt that may serve as shelter belts.

Impact	Social Forestry			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect		Induced
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional		International
Impact Scale	The small patch of shelter belt (social forestry) may potentially get impacted.			
Frequency	During construction phase of the project			
Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium		High
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered Minor			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations)	Significance of impact is considered Minor			

Residual Impact: Considering the above mentioned mitigation measures, the residual impact is assessed to be **minor**.

5.3.18 *Impact on Cultural Heritage*

A private graveyard has been identified during the site visit west of the present lighthouse on the sand beach portion which is north of the proposed land based facility. The graveyard along with portion on the western part of Dakshin Dhurung union was subject to sea erosion due to cyclonic surge; part of the graveyard was reclaimed later and was demarcated by wooden poles by the villagers, where they often visit to seek blessings from their late forefathers.

This area may be indirectly impacted during onshore underground pipeline laying activity due to excavation of trench, lying of pipeline, movement of construction materials, labour and vehicle. The extent of impact on the graveyard is potentially local due to its proximity to the pipeline laying area. The impact duration is temporary as the construction activity will be carried out for only for six month. Impact magnitude thus assessed is small and the receptor sensitivities are high as the local community is highly sensitive about graveyard and they frequently come to this place for praying and seeking blessing from their ancestor. Based on the table below the impact on cultural heritage site is assessed as **moderate**.

Mitigation Measures

- Graveyard area should be avoided if the proposed ROW of the pipeline passes through it;
- Temporary barricading around the four side of the graveyard during construction/laying of pipeline in that stretch, thus restricting the movement of construction materials, labour and vehicle within the graveyard area;
- Access of the community people to the graveyard may not be restricted due to the pipeline laying activity;
- It should be ensured that during the construction phase no spill over takes place due to staging of construction materials;
- Restriction in construction activity during the prayer time.

Impact	Impact on Cultural Heritage site			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional	International	
Impact Scale	Graveyard area may be disturbed only during pipeline laying activity			
Frequency	During onshore pipeline construction			
Impact Magnitude	Negligible	Small	Medium	Large

Resource/ Receptor Sensitivity	Low	Medium	High	
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered Moderate			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations)	Significance of impact is considered Moderate			

Residual Impact: Considering the above mentioned mitigation measures the residual impact will remain same, i.e. **moderate**.

5.3.19 *Benefit to Local Enterprises*

The project is likely to influence development of entrepreneurs in the area. The local enterprises, particularly involved in production and sale of construction materials are expected to be potential benefactors of the civil works to be undertaken for the project. Similarly local transporters of construction materials will also benefit from the project. The significance of the benefit to local enterprises is summarized below:

Impact	Benefit to local enterprise				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional		International	
Impact Magnitude	Positive	Negligible	Small	Medium	Large

5.3.20 *Employment Generation*

The construction phase of the project is likely to generate both direct and indirect opportunities for employment. The estimated direct employment would be approximately 400 un-skilled workers during the peak construction phase which will primarily source from Island. In-direct employment would be primarily in the supply chain as vendors which are anticipated to be set up to support the construction. The local people are expected to be having options for such in-direct employment, even if they are not directly involved as construction labour. Overall construction activity would have positive impact on the socio-economic conditions in general and employment scenario in particular in the study area.

Impact	Employment Generation during construction				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional		International	
Impact Magnitude	Positive	Negligible	Small	Medium	Large

5.3.21 *Demand for Lodging, Housing and Civic Services*

Employment opportunities created by the project is expected to attract large number of people from outside the district. The in-migration of long term or permanent staff will create demand for permanent housing and other support services. There would be requirement of housing and other amenities even though the project will provide on-site lodging facility. This is expected to drive up the demand for housing and supply of other support services in turn resulting in the development of adjoining areas and having a positive impact on the quality of life in the area.

Impact	Demand for lodging, housing and civic services				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional		International	
Impact Magnitude	Positive	Negligible	Small	Medium	Large

5.3.22 *Benefits of Community Development Activities / CSR Activity*

Once the proposed LNG Terminal has established its social license to operate in the community, the continued sustenance of community relations will require the project proponents to engage in community development initiatives among the project affected villages as per needs and priorities identified by opinion leaders of the community. The Upazila and Union Parishad administration can also identify priority areas for social investment that the company would be requested to contribute to. The initiatives of the project proponents are likely to be focussed on livelihood restoration, income generation, education and provision of health facilities which can further improve the quality of life of the community in the vicinity.

Impact	Benefits of Community Development Activities				
Impact Nature	Negative	Positive		Neutral	
Impact Type	Direct	Indirect		Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent	
Impact Extent	Local	Regional		International	
Impact Magnitude	Positive	Negligible	Small	Medium	Large

5.3.23 *Potential Impact on Occupational Health and Safety*

Construction Phase

Source of Impact: The sources of impact to the health and safety of the Project's construction workforce are listed below.

- Accidents and injuries associated with the operation of heavy machinery and other construction activities; and
- Health impacts associated with environmental conditions and changes in environmental quality, arising from emissions to air, water, land and noise emissions from construction activities as well as from storage and handling of waste, particularly hazardous waste.

The construction workforce of 100 managerial, 300 skilled and 600 unskilled workers will be exposed to occupational health and safety impacts arising from construction activities.

Embedded Control: The project embedded control measures are as follows:

- The Contractor will prepare and implement a Health and Safety Plan prior to commencing work. This plan will include method statements for working methods, plant utilisation, construction sequence and safety arrangements;
- A Permit to Enter system will be established to ensure that only authorised persons gain entry to the site;
- Personal Protective Equipment (PPE) shall be worn at all times on the Site. This shall include appropriate safety shoes, safety eyewear, and hard hats. Non-slip or studded boots will be worn to minimize the risk of slips.

Assessment of Impacts

Accidents and Injuries from General Construction Activities

Over-exertion, ergonomic injuries and illnesses, such as repetitive motion, over-exertion, and manual handling, are among the most common causes of injuries on construction sites. Loose construction materials, liquid spills, and uncontrolled use of electrical cords and ropes on the ground, are also among the most frequent causes of lost time accidents at construction sites. Falls from elevation associated with working with ladders, scaffolding, and partially built structures are also among the most common causes of fatal or permanent disabling injury at construction sites.

Construction activities may pose significant hazards related to the potential for dropping materials or tools, as well as ejection of solid particles from abrasive or other types of power tools which can result in injury to the head, eyes, and extremities.

Vehicle traffic, use of lifting equipment and the movement of machinery and materials on a construction site may pose temporary hazards, such as physical contact, spills, dust, emissions, and noise. Heavy equipment operators have limited fields of view close to their equipment and may not see pedestrians close to the vehicle. Center-articulated vehicles create a significant impact or crush hazard zone on the outboard side of a turn while moving.

Construction sites may pose a risk of exposure to dust, chemicals, hazardous or flammable materials, and wastes in a combination of liquid, solid, or gaseous forms. Access to construction areas, including the pipeline corridor and the access road, will be restricted to reduce risks to public health and safety. These risks could create long-term impacts to the health and safety of the construction workforce and therefore the impact severity is assessed to be medium. Measures will be implemented to ensure that these risks are considered prior to the commencement of construction, and that all risks are communicated to the workforce. Appropriate PPE will be provided and equipment maintained and inspected regularly. Taking this into account, the impact to the health and safety of workers is assessed to be **moderate**.

Mitigation Measures

The measures will be in place to minimise the health and safety impacts to personnel from general construction activities include:

- Measures will be implemented to reduce the likelihood and consequence of the following hazards:
 - falling from height;
 - falling into water;
 - entanglement with machinery;
 - tripping over permanent obstacles or temporary obstructions;
 - slipping on greasy walkways;
 - falling objects;
 - asphyxiation;
 - explosion;
 - contact with dangerous substances;
 - electric shock;
 - mistakes in operation;
 - variable weather conditions;
 - lifting excessive weights; and
 - traffic operations.
- Competent and adequately resources sub-contractors will be used where construction activities are to be sub-contracted;
- All persons working on site will be provided information about risks on Site and arrangements will be made for workers to discuss health and safety with the Contractor;
- All workers will be properly informed, consulted and trained on health and safety issues;

- Before starting work all the appropriate safety equipment and the first-aid kit will be assembled and checked as being in working order. Breathing apparatus will be tested at regular intervals in the manner specified by the makers;
- All lifting equipment and cranes will be tested and inspected regularly. All hoist ways will be guarded;
- All scaffolds will be erected and inspected and the appropriate records maintained by the Contractor;
- Safety hoops or cages will be provided for ladders with a height in excess of two metres;
- When there is a risk of drowning the lifebelts shall be provided and it shall be ensured that personnel wear adequate buoyancy equipment or harness and safety lines, and that rescue personnel are present when work is proceeding;
- All breathing apparatus, safety harnesses, life-lines, reviving apparatus and any other equipment provided for use in, or in connection with, entry into Confined Spaces, and for use in emergencies, will be properly maintained and thoroughly examined at least once a month, and after every occasion on which it has been used;
- Where sound levels cannot be reduced at the source, suitable hearing protection will be provided when noise levels indicate an Leq of more than 90 dB(A). When hearing protection is used, arrangements will be made to ensure the wearers can be warned of other hazards; and
- The Contractor shall provide appropriate safety barriers with hazard warning signs attached around all exposed openings and excavations when the work is in progress.

Impact	Accident and Injuries from General Construction Activities			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect		Induced
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional		International
Impact Scale	100 managerial, 300 skilled and 600 unskilled workers			
Frequency	During construction phase			
Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium		High
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered Moderate			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations)	Significance of impact is considered Minor			

Residual Impact: Considering the above mentioned mitigation measures, the residual impact is assessed to be **minor**.

Health Impact associated with Environmental Conditions

Changes in the environmental quality of air, surface water, groundwater and soil quality may occur as a result of construction activities. High noise levels are also expected from the operation of heavy machinery.

An increase in dust and noise during the construction period has the potential to lead to health impacts associated with eye irritation and general disturbance to daily activities. Waste will be generated during the construction including excavated material, construction waste, hazardous waste, sewage sludge and general refuse. The discharge of domestic waste effluent from construction workers may have the potential to cause contamination of surface water and groundwater in this area.

There is a potential for long term impacts to worker's health from changes in environmental quality, as workers will be exposed to higher levels of emissions than off-site receptors. The health and safety impact associated with changes in environmental quality is considered to have *moderate* significance.

Mitigation Measure:

- Mitigation measures as outlined in the immediately preceding section on accidents and injuries from general construction activities to be followed.

Impact	Health impacts associated with environmental conditions			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional	International	
Impact Scale	100 managerial, 300 skilled and 600 unskilled workers			
Frequency	During construction phase			
Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High	
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered Moderate			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations)	Significance of impact is considered Minor			

Residual Impacts: Considering the implementation of above mentioned mitigation measures, the residual impact on occupational health and safety during construction phase is assessed to be **minor**.

Operational Phase

Source of Impact: Occupational health and safety impacts associated with LNG Facilities operations include Fire and explosion, Roll-over, Contact with cold surfaces, Chemical hazards, working in confined spaces¹ etc. The operation workforce of 21 managerial, 39 skilled and 50 unskilled workers will be exposed to occupational health and safety impacts arising from operational activities.

Embedded Control: The project embedded control measures are as follows:

- A Permit to Enter system will be established to ensure that only authorised persons gain entry to the site;
- Personal Protective Equipment (PPE) shall be worn at all times on the Site. This shall include appropriate safety shoes, safety eyewear, and hard hats. Non-slip or studded boots will be worn to minimize the risk of slips;

Impact Assessment

Fire and explosion hazards at LNG facilities may result from the presence of combustible gases and liquids, oxygen, and ignition sources during loading and unloading activities, and /or leaks and spills of flammable products. Storage of large quantities of LNG in tanks may lead to a phenomenon known as roll-over. Roll-over may occur if LNG stratifies into layers of different densities within the storage tank, resulting in pressures that, in the absence of properly operating safety- vent valves, could cause structural damage.

Storage and handling of LNG may expose workers to contact with very low-temperature product.

When LNG comes in contact with air, it begins to vaporize, returning to its natural gaseous state. As LNG is a cryogen, there is a risk of cold burns if it is in contact with skin. LNG vapor cloud can be hazardous if allowed to collect in a confined space. Because LNG can replace oxygen in a confined space, there is a potential of causing dizziness, fatigue, nausea, headache, and irregular breathing.

Confined space entry (storage tanks, secondary containment areas, storm water/wastewater management infrastructure etc.) by workers and the potential for accidents may vary among LNG terminal facilities depending on design, onsite equipment, and infrastructure.

These risks could create long-terms impacts to the health and safety of the operation workforce and therefore the impact severity is assessed to be medium. Measures will be implemented to ensure that these risks are considered prior to the commencement of operation, and that all risks are

¹ http://www.ifc.org/wps/wcm/connect/2757f69d-8936-457e-8d48-7aac7486525f/LNG+Facilities+EHS+Guideline_2016+Vs+2007.pdf?MOD=AJPERES

communicated to the workforce. Appropriate PPE will be provided and equipment maintained and inspected regularly. Taking this into account, the impact to the health and safety of workers is assessed to be **moderate**.

Mitigation Measures

- The Project will adopt a total safety control system, which aims to prevent the probable accidents such as fire accidents or chemical spills;
- Fire fighting systems, such as sprinklers, portable extinguishers (appropriate to the flammable hazard in the area) and automated fire extinguishers will be provided at strategic locations with clear labelling of the extinguisher type;
- Plant equipment at low temperatures that can pose risk to workers should be identified and protected to prevent accidental contact. Training on handling and dispensing of LNG, hazard due to contact with cold surfaces (cold burns) should be provided; PPEs (gloves, insulated clothing should be used);
- Constant monitoring of pressure, density and temperature of LNG storage tanks; installation of pressure safety valves to prevent roll overs;
- Installation of multiple loading points at different tank levels to allow distribution of LNG to prevent stratification;
- Material Safety Data Sheets (MSDS) for each chemical used should be available and readily accessible at the facility;
- Wear cold insulating gloves, a cold insulating apron, eye protection, and face shield while working in extreme cold environment;
- A safety manual for storage and handling of Hazardous chemicals will be prepared and implemented;
- The staff will be trained for first-aid and fire fighting procedures. The rescue team will support the first-aid and fire fighting team;
- A first-aid centre with the trained personnel;
- Training and rehearsal of the emergency response procedures by the emergency team members and personnel on site will be completed periodically;
- A safe assembly area will be identified both at FSU and ORF and evacuation of the premises will be practised regularly through mock drills;
- Safe work practices will be developed to provide for the control of hazards during operation and maintenance;
- In the material storage area, hazardous materials will be stored based on their compatibility characteristics;
- A near miss and accident reporting system will be followed and corrective measures shall be taken to avoid / minimize near miss incidents;
- Safety measures in the form of DO and Don't Do will be displayed at strategic locations;
- Safety audits will be conducted periodically as per the regulatory requirements;
- Fire fighting system will be tested periodically ; and
- All hydrants, monitors and valves will be visually inspected every month.

Impact	Impact on Health and Safety of Operational Workforce			
Impact Nature	Negative	Positive	Neutral	
Impact Type	Direct	Indirect	Induced	
Impact Duration	Temporary	Short-term	Long-term	Permanent
Impact Extent	Local	Regional	International	
Impact Scale	21 managerial, 39 skilled and 50 unskilled workers			
Frequency	During operation phase			
Impact Magnitude	Negligible	Small	Medium	Large
Resource/ Receptor Sensitivity	Low	Medium	High	
Impact Significance (Without Mitigations)	Negligible	Minor	Moderate	Major
	Significance of impact is considered Moderate			
Impact Magnitude (With Mitigations)	Negligible	Small	Medium	Large
Impact Significance (With Mitigations)	Significance of impact is considered Minor			

Residual Impact: Considering the implementation of above mentioned mitigation measures, the impact magnitude will be reduced; however still there would be significant occupational health and safety impacts resulting from the operational activities and the residual impact is considered to be **minor**.

5.4 CUMULATIVE IMPACTS

The impact assessment process has also covered potential for cumulative impacts if any on Valued Environmental and Social Components (VECs) due to presence of existing and planned future developments in the region.

The approach for assessing the cumulative impacts was adopted in reference to the guidance that has been issued by the International Finance Corporation (IFC) in form of the *Good Practice Handbook for Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets (2013)*¹.

Accordingly it was important to determine the present conditions of VECs on the Kutubdia Island and its surrounding areas. A focus was given to assess the present condition of VECs through collection and collation of primary and secondary information and was supplemented with information gained during consultation with various stakeholder groups. Section 4 of this report on Baseline Conditions has spelt out in great details the present conditions of the various environment and social components as established through this ESIA. The findings did not indicate any existing stress on the VECs and the airshed, water shed, etc were relatively unpolluted. At the same time natural

¹ The Good Practice Handbook for Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets (2013) of IFC presents a useful approach for developers in emerging markets the conduct of a rapid cumulative impact assessment (RCIA).

resources and ecosystem services were also not under any additional pressure (usually associated with unplanned urban growth and industrial development) as the Island typically has a rural setting with no industrial presence. Future trends on the VECs as estimated through the present impact assessment process and with due consideration of all mitigation / management plans that have been proposed in this ESIA, no significant deterioration in the existing condition of the VECs is anticipated as result of this proposed LNG Terminal.

As part of this process it was also important to recognize future activities and projects planned in the region may contribute to detrimental effects on the VECs. Accordingly an attempt was made to understand the cumulative impact on the VECs resulting from the present project under consideration (PUC) and other developmental activities including reasonably foreseeable future actions (RFFAs) that can be predicted at this point in time.

The reasonably foreseeable future actions (RFFAs) at this stage comprise of the following developments:

Table 5.10 Reasonably Foreseeable Future Actions

Reasonably Foreseeable Future Action (RFFA)	Proponent	Distance from the Project Under Consideration (PUC)
2X600 MW Coal-Fired Power Station at Matarbari	CPGCBL	15 Km
Coal Fired Power Station at Pekua	EGCB	12 Km
- 2X600 MW - Phase I		
- 2X600 MW - Phase II		
LNG Terminal at Moheshkhali	Power Cell	35 Km
LNG Terminal at Moheshkhali	Petrobangla - Excelerate Energy	35 Km

Amongst the RFFAs mentioned above, the Environmental Impact Assessment for the proposed coal fired power station at Matarbari¹ has been conducted and was reviewed to have an understanding of the impacts anticipated on the VECs. Based on this review it was understood that maximum spread of emissions and discharges from this power station and subsequent impact on air and water environment is limited to a maximum impact zone of 3.5 Km. So it can be generally surmised that the proposed power stations are not likely to contributed to any cumulative impacts in the present area under consideration (i.e. the study area for this ESIA).

From Table 5.10 it is also evident that the LNG Terminals being proposed at Moheshkhali are quite distant to contribute towards any cumulative impacts in the Kutubdia region. No common air shed or water shed is envisaged amongst the present project under consideration (the Kutubdia LNG Project) and the RFFAs. So in in light of the above discussion, cumulative impacts are not anticipated.

¹ Environmental Impact Assessment of Construction of Matarbari 2X600 MW Coal Fired Power Plant and Associated Facilities for Coal Power Generation Company of Bangladesh Limited (Prepared by JICA Study Team), June 2013

6 ANALYSIS OF ALTERNATIVES

6.1 INTRODUCTION

Assessments of alternatives at the time of project design help in finalizing the best option that is techno-commercially viable having minimum impact on the local environmental and social conditions.

Analyses of alternatives were considered for the following aspects of the Kutubdia LNG Terminal Project;

- Site Location
- Technology
- Pipeline Route Alternatives

Analyses of alternatives were conducted based on the following criteria viz.

- A. Techno-economic Feasibility
- B. Operability in different climatic/oceanographic conditions
- C. Flexibility to expand in future
- D. Environmental Consideration
- E. Ecological Aspects
- F. Social Aspects

Details of alternatives assessed for individual options are presented below

6.2 SITE LOCATION ALTERNATIVES

Five locations on the west coast of Bangladesh have been studied as potential locations for the LNG terminal viz. Parki, Kutubdia, Matarbari, Moheshkhali / Sonadia and Elephant Point. Among the sites the Parki site was characterised by very shallow water depths. Thus this site was not found to be suitable for LNG facility construction. Alternative assessment for site location only considered Kutubdia, Matarbari, Moheshkhali/Sonadia and Elephant point sites. The four locations are shown in *Figure 6.1*.

Figure 6.1 LNG Terminal - Location Alternatives



Alternative 1 - Kutubdia Site



Alternative 2 - Matarbari Site



Alternative 3 - Moheshkhali/Sonadia Site



Alternative 4 - Elephant Point Site

Source- DHI, 2016. Consultancy Services for Desktop Study for Site Screening in Chittagong and Moheshkhali Region, Bangladesh

The alternative analysis for the four sites is presented in *Table 6.1*.

Table 6.1 Analyses of Site Alternatives

S No.	Assessment Parameters	Kutubdia	Matarbari	Sonadia	Elephant point
	Site Details	This option considers an FSU moored off Kutubdia Island in approximately 13m water depth, west of Kutubdia lighthouse and at 3 km from the shore line.	This option considers an FSU moored off Matarbari Island in approximately 10m water depth, ~1km from the edge of Kutubdia channel.	This option considers an FSU moored ~2km west of northern tip of Sonadia Island in 15 to 30m water depth.	This option considers an FSU ~3km off Elephant Point in 11m water depth behind a protective breakwater.
A.	Techno-economic Feasibility	Around the Island, the bathymetry map indicates a steeply sloping sea floor with the 10m bathymetry line located within 1km from shore. An area with more than 13m water depth can be found less than 3km from shore. Access to this area by LNGCs would be possible with minimum dredging.	The bathymetry map indicates steeply sloping depth contours close to Matarbari Island	The bathymetry map indicates steeply sloping depth contours in the vicinity of Sonadia Island, with the 20m bathymetry line within 1km of the shore line at the northern end of Sonadia Island.	The bathymetry map indicates depth contours parallel to the shore with the 10 m bathymetry line within 2 km from the shore line
B	Operability in different climatic/oceanographic conditions				
	Shoreline Evolution	Kutubdia Island has been experiencing erosion and deposition at the same time. Strong longshore currents in the monsoon season cause rapid erosion in the southern and western shorelines of Kutubdia Island. However, the coast line near the lighthouse was found to be relatively stable	Matarbari Island was subject to considerable shoreline erosion. However, overall, the island is in a gaining phase in terms of area. Large areas of high suspended sediment concentration are located around Matarbari Island and at the entrance of Kutubdia channel.	The area has unstable bank line on the northern tip of Sonadia Island. For an onshore terminal to be feasible at this location land would need to be reclaimed and this is expected to be a costly solution.	The area have a stable coastline with little soil erosion or deposition has been found to occur
	Tides and Current	Strong tidal currents occur around Kutubdia Island. The maximum current speed is approximately 2m/s.	Strong tidal currents occur around Matarbari Island. The maximum current speed is approximately 2.4m/s.	Strong currents occur around the site of interest off Sonadia Island. The maximum current speed is approximately 2.4m/s.	Currents are relatively lower at Elephant point compared to other locations.

S No.	Assessment Parameters	Kutubdia	Matarbari	Sonadia	Elephant point
	Cyclone (All the areas are prone to cyclones. Cyclones occur mainly from April to May and August to December.)	Storm surge as large as 6m have been recorded during past cyclone events. Cyclonic waves calculated based on the cyclone event in April 1991 indicated Hs up to 4-5m offshore Kutubdia Island. Storm surge for that event was estimated at 1.2m off Kutubdia Island.	Cyclonic waves calculated based on the cyclone event in April 1991 indicated Hs upto 4-5m offshore Matarbari and up to 3m in the Kutubdia channel. Storm surge for that event was estimated at 1.6m off Matarbari Island.	Cyclonic waves were relatively high off Sonadia Island compared to other sites. Cyclonic waves calculated based on the cyclone event in April 1991 indicated reach 8m Hs off Sonadia. Storm surge for that event was estimated at 2m off Sonadia Island.	Cyclonic waves calculated based on the cyclone event in April 1991 indicated Hs reaching 5m nearshore elephant point. Storm surge for that event was estimated at 2m off Elephant point.
	Wave	Wave environmental conditions at site are relatively benign, and thus the site is expected to be suitable for the terminal to operate without the necessity of breakwater.	Wave environmental conditions at the site are higher than for Kutubdia but still relatively benign, and thus the site is also expected to be suitable for the terminal to operate without the necessity of breakwater.	The area around Moheshkhali Island is characterised by a slightly higher wave conditions.	The area around Elephant Point is characterised by a relatively benign wave conditions.
C.	Flexibility to expand in future	Possible	Possible	Possible	Possible
E.	Future Shift to Onshore solution	Possible, distance to shore allows for operations of cryogenic line.	Possible, distance to shore allows for operations of cryogenic line.	Not possible, distance to shore is greater than typical allowable length for operations of cryogenic pipeline.	Possible, distance to shore allows for operations of cryogenic line.
D	Environmental Consideration				
	Overlapping exclusion zone to 3rd parties	Not Applicable	To the Kutubdia Channel	Not Applicable	Not Applicable
	Overlapping safety zone to 3rd parties	Not Applicable	To Kutubdia Channel and onshore infrastructures.	Not Applicable	Not Applicable
	Dredging requirement	Not Applicable	Yes	Not Applicable	Yes
	Breakwater requirement	Not Applicable	Not Applicable	Not Applicable	Yes
E	Ecological Aspects				
	Effect of offshore pipeline to mangrove forest and sandbar	Not Applicable	Lower impact to the mangrove forest at the southwest coast of Kutubdia Island and Matarbari Island	Higher impact to the mangrove vegetation and sand bars at Moheshkhali/Sonadia Island	Not Applicable

S No.	Assessment Parameters	Kutubdia	Matarbari	Sonadia	Elephant point
	Impacts on turtle nesting sites and migratory birds	Few scattered nesting site reported by villagers near the project site. Migratory birds also visit the shores and mudflats of Kutubdia Island	Southern tip of Kutubdia is a known site for nesting of Olive Ridley turtles. Greater number of migratory birds visits the shores and mudflats of Matarbari Island as compared to Kutubdia.	Sonadia Island is designated as Ecologically Critical Area in Bangladesh. The island provides breeding areas for four globally threatened marine turtle species, and serves as a significant bird refuge for over 80 migratory species	The site is not known for nesting site for marine turtles. Few migratory birds visit the shores and mudflats of the area
F	Social Aspects				
	Effect of onshore pipeline routing on general population	Impact to the population of Kutubdia	Impact to the population of Matarbari	Not Applicable	Impact on population of Cox's Bazar

Source: ERM Analyses and Advision. 2016. Reliance Bangladesh LNG Import Terminal Feasibility Study: Site and Configuration Selection Report

Conclusion

The Kutubdia site has a stable shoreline (as also the Matarbari and Elephant Point Site) compared to the Sonadia site which have an unstable bank line at the northern tip of Sonadia Island. Construction of onshore terminal at Sonadia would require land reclamation and this is expected to be a costly solution for construction of LNG terminal. Moreover, the Sonadia site is an Ecologically Critical Area in Bangladesh as nesting of 4 marine turtles and over 80 migratory birds are reported from the island. Kutubdia site is located closer to the shoreline (approximately 3 km) and will not require (also the Matarbari Site, Elephant Point site) construction of long offshore or breakwater for operation of the LNG terminal as compared to the Elephant point site. Lastly, the harsher ocean environment with respect to wave conditions (~73% of the waves with $T_p > 8s$) and very strong currents ($> 2m/s$ during NE monsoon) at the Matarbari location are expected to limit the LNG offloading availability at that site compared to the Kutubdia site which has comparatively stable ocean environment. Matarbari site is ecologically more sensitive than the Kutubdia site as reported turtle nesting areas are close to the site. The Matarbari site is in proximity to mangrove vegetation at the south of Kutubdia and Matarbari islands which have a greater potential to get impacted compared to Kutubdia site which is located far from any mangrove vegetation patch. Moreover, construction of LNG terminal at the Kutubdia Channel will also delimit the movement of local vessels. In view of the following the Kutubdia site is selected for construction of the LNG terminal.

6.3 TECHNOLOGY ALTERNATIVES

The following technological alternatives have been considered

- FSU/FSRU
- Offshore Pipeline- Submerged/ Pipeline on Trestle
- Dual/Single Berthing Options

6.3.1 FSRU/FSU

Options considered at the design phase include LNG storage and regasification at the offshore facility or the Floating Storage and Regasification Unit (FSRU) and only LNG storage at the offshore facility or the Floating Storage Unit (FSU) and regasification at the onshore facility. The alternative assessment for the options is presented in *Table 6.2*.

Table 6.2 *Alternative Assessment-FRSU or FSU*

S No.	Assessment Parameters	FRSU	FSU
A	Techno-economic Feasibility		
	Ground Area Requirement	1 to 2ha	1 to 2ha

S No.	Assessment Parameters	FRSU	FSU
	Offshore equipment	Suitable mooring arrangement or Single or Dual Berth jetty	Single or Dual Berth jetty
	Offloading	SPM: Ship to ship transfer Single Jetty: FSU moored to Jetty, Ship to ship transfer Dual Jetty: Both FSU and LNGC moored to Jetty	Single Jetty: FSU moored to Jetty, Ship to ship transfer Dual Jetty: Both FSU and LNGC moored to Jetty
	Containment System	Moss or Membrane Tanks	Moss or Membrane Tanks
	Offloading System	Marine Loading Arms/hoses	Marine Loading Arms/hoses
	CAPEX	Low	Low
	OPEX	High (High lease rate of FRSU)	Low
B	Operability in different climatic / oceanographic conditions	As the regasification would occur offshore; the process is more vulnerable to extreme weather /oceanographic conditions	As regasification would occur on-shore the system is less vulnerable e to extreme weather/oceanographic conditions
C.	Flexibility to expand in future	Could be done with higher capacity FRSUs	Land would be available for possible expansion of the LNG facility
D	Environmental Consideration	Noise and illumination impact to the local communities from the onshore receiving facility	Noise and illumination impact to the local communities from the onshore storage and regasification facility
E	Ecological Aspects	The process will involve ecological impacts due to noise and illumination on the marine and onshore biodiversity	The process will involve ecological impacts due to noise and illumination on the marine and onshore biodiversity
F	Social Aspects	Local community may experience noise impacts In case of an accident the risk to the local community may arise from the onshore gas storage facility	Local community may experience noise impacts In case of an accident the risk to the local community may arise from the onshore gas regasification and storage facility

Source: ERM Analyses and Advice. 2016. Reliance Bangladesh LNG Import Terminal Feasibility Study: Site and Configuration Selection Report

Conclusion

Both offshore (FRSU) and onshore (FSU) regasification facilities may generate some ecological and social impacts and the impacts are envisaged to be of similar significance. The onshore regasification unit will protect the LNG facility from extreme weather conditions as the offshore facility would be more vulnerable to waves, currents and natural calamities (cyclones etc.). The capital cost of both the options would be low, however, the operation cost of the offshore gasification would be higher due to high lease rate of FRSU. Moreover, with the FSRU solution, gas send out will be interrupted when the FSRU is required to disconnect. Onshore buffer storage and onshore regasification facilities, offer improvement in gas send-out availability as it would be able to continue regasification and gas send-out when the FSU is

required to disconnect. In view of this the FSU option is preferred over the FRSU option.

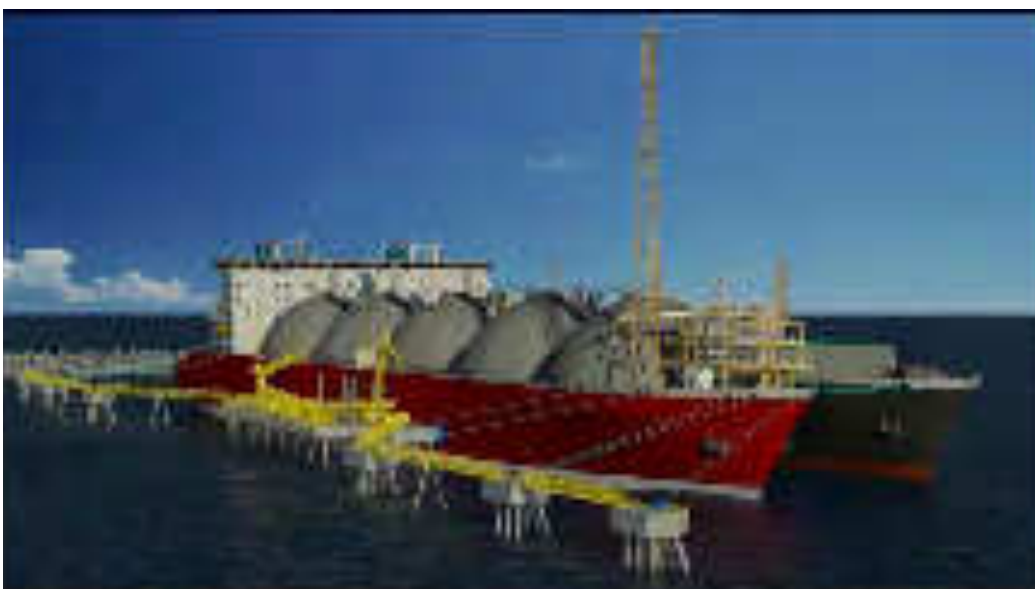
6.3.2 FSU Berthing Options- Dual or Single Berthing

The LNGC may attach with the FSU by dual or single berthing options. Dual berthing includes mooring/fendering structures to moor the FSU and LNGC, loading arms for LNG transfers from the LNGC to the FSU. Single berthing includes mooring/fendering structures to moor the FSU. The FSRU contains loading arms or cryogenic hoses for LNG transfers from the LNGC to the FSU. Dual and single berthing options are shown in *Figure 6.2*.

Figure 6.2 Dual and Single Berthing Options



Schematic diagram of FSU (on Right) and LNGC at Dual Berth Jetty



Schematic diagram of FSU (on Right) and LNGC at Single Berth Jetty

Source: Advison. 2016. Reliance Bangladesh LNG Import Terminal Feasibility Study: Site and Configuration Selection Report

Alternative assessment of dual and single berthing options is presented in *Table 6.3*.

Table 6.3 *Alternative Assessment- Dual Berthing or Single Berthing*

S No.	Assessment Parameters	Dual Berthing	Single Berthing
A	Techno-economic Feasibility	Double berth jetty are sometime preferred by the LNG provider as offloading on these jetty is similar to offloading for onshore terminals	A single berth jetty requires side by side offloading. This is sometimes less preferred than offloading over the jetty by LNGC suppliers
	Cost	This configuration is generally 30-40% more expensive than a single berth jetty	Less cost intensive compared to double berthing
B	Operability in different climatic/ oceanographic conditions	In case of emergency both the FSU and LNGC can detach separately leading to a reduced evacuation time	The FSU will not be able to detach and move unless space is provided by the LNGC.
C.	Flexibility to expand in future	Not Applicable	Not Applicable
D	Environmental Consideration	Not Applicable	Not Applicable
E	Ecological Aspects	Not Applicable	Not Applicable
F	Social Aspects	Not Applicable	Not Applicable

Source: ERM Analyses and Advision. 2016. Reliance Bangladesh LNG Import Terminal Feasibility Study: Site and Configuration Selection Report

Conclusion

As the single berthing option is significantly less cost intensive, the option is preferred over the dual berthing option.

6.3.3 Offshore Pipeline- Submerged/ Pipeline on Trestle

Approximately 3 km pipeline needed to be constructed to transport LNG from FSU to the ORF for regasification. Two options considered for the following pipeline alignment

- Subsea pipeline and
- Pipeline on a trestle with road access

The alternative assessment of the abovementioned options is presented in **Table 6.4**.

Table 6.4 *Alternative Assessment Offshore Pipeline- Subsea Pipeline or Pipeline on a Trestle*

S No.	Assessment Parameters	Subsea offshore pipeline	Offshore pipeline on a trestle
A	Techno-economic Feasibility		
	Use of Field Proven technology	Cryogenic subsea pipeline is not a field proven technology	Cryogenic pipeline mounted on trestle is a field proven technology

S No.	Assessment Parameters	Subsea offshore pipeline	Offshore pipeline on a trestle
	Operation and Maintenance	Operation and maintenance would be difficult and cost intensive	Operation and maintenance comparatively easier and less cost intensive
B	Operability in different climatic/oceanographic conditions	The subsea pipeline would be less vulnerable to oceanographic and climatic conditions	Trestle mounted cryogenic pipeline would be more vulnerable to oceanographic and climatic conditions
C.	Flexibility to expand in future	Not Applicable	Not Applicable
D.	Ecological Aspects	Construction of subsea pipeline would impart less impact to the benthic communities Subsea pipeline do not have the potential to improve the local ecology	Piling at the time of trestle construction would impart significant impact to the benthic communities Barnacles and other sessile organisms may form colonies on the pillars and platforms of the trestle and improve the productivity of the habitat locally and attract more fish in the area
E.	Social Aspects	No barrier to local fishing routes	3 km long trestle mounted pipeline could create barrier to the movement of local fishing vessels.

Source: ERM Analyses and Advision. 2016. Reliance Bangladesh LNG Import Terminal Feasibility Study: Site and Configuration Selection Report

Conclusion

Trestle mounted pipeline would be more vulnerable to oceanographic and climatic conditions compared to the subsea pipeline. The subsea pipeline is not expected to create significance disturbance to the benthic communities and do not create barrier to the movement of vessels as compare to the trestle mounted pipeline. However, the construction and maintenance of the subsea pipeline would be more cost intensive. Finally, as subsea cryogenic pipeline is not a field proven technology, construction of trestle mounted cryogenic pipeline is considered to be more feasible option.

6.4 PIPELINE ROUTE ALTERNATIVES

Cryogenic LNG after regasification at the ORF would be transferred to Napura valve station for connecting to the Anwara-Moheshkhali gas pipeline. Four pipeline alignment options from Kutubdia ORF to Napura valve Station were studied by Imagis Engineering Solutions Pvt. Ltd. to identify the alignment with least environmental and social sensitivity. The alternative routes are presented in *Figure 6.3* and an assessment of the options is indicated in *Table 6.5*. Land use and land cover maps of the four alignments are presented in **Annex 7**.

Figure 6.3 Pipeline Route Alternatives

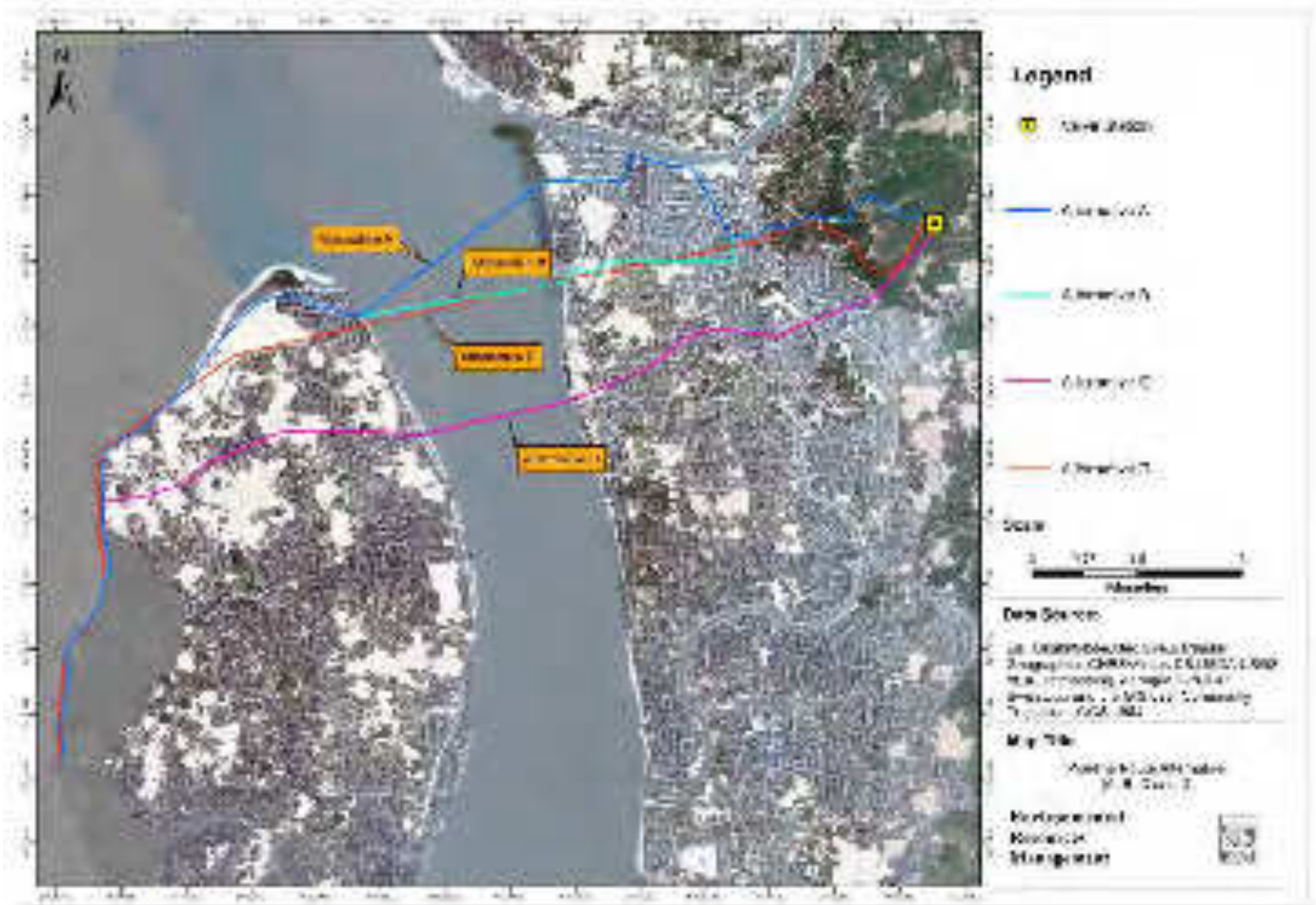


Table 6.5 Analysis of Alternative-Onshore Pipeline Route

Sl. No.	Description	Alignment A		Alignment B		Alignment C		Alignment D	
Route Particulars									
i.	Route length in meter	18863		17757		16391		17000	
ii.	Land use (in %) for Acquisition Strip of 8 m	LHS	RHS	LHS	RHS	LHS	RHS	LHS	RHS
a.	Agriculture	20.89	18.85	27.03	25.16	24.66	23.82	36.66	36.63
b.	Block Vegetation	5.36	6.10	5.66	6.44	5.94	6.86	1.22	0.75
c.	Channel	16.68	16.56	15.62	15.46	14.35	14.56	16.04	16.01
d.	Coastal Sandy Area	8.52	8.55	9.00	9.04	10.56	10.61	19.15	19.90
e.	Creek	0.29	0.29	0.31	0.30	0.00	0.00	0.32	0.33
f.	Embankment cum Road	2.88	2.09	1.22	1.28	0.00	0.00	0.00	0.00
g.	Mudflat and Mangrove	1.04	1.02	1.10	0.94	0.00	0.00	0.00	0.00
h.	Road	2.86	2.45	2.88	2.45	1.54	0.58	0.49	0.48
i.	Saltpan	33.62	33.74	28.12	27.40	41.03	41.61	25.35	25.76
j.	Sea	0.29	0.04	0.30	0.04	0.33	0.04	6.68	0.00
k.	Settlement	6.92	9.05	8.06	10.16	1.59	1.86	0.10	0.14
l.	Waterbodies	0.65	1.26	0.69	1.33	0.01	0.06	0.00	0.00
A	Techno-economic Feasibility								
	Construction problem Due to Channel and Road Crossing	Number of channel crossing five; numbers of road crossing one.		Number of channel crossing five; numbers of road crossing two.		Number of channel crossing six; numbers of road crossing seven.		Number of channel crossing four; numbers of road crossing seven.	
		Channel and road crossing length is more (3.40 km). Pipe laying is very difficult below the water channel, where in special technology is to be used not only for investigation but also for laying and operations. The laying cost per unit length becomes high at such places.		Channel and road crossing length is more (3.01km). Pipe laying is very difficult below the water channel, where in special technology is to be used not only for investigation but also for laying and operations. The laying cost per unit length becomes high at such places.		Channel and road crossing length is less (2.32 km).		Channel and road crossing length is less (2.27km).	
	O & M Problem	Channel crossing length is more so operation and maintenance would be difficult		Channel crossing length is more so operation and maintenance would be difficult		Channel crossing length is less so operation and maintenance would be easier		Channel crossing length is less so operation and maintenance would be easier	

Sl. No.	Description	Alignment A	Alignment B	Alignment C	Alignment D
B.	Operability in different climatic/oceanographic conditions	Major part of the pipeline is passing through sea shore. In that case, it is expected that the pipeline laying is strong enough to sustain the natural forces like tsunami, cyclones, tidal effects, tornado etc, this attracts more cost in terms of pipe anchorage.	Major part of the pipeline is passing through sea shore. In that case, it is expected that the pipe laying is strong enough to sustain the natural forces like tsunami, cyclones, tidal effects, tornado etc, this attracts more cost in terms of pipe anchorage.	Small part of the pipeline passing through sea shore.	Small part of the pipeline passing through sea shore
C.	Environmental Details				
i.	Name of District/District details (Through which line pass)	Kutubdia Upazila of Cox Bazar District and Banskhali Upazila of Chittagong District	Kutubdia Upazila of Cox Bazar District and Banskhali Upazila of Chittagong District	Kutubdia Upazila of Cox Bazar District and Banskhali Upazila of Chittagong District	Kutubdia Upazila of Cox Bazar District and Banskhali Upazila of Chittagong District
ii.	Town in Alignment nearby	Not Present	Not Present	Not Present	Not Present
iii.	Settlement area within ROW in ha	1.19	1.2	0.22	0.016
iv.	Forest in Km/Ha.	Not Present	Not Present	Not Present	Not Present
v.	Block Vegetation in ha	0.85	0.85	0.82	0.130
vi.	Mangrove Vegetation in ha	0.15	0.14	0.00	0.00
x.	Historical/Cultural monument	None	None	None	None
D.	Ecological Aspects				
	Crossing through Block/mangrove Vegetation	Pipeline passing through <i>Casuarina</i> and mangrove vegetation patches	Pipeline passing through <i>Casuarina</i> and mangrove vegetation patches	Pipeline passing through <i>Casuarina</i> vegetation but not through mangrove patches	Pipeline passing through <i>Casuarina</i> vegetation but not through mangrove patches
	Crossing through reported turtle nesting sites	Few scattered Olive Ridley turtle nesting sites were reported by the villagers of Uttar Dhurung and Dakshin Dhurug. Stretch of pipeline may pass in proximity of such reported nesting areas.	Same as Alignment A	Same as Alignment A	Same as Alignment A

Sl. No.	Description	Alignment A	Alignment B	Alignment C	Alignment D
E.	Social Aspects				
	Physical Resettlement	Physical resettlement is more. This situation may result in some resistance from local community to offer the land holdings or may give rise to acquisition cost.	Physical resettlement is more. This situation may result in some resistance from local community to offer the land holdings or may give rise to acquisition cost.	Physical resettlement is less but more than Alignment D.	Minimum physical resettlement.
	Compensation Cost	Major part of the land use under pipeline corridor is under salt pan. Land price of salt pan is more than agricultural land and compensation for land price, cost for three month income from salt cultivation to be provided.	Major part of the land use under pipeline corridor is under salt pan. Land price of salt pan is more than agricultural land and compensation for land price, cost for three month income from salt cultivation to be provided.	Major part of the land use under pipeline corridor is under salt pan. Land price of salt pan is more than agricultural land and compensation for land price, cost for three month income from salt cultivation to be provided.	Major part of the pipeline is under mono-cropped agricultural land. Land Price of agricultural land is less than the price of salt pan and crop compensation will be for one seasoned standing crop.

Source: ERM Analyses and Imagis 2016. Reconnaissance Survey for LNG Terminal and associated Pipeline at Kutubdia Island, Bangladesh

Conclusion

Channel and road crossing is more for Alignment A and Alignment B compared to the other alignments. Among the 4 alignments considered Alignment A and B will pass through mangrove vegetation and the other two alignments would not. Minimum physical resettlement would take place for Alignment D. Major part of the Alignment D is under mono-cropped agricultural land compared to the other alignments where salt pans exist more on the pipeline corridors. Land price of agricultural land is less than the price of salt pan. In view of this Alignment D is preferred over the other options.

7 CONSULTATION AND PARTICIPATION

7.1 INTRODUCTION

A stakeholder is defined as “an individual, group, or organization, who may affect, be affected by, or perceive itself to be affected by a decision, activity, or outcome of a project”. “Stakeholder Analysis” is the process of sorting identified stakeholder groups according to their impact on the project and the impact the project will have on them. This information is then used to assess the manner in which the interests of the stakeholders or projects impact on them should be addressed in the project development plan or its operation.

The importance of stakeholder analysis lies in the assessment and understanding of the socio-political environment surrounding the project. It allows for:

- Identification of the interests, concerns and societal risks surrounding the stakeholders, as well as conflicts of interests (if any);
- Identification of relations between stakeholders that may enable “coalitions” of project sponsorship, ownership and co-operation as well as the mechanisms which may influence other stakeholders;
- Key groups/ individuals to be identified who need to be informed about the project during the execution phase;
- Identifying stakeholders (those who might have an adverse impact on the project) and taking appropriate measures to mitigate their influence; and;
- Development of a framework for participatory planning and implementation of various project activities including interventions for community development.

The identification of stakeholders and their inclusion in the decision-making process is thus essential in the process of prioritizing, analyzing and addressing issues; and in creating management systems and strategies to address the concerns/ expectations of various stakeholders.

The following sub-sections provide a profile of the various stakeholders in the project as well as their concerns and relative influence with regards to the project.

7.2 IDENTIFICATION OF STAKEHOLDERS

The stakeholders who would directly impact or are directly impacted by the project are known as Primary Stakeholders, those who have an indirect impact or are indirectly impacted are known as Secondary Stakeholders. Keeping in mind the nature of the project and its setting, the stakeholders have been identified and listed in the table below;

Table 7.1 *List of key stakeholders*

Stakeholder Category/ Group	Key Stakeholders
Primary Stakeholders	
Local Community	<ul style="list-style-type: none"> Land Owners (whose land will acquire for the Kutubdia Project) Local Community Other than land owner Community involved in Fishing activity Community involved in Salt Cultivation Cultivator involved in Agricultural activity
Local Administration	<ul style="list-style-type: none"> Dakshin Dhurung Union Uttar Dhurung Union Chhanua Union Puichhari Union Kutubdia Upazila Banskhali Upazila
Other Primary Stakeholders	<ul style="list-style-type: none"> Reliance Bangladesh LNG Terminal Ltd.
Secondary Stakeholder	
Institutional Stakeholders	<ul style="list-style-type: none"> District Administration District Land Acquisition Department District Land Acquisition Department District Fisheries Department Upazila Agriculture Department Upazila Fisheries Department Upazila Forest Department District and Upazila Water Development Board Department of Environment (DOE), Cox's Bazar Bangladesh Small and Cottage Industries Corporation (BSCIC)
Other Secondary Stakeholder	<ul style="list-style-type: none"> EPC Contractors Local NGOs

Consultations with District Administration

The ERM team held meetings with District Administration at District Collectorate Office in Cox's Bazar, details of which are as follows:

- Consultation was held with Md. Ali Hossain, Deputy Magistrate (DM), Cox's Bazar District on 23.08.2016. DM was briefed on the background of the project and the objective and scope of the ESIA Study and his assistance was sought in interacting with Upazila officials of different government departments located within Kutubdia.
- Consultation was held with Md. Anwarul Naser, ADM (Revenue), Cox's Bazar District on 14.11.2016. ADM was briefed on the background of the project and the objective and scope of the ESIA Study. The discussions helped to understand the land acquisition process in Bangladesh and the overall status of the lands identified for the project site.

Consultations with District Fishery Department

ERM team also held meetings with Mr. Amitosh Sen, District Fisheries on 23.08.2016 and 19.11.2016. These consultations included discussion and information requests regarding various aspects of fishing practices, fishery resources, fishermen communities, etc.

Consultations with BSCIC

A meeting was also conducted with Md. Shameem Alom, Coordination Officer, Bangladesh Small & Cottage Industries Corporation (BSCIC) on 23.08.2016. BSCIC (Salt Office), Cox's Bazar is managing salt cultivation process in the district. These consultations included discussion and information requests regarding various aspect of salt cultivation activity in the Kutubdia Island.

Consultations with District Forest Officer

ERM team also held meetings with Md. Ali Kabir, Divisional Forest Officer (DFO), Cox's Bazar South Forest Division and G M Mohammad Kabir, ACF, Cox's Bazar, Chittagong Coastal Forest Division on 23.08.2016. These consultations included discussion and information requests regarding presence of forest land within the island, process of acquisition of forest land, future plans (if any) of the Forest Department in respect of Kutubdia, social forestry related activities within island , etc.

Consultations with Department of Environment (DOE), Cox's Bazar

A meeting was also conducted with Sarder Shariful Islam, Assistant Director, Department of Environment (DoE), Cox's on 25.08.2016. These consultations included discussion and information requests regarding Environmental Clearance process, IEE application, facilities for disposal of solid and/or hazardous wastes in Cox's bazar District, etc.

Consultations with M Zahirul Islam, Principal Investigator, Marineliflife Alliance, Cox's Bazar

ERM team also held a meeting with a local NGO (Marinelife Alliance) who are working in the area of marine life conservation in the entire coastline along the Cox's Bazar region. These consultations included discussion and information sharing regarding marine ecology of the Kutubdia region and presence of habitats and nesting grounds for faunal species including sea turtle.

Consultations with Salahin Tanvir Gazi, Upazila Nirbahi Officer (UNO), Kutubdia

The ERM team held meetings with Upazila Administration at Upazila Office in Kutubdia, details of which are as follows:

- Consultation was held with Mr. Salahin Tanvir Gazi, Upazila Nirbahi Officer (UNO), Kutubdia on 24.08.2016. The UNO was briefed on the background of the project and the objective and scope of the ESIA Study and his assistance was sought in interacting with Upazila officials of different government departments located within Kutubdia.
- Another round of consultation was held with the UNO along with Chairmen from all five unions at Upazila Office on 14.11.2016. UNO and other chairmen were briefed on the background of the project and the objective and scope of the ESIA Study. Consultations were conducted to

understand the land acquisition process, general status of the land identified for the project, livelihood status of the residents of the Upazila, etc.

Figure 7.1 *Consultations with Upazila Administration*



Consultations with Upazila Nirbahi Officer (UNO), Kutubdia and the Union Chairmen

Consultations with Nasim Al Mahmood Upazila Fisheries Officer, Kutubdia

Consultations with the Upazila Fishery Officer were conducted on 24.08.2016 to get an insight into fishing practices within the island, process of registration of the fishermen, socio economic status of fisherman, fish catch, marketing etc.

Consultations with Md. Monir, Sub. Asst. Agriculture Officer, Kutubdia

Consultations were held with the Sub. Asst. Agriculture Officer, Kutubdia on 24.08.2016 to get an insight on agricultural activities and farming practices, agricultural produce, category of farmers, socio economic condition of the farmers, reason behind conversion of agricultural land into salt pan within the island, etc.

Consultations with Omar Farukh, Asst. Upazila Education Officer, Kutubdia

Consultations were held with the Asst. Upazila Education Officer, Kutubdia on 24.08.2016 to get an insight into educational status of community, the educational infrastructure present within the island, etc.

Consultations with Dr. Abdulah Hassa, Medical Officer, Upazila Health Complex, Kutubdia

Consultations were held with the Medical Officer, Upazila Health Complex, Kutubdia on 24.08.2016 to get an insight on disease profiles and morbidity pattern of the island, the health infrastructure present within the island, etc.

Consultations with Humayun Kabir, Observer, Bangladesh Meteorological Dept., Station Kutubdia

Consultations were held with the Observer, Bangladesh Meteorological Dept., Station Kutubdia on 24.08.2016 to understand the meteorological information

that is being collected through this station and also to understand the micro-climatic setting of the island.

Consultations with Elton Section Officer & Mongsa Thaymarma, Surveyor, Water Development Board, Kutubdia

Consultations were held with the officers of the Upazila Office of the BWDB on 24.08.2016 to get an insight on coastal protection structures (earthen embankment) in Kutubdia Island, their status along with future development plans, if any.

Consultations with Asit Kumar Ray, Range Officer, Coastal Forest Department, Kutubdia

Consultations were held with the Range Officer, Coastal Forest Department, Kutubdia on 24.08.2016 to get an insight on ecological sensitivities of the island in terms of forest areas, mangrove vegetation, coastal shelter belts, social forestry programs, etc. Discussions were also held on presence of habitats and nesting grounds for faunal species including sea turtles on the island. A subsequent round of discussions on these issues was further held on 16.11.2016.

Figure 7.2 ***Consultations with Forest Department***



Consultations with Range Officer, Coastal Forest Department, Kutubdia

Consultations with Dakshin Dhurung Union

Consultations were held with the members of the Dakshin Dhurung Union, Kutubdia on 16.11.2016 to get an insight about population, livelihood, infrastructure, future development plan and potential areas of development through CSR activity in respect of the Dakshin Dhurung Union.

Figure 7.3 *Consultations with Dakshin Dhurung Union*



Consultations with Dakshin Dhurung Union, Kutubdia

Consultations with Local Communities

Community consultation is central to every impact assessment study because it helps to gather the opinion of the public on the proposed project and assess its potential effect on the public especially vulnerable groups. Consultations were carried out with community people residing in the region across all the Union Parishads to assess the extent of impact on the common people.

Figure 7.4 *Consultations with Local Communities*



*Bati Ghar Para, Ali Fakir Deil,
Dakshin Dhurung Union*

Binda para, Kaiyarbil Union

Consultations with Fisherman Community

Fisherman community is the frontline community who can be adversely impacted due any FSU project as their livelihood is entirely dependent on fishing activity in the sea. For that reason fisherman community of the island is considered as one of the primary stakeholder of the project. Consultations in form of Focus Group Discussions (FGDs) were carried out with fisherman community residing in the island across all the Union Parishads to assess the extent of impact on them

The locations where FGDs were conducted with the fishermen community and the fishing settlements that it represented, is presented in *Figure 7.5*.

Figure 7.5 Location of Focus Group Discussion with Fisher man Community

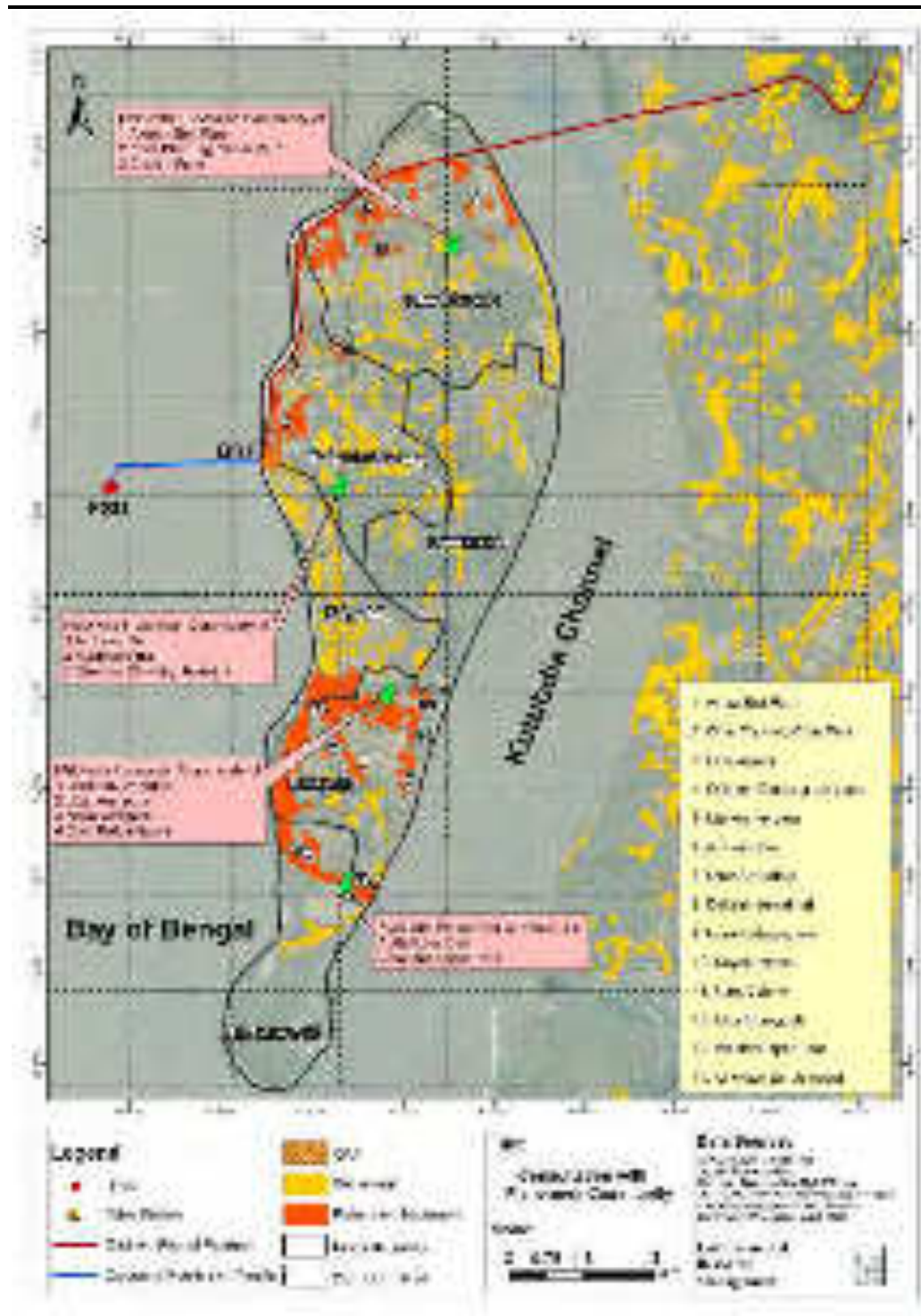


Figure 7.6 Consultations with Fisherman Communities



Fisherman Community of Dakshin Dhurung Union



Fisherman Community of Boroghop Union



Fisherman Community of Ali Akbar Deil Union



Fisherman Community of Uttar Dhurung Union



*Key Informant Interview-Secretary of
Kutubdia Fisherman Union*

*Key Informant Interview - Mr. Abaul Kalam,
Knowledgeable Fisherman (referred as a resource
person by District Fishery Officer)*

The brief outcome of the consultations with the key stakeholder groups are listed below. The minutes of all consultations are recorded under **Annex 8** of this document.

7.3 SUMMARY OF STAKEHOLDER CONSULTATIONS

ERM undertook consultations/ meetings with identified stakeholders during the course of the site visit. The intensive deliberations provided a platform for two-way communication between the team of consultants and the stakeholder groups. This in turn helped in developing an understanding of the perceptions of stakeholders with regards to the project and also allowed for a means of recording their feedback. The key points discussed with each of these stakeholders are provided in the table below:

Table 7.2 Stakeholders and Key Points Discussed

S. No.	Stakeholder Category	Key Points Discussed	Outcomes in brief
Local Community			
1.1	Land Owner of Dakshin Dhurung Union	<ul style="list-style-type: none"> • Issues/ grievances with respect to the land purchase process; • Community perception towards the project • Socio-economic condition of the people inhabiting the study area. 	<ul style="list-style-type: none"> • Proposed Project area is primarily single cropped agricultural land as irrigation facility is not available. • Only individual level pond irrigation is present in a few land parcels • As per local community, original embankment was about 100-200 m towards west of the present bund. The present embankment area was under cultivation and under private ownership. This land parcel was eroded around 10 year back. • Presently villagers use the land available along the shore for activities like boat maintenance, drying of fishing nets, repairing of fishing nets, cultivation of water melon and vegetable etc.
1.2	Local Community other than land owner	<ul style="list-style-type: none"> • Land holding pattern in the study area; • Impact of land purchase on livelihood; • Perception of agricultural labourers towards the project; • Current engagement scenario – alternate livelihood options; • Basic amenities in the village – electricity, water supply etc.; • Profile of households by source of water; • Proposed schemes for water supply in the village; • Health scenario in the village and distances of Hospitals/ Clinics; 	<ul style="list-style-type: none"> ▪ There is an anchorage point about 100 m north of the existing lighthouse. This point is in use by the fishermen of the village. About 20-30 boats are anchored here. ▪ Most of the boats are motorized and go out for fishing for 3-4 days at a stretch in sea. ▪ There is a ship navigation channel upto the Chittagong port which is about 6-7 km from the shore. ▪ During low tide the fishing boats goes west of the navigation channel and during high tide it goes east of the navigation channel. ▪ During cyclonic weather the fishermen keep the boats in the <i>Kutubdia</i> Channel. ▪ The original embankment was about 100-200 m towards west of the present bund. Location of the present bund was used as an airstrip during the British period. The present embankment area was under cultivation and was also under private ownership ▪ There are around 8-10 huts just along the bund towards the southern side of the potential site. They are part of the <i>Kaiyarbil</i> Union. ▪ Cultural sites: <ul style="list-style-type: none"> – There was a <i>mazhar</i> that has been washed off. – On the beach side just north of the present lighthouse there was a graveyard which has been washed off and is presently demarcated by four wooden posts. It is not in use. – Cultural properties within Island include (i) Ek Hatia Fakir Mosque, established in 1904, (ii) Tomb of <i>Kutub Aulia</i> (iii), <i>Kalarna</i> Mosque • The <i>Ek Hatia Fakir</i> Mosque is located close to the Project site • Consultations revealed that only a few households were engaged in agricultural activities and majority are engaged in fishing activity • Lands are mostly used for growing crops for self-consumption. • Due to frequent cyclonic events and sea water surge, more and more agricultural lands

S. No.	Stakeholder Category	Key Points Discussed	Outcomes in brief
1.3	Community involved in fishing activity	<ul style="list-style-type: none"> ● Total number of fishermen ● Type of fishing ● Number of fisherman in Kutubdia Upazila (daily/ deep sea) ● Number of fisherman in Dakshin Dhurung and Kaiyarbil Union (daily and deep sea) ● Number of fisherman in Ali Fakir Deil village and Bindapara village (daily/ deep sea) ● Type of fishing - Daily fishing/ Deep sea fishing ● Type and number of boat use for daily fishing and deep sea fishing ● Number of fisher man engaged per boat ● Type of fish catch both in daily fishing and deep sea fishing ● Number of fisherman involved in daily fishing and deep sea fishing ● Season for deep sea fishing and daily fishing ● Number of days of deep sea fishing in year ● Number of days of daily fishing ● Annual income from fishing - both deep sea and daily fishing ● Distance and direction for daily fishing in different season ● Distance and direction for deep sea fishing in different season ● Fish landing point in this two villages ● Point of offshore fish trading 	<p>are becoming infertile and getting converted for salt cultivation.</p> <ul style="list-style-type: none"> ● People are very positive about the industrial development as it will create some livelihood opportunity for local people however they also apprehensive about the pollution which might emanate from industrial activity. ● Water supply is not present in the village. Villagers totally are dependent on tube well for fulfil their water requirement for drinking and other household activity. ● Electricity is not present in the Dakshin Dhurung and Kaiyarbil unions. People expect some help for the industrial developer on this aspect. ● Union level health facility is present in Dakshin Dhurung and Kaiyarbil union but it is not enough to cater the health related need of the local people. People are totally dependent on Upazila Health Complex for their health issue. <hr/> <ul style="list-style-type: none"> ● Maximum fisherman (around 4000) are residing in 3 fisherman colonies within Dakshin Dhurung Union; most of them reside in Dakshin Dhurung Jelepura, Ali Fakhir deil, Madaniyar Para settlements (around 2200 to 2300 fisherman) ● There are around 500 fisherman residing in Kayiar Bil and Bindapara village in Kaiyarbil Union ● Fishing activity is conducted around the year. It is restricted only between October to November for a period of 20-25 days for hilsa breeding migration ● There are three type of boats used for fishing activity i.e. industrial trawler, mechanised boat and small mechanised fishing boat ● Industrial trawlers and mechanical boats are used for deep sea fishing activity ● 20 to 35 fisher man per boat is usually engaged in deep sea fishing activity while 8 to 10 fisherman per boat is involved in day fishing. ● Almost 6 month a year all boat are involved in Hilsa fishing. It is the prime fish catch for all fishermen. ● Gondapara in Kutubdia Channel north of the Kutubdia Island in the main breeding center for hilsa fish in Bangladesh ● A deep sea fishing boat has a fish catch worth of around 4 to 6 lakh BDT in one trip while for a day fishing boat, the fish catch is worth around 0.5 to 1.5 Lakh BDT. ● One deep sea fishing trip is continued for 15 days and they move upto 300 km south west inside the sea ● Three category of personnel are generally involved in a fishing boat i.e. Sailor, Engine Driver and Fisherman ● All of them are the contractual worker of the boat owner ● Annual contract value of sailor, engine driver and fisher man is 4 to 8 lakh, 1 to 1.5 lakh, 0.9 - 1.2 lakh respectively ● Day fishing boat sells their fish catch to the trader in Kutubdia channel near Sekhkhali

S. No.	Stakeholder Category	Key Points Discussed	Outcomes in brief
			and Banskhal <ul style="list-style-type: none"> Deep sea boat sells their fish catch in Chittagong and Cox Bazar The most common fish net is Behundi (marine setbag net)
1.4	Cultivator involved in Agricultural activity	<ul style="list-style-type: none"> Number of people involved in Agriculture in Dakshin Dhurung and Kaiyabil Union Type of Agricultural land-Irrigated or Unirrigated Involvement of Agricultural Labour Number of Crop in a year- Single and Bi-Cropped Type of Agricultural Produce Number of people involved in Agriculture 	<ul style="list-style-type: none"> Agricultural activity is very limited with in the island due to repeated storm surge and salt water ingression in agricultural field and due to that fertility of agricultural field deteriorated Most of agricultural land is mono cropped or bicropped. Paddy is the main agricultural produce of the area. Other than that vegetable are also produced Community are not interested in agriculture due to less profit. So that most of agricultural land is converted in to salt pan for earning more profit.
Local Administration			
2.1	Union and Upazila Administration	<ul style="list-style-type: none"> Administrative composition of the Union Temporal changes in the landuse; Positive and negative impacts of industrialization; 	<ul style="list-style-type: none"> The objective and scope of the present visit was explained to the Upazila Nirbahi Officer (UNO) and his assistance was sought in interacting with Upazila officials of different government departments located within Kutubdia The UNO introduced the ERM team to Upazila officials, Union Chairmen and facilitated their interactions with individual departments in Kutubdia. Land which is present in the sea shore is not belongs to Government. Reliance Power has to select the land first and submit a formal proposal to the land office After getting the formal proposal from Reliance Land office will react on the issue First they will check the land rights If it is Khas (Govt.) Land then it will be a permanent settlement between Land Ministry, Govt. of Bangladesh and Reliance Power If it is eroded land before 30 years and no claim has been established then it is considered as govt. land as per "State Acquisition and Tenancy Act 1950" and then it will be a permanent settlement between Reliance Power and Land Ministry. Govt. of Bangladesh If it is eroded land but not before 30 years and before acquisition if any claim on this land parcel surfaces, then it will considered as private land and land acquisition will be initiated as per "Acquisition and Requisition of Immovable Property Ordinance, 1982". There are no legal rights of the community on reclaimed land if it is a eroded before 30 years and then subsequently reclaimed for community use. Sub-Registry Office of land office at Upazila level records the data regarding land erosion. Land Ministry, Govt. of Bangladesh will decide the rent for Khas (Govt.) land under permanent settlement between Govt. of Bangladesh and Reliance Power If it is Private land acquisition then last 12 month average land price will consider Private land price will be last 12 month land price multiplied by 1.5

S. No.	Stakeholder Category	Key Points Discussed	Outcomes in brief
2.2	Upazila Fisheries Officer, Kutubdia	<ul style="list-style-type: none"> Total Number of fisher man in Kutubdia Island Total Number of registered fisher man Registration process of the fisherman Type of Fishing activity Type of fishing boats Number of fishing boats Type of Fishing gear Fishing landing site Commercial Fish drying activity Aquaculture with in the island 	<ul style="list-style-type: none"> Two rounds of registration of fisher men have been undertaken in Kutubdia - 5716 fishermen have been registered under Phase I while 1228 fishermen have been registered under Phase II. Both mechanised as well as non-mechanised boats are in use in the Kutubdia Upazila. It is understood that at present approx. 150-200 boats mechanised boats (Danish boat/tempo boat and medium/large size wooden boats) are presently operating from this island; the number of non-motorised boats wooden boats in use is much higher (approx. 800 boats) Two separate form of fishing are practiced including daily fishing (which continues for maximum of 1 to 1.5 days) and deep sea fishing (continues at a stretch for 10-12 days); Around 80% of the fisher men are involved in day fishing Type of fishing gear commonly used include <i>Hundara Jal</i>, <i>Behundi Jal</i> Fishermen use push net, beach side seine net, shrimp net, etc. In <i>Dakshin Dhurung</i> and <i>Kaiyerbil</i> Unions, 876 and 260 fishermen have received FIDs Fishermen use the entire stretch of the coast for anchoring the boats, venturing in the seas and also for drying of their nets. There is no fish landing site on the island as the fish catch is sold off in the high sea. Commercially the fish drying activities are carried out towards the south-eastern part of the island; it is done privately and without any association with the Fisheries Department.
2.3	Sub. Asst. Agriculture Officer, Kutubdia	<ul style="list-style-type: none"> Total Agricultural Land in Kutubdia Island Total irrigated and unirrigated agricultural land within the island Total number of farmer within the island Cropping pattern of the area Types of Agricultural produce Type of farmer as per the land holding size 	<ul style="list-style-type: none"> Total area of the <i>Kutubdia Upazila</i> is 15,102 Ha of which area under cultivation is 5465 Ha. Some of the regions in this <i>Upazila</i> are tripled cropped with <i>Rabi</i>, <i>Kharif I (Aaush)</i> and <i>Kharif II (Amon)</i> Single cropped area is 250 Ha, double cropped area is 1670 Ha while the triple cropped area is 2500 Ha Farmers are being given identity cards – <i>Krishi Upakaran Sahayata Card</i> At present there are 13,740 farmers who are involved in cultivation of paddy and vegetables Farmers are classified as landless, marginalised, small, medium and big - based on the agricultural land holding size Net cropped area in <i>Dakshin Dhurung Union Parishad</i> is 680 Ha while that in <i>Kaiyerbil Union Parishad</i> is 360 Ha Due to frequent cyclonic events and sea water surge, more and more agricultural lands are becoming infertile and getting converted for salt cultivation.
2.4	Asst. Upazila Education Officer, Kutubdia	<ul style="list-style-type: none"> Literacy rate of Kutubdia Island Educational infrastructure within the island 	<ul style="list-style-type: none"> The literacy rate of <i>Kutubdia Upazila</i> is 71%. The department has focused on 100% enrolment of children and has achieved enrolling almost 95% of the children into schools.

S. No.	Stakeholder Category	Key Points Discussed	Outcomes in brief
			<ul style="list-style-type: none"> • Three types of educational systems in practice – general school, madrasa and vocational institutions • For graduate / post graduate education, students have to visit <i>Chittagong</i> • Details on educational Infrastructure available in <i>Kutubdia Upazila</i> was shared with ERM • Dropout rate among boys are more especially during winter. They get involved into fish drying activity during this period as it is an easy source of earning money.
2.5	Medical Officer, Upazila Health Complex, Kutubdia	<ul style="list-style-type: none"> • Health infrastructure of the island • No of health practitioner in Upazila health complex • Health infrastructure at union level • Diseases profile of the island 	<ul style="list-style-type: none"> • The <i>Upazila</i> Health Complex has three departments – Out Patient Department (OPD), 31 bedded indoor facility and an emergency ward. • There are 3 Medical Officers (MOs) at the <i>Upazila</i> Health Complex along with one Family Welfare Councillor and one UHNFO. • At Union <i>Parishad</i> level there are Family Welfare Centers. • It was reported by the MO that diarrhoea and respiratory tract infections are some of the common diseases among the population of the island • Usually after natural disasters people suffer from water borne diseases. • There are no ambulance service available on the island • Inorder to reach out to all the community people 12 Community Clinics are held by the health department, 2 each for 6 Union Parishads. • Immunization camps are held regularly
2.6	Observer, Bangladesh Meteorological Dept., Station Kutubdia	<ul style="list-style-type: none"> • Information regarding meteorological parameters 	<ul style="list-style-type: none"> • Meteorological parameters such as temperature, humidity, wind speed, wind direction, barometric pressure, cloud cover and rainfall are manually recorded at this weather station at <i>Kutubdia</i>. • This station however does not record specific data on special weather events (such as cyclones, storm surges, tidal flows, etc.) • Recent information collected on select meteorological parameters was discussed
2.7	Elton, Section Officer & Mongsa Thaymarma, Surveyor, Water Development Board, Kutubdia	<ul style="list-style-type: none"> • Information regarding the earthen embankment surrounding the island 	<ul style="list-style-type: none"> • The <i>Upazila</i>, which is an island is surrounded by 40 km bund (embankment) • The height of the embankment ranges from 6.5 -7 m from the ground level. • The width at the base of the embankment ranges from 45 to 150 m at different locations whereas the width of the top of the embankment is 2.5 m. • The Water Development Board has a plan to upgrade and reconstruct some portions of the embankment that has been damaged due to Ruanu Cyclone (May 2016)
2.8	Range Officer, Coastal Forest Department, Kutubdia	<ul style="list-style-type: none"> • Total forest land within the island • Forest land in Dakshin Dhurung and Kaiyarbil Union • Land acquisition process for the forest land • Presences of wildlife in Kutubdia island • Future social forestry program of forest department 	<ul style="list-style-type: none"> • Total protected forest area (Gazetted forest land) in <i>Kutubdia Upazila</i> is 867.19 acres • <i>Dakshin Dhurung</i> and <i>Kaiyarbil</i> unions, where the project is located, have no protected / reserve forest lands. • However in both the unions, a total of 30 Ha. were under social forestry, of which 14 Ha. were lost during the recent Ruanu cyclone. • For acquiring any land that is either under Protected or Reserve Forest under <i>Kutubdia Upazila</i>, application has to be filed with the DFO (Coastal), <i>Chittagong</i> Division for

S. No.	Stakeholder Category	Key Points Discussed	Outcomes in brief
			<p>permission.</p> <ul style="list-style-type: none"> For areas that are under social forestry, applications are to be filed with the DC who will then place it with the Forest Department for valuation of the trees that may be required to be felled for the project. It was informed by the Range Officer that in the south western part of the island turtles comes for nesting; migratory birds also visit this portion of the island during the winter season. Crocodiles and <i>Kamots</i> (sharks) have also occasionally been sited on the coastal beaches of the island (especially in the northern portion of the <i>Kutubdia</i> Channel).
Institutional Stakeholders			
3.1	District Administration	<ul style="list-style-type: none"> Land acquisition process 	<ul style="list-style-type: none"> Stressed on the need to protect sea and land Advised to collect information on special weather events (cyclone, storm surge, etc.) as well as meteorological and hydrogeological information – the project planning should appropriately consider such factors DC Office cannot enter into any type of contract with foreign/private agency The project proponent needs to enter into an agreement with the concerned ministry – the Ministry of Power, Energy and Mineral Resources (MoPEMR) in this case. MoPEMR will pass on the information to the DC Office accordingly The process of land uptake for the project will involve the following: <ul style="list-style-type: none"> Once an agreement is entered on with the Project Proponent, the Ministry can forward the proposal to DC Office for reviewing DC Office will then examine schedule of land (mouza/khatian /Dag No.) and establish ownership In case of government land DC will ask for a settlement proposal (leasing of land). In case of private land the DC will initiate land acquisition. For GTCL gas grid project (Moheshkhali Anwara stretch) acquisition of private land for the pipeline RoW has been carried out through the DC All Government land (khas) within a district belongs to the DC. This includes canal, road, river, grazing land and reclaimed land. For all cases DC sends the proposals to the Land Department for verification.
3.2	District Fisheries Department	<ul style="list-style-type: none"> Total Number of fisher man in Kutubdia Island Total Number of registered fisher man Registration process of the fisherman Type of Fishing activity Type of fishing boats Number of fishing boats Type of Fishing gear 	<ul style="list-style-type: none"> Ongoing program of Govt. of Bangladesh for registration of fishermen and issuing them fishermen identity cards (FID cards) Till date 7116 fishermen have been registered in Kutubdia, out of which 2464 fishermen have been issued FIDs FIDs are issued only to Bangladeshi citizens having National Identity Cards (NIDs) and only to adult fishermen (age > 18 years) So actual number of fishermen are expected to be around 20% higher

S. No.	Stakeholder Category	Key Points Discussed	Outcomes in brief
		<ul style="list-style-type: none"> Fishing landing site Commercial Fish drying activity Aquaculture with in the island 	<ul style="list-style-type: none"> Minimum 8 months of involvement in fishing in a year is required for being considered as a fisherman, In future in absence of FIDs, coast guards may prevent from fishing in the seas There is an ongoing systems for registration of boats; registration of boats is by Marine Mercantile Dept. (MMD) located in Chittagong The fees required for registration of boats is based on engine capacity of the boats Two types of fishing is prevalent in this region – day fishing and deep sea fishing Day fishing is with boats with engine capacity less than 30 HP Deep sea fishing involves a trip of 7-15 days and with boats of engine capacity around 50-70 HP The most common fish net is Behundi (marine setbag net)
3.3	Bangladesh Small and Cottage Industries Corporation (BSCIC)	<ul style="list-style-type: none"> Total are of salt cultivation Number people involved in salt cultivation Seasonality of the salt cultivation Location of salt cultivation Marketing process of salt 	<ul style="list-style-type: none"> Frequent cyclonic storms and sea water surge into the Kutubdia Island over the years has caused infertility of the island soil - this has prompted island residents to opt for salt cultivation. This region earlier used to have mostly agricultural land. Salt cultivation is done for almost 6 months in a year between November and May. Salt cultivation is mainly carried out on both sides of 'Pilat Kata Khal' (inland channel) within Kutubdia Island. Water from Bay of Bengal is channelized to the Kata Khal through several sluice gates from the Kutubdia Channel. In Kutubdia Island 7000 acres of land is under salt cultivation with around 4600 salt cultivators The salt cultivators take land on lease / 'barga' for 6 months for salt cultivation. Salt is sold through middlemen. There are no local markets in Kutubdia for selling salt and it proves costlier for the cultivators to take the salt and sell it in Chittagong markets. In most cases the salt cultivators take loan from the middlemen for leasing out land and hence there is an arrangement between them that the salt will be sold only to them. Apart from salt cultivation, people on the island also earn their livelihood through fishing, paddy cultivation and working as daily labourers. The number of salt cultivators is not same every year. If the yield is better in one year then the number of salt cultivators increases the next year, almost by 10%. Unlike other areas such as Moheshkhali, in Kutubdia all the salt cultivators are from the island itself.
3.4	District Forest Department	<ul style="list-style-type: none"> Total forest land within the island Land acquisition process for the forest land Presences of wildlife in Kutubdia island Future social forestry program of forest department 	<ul style="list-style-type: none"> <i>Kutubdia</i> Island has coastal afforestation zones and social forestry areas. Casuarina trees have been planted by the department as part of the Social Forestry measure on the sea facing side of the island. Community people are involved in maintenance and protection of the plants. The coastal afforestation programmes are undertaken on <i>Khas</i> land (Government land) –

S. No.	Stakeholder Category	Key Points Discussed	Outcomes in brief
3.5	Department of Environment (DoE), Cox's Bazar	<ul style="list-style-type: none"> ● Environmental Clearance process ● Application for Environmental Clearance ● Process of Site clearance ● Landfill and disposal site for hazards waste ● Ecological Sensitive area in and around the Kutubdia Island ● Future industrial development planning in Kutubdia island 	<p>in such cases the land is not owned by the Forest Department</p> <ul style="list-style-type: none"> ● Forest Department had planted casuarina trees under the coastal afforestation program in <i>Kutubdia</i> Island – however during the recent cyclonic event (Roanu) in May 2016, a large of these trees was uprooted. ● The Forest Department has planted mangrove species along the south eastern part of the Island especially around <i>Boroghop Ghat</i>. The species of mangrove planted include Keora (<i>Sonneratia apetala</i>) and Byne (<i>Avicennia sp.</i>) ● The Forest Department has not carried out any wildlife survey / study in the <i>Kutubdia</i> Island. ● The Forest Department suggested interacting with Marinelife Alliance (an NGO), who have been working on a 'Sea Turtle Project' along this entire coastline together with the Forest Department and the World Bank. <hr/> <ul style="list-style-type: none"> ▪ Monitoring of the projects is being done by different offices of the DoE: <ul style="list-style-type: none"> ● Green & Orange 'A' Category Projects: District Office ● Orange 'B' Category Projects: Divisional Office ● Red Category Projects: Head Office ▪ Application for site clearance (IEE) needs to be submitted to the District Office of DoE in three copies along with application fee as per the Environmental Conservation Rules, 1997. ▪ Processing of site clearance application in District and Divisional Offices will take minimum 2 weeks and as the project will be falling in Red Category and hence, the final clearance will be issued by the DoE Head Office only. ▪ Due to limited infrastructure and resources, the District Office is not involved in regular monitoring of environmental conditions in the Cox's Bazar District. However, Divisional Office at Chittagong provides support as the need arises. The District Office does carryout some water testing. ▪ No secured landfill for disposal of solid and/or hazardous wastes is currently available in Cox's Bazar District. The Cox's Bazar Municipal Corporate is having a dumping ground for municipal waste; however, this is not designed scientifically. ▪ The DoE is currently developing four landfills and treatment sites in Bangladesh, which are at (a) <i>Gazipur</i>; (b) <i>Narayanganj</i>; (c) <i>Rangpur</i>; and (d) <i>Cox's Bazar</i>. Out of these <i>Narayanganj</i> facility is completed and operational, whereas other three sites will be commissioned by mid- 2017. ▪ At present, Cox's Bazar district is not having any sewerage treatment plant and hazardous waste disposal site. However, the Cox's Bazar Development Authority has taken into consideration the development of a sewerage treatment plant, which is currently in initial planning and approval phase.

S. No.	Stakeholder Category	Key Points Discussed	Outcomes in brief
			<ul style="list-style-type: none"> ▪ Nearest hazardous waste incineration facility is available at Chittagong Port Authority. ▪ Cox’s Bazar is not having any waste oil/ used oil and lubricant processing facility. At present, such waste oil/ lubricant is being collected by local businessmen and sold to reprocessing facilities in Chittagong region. ▪ No coastal zone management authority exists. However, coastal area security is being looked by Coast Guards. ▪ The proposed site is away from any ecological sensitive locations, however, the project could have impact on aquatic flora and fauna due to hot/ cold water discharges. ▪ Any destruction to the mangroves should be avoided during project construction and/or operations. • No major development is currently planned in Kutubdia Island. However, Bangladesh Navy has taken site clearance for a submarine station to be located between Magnama Ghat and Ujantia in Pekua Upazila. This facility will use the Kutubdia channel as well.

7.4 *STAKEHOLDER MAPPING*

“Stakeholder mapping” is a process of examining the relative influence that different individuals and groups have over a project as well as the influence of the project over them. The purpose of a stakeholder mapping is to;

- Study the profile of the stakeholders identified and the nature of the stakes;
- Understand each group’s specific issues, concerns as well as expectations from the project that each group retains;
- Gauge their influence on the project.

On the basis of such an understanding, the stakeholders are categorized into High Influence/ Priority, Medium Influence/ Priority and Low Influence/ Priority. The stakeholders who are categorized as high influence are those who have a high influence over the project or are likely to be heavily impacted by the project activities, and are thus high up on the project proponent’s priority list for engagement and consultation.

Similarly, the stakeholders categorized as medium influence are those who have a moderate influence over the project or even though they are to be impacted by the project, it is unlikely to be substantial and these stakeholders are thus neither high nor low in the project proponent’s list for engagement. On the other hand, the stakeholders with low influences are those who have a minimal influence on the decision making process or are to be minimally impacted by the project and are thus low in the project proponent’s engagement list.

7.5 *APPROACH AND METHODOLOGY FOR STAKEHOLDER MAPPING AND ANALYSIS*

The significance of a stakeholder group is categorized considering the magnitude of impact (type, extent, duration, scale, frequency) or degree of influence (power, proximity) of a stakeholder group and urgency/likelihood of the impact/influence associated with the particular stakeholder group in the project context. The magnitude of stakeholder impact/influence is assessed taking the power/responsibility¹ and proximity² of the stakeholder group and is categorized as negligible, small, medium and large. The Urgency or likelihood of the impact on/influence by the stakeholder is assessed in a scale of low, medium and high. The overall significance of the stakeholder group is assessed as per the matrix provided below:

-
1. Power/Responsibility: Those stakeholders to whom the organisation has, or in the future may have, legal, financial, and operational responsibilities in the form of regulations, contracts, policies or codes of practice.
 2. Proximity: indicates stakeholders that the organisation interacts with most, including internal stakeholders, those with long-standing relationships and those the organisation depends on its day-to-day operations.

Table 7.3 Stakeholder Significance and Engagement Requirement

		Urgency/Likelihood of Influence on/by Stakeholder		
		Low	Medium	High
Magnitude of Influence/ Impact	Negligible	Negligible	Negligible	Negligible
	Small	Negligible	Minor	Moderate
	Medium	Minor	Moderate	Urgent
	Large	Moderate	Urgent	Urgent

The following table provides brief profiles of the various stakeholders in the project as discussed in the previous sub section along with their key concerns about the project and their degree of influence.

Table 7.4 Stakeholder Profiles and Influence Mapping

Stakeholder Category	Relevant Stakeholder Groups	Profile/ Status	Magnitude of Influence/Impact (Negligible, Small, Medium, Large)	Urgency/ Likelihood of Influence (Low, Medium, High)	Rating of Stakeholder Influence		
Primary	Community: Land Owner	<ul style="list-style-type: none"> This stakeholder group comprises of families whose land will be acquired for the proposed project. Small, medium farmers who own single or multi crop ancestral agricultural land or salt pans; Although land is an important asset, but economic value of agricultural land is limited due to low productivity and dependence on rainfall; and most of the cultivation on land is for subsistence and not for sale in market. Due to frequent cyclonic events and sea water surge, more and more agricultural lands are becoming infertile and getting converted for salt cultivation 	<ul style="list-style-type: none"> Land acquisition can be considered as an opportunity to liquidate their assets as the profit margin in agriculture become less due high production cost. Decline in land holding size of the farmers until money received out of land sale is reinvested by farmers for further land purchase. 	Medium	<ul style="list-style-type: none"> Land (Approx 40 acres land for land based facility and 34 acre land for pipeline) need to be acquired from private land owner which is less than 0.1 percent of total land mass of the Kutubdia island. It is anticipated that for setting up the land based facilities homestead land with possibly few structures may be acquired. In such a case the affected household have to be resettled in other place within the island. However this can only be ascertained after land surveys are conducted by the DC Office / Land Revenue Department. 	Medium	Moderate
	Community: Local Community	This stakeholder group comprises of the community residing in the study area.	<ul style="list-style-type: none"> The local population has high expectation on getting employment opportunity from the project; and Is apprehensive of increase in pollution – dust, noise and water; 	Small	<ul style="list-style-type: none"> Concerned about safety due to plying of heavy vehicles in their area; Concerned about loss of standing crops due to movement of labour and equipment close by their fields; Want preference in employment opportunities generated by the project. 	Medium	Minor

Stakeholder Category	Relevant Stakeholder Groups	Profile/ Status	Magnitude of Influence/Impact (Negligible, Small, Medium, Large)	Urgency/ Likelihood of Influence (Low, Medium, High)	Rating of Stakeholder Influence	
	Community involved in fishing activity	<ul style="list-style-type: none"> Approximately 15000 fisherman residing in the Kutubdia Island Among them around 7200 are Govt. registered fisherman Approximately 5000 seasonal fisherman are also present in Kutubdia Island 	<ul style="list-style-type: none"> Fisherman has high expectation on getting employment opportunity for the younger generation as they are mostly not interested in pursuing fishing activities 	Medium	<ul style="list-style-type: none"> Concern about pipeline from FSU unit to land based facility which can block their navigational channel for fishing They have to travel a greater distance for fishing 	Moderate
	Community involved in agricultural activity	<ul style="list-style-type: none"> Few people are involved in agricultural activity Lands are mostly used for growing crops for self-consumption. Due to frequent cyclonic events and sea water surge, more and more agricultural lands are becoming infertile and getting converted for salt cultivation. 	<ul style="list-style-type: none"> Agricultural activity is not very profitable with in the island due to frequent salt water ingress Community is not solely dependent on agriculture. Cultivator has high expectation on getting employment opportunities from the project 	Medium	<ul style="list-style-type: none"> Amount of agricultural land being acquired for the project is low (<i>however exact estimate cannot be arrived at this stage</i>) Agricultural land acquired for pipeline laying can be used for agricultural activity when the activity is over 	Low
	Community involved in Salt Cultivation	<ul style="list-style-type: none"> Most of agricultural land was converted into salt pan for the profitability of the activity a People are involved in this activity only for the six month Number of people involved in salt cultivation activity is increasing with time 	<ul style="list-style-type: none"> People are not solely dependent on this activity. This activity continues only for six to seven month of the year Salt pan is the most costly land parcel on the island 	Medium	<ul style="list-style-type: none"> Amount of salt pan being acquired for the project is low (<i>however exact estimate cannot be arrived at this stage</i>) Salt pan acquired for pipeline laying can be used for salt cultivation when the activity will over 	Low
	Vulnerable Community	<ul style="list-style-type: none"> This stakeholder group is comprised of the economically weaker families (Below the Poverty Line Families), the ST population, and women headed households. These 	<ul style="list-style-type: none"> The employment opportunities available to them will be for short term only. 	Small	<ul style="list-style-type: none"> The study area population is likely to get only short term benefit of employment in construction phase. The operational phase would have very limited job 	Medium

Stakeholder Category	Relevant Stakeholder Groups	Profile/ Status	Magnitude of Influence/Impact (Negligible, Small, Medium, Large)	Urgency/ Likelihood of Influence (Low, Medium, High)	Rating of Stakeholder Influence		
		subdivisions have been drawn on the basis of the understanding of the possibility of differentiated impacts on the community on the basis of the economic and social status in the society.		opportunity like few security personnel.			
	Local Administration both Union and Upazila	<ul style="list-style-type: none"> They are the main administrative group who are responsible for the development activity of the area 	<ul style="list-style-type: none"> Most concern is around land acquisition and compensation Concerned about the Pollution due to industrial activity Concerned about the restricted movement in sea shore and sea High expectation on getting employment opportunity for the local people and development activity in the area Local administrative body has authority to restrict the land-use and resource utilization within the area of their jurisdiction. 	Medium	<ul style="list-style-type: none"> Local Administration need to work out a mechanism for cooperation to avoid loss to the property of villagers during construction works; They needs to play an effective role on in grievance redress mechanism established by RBLTL. 	Low	Minor
		<ul style="list-style-type: none"> Local area is having adequate workforce in unskilled category as mostly working population of the local area are salt pan worker, agricultural labor, fisherman; In absence of any industry 	<ul style="list-style-type: none"> Mostly employment opportunities for local people would be limited during till construction phase; The employment opportunities could be 	Small	<ul style="list-style-type: none"> The local wage earners have high expectation of employment from the project; and The local availability of wage earners is linked to the agricultural and salt cultivation season. 	Medium	Minor

Stakeholder Category	Relevant Stakeholder Groups	Profile/ Status	Magnitude of Influence/Impact (Negligible, Small, Medium, Large)	Urgency/ Likelihood of Influence (Low, Medium, High)	Rating of Stakeholder Influence
Secondary	District Administration	<p>nearby, mostly people have to stick to agricultural activity, fishing activity and salt cultivation activity industry;</p> <ul style="list-style-type: none"> • Employment opportunities generated during construction phase will attract local workers. • The revenue department is responsible for registration of land sale, mutation, updating and records and transfer of land; • Local land survey department; land surveyor plays a significant role as land survey and record keeping; and • The Dy. Commissioner is overall responsible for protection and maintenance of peace in the area. 	<p>in form of requirement for construction labor, vending opportunities like vehicle hiring, tractors hiring, food item supply to labor colony etc.;</p> <ul style="list-style-type: none"> • The construction phase requires a number of permissions and support from the local administration; • The procedural complication can cause significant project delay; and • The land-matters can give rise to unnecessary litigations; 	<p>Medium</p> <ul style="list-style-type: none"> • The influence of the stakeholders pertains to the role played in the land allotment process and the smooth functioning of the project 	<p>Low</p> <p>Minor</p>
	Department of Environment;	<ul style="list-style-type: none"> • The primary regulator for this FSU project in Bangladesh is Department of Environment, Govt. of Bangladesh 	<ul style="list-style-type: none"> • The project is required to obtain Environment Clearance from Department of Environment 	<p>Medium</p> <ul style="list-style-type: none"> • This process will start before project execution phase 	<p>Medium</p> <p>Moderate</p>
	Contractors/ Sub-contractors	<ul style="list-style-type: none"> • Contractor for the project is yet to be finalized 	<ul style="list-style-type: none"> • Civil construction work during construction phase will absorb daily wagers mostly from local areas; and • Migrant workforce would be hired for skilled jobs. 	<p>Medium</p> <ul style="list-style-type: none"> • It was reported by the developer that an estimated 400 laborers in the unskilled, semi-skilled and skilled categories will be employed during the construction phase under different contractors and sub-contractors. 	<p>Low</p> <p>Minor</p>

7.6 STAKEHOLDER ENGAGEMENT PLAN

RBLTL will establish a stakeholder engagement program for Kutubdia LNG Project which includes a comprehensive suite of stakeholder's consultation, disclosure activities and engagement exercises and media interactions. The objective of the communication plan includes:

- Setting up a process for identifying information and communication needs of RBLTL.
- Undertake activities to supply the identified information and communication needs of RBLTL.
- Provide support to the human resource department to ensure effective intra and inter departmental communication.
- Identify RBLTL external stakeholders, their issues and information needs.
- Develop communication support material for RBLTL key messages.
- Develop appropriate corporate social responsibility policy initiatives.
- Establish and maintain cordial relation with all stake holders including government, media, traditional authorities, local communities, and the general public as well as employees.
- Assess effectiveness of the communication manual relevant to RBLTL

7.6.1 *Resource and Responsibility:*

As project Owner RBLTL has overall responsibility for stakeholder's consultation and engagement program. RBLTL's CSR department is responsible for implementing of this plan. The RBLTL's corporate head for external affairs is responsible for communicating with international stakeholders.

RBLTL's Responsibilities:

- Responding to the concerns and issues expressed during public consultations.
- Allocating sufficient funds to implement a viable Stakeholder Engagement Plan.
- Ensuring that all public consultation and information disclosed is documented.

7.6.2 *Communication Process*

Project related community education activities, and documented stakeholder's engagement will be carried out by RBLTL. This are-

- Project Related Community Education Activities
 - Interaction with community
 - Local Labour training
 - Interaction with media
 - Interaction with regulatory agencies

- Interaction with local NGO
- Documented Stake holders Engagement
 - Quarterly photo shots of changing scope and size of the project development
 - Video & photo documentation -Livelihood ,community education, local labour
 - Rehabilitation & Resettlement
 - CSR activities
 - Stake holder engagement Register
 - Stake holder contact reports
 - Issues log
 - Daily
 - Newspaper clippings
 - Monthly media summary

7.7 INFORMATION DISCLOSURE

RBLTL used a variety of communication technique to announce major project milestones and decision points. This are -

7.7.1 Reporting

Stakeholder Engagement Plan is the part of the Environment & Social Management Plan, which will be used for public consultations. Ongoing public consultation, meeting minutes and records will be kept in record. A summary report of all public consultation issues, grievances and redressal will be prepared at project level.

7.7.2 Informal Stakeholder Consultation

RBLTL will pursue a vigorous community outreach strategy throughout the project life cycle to buildup trust and facilitating open information exchange among stakeholders. RBLTL CSR department will interacts with community daily and consult on a broad range of issues with local leadership-traditional and political-and the general population. These interactions will be happen during CSR representatives are on their daily round, meeting with local people, providing informal updates on the progress of the project, and answering questions.

7.7.3 Formal Stakeholder Consultation

Meeting and briefing on the project will be provided to the following:

- Lender
- District Administration
- Union representative
- Government of Bangladesh
- Department of Environment

- Other regulatory Agencies
- International ,national & local media

Table 7.5 Stakeholder Engagement Plan

Stakeholder	Objective	Engagement Plan	Frequency
- District Administration	- License and Clearances	- Regular meetings for taking / giving progress updates	On regular interval
- Upazila and Union Administration	- Environmental Clearance	- Timely submission of responses to queries raised	
- Department of Environment		- Proper filing of applications as per requirements	
- Forest Department		- Undertaking environment and social impact assessments	
- Other Concerned Government Department		- Community Interaction Programs	One meeting every month
- Local Community	- Reputation	- Group Meetings	
- Local Elected Representatives	- Building	- Public Announcements & Press Release	
- NGOs	- Right Information	- Information sheets distribution	
- Effected Community	- Dissemination		
	- Effective Grievance Management		
- Lender	- Compliance	- Interim Assessments	On Regular Interval
- Regulator	- Adherence	- Report Submission for Financial and Physical Progress	
	- Reputation	- Quarterly Progress Report	
	- Building	- Community development stories and significant Project Updates will be publicized through Press Releases, Press Briefings, Press conferences, By-lined articles in the media, A print and radio advertising	Two media releases (any type) every year
- Local National and International Media	- Building		
	- Positive Opinion		

Budgetary requirements for implementing the stakeholder engagement plan have been duly incorporated in the ESMP budget presented in Section 9 of the ESIA.

The implementation of a project is a complex time and labour intensive process involving multitude of lifecycle phases and processes. Over the duration of the project, it encounters numerous instances of conflicts, allegation and dissatisfaction within the working and associated human capital and their interactions. Some of these issues could be related to

- compensation payment,
- improper estimation of affected assets,
- failure to fulfil commitments,
- poor management of construction activities,
- accidents due to inappropriate planning of vehicle movement, and
- Cultural conflicts between migrant workers and local communities etc.

Most of the conflicts and allegations may not appear to be of serious nature but if not managed appropriately from the beginning may snowball into a bigger issue.

In order to manage these risks, an internal mechanism is required to be in place where the aggrieved party/s can lodge their complaints and get it amicably settled prior to approaching the formal mode of solution available to them i.e. access to legal system through courts. In order to provide a formal forum to the aggrieved parties to deal with issues arising out of project, it is proposed that a joint grievance redress mechanism be instituted for both environmental and social related issues.

It is understood that Reliance Power already has a Grievance Redressal Mechanism (GRM) in place. There will be a specific GRM that will be put in place by Reliance Bangladesh LNG Terminal Limited (RBLTL - subsidiary of Reliance Power) for this project. This project specific GRM will be formulated in keeping with the process and procedure of the existing GRM and will be integrated into the same. The following sub sections provide an understanding of the GRM proposed for the project.

8.1 OBJECTIVES OF THE GRIEVANCE REDRESSAL MECHANISM

The basic objective of the GRM shall be to provide an accessible mechanism to the affected people, community or any stakeholder(s) having a stake in the project to raise their issues and grievances in regards to project functioning.

The fundamental objective of GRM is to resolve any social (including labour, contractor, community amongst others) and environmental related grievances locally in consultation with the aggrieved party to facilitate smooth implementation of project related work activities. The other important objective is to democratize the development process at the local level and to establish accountability towards the stakeholders.

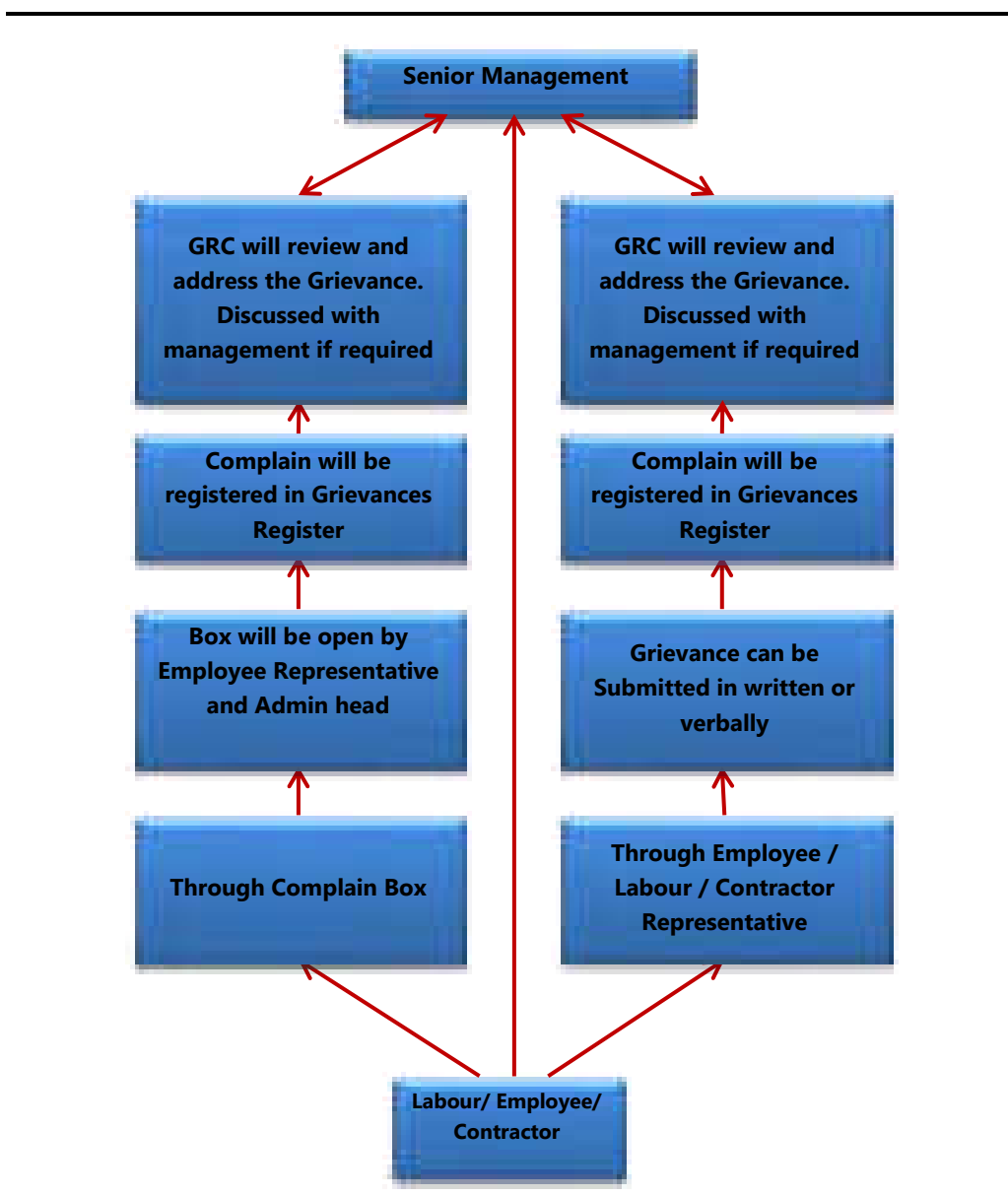
8.2 *PROCESS OF GRIEVANCE REDRESS MECHANISM OF RBLTL*

The key elements of the GRM to be adopted by RBLTL for the present project is summarised in the following sections.

8.2.1 *Grievance Redressal Mechanism for Employees and Contractual Workers*

A schematic representation of the grievance redress procedure for employee and contractor will be followed by Reliance Power is being shown below in *Figure 8.1*.

Figure 8.1 Existing Grievance Redress Process for the Employee and Contractor



As stated in the above figure, the employees and contractual workers can register their grievances in verbal or written form by communicating their grievances to the compliance personnel or group audit personnel or by dropping the grievance in the complaint box, which will be located at every strategic location of the facility. The GRC will maintain a log of all complaints

received in the form of a Grievance Register, as has been discussed in *Section 8.6*. Grievance log will help to track cases, respond to grievances in a timely manner, check the status of complaints and track progress, measure effectiveness, and report on results.

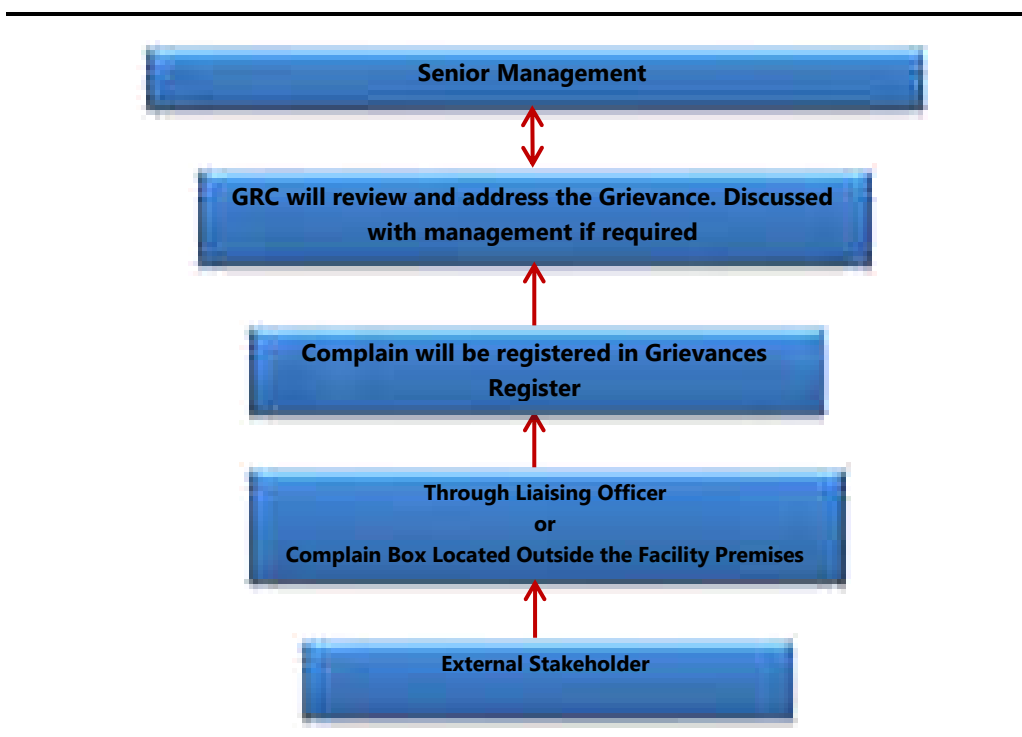
The GRC will then review and investigate the grievance, along with the representatives from the concerned departments, and identify measures to resolve the grievance as appropriate. This could involve provision of information to clarify the situation, undertaking measures to remedy actual problems or compensate for any damage that has been caused, and introduction of mitigation measures to prevent recurrence of the problem in the future. Where a grievance is found to be not a real problem a clear explanation will be provided to the complainant.

On the basis of the investigation, a formal response detailing how the grievance has been resolved will be provided to the complainant within 15 days where possible, and at the most within 4 weeks. Where resolution is delayed the complainant will be provided with regular updates on progress. On the basis of the response, the grievance form will be updated and the grievance will be closed.

8.2.2 *Grievance Redressal Mechanism for External Stakeholders*

The grievance redressal mechanism for the external stakeholders for RBLTL is presented in the *Figure 8.2*.

Figure 8.2 **Grievance Redressal Mechanism for External Stakeholders**



As can be seen from the above figure,

- The external stakeholders, including the local community, can register their grievances in verbal or written form by communicating their grievances to the Liaison Officer or by dropping the grievance in the complaint box/register, which will be located at the entry gate of the land based facility.
- The GRC will maintain a log of all complaints received in the form of a Grievance Register, as has been discussed in *Section 8.6*. The process for review and investigation of the grievances will be similar to the process for the employees and contractual workers, as discussed in the *Section 8.2.1*.
- As part of the review process, the GRC will also undertake site inspections, if required. A site inspection will be undertaken by the factory manager or a member of the GRC. The purpose of the site inspection will be to check the validity and severity of the grievance. The inspection will be undertaken within ten days of receiving the grievance.
- The assigned individual will then work with other relevant members of the GRC and concerned departments to investigate the problem and identify measures to resolve the grievance as appropriate. On the basis of the investigation, a formal response detailing how the grievance has been resolved will be provided to the complainant within 15 days where possible, and at the most within 3 weeks. Where resolution is delayed the complainant will be provided with regular updates on progress.
- On the basis of the response, the grievance form will be updated and the grievance will be closed.

8.2.3 *Grievance Redressal Mechanism for Resettlement*

As per ADB procedures, RBLTL has to establish a project specific Grievance Redress Mechanism (GRM) having suitable grievance redress procedure to receive and facilitate resolution of affected people's concerns, complaints, and grievances. A grievance mechanism will be established within one month from the approval and disclosure of draft Resettlement Plan to allow Project Affected Persons (APs) appealing any disagreeable decision, practice or activity arising from land or other assets compensation. APs will be fully informed of their rights and of the procedures for addressing complaints whether verbally or in writing during consultation, survey, and time of compensation. Care will always be taken to prevent grievances rather than going through a redress process. This can be done through careful land acquisition and resettlement design and implementation, by ensuring full participation and consultation with the APs, and by establishing extensive communication and coordination between the affected communities and local government in general. RBLTL will ensure that the public, particularly those directly affected by the project components will have the chance to express

their legitimate grievance or to file a complaint about the project by setting up a mechanism to address the issues raised. This mechanism is not intended to bypass the government's own legal process, but is intended to provide a time-bound and transparent mechanism that is readily accessible to all segments of the affected people. The grievance mechanism should not impede access to the country's judicial or administrative remedies. APs can approach the court of law at any time and independent of grievance redress process.

All costs involved in resolving the complaints (meetings, consultations, communication and reporting / information dissemination) will be borne by the Project.

The GRM structure especially this purpose is as follows

GRM Committee Structure for Resettlement

- Representative of RBLTL
- Representative of RP implementing Agency
- Representative of the Local Administrative Body
- Local member from Union
- Representative of the APs
- Representative of the District Commissioner

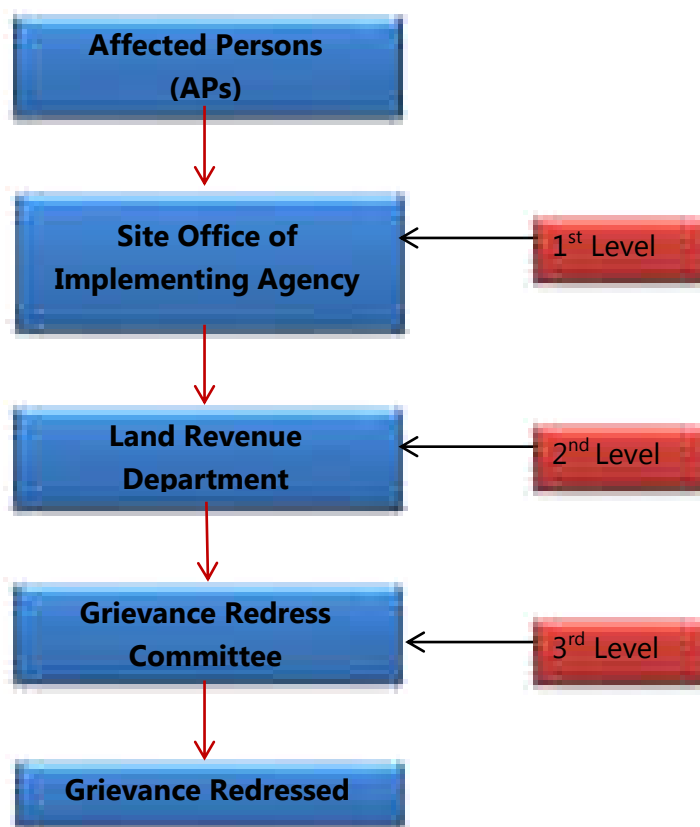
Grievance Redress Process

There will be three entry points in filing a grievance as follows:

- **1st Level-** APs will be informed in writing by the RBLTL through Land Revenue Department, Govt. of Bangladesh of their losses and entitlements. If APs agree with the conditions of entitlements, they can claim for the payments from the RP implementing agency.
- **2nd level** – If the APs disagree, contact person from Land Revenue Department can be approached for clarifications. The Land Revenue Department will respond to queries within two weeks. Grievances raised will be documented providing details on the person, concerns raised, and the action taken by the Land Revenue Department. If the AP is satisfied, the compensation can be claimed from the Land Revenue Department.
- **3rd level** – If the APs is not satisfied, Land Department will refer the issue to the GRC who will resolve it within four weeks. A hearing can be called, if needed, to give chance to the APs to present the concern in person.

The grievance redressal mechanism for Resettlement for RBLTL's Kutubdia LNG project is presented in the *Figure 8.3*

Figure 8.3 *Grievance Redressal Mechanism for External Stakeholders*



8.3 *COMPOSITION OF GRC IN RBLTL*

The GRM of RBLTL will be one single level of grievance redress mechanism or agency. This agency is called as the Grievance Redress Cell (GRC). GRC has the following representation to ensure fair and timely solution to the grievances:

- RBLTL Site personnel serving as the Community relations officer will also be serving as the Grievance Officer.
- General Manager on behalf of RBLTL management and site manager of site. However in cases the site manager is not available, this role may be deputed to his immediate deputy or any individual with that level of authority;
- Senior contractor personnel as a part of the GRC in case of a contractor labour dispute or issue;
- Community representative as a part of GRC in case of community grievance.

A grieved party can register their grievances with the GRC. The GRC has empowered to take a decision which is to be considered final and binding on RBLTL. However, the decision of the GRC is not binding on the aggrieved person and he or she may take the grievance to the administrative setup in

case any grievance channel is available at that level or take a legal course, in case not satisfied with the outcome of GRC decision.

8.4

FUNCTIONAL PREMISES OF GRC FOR GRIEVANCE REDRESS

The GRC meetings will be held in RBLTL project office at site and the same will be widely publicised in project area for the knowledge of general public. The key responsibilities of GRC are as follows:

- Review, consider and resolve grievances related to social and environmental aspects received by the RBLTL Site Office;
- Entertain grievances of indirectly affected persons and/or persons affected during project implementation;
- Resolve grievances within a period of two weeks at the GRC level and communication of the resolution to the aggrieved party;
- The GRC shall not engage in any review of the legal standing of an “complainant” nor shall deal with any matters pending in the court of law;
- Arrive at decisions through consensus, failing which resolution is based on majority vote. Any decision made by the GRC must be within the purview of Environmental Management Plan, Corporate EHS and Social Policies or any such documents of relevance of that matter;
- If needed, may undertake field visits to verify and review the issues, dispute or other relevant matters.

8.5

DISCLOSURE OF THE GRIEVANCE REDRESS MECHANISM

The process of existing disclosure mechanism of GRM followed by RBLTL facility, will keep the following aspects in mind:

- The grievance redress process shall be disclosed and the procedures mentioned therein shall be properly disseminated to the identified stakeholders.
- RBLTL shall integrate the grievance redress mechanism as a part of the induction training programme especially those conducted for self-employees and the contractors.
- The disclosure of the information shall clearly mention the name and designation of the grievance redress officials, office location and their respective contact numbers.

8.6

GRIEVANCE REPORTING PROCEDURE

An aggrieved person, a group of persons or a community can file grievances without any fear and intimidation. The grievances can be submitted in either in writing or may be submitted orally/ telephonically to the GRC; the whole purpose is to make the GRM easily accessible to the affected population. The decision made by GRC will be communicated to the concerned person/group/community in writing.

The GRC will maintain records of the grievances received, in written and oral form, including the details of the complainant, the subject of the grievance, the appropriate department, and the status of the grievance. A sample recording format is provided in the following table

Table 8.1 *Sample Recording Format for Grievances Received*

S. No	Date	Village	Name of Complainant	Details of Grievance	Concerned Department	Status	Remarks
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8.7 *MONITORING AND EVALUATION*

Like the other project components, GRM will be monitored to ensure that the stakeholders are having no or limited issues with the project and in case there are concerns, they are being adequately addressed as per the mandate. In order to keep track on the effectiveness of GRM, it is the responsibility of the GRC to compile and maintain database on grievances for periodic review. The process of monitoring will include an internal monitoring and an external monitoring process.

The internal monitoring will be undertaken by the GRC, on a regular basis (at least six monthly). This process will allow for a review of the GRM to be undertaken, in terms of the efficacy of the mechanism and the average time taken for the redressal of the grievances received. These monitoring reports will be shared with the senior management of RBLTL.

In addition to the internal monitoring process, the Project will consider engaging an external agency for undertaking monitoring of the GRM on an annual basis. This monitoring process will allow for an assessment to be undertaken of the number and nature of grievances received, the manner in which the grievances were settled and the number of pending grievances. The external monitoring report will also be disclosed to the local community and other identified stakeholders.

8.8 *BUDGETING*

The RBLTL administration shall ensure adequate budgeting and resource allocation for implementing the grievance redress mechanism.

The Project specific Environment and Social Management Plan (ESMP) has been developed with an aim to avoid, reduce, mitigate, or compensate for adverse environmental and social impacts/risks and to propose enhancement measures. This includes: mitigation of potentially adverse impacts;

- monitoring of impacts and mitigation measures during project implementation and operation;
- institutional capacity building and training;
- compliance to statutory requirements; and
- integration of the ESMP with Project planning, design, construction and operation.

9.1 MITIGATION MEASURES

Key environmental and social impacts have been identified and reported in *Section 5* along with mitigation measures. A summary of mitigation measures identified for the construction¹ and operation phases of the Project is presented in *Table 9.1*. This also identifies lead responsibility for implementing the mitigation measures and sources of funds for such implementation

The construction phase of the land based facility is anticipated to last two years and for pipeline laying construction period is 9 month (3 season), whereas the life span of the Project is 22 years and Reliance Bangladesh LNG Terminal Limited (RBLTL), a subsidiary of Reliance Power, will be responsible for ensuring that the mitigation measures in the ESMP are implemented throughout the life span of the Project.

An Engineering, Procurement and Construction (EPC) Contractor will be engaged by RBLTL to design, construction and commission the Kutubdia LNG Project. The EPC Contractor in general will be responsible for implementation of most of the mitigation action plans that have been proposed as part of the ESIA for the construction phase. So it is recommended that using a framework of the mitigation measures and management plans that have been proposed as part of this ESIA, the EPC contractor will develop a site specific EMP and seek approval of RBLTL on the same before the initiation of construction activities.

9.2 ENVIRONMENTAL MONITORING

The environmental monitoring programme has been devised with the following objectives:

¹ Social impacts associated with the pre-construction phase of the Project have been covered under the construction phase.

- To evaluate the effectiveness of the proposed mitigation measures and the protection of the ambient environment as per prescribed/ applicable standards for the Project;
- To identify the need for improvements in the management plans;
- To verify compliance with statutory and community obligations; and
- To allow comparison against baseline conditions and assess the changes in environmental quality in the Project area.

9.2.1 *Performance Indicators and Monitoring Schedule*

Physical, biological and social environmental management components of particular significance have been identified as performance indicators. A comprehensive monitoring plan for each performance indicator has been prepared for all phases of the Project and is presented in *Table 9.2*. This includes parameters to be measured, methods to be used, sampling locations, frequency of measurements, detection limits, cost and responsibilities for implementation and supervision.

9.2.2 *Reporting Mechanism for Environmental and Social Monitoring Program*

A robust reporting system will provide the Project with the necessary feedback mechanisms to ensure quality and timely implementation of the works. The reporting system will ensure regular flows of information from the Project site to the Project headquarters and, as necessary, to regulatory authorities and funding agencies. The reporting system will provide a mechanism for ensuring that the measures proposed in the Project's ESMP are implemented.

Before the civil works start, the EHS Division of RBLTL will finalise the format for reporting on the status and progress of environmental monitoring. The format will be designed to meet all the compliance conditions associated with the environmental clearance from the Department of Environment and the Government of Bangladesh. The contractor will be required to submit the duly filled up reporting form on a monthly basis to the Project Developer (ie, RBLTL). A further report, detailing the results of pollution monitoring for air, noise, soil, and water will be submitted quarterly as envisaged in the monitoring plan. A health and safety incident/accident report will be prepared and submitted in the event of an incident or accident. The EHS Manager will monitor the effectiveness of the ESMP implementation. The CSR Manager will have responsibility of monitoring the implementation of social components of the ESMP. Both the EHS and CSR Managers will further report to the Plant Manager, who will be overall in-charge of the Plant operations and management.

The quarterly reports of the management measures will form an integral part of the Quarterly Progress Reports that can be submitted to the lenders. Additional compliance reports to the Regional Office and Head Office of the DOE required as a part of environmental clearance process shall also be prepared and submitted based on the necessary monitoring and reporting formats.

Table 9.1 Environmental and Social Management Plan for Construction and Operation Phase of the Project

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
A Environmental Issues Associated with Site Preparation and Construction							
1.1	Aesthetic and Visual Quality	<ul style="list-style-type: none"> Raising of land – ORF; Storage of construction materials; Storage and disposal of construction waste, municipal waste; Physical presence of labour camp; Earth work along the pipeline route; Dust deposition in the nearby property/ vegetation Disposal of HDD cut material generated from pipeline laying 	<p>Visual and aesthetic impact on the nearby villages</p> <p>Disposal of MSW in open area around the village will create nuisance.</p>	<ul style="list-style-type: none"> Moderate 	<ul style="list-style-type: none"> Entire ORF facility will be fenced with bamboo mat or tin sheet; All the construction activities will be restricted within the designated site; Fugitive dust will be suppressed with periodic water sprinkling; On completion of work all temporary structures, surplus materials and wastes will be completely removed from site and disposed at a designated area; Construction wastes and municipal solid waste temporarily stored at the sites will be transported to the designated disposal site/facility at regular intervals; 	EPC Contractor	EPC Contractor Cost
2.1	Soil Quality	Site clearing and preparation	Loss of topsoil	<ul style="list-style-type: none"> Minor 	<ul style="list-style-type: none"> Top soil from the entire proposed ORF will be stripped before site development activity; Top soil will be stored in a dedicated top soil storage site, having adequate mitigation measures for preventing erosion due to runoff; Activities will be scheduled (as far as possible) to avoid extreme weather events, such as heavy rainfall and high winds. Top soil will be restored after completion of the pipeline construction activity Top soil will be used for landscaping within the plant area 	EPC Contractor	EPC Contractor Cost

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
2.2	Soil Quality	Site clearing and preparation	Soil compaction	• Minor	<ul style="list-style-type: none"> • Demarcation of routes for movement of heavy vehicles; • Stripping and placing soils when dry, and not when wet. 	EPC Contractor	EPC Contractor Cost
2.3	Soil Quality	Fuelling and operation of heavy machinery and transport vehicles	Soil compaction	• Minor	<ul style="list-style-type: none"> • Refer ESMP 1.2 	EPC Contractor	EPC Contractor Cost
2.4	Soil Quality	Fuelling and operation of heavy machinery and transport vehicles	Soil contamination through spills and leaks	• Minor	<ul style="list-style-type: none"> • Preparation of guidelines and procedures for immediate clean-up actions following any spillages of oil, fuel or chemicals; • Storage areas for oil, fuel and chemicals to be surrounded by bunds or other containment devices to prevent any spilled oil, fuel or chemicals from contaminating soils, water or groundwater; • Use of spill or drip trays to contain spills and leaks, and use of spill control kits to clean small spills and leaks; and • Installation of oil/water separators to treat surface run-off from bunded areas prior to discharge to the storm water system. 	EPC Contractor	EPC Contractor Cost
2.5	Soil Quality	Storage and handling of chemicals	Soil contamination through spills and leaks	• Minor	<ul style="list-style-type: none"> • Refer ESMP 1.4 	EPC Contractor	EPC Contractor Cost
2.6	Soil Quality	Storage, handling and disposal of construction waste	Soil contamination	• Minor	<ul style="list-style-type: none"> • Design processes to prevent/minimise quantities of wastes generated and hazards associated with the waste generated; • Implement a construction materials inventory management system to minimise over-supply of the construction materials, which may 	EPC Contractor	EPC Contractor Cost

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
					<p>lead to disposal of the surplus materials at the end of the construction period;</p> <ul style="list-style-type: none"> • Segregate hazardous and non-hazardous waste and provide appropriate containers for the waste types generated (e.g. enclosed bins for putrescible materials to avoid attracting pests and vermin and to minimise odour nuisance); • Store wastes in closed containers away from direct sunlight, wind and rain; • Ensure storage area has an impermeable floor and containment, of capacity to accommodate 110% of the volume of the largest waste container; • Dispose of waste by authorised vendor. 		
2.7	Soil Quality	Generation of sanitary effluent	Soil contamination	<ul style="list-style-type: none"> • Minor 	<ul style="list-style-type: none"> • Adequate sanitary facilities, i.e. toilets and showers, will be provided for the construction workforce; • Septic tank and soak pit will be provided to treat domestic waste water. 	EPC Contractor	EPC Contractor Cost
3.1	Physiography & Drainage	<p>Raising of land for ORF up to 8 m</p> <p>Laying of pipeline along the agricultural land/ crossing of drainage channel/ nalas (minor streams)</p>	<p>ORF may disturb the low laying areas and its drainage slope towards west.</p> <p>Temporary disturbance of micro drainage</p>	<ul style="list-style-type: none"> • Moderate 	<ul style="list-style-type: none"> • Provide drainage system for the eastern side of the ORF to maintain the micro-drainage of area; • Reclaim the site after completion of the pipeline laying; • Maintain the cross drainage structure along the pipeline route. 	EPC Contractor	EPC Contractor Cost

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
4.1	Surface Water Quality	Erosion from excavation, levelling, filling and other activities	channel due to laying of pipeline Increased sediment content of surface water	<ul style="list-style-type: none"> Moderate 	<ul style="list-style-type: none"> Provision of channels, earth bunds or sand bag barriers on site to direct storm water to silt removal facilities; Protection of stockpiles by plastic sheeting to ensure that they are suitably secured against the wind at the end of each working day if rain is forecasted; Appropriate surface drainage will be designed and provided where necessary; Drainage systems, erosion control and silt removal facilities will be regularly inspected and maintained to ensure proper and efficient operation at all times and particularly following rainstorms. Deposited silt and grit will be removed regularly; Any temporarily diverted drainage will be reinstated to its original condition when the construction work has finished or when the temporary diversion is no longer required; Oil interceptors will be provided in the drainage system where necessary and regularly emptied to prevent the release of oil and grease into the storm water drainage system after accidental spillages; and Temporary and permanent drainage pipes and culverts will be 	EPC Contractor	EPC Contractor Cost

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
					provided to facilitate runoff discharge. These will be designed for the controlled release of storm flows.		
4.2	Surface Water Quality	Site run-off	Increased sediment content of surface water	• Moderate	<ul style="list-style-type: none"> • Ref. ESMP 2.1 	EPC Contractor	EPC Contractor Cost
4.3	Surface Water Quality	Construction of marine structures like twin berth jetty and pipeline trestle	Disturbance to the sea bed and localised sediment dispersion.	• Moderate	<ul style="list-style-type: none"> • Less intrusive piling techniques shall be adopted to minimise turbidity • It will be ensured that suitable piling equipment is deployed to minimise the suspension of fine sediments at the site • Piling activity will be regulated during rough sea conditions • It will be ensured that barges / workboats have slop tanks for collection of liquid / solid waste generated on board. Discharge of wastes into sea will be prohibited. • Spill control measures will be adopted while fuelling piling equipment, barges, workboats, etc. • Environmental Monitoring Programme comprising of monitoring of marine water quality, marine sediment quality and marine ecology will be initiated one week prior to commencement of construction activity and will be carried out throughout construction period 	EPC Contractor	EPC Contractor Cost
4.4	Surface Water Quality	Fuelling and operation of heavy machinery and transport vehicles	Contamination of surface water	• Moderate	<ul style="list-style-type: none"> • Vehicle servicing areas, vehicle wash bays and lubrication bays will, as far as practical, be located within roofed and cemented areas. 	EPC Contractor	EPC Contractor Cost

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
					<p>The drainage in these covered areas will be connected to sewers via an oil/water interceptor;</p> <ul style="list-style-type: none"> Any oil leakage or spillage will be contained and cleaned up immediately. Waste oil will be collected and stored for recycling or disposal; Any surplus wastewater from the concrete batching plant will be treated to comply with discharge standards before it is discharged to the Sea; 		
4.5	Surface Water Quality	Storage and handling of chemicals	Contamination of surface water	• Moderate	• Ref. ESMP 2.4	EPC Contractor	EPC Contractor Cost
4.6	Surface Water Quality	Storage, handling and disposal of construction waste	Contamination of surface water by sanitary effluent	• Moderate	• Ref. ESMP 1.6	EPC Contractor	EPC Contractor Cost
4.7	Surface Water Quality	Generation of sanitary effluent	Contamination of surface water	• Moderate	• Provide sanitation facilities	EPC Contractor	EPC Contractor Cost
4.8	Surface Water Quality	Barge transport	Impact on Sea water environment due to routine discharges of oily bilge and ballast water from barges; dumping of non-biodegradable solid waste and accidental oil/cargo spills or toxics	• Moderate	<ul style="list-style-type: none"> Barge transport operators who are compliant to the GOB regulations and are permitted to operate barges for transportation purpose by appropriate authorities in Bangladesh will be engaged for providing the transport services.; and Barges used for Project material transport will be periodically independently inspected and audited by the Project EHS Management Team members periodically. Each barge will be inspected at least once in every 6 	EPC Contractor	EPC Contractor Cost

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
					months or earlier. If any continued non-compliance with respect to the GOB regulations is observed over two (2) audit inspections, the Project will terminate the services of the barge transporter.		
5.1	Ground Water Quality	Fuelling and operation of heavy machinery and transport vehicles	Contamination of groundwater	• Moderate	• Ref. ESMP 1.4 and 2.3	EPC Contractor	EPC Contractor Cost
5.2	Ground Water Quality	Generation of sanitary effluent	Contamination of groundwater by sanitary effluent	• Moderate	• Ref. ESMP 2.7	EPC Contractor	EPC Contractor Cost
5.3	Ground Water Quality	Storage and handling of chemicals	Contamination of groundwater	• Moderate	• Ref. ESMP 1.4	EPC Contractor	EPC Contractor Cost
6.1	Air Quality	Operation of heavy machinery and transport vehicles	Exhaust Emissions	• Minor	<ul style="list-style-type: none"> • Minimise movement of construction vehicles and enforce a speed limit around the construction site; • Regularly maintain all diesel-powered equipment and reduce idling time to avoid emissions of NO_x, PM₁₀ and SO₂; • Where available use low sulphur diesel (LSD) in HGVs and diesel powered equipment in collaboration with best management practices; • Implement best practice procedures to control vehicle / equipment air emissions (such as turning off equipment when not in use); and • Vehicle / equipment exhausts observed to be emitting significant black smoke from their exhausts should be serviced/ replaced. 	EPC Contractor	EPC Contractor Cost

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
6.2	Air Quality	Topsoil and spoil piles management	Dust	<ul style="list-style-type: none"> Minor 	<ul style="list-style-type: none"> As far as possible, locate the concrete batching plant away from sensitive receptors like the settlement of Ali Fakir Deil; Implementation of a periodic watering and sprinkling regime in particular during the dry season; Minimise the height from which fill materials are unloaded during site backfilling as far as possible. Where possible, this should be below the height of the hoarding around the Project site boundary; During construction, the approach road will be regularly maintained to keep it clean, free from mud and slurry. The approach road will be properly shaped and compacted by rolling to an even and uniform surface to receive pavement. Totally enclose any skips for material transport with impervious sheeting; and No waste will be burnt on or around the Project site. 	EPC Contractor	EPC Contractor Cost
7.1	Noise	Heavy machinery operations for construction works	Increase in ambient noise levels	<ul style="list-style-type: none"> Minor 	<ul style="list-style-type: none"> Normal working hours of the contractor will be between 06:00 and 21:00 hours from Monday to Sunday. If work needs to be undertaken outside these hours, it should be limited to activities that do not lead to exceedance of the noise criteria at nearby sensitive receptors; Regular maintenance of equipment including lubricating moving parts, tightening loose parts and replacing worn out components 	EPC Contractor	EPC Contractor Cost

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
					<p>should be conducted;</p> <ul style="list-style-type: none"> • Low noise equipment should be used as far as practicable; • The number of equipment operating simultaneously should be reduced as far as practicable; • Equipment known to emit noise strongly in one direction should be orientated so that the noise is directed away from nearby sensitive receptors like Ali Fakir Deil settlement as far as practicable; • Acoustic enclosure should be erected around DG sets and other stationary noise generating equipment; 		
7.2	Noise	Increased traffic	Increase in ambient noise levels	<ul style="list-style-type: none"> • Minor 	<ul style="list-style-type: none"> • Only those vehicles meeting the standards stipulated in Schedule 5 of the Environmental Conservation Rules, 1997 shall be used; • Vehicles should be regularly maintained; 	EPC Contractor	EPC Contractor Cost
8.1	Occupational Health and Safety	General construction activities	Health and safety of construction workforce	<ul style="list-style-type: none"> • Moderate 	<ul style="list-style-type: none"> • The Contractor will prepare and implement a Health and Safety Plan prior to commencing work. This plan will include method statements for working methods, plant utilisation, construction sequence and safety arrangements; • Measures will be implemented to reduce the likelihood and consequence of the following hazards: <ul style="list-style-type: none"> - falling from height; - falling into water; - entanglement with machinery; - tripping over permanent 	EPC Contractor	EPC Contractor Cost

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
					<p>obstacles or temporary obstructions;</p> <ul style="list-style-type: none"> - slipping on greasy oily walkways; - falling objects; - contact with dangerous substances; - electric shock; - variable weather conditions; - lifting excessive weights; <ul style="list-style-type: none"> • A Permit to Enter system will be established to ensure that only authorised persons gain entry to the site; • All persons working on site will be provided information about risks on Site and arrangements will be made for workers to discuss health and safety with the Contractor; • All workers will be properly informed, consulted and trained on health and safety issues; • Personal Protective Equipment (PPE) shall be worn at all times on the Site. • Women in the region generally wear “sarees”, which is not appropriate while working in hazard prone construction areas. If women will be working in the hazard prone areas, then the contractor needs to ensure proper outfit and PPEs. • Before starting work all the appropriate safety equipment and the first-aid kit will be assembled and checked as being in working order; 		

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
					<ul style="list-style-type: none"> All lifting equipment and cranes will be tested and inspected regularly. All hoist ways will be guarded; All scaffolding will be erected and inspected in conformity with the Factories Act and the appropriate records maintained by the Contractor; Safety hoops or cages will be provided for ladders with a height in excess of two metres; When there is a risk of drowning lifejackets shall be provided and it shall be ensured that personnel wear adequate buoyancy equipment or harness and safety lines, and that rescue personnel are present when work is proceeding; The Contractor shall provide appropriate safety barriers with hazard warning signs attached around all exposed openings and excavations when the work is in progress. 		
8.2	Occupational Health and Safety	Changes to/existing environmental conditions	Health of construction workforce	<ul style="list-style-type: none"> Moderate 	<ul style="list-style-type: none"> Provision of clean drinking water in accordance with <i>Schedule 3 (b) of ECR, 1997</i>; and Ref. ESMP 1.5, 2.1, 2.4, 3.1, 3.2, 4.1 	EPC Contractor	EPC Contractor Cost
9.1	Community Health and Safety	Influx of construction workers	Increased prevalence of disease	<ul style="list-style-type: none"> Minor 	<ul style="list-style-type: none"> Barriers will be provided to prevent ingress of persons into the construction site and also to protect the public from exposure to hazards associated with the construction activities; Screening, surveillance and treatment of workers, through the provision of medical facilities and, 	EPC Contractor	EPC Contractor Cost

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
					<p>where required, immunization programmes;</p> <ul style="list-style-type: none"> • Undertaking health awareness and education initiatives among workers; • Avoiding collection of stagnant water; 		
9.2	Community Health and Safety	Road transportation	Traffic safety	• Minor	<ul style="list-style-type: none"> • Ref. ESMP 5.1. • Road safety awareness building for villagers living along the transportation route. 	EPC Contractor	EPC Contractor Cost
10.1	Terrestrial Ecosystem	Filling and raising of the Project site	Vegetation Clearance	• Minor	<ul style="list-style-type: none"> • Land clearing to be kept to a minimum to the extent practicable for the ORF and gas pipeline; • Wherever feasible, changes in the alignment of the gas pipeline will be made to avoid felling of larger trees and • Topsoil of the site should be preserved for later use in reinstatement activities • Local fruit bearing trees and local vegetation will be selected for greenbelt development. • Plantation of local species for stabilization of the filled in material and plantation in surrounding areas; and • Additional plantation at other identified areas such as inland pipeline line corridor; • Strict instruction should be given to the construction workers not to cut trees from the nearby areas for their fuel and timber use; • Use of LPG/ Kerosene for cooking 	EPC Contractor	EPC Contractor Cost

Ref No.	Project Stage/ Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
					need to be provided/ encouraged in order to reduce the impacts on vegetation from the vicinity of the Project site.		
10.2	Aquatic Ecosystem	Construction of FSU, ORF and trestle for cryogenic pipeline.	Spillage & leakage of fuel & lubricant	• Moderate	<ul style="list-style-type: none"> Proper spill control measures viz. spill kits to be made available on site. 	EPC Contractor	EPC Contractor Cost
10.3	Aquatic Ecosystem		Impact on turtle nesting sites	• Moderate	<ul style="list-style-type: none"> Survey of turtle nesting habitats at the project location and pipeline route prior to start the activity; Prohibition under contractual condition for poaching of Turtle eggs by the construction workers; 	EPC Contractor	EPC Contractor Cost
10.4	Aquatic Ecosystem	Noise and vibration due to piling activities in the sea	Disorientation, loss in communication in dolphins. Hearing loss and disorientation in turtles	• Moderate	<ul style="list-style-type: none"> Big bubble curtain (BBC): Freely rising bubbles injected by perforated pipes encircling the pipe will reduce underwater noise levels Using High frequency - low energy piling - (90 blows/min) technology If possible piling activities could be minimized during the nesting season of turtles 	EPC Contractor	EPC Contractor Cost
10.5	Aquatic Ecosystem	Movement of ship and vessels	Likelihood of turtle and dolphin mortality/injury during due to boat and vessel movement in sea and channel area.	• Moderate	<ul style="list-style-type: none"> Minimize the vessel movement during the egg nesting months of December to March; 	EPC Contractor	EPC Contractor Cost
10.6	Aquatic Ecosystem	Illumination	Disoriented movement of the turtle hatchlings may occur due to illumination	• Moderate	<ul style="list-style-type: none"> Minimum illumination at the coastal side as they may disrupts the hatchling movement; 	EPC Contractor	EPC Contractor Cost

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
11.1	Social Forestry	Construction of Land based facility	Disruption of social forestry site	<ul style="list-style-type: none"> Negligible 	<ul style="list-style-type: none"> Permission is to be availed from the Forest Department and DC (being the owner of the land). Compensation for the trees to be paid at market value and as assessed by the Forest Department More trees to be planted by the project proponent apart from Green belt that may serve as shelter belts. 	RBLTL	Project Management Cost
B <i>Social Issues Associated with the Pre-construction and Construction Phase</i>							
<p>The land acquisition, involuntary resettlement and livelihood restoration of the Affected Persons (AP) will be guided by a Resettlement Framework (RF) for the entire project (covering all the project components). On finalisation of the Project design and foot print - subsequently Resettlement Plan (RP) will be prepared that will delineate the exact magnitude of impact, number of DPs and Aps and their compensation entitlement along with cost for implementing the RP.</p>							
1.1	Land acquisition	Land acquisition for the Project activity areas	Loss of Land Change in Land Use Fragmentation of Land Holdings	<ul style="list-style-type: none"> Minor 	<ul style="list-style-type: none"> The land owners those who will be losing land will receive cash compensation under the law (CCL) which is Mouza Rate additionally with 50 percent of it as premium as per ARIPO. Cash grant to cover the difference between cash compensation under law (CCL) and the replacement cost. Provision for stamp duty and land registration cost incurred for replacement land purchase at the replacement value, capital gain tax, and value added tax incurred for replacement land. If any structural loss is envisaged – cash compensation equivalent to replacement value of structure or part of structure. For any displacement of encroachers from government land 60 days advance notice to be served with cash compensation equivalent 	RBLTL and District Administration	Part of the RP

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
					<p>to replacement value of structure.</p> <ul style="list-style-type: none"> • Additional compensation for vulnerable household, if any. • Dissemination of information about the acquisition and compensation calculation process; • Gas pipeline alignment to be finalized taking into consideration minimum land and structural loss • All possible alignment options should be explored and the one with the least amount of acquisition and impacts associated, should be selected; • Alignments that leaves the land highly fragmented and which may deem the fragmented land parcels useless for any further use are to be avoided as much as possible. Revenue map to be used to fix the alignment to minimise bifurcation of land parcel; • Marginal and small land owners while fixing alignment are to avoided as much as possible; • Prior intimation to land losers on restriction to crop cultivation within the acquired land in order to prevent any further losses; • The land owners should be allowed to use the gas pipeline RoW after adequate information disclosure with respect to any limitations such as construction of physical structure, safety and other hazards in relation to the corridor • Preference in employment opportunities for land losers during 		

Ref No.	Project Stage/ Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
					<ul style="list-style-type: none"> project construction period; Provision of training for skill improvement for alternate occupations other than agriculture; Provide additional support and assistance to land owners deemed landless from the acquisition in terms of temporary financial sustenance, jobs, etc. Implementation of grievances redress mechanism (as presented in Chapter 8) to address concerns and grievances of the land losers 		
1.2	Loss of Livelihood	Land acquisition for the Project activity areas	<p>Loss of Livelihood of land owner</p> <p>Livelihood of Sharecroppers, Lessee Farmers and Salt Pan Workers</p>	Moderate	<ul style="list-style-type: none"> The land owners will be compensated for their standing crops and trees as per the entitlements detailed out in the Resettlement Framework. As a mitigation measure the share croppers, lessee farmers and the salt pan workers will be appropriately compensated as detailed out in Entitlement Matrix in the Resettlement Framework. For lease holders and sharecroppers using the land parcel at least 60 days advance notice will be served so that they can harvest standing seasonal crops and collect the salts. If harvest is not possible they will be equivalently compensated. Unskilled labour during the project construction phase should be sourced from the local community; Training should be provided to the local people for their skill enhancement. 	RBLTL	RP

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
	Fishing Activity	Construction of Land based facility, Cryogenic Pipeline on Trestle, Onshore Gas Pipeline and Twin Berth for FSU and LNG Carrier.	<p>Partial Impact on Family Income</p> <p>Impact on Deep-sea Fishing Access Route</p> <p>Impact of Daily Fishing</p> <p>Impact of Daily Fishing access route</p> <p>Impact the navigation of the trawlers and fishing boats</p>	Moderate	<ul style="list-style-type: none"> • A monitoring study with GPS may be undertaken by the Project proponent that will monitor and assess the actual fishing routes, fishing zones and fish catch of the local fishermen that may potentially get impacted due to the project activities. • Financial compensation of loss of income incurred as a result of the Project until fishing or alternative income is secured • Alternative livelihood plan for shore line fisherman should be implemented • Compensation of assets that can no longer be used at fair market price • Gas pipeline laying along the Kutubdia Channel the work may be conducted in sections such that traffic movement on the channel is not restricted. 	RBLTL and EPC Contractor	RP and EPC contractor Cost
1.3	Migrant Workers & Labourers	Inflow of Migrant labourers & workers expected during construction phase of the project	<p>Potential conflict with local community;</p> <p>Health risks due to spread of communicable diseases and sexually transmitted diseases</p> <p>Issue of Sanitation and hygiene</p>	<ul style="list-style-type: none"> • Moderate 	<ul style="list-style-type: none"> • Engage locally available human resources to the maximum extent possible in order to avoid large scale in migration of external labourer. • Provide adequate facilities to the migrant workers and labourers such as properly constructed and well ventilated labour camps, clean and hygienic sanitation facilities, cooking areas etc. to minimize the health related impacts; • Separate toilet and bathing facilities for men and women; • Creating awareness about local 	RBLTL and EPC Contractors	Project Management Cost

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
					<p>tradition and culture among outside migrant and encouraging respect for same;</p> <ul style="list-style-type: none"> • Conducting awareness programme about sexually transmitted diseases among the migrant workers, labourers and for community around project site; • Proper disposal of wastes generated from the camp and construction activity to maintain general hygiene in the area; 		
1.4	Community Health & Safety	Project Construction Phase	<p><u>Traffic Movement:</u> Traffic congestions and potential disruption to community life;</p> <p>Risks associated with traffic movement and community safety;</p> <p>Additional risks to children, women and old people due to traffic movement;</p> <p>Dust and noise caused by the movement of vehicles;</p>	<ul style="list-style-type: none"> • Moderate 	<ul style="list-style-type: none"> • Prepare a traffic management plan for managing inflow and outflow of traffic and related safety risks and issues during construction phase; • Train drivers and navigators on traffic related rules and regulations as well as safety aspects in order to reduce risks of accidents; • Covering of trucks while carrying soil, sand, cement, aggregates etc. to minimise spread of dust and spill over; • Creating awareness among the drivers about speed, traffic safety, honking etc. while driving through settlement area; • Avoid unnecessary movement of vehicle through settlement area to minimise disturbance and traffic safety related issues; • Create awareness among children, women and old people about traffic safety through using the medium of school, women self-help group, village union office; • Regular maintenance of village 	RBLTL and EPC Contractors	Community Health & Safety

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
			<p><u>Health & Safety</u></p> <p>Generation of dust, noise and odour emanating from the construction site</p> <p>Potential fire hazards in form of flammable chemicals and materials stored during construction ;</p> <p>Improper disposal of sewage and construction wastes into the surroundings posing risk of contamination to local resources utilized by the community</p> <p>Risk of spread of sexually communicable disease</p>		<p>road to minimise damage to road surface;</p> <ul style="list-style-type: none"> • Regular sprinkling of water to suppress dust generating from the construction site; • Proper disposal of wastes generated from the camp and construction activity to maintain general hygiene in the area; • Disposal of wastes at pre identified waste dumping site to avoid unauthorised dumping; • Create awareness among workers about maintaining health, safety and hygiene in the area; • Prepare a Community Health & Safety Management Plan (CHSMP) that prescribes a chartered plan of action to manage health and safety impacts on the community emanating from the construction and operating phase activities • Disclose the CHSMP to the community under project influence zone and generate awareness about the various impacts envisaged during the project lifecycle • Create awareness about sexually transmitted disease among larger community around project area 		

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
1.5	Cultural Heritage	Pipeline Construction Activity	Distrubence in Graveyard due excavation of trench, movement of labour and vehicle, restriction in community access during pipeline laying activity	• Moderate	<ul style="list-style-type: none"> Graveyard area should be avoided if the proposed ROW of the pipeline going through the Graveyard area. Temporary barricading around the four side of the graveyard should constructed for restricting the movement of labour and vehicle within the graveyard area Access of the community people to the graveyard may not be restricted due to the pipeline laying activity It is should be ensured that during the construction phase no spill over takes place due to staging of construction materials. Restriction in construction activity during the prayer time 	RBLTL and EPC Contractors	Project Management Cost
C <i>Environmental Issues Associated with the Operation Phase</i>							
1.1	Aesthetic and visual quality	Physical presence of the ORF; Physical presence of 3.0 km long Trestle with Cryogenic Pipeline (10 -12m height) Illumination from the LNG facility.	Aesthetic and Visual impact	• Moderate	<ul style="list-style-type: none"> Appropriate shading of lights to prevent scattering 	EHS Team of RBLTL	Project O&M Cost
2.1	Surface and ground water quality	Oil spills from oil tanks	Impact on soil and ground water environment Contaminated storm water runoff carrying contaminants to Sea Water	• Moderate	<ul style="list-style-type: none"> The secondary containment structures such as berms, dykes, or walls that could hold up to 110 % of the primary containment volume will be made of firm and impervious material at diesel and lubricating oil storage areas; SOPs will be prepared to manage any oil spills, leaks seepages. SOPs will cover transport, handling, storage, use and disposal of oil/ oil 	EHS Team of RBLTL	Project O&M Cost

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
					<p>wastes/ empty drums etc. Operating personnel will be trained on the SOPs and monitored in their use on a daily basis;</p> <ul style="list-style-type: none"> • Empty drums will be sent for reuse or for recycling in line with DOE guidelines; • At all oil and diesel storage tank locations, emergency spill kits will be provided for the operating personnel to use. Operating personnel will be trained to use such kits and dispose of them as part of hazardous waste; and 		
2.2	Surface and ground water quality	Oily water-runoff	Contaminated storm water runoff carrying contaminants to Sea Water and Kutubdia Channel	<ul style="list-style-type: none"> • Moderate 	<ul style="list-style-type: none"> • Oily water runoff collected in the oil handling & storage area and oil filled motors and pump bases will be collected in different sump and taken to a common oily waste water sump; • The oily wastewater and storm runoff collected from specific areas mentioned above will be treated using an oil water separator; and • Separated oil will be disposed of as part of oily wastes and handled as a hazardous waste stream. The treated de-oiled water will be transferred to waste water chamber 	EHS Team of RBLTL	Project O&M Cost
2.3	Surface and ground water quality	Spills of fuel, oil and chemicals	<p>Impact on soil and ground water environment</p> <p>Occupational health and safety hazard</p>	<ul style="list-style-type: none"> • Moderate 	<ul style="list-style-type: none"> • Acids and other hazardous materials will be stored in a dedicated room as per their MSDS specifications with adequate ventilation; • All chemicals will be stored in primary containers that have in-built secondary containment of capacity that is at least 110% of 	EHS Team of RBLTL	Project O&M Cost

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
			Contaminated storm water runoff carrying contaminants to Sea Water and Kutubdia Channel		<p>primary containment;</p> <ul style="list-style-type: none"> The Spill prevention and response guidance presented in Sections 1.5 and 3.7 of the General IFC EHS Guidelines (2006) will be followed and implemented. 		
2.4	Surface and ground water quality	Barge transport	Impact on Sea and Kutubdia Channel water environment due to routine discharges of oily bilge and ballast water from barges; dumping of non-biodegradable solid waste and accidental oil/cargo spills or toxics	<ul style="list-style-type: none"> Minor 	<ul style="list-style-type: none"> The need for barge transport is likely to be limited during the O&M phase. In case barge transport services are required, the mitigation measures suggested in the construction phase ESMP will be implemented. 	EHS Team of RBLTL	Project O&M Cost
2.5	Surface and ground water quality	Discharge of domestic wastewater	Impact on Sea Water and channel water quality	<ul style="list-style-type: none"> Minor 	<ul style="list-style-type: none"> The sewage from the entire plant area will be collected and treated in septic tank/soak pit or a mobile STP. No untreated sewage will be directly discharged into Sea water or disposed of on land through the project life cycle; The treated effluent will comply with GOB ECR 1997 Schedule 9 (Standards for Sewage Discharge) and IFC Guidelines before discharge into the Sea water; and In order to monitor STP performance, continuous 	EHS Team of RBLTL	Project O&M Cost

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
					evaluation and monitoring of discharge parameters will be undertaken at the outlet point of STP.		
2.6	Surface and ground water quality	Non-oily site or storm water runoff	Impact on Sea water quality	<ul style="list-style-type: none"> Minor 	<ul style="list-style-type: none"> Storm water and non-oily surface run off will be collected separately and disposed into Sea through for this stream of wastewater; The discharge system will be periodically inspected for blockages and cleaned at least once before the monsoon season to ensure its functioning; and Operating personnel will be trained to visually inspect discharged water quality for oil and grease traces (that will be visible on the surface) periodically and take appropriate corrective action. 	EHS Team of RBLTL	Project O&M Cost
3.1	Air Quality	Stack emissions	Impact on ambient air quality GHG emissions	<ul style="list-style-type: none"> Negligible 	<ul style="list-style-type: none"> The Project will adopt Dual Fuel (Gas and HSD) Gas Turbine system for captive power generation which has a relatively high energy-efficiency and low polluting per unit of power produced compared to other thermal power plants; Two air emission stacks -42m height will be included - to disperse the air pollutants such that ground level concentration of air pollutants do not exceed the background concentration and meets GOB/DOE norms; Comply with the Emission guidelines for Combustion engines in the IFC EHS guidelines for Thermal Power Projects. Monitor ambient air quality in and 	EHS Team of RBLTL	Project O&M Cost

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
					around the Project site as per the Environment Monitoring Program formulated for the Project which will comply with National Regulatory requirements.		
3.2	Air quality	Indoor air quality	Impact on health of workers and staff	<ul style="list-style-type: none"> Negligible 	<ul style="list-style-type: none"> Implement leak detection and repair (LDAR) program that will control fugitive emissions. A gas detection system (GDS) will be provided to warn the operational personnel immediately in the event of a leakage within the GTG and skid area. The GDS will be infrared system suitable for natural gas detection; Supply mechanical supply ventilation systems by wall mounted supply air fans at GTG building and chemical storage area to reduce the VOC levels in the ambient environment inside the operational buildings; and 	EHS team of RBLTL	Project O&M cost
4.1	Noise	Plant operations	Impact on health of workers and staff	<ul style="list-style-type: none"> Negligible 	<ul style="list-style-type: none"> Install gas turbine generators (GTG) with noise attenuation measures such as air intake silencers and acoustic insulation. At fuel gas skid, sound absorption walls will be erected to reduce the ambient noise levels; Maintain operator exposure to Ambient Noise Level (ANLs) to less than 85 dB(A) for 8 hour normalised exposure limit as recommended in the IFC EHS guidelines; Comply with the noise emission criteria as per the Schedule 4 of ECR, 1997; Noise Pollution 	EHS Team of RBLTL	Project O&M cost

Ref No.	Project Stage/ Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
					(Control) Rules, 2006 and noise guidelines prescribed in the General EHS guidelines of the IFC; <ul style="list-style-type: none"> • Maintain ANLs at office areas at 45-50 dB(A) in line with IFC guidelines; • Monitor ambient noise levels in and around the Project site as per the Environment Monitoring Program formulated for the project which will comply with National Regulatory requirements. 		
4.2	Noise	Operation of FSU	Impact on health of workers and staff	• Negligible	<ul style="list-style-type: none"> • All noise generating units would be acoustically enclosed; • Use of rubber padding underneath high noise and vibration generating machines; • Personnel working onsite in high noise generating areas will use ear plugs /ear muffs; 	EHS Team RBLTL	Project O&M cost
5.1	Greenhouse Gases	Captive Power Plant emissions	GHG emissions from the plant may add to larger global warming issue	• Negligible	<ul style="list-style-type: none"> • Natural gas based Power Plant are the least GHG emitting plants among the contemporary thermal power plant technologies and release lower quantities of carbon dioxide, a greenhouse gas; • Project has chosen the best power generation technology for the natural gas fuel to balance the environmental and economic benefits. The project has adopted Gas Turbine system which is higher energy-efficient and lower GHG producer per unit of power produced compared to other thermal power plant technologies; • Commit to good design and maintenance of the natural gas 	EHS Team RBLTL	Project O&M Cost

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
					<p>combustion system such that the designed GHG emission performance can be maintained through the project life cycle;</p> <ul style="list-style-type: none"> Install a continuous emission monitoring (CEM) system for monitoring AAQ levels in the HRSG stacks and calculating GHG emissions. 		
6.1	Community Health and Safety	Plant operations	<p>Impact on community assets such as water due to water intake and cooking water discharge</p> <p>Increased vehicular traffic in the region</p> <p>Exposure to site accidents and incidents</p> <p>Project Security</p>	<ul style="list-style-type: none"> Minor 	<ul style="list-style-type: none"> Comply with the Community health and safety guidelines presented in Section 3.0 of the General EHS Guidelines published by IFC; Formulate and implement an Off-site Emergency Management Plan in consultation and collaboration with local government authorities to streamline the emergency management response and strategy. Institute and operate a Community Grievance Redress System in line with ADB SPS and IFC Performance Standard 4 that pertains to Community Health, Safety and Security aspects; and If required, Project Security personnel will be engaged and trained in line with the recommendations of IFC Performance Standard 4. 	EHS Team RBLTL	Project O&M Cost

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
8.1	Terrestrial Ecosystem	ORF Operations	Incremental noise	• Minor	<ul style="list-style-type: none"> Attenuate noise levels to the extent possible by proper lubrication of machinery and equipment and installation of noise barriers/acoustic enclosures at appropriate locations. 	EHS Team of RBLTL	Project O&M cost
8.2	Aquatic Ecosystem	FSU, ORF Operations	Spillage & leakage of fuel & lubricant	• Moderate	<ul style="list-style-type: none"> Proper spill control plan to be adopted on site. Oily water separator to be installed at the point of surface run-off discharge Suggestions from Oil Spill Contingency Plan to be strictly implemented in case of spillage 	EHS Team of RBLTL	Project O&M cost
8.3	Aquatic Ecosystem	FSU, ORF Operations	Move of ship and vessels	• Moderate	<ul style="list-style-type: none"> Support Local Forest Department and Local NGOs for in situ turtle nesting activities Support government initiatives in terms of research and monitoring for Dolphin studies in the region. 	EHS Team of RBLTL and	
8.4	Aquatic Ecosystem	FSU, ORF Operations	Illumination	• Moderate	<ul style="list-style-type: none"> Minimum illumination at the coastal side 	Operation Team of RBLTL	
D	<i>Social Issues Associated with the Operation Phase</i>						
1.1	Traditional Fishing Route	Project Operation Phase	Impact on fishing activity	• Moderate	<ul style="list-style-type: none"> Communicate the problem to the affected community prior to the construction activity Maintaining healthy relationship with community through CSR activity 	RBLTL	Project management Cost

Ref No.	Project Stage / Affected Aspect	Project Activity	Potential Impacts	Impact Significance	Proposed Mitigation Measures	Responsibility for Mitigation Implementation	Mitigation Cost Source
1.2	Community Health and Safety and other issues	Project Operation Phase	Traffic Movement in newly constructed site approach road	<ul style="list-style-type: none"> Minor 	<ul style="list-style-type: none"> Awareness campaign among the community residing adjacent to the road Maintaining healthy relationship with community through CSR activity 	Project Management	O&M Cost
1.3	Occupational Health and Safety	Project Operation Phase	Risk of accident and fatality to worker	<ul style="list-style-type: none"> Minor 	<ul style="list-style-type: none"> On job training for the workers shall be carried out; Work permit system shall be followed; PPEs to be provided and use of PPEs shall be encouraged; SOPs to be developed for operation and maintenance of the project site. 	EHS Team of RBLTL	O&M Cost

Note: The Environmental and Social Management Plan (ESMP) as stated above would form the basis for management of environmental and social impacts of the Kutubdia LNG Project. The ESMP would also be used as a guiding framework for RBLTL, EPC contractors and other subcontractors for management of environmental and social issues on site. As stated earlier the EPC contractor will develop a site specific EMP and seek approval of RBLTL on the same before the initiation of construction activities. In addition to the ESMP, RBLTL will develop specific Standard Operating Procedures (SOPs) for proper management of environmental issues. An outline on the SOPs for certain key aspects like waste management, occupational health and safety, fire protection and management, etc. are presented in Annex 10 of this ESIA.

Table 9.2 Environmental Monitoring Programme (Pre-Construction, Construction and Operation Phases)

Project Stage / Affected Component	Potential Impact / Mitigation	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility	Monitoring Cost Source
<i>Site Preparation and Construction Phase</i>							
Ambient Air Quality	Air pollution	Respirable Particulate Matter (PM ₁₀ , PM _{2.5}), Sulphur Dioxide (SO ₂), Oxides of Nitrogen (NO _x) and Carbon Monoxide (CO)	6 locations within Kutubdia Island: Light House, Ali Fakir Deil; Pachar Para, Dakshin Dhurung; Kata Para, Lemshikhali ; Ismail Haji Para, Kaiyarbil; Uttar Musjit Para, Uttar Dhurung; Uttar Mogdil Para, Boroghob.	Standard analytical methods	6weeks, once a week at each location during pre-monsoon season (Total 36 samples) CO will be monitored 8 hourly while the rest of the parameters will be monitored over 24 hours.	3 rd Party Environmental Consultant / RBLTL	ESMP Budget
Ambient Noise	Incremental noise levels	Noise levels. Results will be analysed to work out Leq hourly, Leq day and Leq night	6 locations within Kutubdia Island: Light House, Ali Fakir Deil; Dakshin Dhurung Union complex, Pachar Para; Nurul Hasan House, Kata Para, Lemshikhali; Kamal Hossain House, Ismail Haji Para, Kaiyarbil; Saju Mia House, Uttar Masjid Para, Uttar Dhurung; Kutubdia Upazila Health Complex;	Standard analytical methods	Once during pre-monsoon continuously for 24 hours	3 rd Party Environmental Consultant/ RBLTL	ESMP Budget
Traffic Survey	Incremental traffic density	Traffic count for different categories of vehicles / vessels	Road Traffic - 1 location T1 - Road connecting Ali Fakir Deil with the Uttar Dhurung Road is selected for the road Waterway traffic - 2	Volume count	Once during pre-monsoon continuously for 24 hours	3 rd Party Environmental Consultant/ RBLTL	ESMP Budget

Project Stage / Affected Component	Potential Impact / Mitigation	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility	Monitoring Cost Source
			locations T2 - Boroghop Ferry Ghat; T3 –Darbarghat Ferry Ghat.				
Soil Quality	Soil contamination	Particle size distribution, Texture, pH, salinity, SAR, electrical conductivity, organic carbon, NPK, TDS, Na, Mg, Ca, Chloride, Fluoride, Permeability, Porosity, Cation Exchange Capacity, Infiltration rate	Two locations in agricultural land in Kutubdia Island Agricultural land near embankment of Ali Fakir Deil village; Agricultural land of Darbar village.	Standard analytical methods	Once during pre-monsoon	3 rd Party Environmental Consultant/ RBLTL	ESMP Budget
Ground Water Quality	Groundwater contamination	Temperature, pH, TDS EC, Salinity, Colour, Odour, Turbidity, Total Hardness (as CaCO ₃), Alkalinity (HCO ₃) Chloride (Cl), Sulphate Nitrate , Fluoride (F), Sodium (Na), Potassium (K), Arsenic (As), Cadmium (Cd), Chromium (Cr), Mercury (Hg), Lead (Pb), Iron (Fe), Nickel (Ni), Manganese (Mn), Copper (Cu), Zinc (Zn), Boron (B), Fecal Coliform, Total Coliform	4 locations (tube wells) within Kutubdia Island Ali Fakir Deil village, Dakshin Dhurung Union; Baitul Sharif Madrasa Complex, Kaiyabil Union; Darbar village, Lemshikhali Union; Uttar Mogdil village, Boroghop Union.	Standard analytical methods	Once during pre-monsoon	3 rd Party Environmental Consultant/ RBLTL	ESMP Budget

Project Stage / Affected Component	Potential Impact / Mitigation	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility	Monitoring Cost Source
Marine Water Quality	Water contamination	Temperature, pH, Electrical Conductivity, Dissolved Oxygen, Turbidity, Salinity, TDS, Suspended Solids, Cadmium, Lead, Chromium, Zinc, Copper, Nickel	6 samples to be collected from Bay of Bengal and Kutubdia Channel 500 m west towards the sea from the proposed ORF; 3000 m west towards the sea from the proposed ORF; 1500 m South West towards the sea from the proposed ORF; 1500 m North West towards the sea from the proposed ORF; 300 m towards the Kutubdia channel from right bank near to the Dhurung ghat; 300 m towards the Kutubdia channel from left bank near to the Chunura ghat.	Standard analytical methods	Once during pre-monsoon	3 rd Party Environmental Consultant/ RBLTL	ESMP Budget
Inland Surface Water Quality	Water contamination	Temperature, pH, Electrical Conductivity, Dissolved Oxygen, BOD ₅ , COD, Turbidity, Salinity, TDS, Suspended Solids, Nitrate, Nitrite, Manganese, Phosphate, Iron, Oil and Grease	One sample from Pilat Kata Khal	Standard analytical methods	Once during pre-monsoon	3 rd Party Environmental Consultant/ RBLTL	ESMP Budget

Project Stage / Affected Component	Potential Impact / Mitigation	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility	Monitoring Cost Source
Marine Sediment	Sediment contamination	Sand, Silt, Clay, Texture, Dissolved Oxygen, pH, Organic Carbon, Total Sulphur, Cadmium, Lead, Chromium, Zinc, Copper, Nickel	4 locations in Bay of Bengal off Kutubdia Island 500 m west of the ORF in Bay of Bengal; 500 m North West of ORF in Bay of Bengal; 300 m towards the Kutubdia channel from right bank near Dhurung ghat; 300 m towards the Kutubdia channel from left bank near to the Chunura ghat.	Standard analytical methods	Once during pre-monsoon	3 rd Party Environmental Consultant/ RBLTL	ESMP Budget
Aquatic Ecology	Impact on turtle nesting	Nesting frequency of turtles	Kutubdia Island	Frequency count	Once during egg laying season	Biodiversity Expert/ RBLTL	ESMP Budget
Fishing Routes	Impact on fishing	Identification of fishing routes through GPS survey	Kutubdia region	GPS tracking	Once during pre-construction phase	Fisheries Expert/ RBLTL	ESMP Budget
Tree Enumeration	Tree felling	Matured trees to be cut for development of ORF and onshore pipeline	ORF area; onshore pipeline corridor from ORF to Napura valve station	Frequency count	Once during pre-construction phase	Biodiversity Expert/ RBLTL	ESMP Budget
Site Preparation and Construction Phase							
General	Inspection of mitigation compliance	General compliance with mitigation measures presented in the ESMP and as specified in EPC Contractor Manual	Project activity areas ¹ and construction workers camp	Visual inspection of all active work areas	Daily	EHS Team of EPC Contractor	EPC Contractor Cost
Ambient Air Quality	Dust generation	PM _{2.5} and PM ₁₀	Identified air sensitive receptors within 500 m from the construction site	24-hour	Monthly	3 rd Party Environmental Consultant / EPC Contractor	ESMP Budget
	Vehicle exhaust	NO ₂ , SO ₂ , CO	Identified air sensitive	1-hourly and 24	Monthly	3 rd Party	ESMP Budget

¹ Activity areas are defined as Project site, approach road and gas pipeline alignment.

Project Stage / Affected Component	Potential Impact / Mitigation	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility	Monitoring Cost Source
			receptors within 100 m from the activity areas	hourly		Environmental Consultant/ EPC Contractor	
Noise	Increase in ambient noise levels	Noise levels in Leq, Leq day, Leq night and hourly Leq	Identified noise sensitive Receptors within 100 m from the activity area/s	24-hour	Once every fortnight	3rd Party Environmental Consultant/ EPC Contractor	ESMP Budget
Soil	Quality of filling earth/ sand	pH, salinity, NH ₄ ⁺ , total P, heavy metals, oil & grease	Barge/ trawler	Standard analytical methods	The first delivery from any source and then random sampling of deliveries from that source	3rd Party Environmental Consultant/ EPC Contractor	ESMP Budget
	Contamination of soil	pH, salinity, NH ₄ ⁺ , total P, heavy metals, oil & grease	Construction site or laydown area or spill area	Standard analytical methods	In the event of any leakage or spillage of hazardous substances, oil, or toxic chemicals	3rd Party Environmental Consultant/ EPC Contractor	ESMP Budget
Water	Contamination of surface water	Turbidity, pH, DO, Total dissolved solids, oil & grease, total coliform, heavy metals	Sea and Kutubdia Channel (close to construction area) at 2 locations (upstream and downstream)	Standard analytical methods	Monthly	3rd Party Environmental Consultant/ EPC Contractor	ESMP Budget
	Ground water quality	Drinking water quality parameters as per Schedule 3 of ECR 1997	Groundwater Bore well in nearest village of the construction area	Standard analytical methods	Monthly	3rd Party Environmental Consultant/ EPC Contractor	ESMP Budget
Occupational Health and Safety	Accidents or incidents due to construction activities, workers' health	Near-misses, incidents, occupational diseases, dangerous occurrences	Project activity areas and construction workers camp	Incidents, accidents and community complaints	Based on occurrence	EHS Team of EPC Contractor	EPC Contractor Cost
Community Health and Safety	Community disturbance and potential safety hazard due to	Accidents, incidents and complaints	Newly constructed approach road on the embankment	Incidents, accidents and community complaints	Based on occurrence	EHS and/or Community Liaison Officer of EPC Contractor	EPC Contractor Cost

Project Stage / Affected Component	Potential Impact / Mitigation	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility	Monitoring Cost Source
	road traffic						
	Community disturbance and potential safety hazard due to waterway transportation	Accidents, incidents and complaints	Sea and Kutubdia Channel	Incidents, accidents and community complaints	Based on occurrence	EHS and/or Community Liaison Officer of EPC Contractor	EPC Contractor Cost
	Public concerns	Complaints from community	Neighbouring communities around the Project activity areas	As per the grievance redress mechanism	Continuous	RBLTL	EPC Contractor Cost
Land acquisition and livelihood restoration	Loss of residential house, land, loss of earning	Budget and timeframe, disbursement of entitlements to Aps/DPs, Disclosure and consultations, grievances and complaints, benefit monitoring	Project activity area	Indicators as covered in RP and mentioned in Resettlement Framework	Regularly during RP implementation and follow up	RBLTL/ District Administration	Part of RP Implementation Budget
RP Implementation	Loss of residential house, land, loss of income	Periodic assessment of the RP implementation and impacts to verify internal monitoring and to suggest adjustments in delivery mechanism and procedures as required	Project activity area	Indicators as covered in RP and mentioned in Resettlement Framework	Regularly during RP implementation and follow up and provide biannual reports	External Monitoring Agency to be hired by RBLTL	Part of RP Implementation Budget
Aquatic Ecology	Impact on turtle nesting sites	Nesting locations and numbers of nests per season	Project activity areas	Visual inspection of all active work areas	Weekly during nesting season (December-March)	EHS Team of RBLTL	Included in operation and maintenance (O&M) cost

Project Stage / Affected Component	Potential Impact / Mitigation	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility	Monitoring Cost Source
<i>Operation Phase</i>							
General	Inspection of mitigation compliance	General compliance with mitigation measures presented in the ESMP and operational manual	Project activity areas	Visual inspection of all active work areas	Daily	EHS Team of RBLTL	Included in operation and maintenance (O&M) cost
Air Pollution	Stack emissions concentrations from captive power plant	NOx, CO, PM	Main stack and by-pass stack	CEM	Continuous	EHS Team of RBLTL	Installation included in EPC Cost. Monitoring and maintenance in O&M cost
	Ambient air quality	NOx, CO, PM10, SO2	3 locations within 2 km from the Project boundary	Standard methods	Monthly	3rd Party Environmental Consultant / RBLTL	ESMP Budget
Noise	Noise generation by Plant equipment	Sound Pressure Level	1 m from the noise generating equipment	Noise monitoring	Monthly Quarterly	RBLTL EHS Team or 3rd Party Environmental Consultant In case of monitoring done by RBLTL, verification by 3rd Party Environmental Consultant	ESMP Budget
	Ambient noise	Ambient noise levels	At Project boundary and at nearest NSRs in all direction from the Plant	Noise monitoring with data logger	24-hour observations with hourly noise levels, monthly once at each location	3rd Party Environmental Consultant/ RBLTL	ESMP Budget
GHG Emissions	Climate change	GHG production	Plant control room	Natural gas consumption	Annual	RBLTL	-

Project Stage / Affected Component	Potential Impact / Mitigation	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility	Monitoring Cost Source
Soil	Soil and Sediment Contamination	pH, salinity, NH ₄ ⁺ , total P, heavy metals, oil & grease	Accidental spillage area, waste storage area, and Sea	Standard analytical methods	Half Yearly	3 rd Party Environmental Consultant/ RBLTL	ESMP Budget
Water	Ground water quality	Drinking water quality parameters as per Schedule 3 of ECR 1997	Bore well water to be used for domestic purposes in the nearest village	Standard analytical methods	Monthly	3 rd Party Environmental Consultant/ RBLTL	ESMP Budget
	Wastewater	Temperature, chlorine, pH, BOD ₅ , COD, oil & grease, heavy metals, total faecal coliform	Outlet of discharge channel	Standard methods	Monthly	3 rd Party Environmental Consultant/ RBLTL	ESMP Budget
	Surface water quality	Temperature, conductivity, pH, DO, TDS	9 stations. 3 each along 3 transects perpendicular to the shoreline (at 0 m, 200 m and 500 m from the point of discharge of effluent)	Potable water quality analyser	Monthly Quarterly	RBLTL EHS Team or 3 rd Party Environmental Consultant In case of monitoring done by RBLTL, verification by 3 rd Party Environmental Consultant	ESMP Budget
Occupational Health and Safety	Accidents or incidents due to operation and maintenance activities, workers' health	Near-misses, incidents, occupational diseases, dangerous occurrences	Project activity areas	As to be defined in the H&S Plan to be prepared by RBLTL for the Project	As defined in H&S Plan	EHS Team of RBLTL	O&M Cost
Community Health and Safety	Community disturbance and potential safety hazard due to road traffic	Accidents, incidents and complaints	Newly constructed site approach road	Incidents, accidents and community complaints	Based on occurrence	EHS and/or Community Liaison Officer of RBLTL	O&M Cost

Project Stage / Affected Component	Potential Impact / Mitigation	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility	Monitoring Cost Source
	Community disturbance and potential safety hazard due to waterway transportation	Accidents, incidents and complaints	Sea	Incidents, accidents and community complaints	Based on occurrence	EHS and/or Community Liaison Officer of RBLTL	O&M Cost
	Public concerns	Complaints from community	Neighbouring communities around the Project activity areas	As per the grievance redress mechanism	Continuous	Community Liaison Officer of RBLTL and Station Manager	O&M Cost
Aquatic Ecology	Fisheries	Visible fish kills	FSU Point	Visual inspection	Six monthly	RBLTL EHS Team	O&M Cost
	Turtle and Dolphin population	Turtle stranding, nesting activities Dolphin stranding	FSU and offshore cryogenic pipeline area	Visual inspection	Monthly in nesting season for turtles Yearly	RBLTL EHS Team	O&M Cost

As mentioned earlier the Environmental and Social Management Plan (ESMP) will be used as a guide for site specific management of environmental and social impacts. This document would also be used as a reference framework for EPC contractors for management of environmental and social issues on site. In addition to the ESMP, the EPC Contractor / RBLTL will also develop specific Standard Operating Procedures (SOPs) for management of environmental issues during construction and operation phases. A brief outline of SOPs on key aspects such as occupational health and safety management, hazardous waste management, solid waste management, fire protection and management, etc. are presented in **Annex 10** of this ESIA.

9.3 *ESMP BUDGET*

Budgetary estimates for environmental and social management for the Kutubdia LNG project includes items envisaged as part of the ESMP. These have been worked out based on details and specifications for mitigation measures. The ESMP budget includes provisions for environmental management and monitoring (other than measures considered under good engineering practices or those integrated as embedded project controls) along with provisions for stakeholder engagement and for implementation of the adopted CSR programs.

The budget for environmental management is distributed in three parts. As baseline monitoring during the ESIA study was conducted during post-monsoon; another monitoring programme during pre-monsoon is recommended before commencement of construction activities. The pre-construction phase monitoring should include monitoring for air, noise, groundwater, surface water, soil, traffic etc. In addition, a dedicated survey to estimate the nesting frequency of turtles in Kutubdia region is also suggested. Apart from that, two other surveys involving identification of fishing routes near Kutubdia Island and enumeration of trees with respect to pipeline corridor (that is required to be felled) are also considered. The estimated budget for environmental management and monitoring during pre-construction phase is calculated to be **BDT 3,203,000**

Monitoring of physical environment during construction phase will involve air, noise, soil, surface water, groundwater monitoring. Construction phase is expected to continue for 3 years. Total budget for environmental monitoring during construction phase is estimated to be **BDT 14,068,000**.

Monitoring of physical environment during operation phase will involve stack, air, noise, soil, surface water, groundwater monitoring. Operation phase is designed for 22 years. Total annual budget for environmental monitoring during operation phase is estimated to be **BDT 2,466,000**.

An annual CSR budget of **BDT 10,300,000** is estimated for the proposed project which is planned to be utilized in health, education, skill improvement and development of rural infrastructure for the local community. In addition, an annual budget for stakeholder engagement of **BDT 215,000** will be utilized

for community interaction programs, group meetings, information sheets distribution, press releases, press conferences, print and radio advertising etc.

The budgetary provisions of the ESMP are presented in *Table 9.3*. It should be noted that the ESMP budget excludes all costs towards implementation of the Resettlement Plan (RP).

9.4 *INFRASTRUCTURE FOR CONDUCTING ENVIRONMENTAL & OHS ANALYSIS*

RBLTL will engage external 3rd party consultants for conducting environmental monitoring on site. In addition, RBLTL will also procure environmental monitoring equipment and hire environmental analyst for conducting basic environmental analysis on a day to day basis. A small field laboratory will be set up at the ORF.

Field equipment to be procured is listed below;

- Thermometer
- pH meter
- TDS meter
- Electrical Conductivity meter
- DO meter
- Noise meter

Basic infrastructure to be developed at the field laboratory

- Distilled water system;
- Digital weighing machine;
- Chemicals;
- Consumables- graduated pipette, burette, conical flasks, beakers etc.;
- Heating system;
- Computer and printer
- Lab furniture etc.

Moreover, RBLTL will also coordinate with Chittagong University and other local experts (college professors, NGOs) for undertaking specialized environmental/ecological monitoring and survey for the project.

A medical centre will be set up at the RBLTL facility for regular health check-up for the staffs and contractors. Pre-employment medical checks would be conducted for each employee and records will be kept. Training on occupational health and safety aspects, use of personal protective equipment

Table 9.3 ESMP Budget

SN.	Component	Parameters	Frequency	Cost in BDT
A. Budget for Pre-Construction Stage				
1.	Environmental Monitoring			
(a)	Ambient Air Quality	<ul style="list-style-type: none"> Respirable Particulate Matter (PM₁₀, PM_{2.5}), Sulphur Dioxide (SO₂), Oxides of Nitrogen (NO_x) and Carbon Monoxide (CO) 	6weeks, once a week at each location during Pre-monsoon season (Total 36 samples) CO will be monitored 8 hourly while the rest of the parameters will be monitored over 24 hours.	3 locations x2 per week x 6weeks x BDT 20,000= BDT 720,000
(b)	Ambient Noise	Noise levels. Results will be analysed for to work out Leq hourly, Leq day and Leq night	Once during pre-monsoon continuously for 24 hours at 6 locations	6 locations x 1 sample x BDT 5,500= BDT 33,000
(c)	Traffic Survey	Traffic Count for different categories of vehicles / vessels	1 road traffic survey and 2 river traffic survey Once during pre-monsoon continuously for 24 hours	3 locations x 1 sample x BDT 15,000= BDT 45,000
(d)	Soil Quality	Particle size distribution, Texture, pH, salinity, SAR, electrical conductivity, organic carbon, NPK, TDS, Na, Mg, Ca, Chloride, Fluoride, Permeability, Porosity, Cation Exchange Capacity, Infiltration rate	Once during pre-monsoon at 2 locations	2 locations x 1 sample x BDT 25,000= BDT 50,000
(e)	Ground Water Quality	Temperature, pH, TDS, EC, Salinity, Colour, Odour, Turbidity, Total Hardness (as CaCO ₃), Alkalinity (HCO ₃), Chloride (Cl), Sulphate, Nitrate, Fluoride (F), Sodium (Na), Potassium (K), Arsenic (As), Cadmium (Cd), Chromium (Cr), Mercury (Hg), Lead (Pb), Iron (Fe), Nickel (Ni), Manganese (Mn), Copper (Cu), Zinc (Zn), Boron (B), Fecal Coliform, Total Coliform	Once during pre-monsoon at 4 locations	4 locations x 1 sample x BDT 20,000= BDT 80,000
(f)	Marine Water Quality	Temperature, pH, Electrical Conductivity, Dissolved Oxygen, Turbidity, Salinity, TDS, Suspended Solids, Cadmium, Lead, Chromium, Zinc, Copper, Nickel	Once during pre-monsoon at 6 locations	6 locations x 1 sample x BDT 25,000= BDT 150,000
(g)	Inland Surface Water Quality	Temperature, pH, Electrical Conductivity, Dissolved Oxygen, BOD ₅ , COD, Turbidity, Salinity, TDS, Suspended Solids, Nitrate	Once during pre-monsoon at 1 location	1 location x 1 sample x BDT 25,000= BDT 25,000
(h)	Marine Sediment	Nitrite, Manganese, Phosphate, Iron, Oil and Grease Sand, Silt, Clay, Texture, Dissolved Oxygen, pH Organic Carbon, Total Sulphur, Cadmium, Lead, Chromium, Zinc, Copper, Nickel	Once during pre-monsoon at 4 locations	4 locations x 1 sample x BDT 25,000= BDT 100,000

SN.	Component	Parameters	Frequency	Cost in BDT
2.	Aquatic Ecology Study	Nesting frequency of turtles	Once during egg laying season	BDT 1,000,000 (lumpsum)
3.	Mapping of Fishing Routes	Identification of fishing routes through GPS survey	Once during pre-construction phase	BDT 750,000 (lumpsum)
4.	Tree Enumeration Survey	Matured trees to be cut for development of ORF and onshore pipeline	Once during pre-construction phase	BDT 250,000 (lumpsum)
5.	Stakeholder Engagement	Community interaction programs, group meetings, information sheets distribution, press releases, press conferences, print and radio advertising etc.	Annually for 1 year	BDT 215,000
Total (For Pre-Construction Stage - 1 Year)				BDT 3,418,000
B. Budget for Construction Stage				
1.	Environmental Monitoring			
(a)	Ambient Air Quality	PM _{2.5} and PM ₁₀ , SO ₂ , NO _x and CO	Three sensitive receptors within 500 m from the construction site; once every month	3 locations x 1 per month x 12 months x BDT 2,0000 x 3years= BDT 2,160,000
(b)	Noise	Noise levels in Leq, Leq day, Leq nigh and hourly Leq	Three sensitive receptors within 100 m from the activity area; once every fortnight	3 locations x 2 per month x 12 months x BDT 5,500 x 3years= BDT 1,188,000
(c)	Soil (Fill Material)	pH, salinity, NH ₄ ⁺ , total P, heavy metals, oil & grease	The first delivery from any source and then random sampling of deliveries from that source	10 samples x BDT 25,000= BDT 250,000
(d)	Soil (Contaminated)	pH, salinity, NH ₄ ⁺ , total P, heavy metals, oil & grease	Construction site or laydown area or spill area in the event of any leakage or spillage of hazardous substances, oil, or toxic chemicals	30 samples x BDT 25,000= BDT 750,000
(e)	Surface Water	Turbidity, pH, DO, Total dissolved solids, oil & grease, total coliform, heavy metals	Sea and Kutubdia Channel (close to construction area) at 2 locations (upstream and downstream); monthly	6 locations x 1 per month x 12 months x BDT 25,000 x 3years= BDT 5,400,000
(f)	Ground Water	Drinking water quality parameters as per Schedule 3 of ECR 1997	Groundwater Bore well in nearest village of the construction area ; fortnightly	3 locations x 2 per month x 12 months x BDT 20000 x 3years= BDT 432,0000
2.	Stakeholder Engagement	Community interaction programs, group meetings, information sheets distribution, press releases, press conferences, print and radio advertising etc.	Annually for 2 years	BDT 430,000
Total (For Construction Stage - 3 Years)				BDT 14,498,000

SN.	Component	Parameters	Frequency	Cost in BDT
C. Budget for Operation Stage				
1.	Environmental Monitoring			
(a)	Source Emission (Stack)	NO _x , CO, PM	Main stack and by-pass stack; continuous	BDT 0 (Cost included in project budget)
(b)	Ambient Air Quality	NO _x , CO, PM ₁₀ , SO ₂	3 locations within 2 km from the Project boundary; monthly	3 locations x 1 per month x 12 months x BDT 20,000= BDT 720,000
(c)	Source Noise	Sound Pressure Level	1 m from the noise generating equipment; monthly	5 locations x 1 per month x 12 months x BDT 3,000= BDT 180,000
(d)	Ambient Noise	Ambient noise levels	At Project boundary and at nearest receptors in all direction from the Plant 24-hour observations with hourly noise levels; monthly	6 locations x 1 per month x 12 months x BDT 5,500= BDT 396,000
(e)	Soil	pH, salinity, NH ₄ ⁺ , total P, heavy metals, oil & grease	Accidental spillage area, waste storage area, and sea; half yearly	6 samples x BDT 25,000= BDT 150,000
(f)	Ground Water	Drinking water quality parameters as per Schedule 3 of ECR 1997	Bore well water to be used for domestic purposes in the nearest village; monthly	3 locations x 1 per month x 12 months x BDT 20,000= BDT 720,000
(g)	Effluent discharge	Temperature, chlorine, pH, BOD ₅ , COD, oil & grease, heavy metals, total fecal coliform	Outlet of discharge channel; monthly	1 location x 1 per month x 12 months x BDT 15,000= BDT 180,000
(h)	Surface Water	Temperature, conductivity, pH, DO, TDS	9 stations. 3 each along 3 transects perpendicular to the shoreline (at 0 m, 200 m and 500 m from the point of discharge of effluent); monthly	Capital cost BDT 100,000; O& M cost BDT 20,000
2.	Stakeholder Engagement	Community interaction programs, group meetings, information sheets distribution, press releases, press conferences, print and radio advertising etc.	Annually for 1 year	BDT 215,000
3.	CSR Plan	Health, education, skill improvement and development of rural infrastructure for the local community	Annually for 1 year	BDT 10,300,000
Total (For Operation Stage - Per Year)				BDT 12,981,000

The ESMP (mitigation plan) will be included in the construction contract and the contractor will be responsible for implementation of the measures associated with design and construction. The Project Developer's staff, specifically the EHS and CSR Managers, will monitor the implementation of these mitigation measures by the contractors at the site. These two Managers will be responsible for the field level monitoring of the Project. Details of manpower deployed for implementation and monitoring of ESMP is presented in *Error! Reference source not found.*

Table 9.4 *Staffing Details for Implementation of ESMP*

Construction Phase			Operation Phase	
Corporate Level	Project Site	EPC Contractor	Corporate Level	Plant Level
Head Environment (RPL)	• 2 EHS Manager (RBIPL)	• 1 EHS Manager for every contractor	Head Environment (RPL)	• 1 EHS Manager (RBIPL)
Posted at New Delhi	• Safety and Environmental Supervisor (RBIPL)	• EHS Supervisor in all shift	Posted at New Delhi	• Safety Supervisor in each shift (RBIPL)
	• 1 CSR Manager with volunteers (RBIPL)	Number staff will finalized after EPC and package works are awarded		• 1 CSR Manager with volunteers (RBIPL)

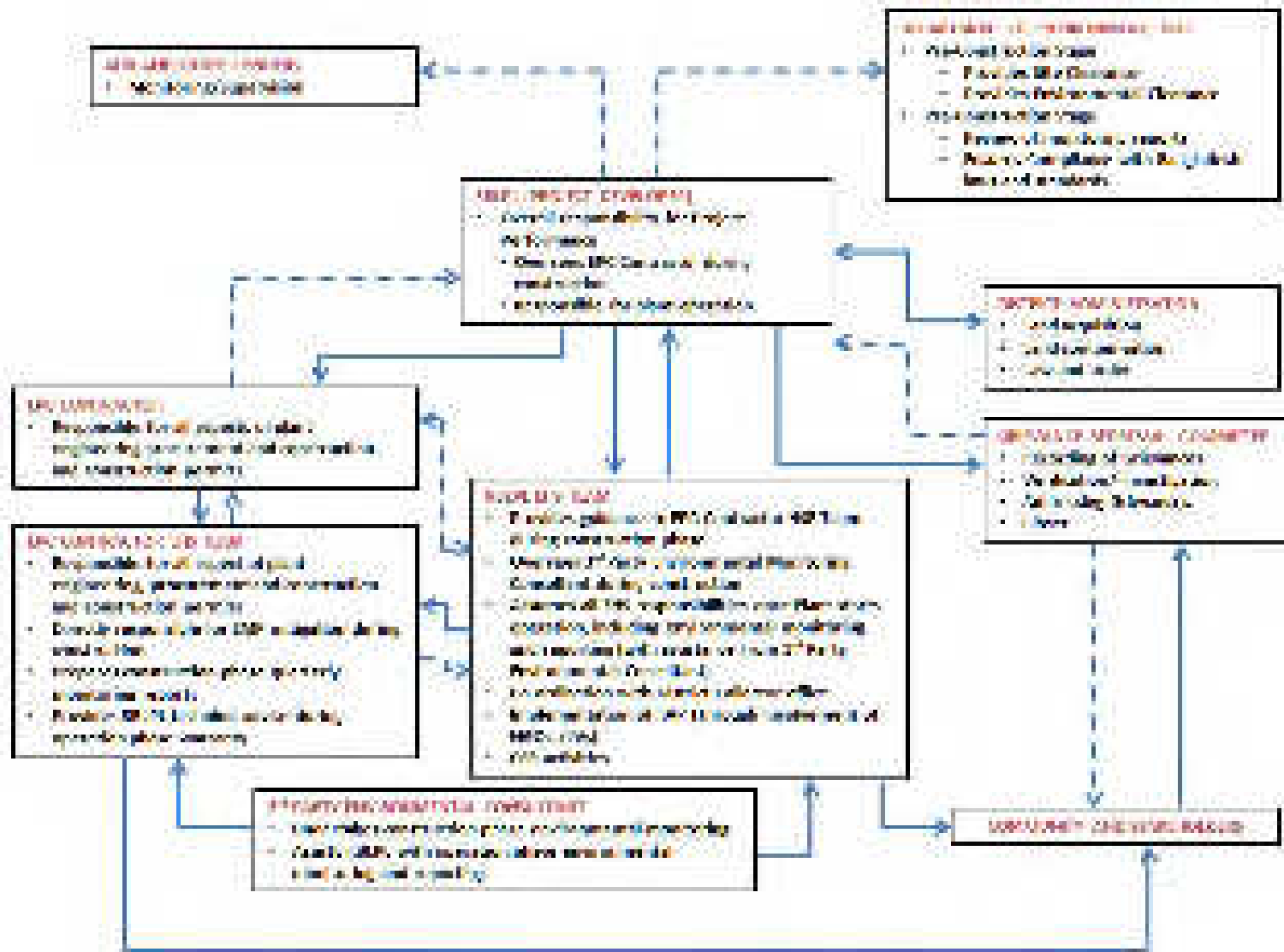
The roles and duties of the Project Developer and EPC Contractor for implementation and monitoring have been outlined in *Table 9.5*. The flow diagram depicting the institutional arrangement for implementation of the ESMP is presented in *Figure 9.1*.

Table 9.5 *Roles and Responsibilities of Project Developer and EPC Contractor*

Project Developer (RBLTL)	EPC Contractor
<ul style="list-style-type: none"> • Obtaining statutory clearances required during pre-construction stage of the Project • Overall project co-ordination and management through EPC and supported by the third party environmental consultant/s • Interaction and reporting to the respective department of GOB • Interaction and reporting to lenders • Effective implementation of ESMP and monitoring of ESMP implementation 	<ul style="list-style-type: none"> • Obtaining permits required during the construction stage • Joint verification with Project Developer and Third Party Environmental Consultant for review of ESMP implementation • Interaction with Project Developer and appointed supervision consultant, if any • Filling of reporting formats as per the reporting schedule and submission to Project Developer • Environmental monitoring through Third Party Environmental Laboratory

Project Developer (RBLTL)	EPC Contractor
<ul style="list-style-type: none"> • Carryout verification/ supervision exercises during the construction phase of the Project for implementation of ESMP • Keeping records of all permits obtained by EPC Contractor • Overall supervision of ESMP implementation • Approval of plans prepared by EPC Contractor • Addressing grievances of local community and information dissemination • Environmental monitoring through laboratory 	<ul style="list-style-type: none"> • Preparation of various plans for effective implementation of ESMP as detailed out in the "Specification Manual" by the Project Developer • Identification of site for labour camp, batch mix plant, laydown areas • Management of labour camp and to provide drinking water, sanitation facility

Figure 9.1 Organization Chart for Environmental and Social Management and Reporting Responsibilities during Construction and Operation Phases of the Project



This environmental and social impact assessment of the Kutubdia LNG Project ('Project') has been prepared based on review of draft technical specifications of the Project as provided by Reliance Power. The assessment process included scoping site visits, site surveys for impact assessment based on project level information provided by the project developer, primary baseline studies and monitoring and extensive stakeholder consultations along with reviewing of Site and Configuration Selection Report, Reconnaissance Survey Report for Onshore Pipelines, Process Layout of LNG Facilities, Cadastral Maps of the locations and studying satellite imageries. Through this process, an assessment has been undertaken of the potential environmental and social risks and impacts that may be attributed by the development of the project in its pre-construction, construction and operation phases. Assessments of the impacts have been presented with impact rating of each potential impact. Alternatives to the Project and key design aspects were also taken into consideration.

The chosen Project site for the land Based Facility is located within an area that is predominantly used for agricultural activities, salt pans and homestead areas with plantations currently covering approximately 240 plots¹ in two *mouzas* – *Dakshin Dhurung and Kaiyabil*. Development of the project will potentially cause economic displacement for the people involved in agricultural activities, and salt cultivation.

Land will also be required for the 8 meter RoW for the 17 km onshore gas pipeline that may potentially result in temporary land loss and fragmentation of land parcels. Potential impacts resulting due to land acquisition will be addressed in a separate document, the Resettlement Plan following a detail survey.

At the two adjacent villages – Ali Fakir Deil (168 registered fishermen) and Bindapara (23 registered fishermen), fishing and fishing related activities are undertaken by the fishermen community in these two unions (there may be more unregistered fishermen as highlighted by the Upazila and District Fisheries Department). Activities involve drying of nets, net repairing, boat repairing on shore, anchorage and fish drying for self-consumption. The fishermen involved in shoreline fishing and foot fishing especially from the Ali Fakir Deil village of the Dakshin Dhurung Union and Bindapara village in Kaiyabil union and those conducting daily fishing not far from the coast line will potentially get impacted due to the project. The fishermen will also face access related impacts while sailing for deep-sea fishing and daily fishing due to the exclusion zones for various project sub-components.

¹ The exact number of Affected Persons (APs) will be ascertained when the Project footprint is finalized and land ownership is determined through review of records maintained by the Land Department

The impacts related to fishing activities may be minimised and mitigated through effective measures – plan on alternate livelihood options to be developed among the members of the fishermen families through skill trainings, appropriate compensation for the fishing gears and other assets that may not be used and compensation for income loss. The compensation to be received by the fishermen will be quantified in a separate document, Resettlement Plan following a detailed study and the entitlements will be calculated on basis of the entitlement matrix provided in the Resettlement Framework.

It is also suggested that a fishing monitoring study be conducted for 2-3 seasons to have a better insight into the fishing activities, distance travelled, fish yields, etc. so as to further ascertain the extent and magnitude of impact on fishing activities.

During the construction phase of the Project, the key Environmental issue are noise and dust generation and disturbance to the natural vegetation along the gas pipeline alignment. There is also a risk of contamination of soil, groundwater and surface water in Kutubdia channel and the Sea (Bay of Bengal) from accidental spills and leaks of hazardous materials (e.g. oil) during handling, transportation, and storage at the site. In addition, erosion of soil and infill material brought to the site during the rainy season may lead to increased turbidity in the Sea water. Construction of jetty near FSU and the Trestle will require excavation of seabed material near shore and will involve piling work. The excavation activities and piling work in the seabed will generate fine sediments and will also result in resuspension of sediments in water. This expected to increase the turbidity of water and this have an adverse impact on surface water quality. The turbid water may have impact on aquatic ecology; thus affecting primary productivity.

Increase noise and dust levels including contamination of groundwater constitute public health concerns. The Kutubdia Channel and Sea is primarily used for navigation and fishing and is considered to be of moderate ecological and economic importance in the Project area. Hence, deterioration of its quality would be considered as a moderate adverse impact. However, these impacts are not unforeseen issues for similar type of Projects during their construction phase. Various mitigation measures will be developed by the Project Developer (RBLTL) for implementation through the EPC Contractor. The adverse impacts identified are generally manageable through good housekeeping and a diligent implementation of the ESMP by the EPC Contractor and its supervision by the Project Developer and their team of consultants. The nearest sensitive receptor will be a focus for monitoring of any impact arising due to the construction activities.

There are no protected areas like National Park, Wildlife Sanctuary of Ecologically Critical Areas etc. within the study area of 10 km radius from FSU location. The terrestrial fauna reported from this region included 17 species of herpetofauna, 91 species of avifauna and 11 species of mammalian fauna. It was found that only two species of fishes were threatened and these were

Korat mach (*Anoxypristis cuspidate*) is listed as Endangered and Koiputi (*Anodontostoma chacunda*) is now a rare locally. Hilsha reported to migrate from deep sea to north of 150-200 km offshore of Kutubdia and then the Hilsha school crosses eastern Nearshore of Kutubdia and aggregate near Bashkhali at Gandamara point (hilsha nursery). Olive Ridley's Turtle (*Lepidochelys olivacea*) IUCN listed Vulnerable 2016.3 nesting sites are reported from the west coast of Kutubdia islands by the locals. Four (04) marine Dolphin species were reported by the local fishermen to be present within 5 km area of Kutubdia Island.

Project induced impacts are mainly on the species of conservational significance as listed above. It is suggested that pre-survey of Olive ridleys nesting sites be conducted near to the project site and pipeline route during the nesting season (December to March) if construction activities are to be started in the nesting season. The Project will ensure that construction activities are reduced during the nesting season. Working labourers will also be instructed to avoid disturbing the Olive ridleys nest. Efforts will also be undertaken to reduce the underwater construction noise. The coast side illumination will also be kept minimal. Proponent should involve in the conservation of species of conservational significance through in situ conservation measures in consultation of Forest Department and NGOs involved in conservation of species.

The Project will have both positive and adverse impacts on social environment. The positive impacts will include temporary employment opportunity for the unskilled labourers during the construction period (the Project Developers plans to hire unskilled labour from the island Upazila), business opportunities for the local people (tea stalls, eateries, shops for general provisions, garages, etc.). Based on the present level of information available from the Project Developer it is anticipated that the Project is likely to have adverse social impacts pertaining to land loss, land fragmentation, potential physical displacement, loss of income (that may include agricultural labourers, sharecroppers, workers/labourers of salt pans), loss of productive land, potential income loss for fishermen and preventing to fishing related activities and fishing routes. The impacts may be localised and some are permanent in nature that can be mitigated with appropriate measures; it is anticipated that vulnerable groups (women headed households, to be identified during Census survey and social impact assessment) may also experience impacts due to the project implementation. The community at large will lose agricultural land, salt pan land, homestead lands and structures, access to near shoreline fishing grounds and use of sea shore for other activities related to fishing. However, the exact impacts and the number of Affected Persons (APs) will be ascertained based on the final technical design and Project footprint that will be made available by Reliance Power tentatively by end of January, 2017.

During the construction phase it is anticipated that there will be impacts on community health and safety around the proposed project site due to noise generation. Also influx of unskilled construction workers may cause impacts

on public health, especially due to prevalence of communicable diseases, waste disposal system and unhygienic conditions. The magnitude and significance of most of these impacts would be limited to the construction period, with limited spill over to the operation phase. As the project intends to have a construction camp at the facility, the interaction between the community and migrant workers would be limited. Additionally, an increase in traffic during the peak construction activities may create public safety issues for local residents, especially those residing along the newly constructed site approach road. The probability of pedestrian traffic accidents are less as this road primarily be used by the RBLTL vehicle as it is at the extreme northern and western part of the island. With mitigation measures as speed control in place the impact can be minimised or reduced significantly. In operation phase the social impacts are anticipated to be considerably less for community health and safety.

During the operation phase of the Project, the two key impacts will be from the increase in ambient noise and air quality levels due to operation of plant equipment and auxiliary machinery. It has been demonstrated through air quality dispersion modelling that the incremental ground level concentrations due to the operation of the plant will be well within the applicable GOB and WHO ambient air quality standards. Continuous emission monitoring from the stacks and periodic ambient air quality monitoring throughout operations will verify adherence with the applicable standards and enable identification of further measures to reduce impacts to ALARP. Incremental noise levels are planned to be within the applicable GOB standards for industries, however, ambient noise monitoring at the nearby sensitive location will be conducted to check and assess the requirements for further mitigation to reduce impact to ALARP.

Surface run off from oil storage waste handling unit (waste oil, used oil, etc.) may lead to the pollution of receiving water bodies viz. Bay of Bengal; as the slope of the area is towards. The surface run off may contain oil and lubricant, in case there is spillage from above mentioned areas. However, taking into account the provision of onsite drainage system with sedimentation tank, oil filters, etc., pollution load will not be significant. The sewage generated from the residential facilities or office area of the ORF will be treated through septic tank and soak pit; therefore, any direct discharge is not envisaged. The grey water, black water, ballast water and bilge water will be discharged into the Chittagong Port facility. However a surface water quality monitoring program, along with quarterly monitoring of aquatic ecology and fisheries has been formulated to further understand the extent of impact, if any, and to alert RBLTL to take additional mitigation measures.

The effective implementation of the EMP and adherence with the GOB and IFC guidelines will assist in minimising the environmental impacts to acceptable levels. Post environmental assessment, surveillance and monitoring are essential to track and sustain the effectiveness of the mitigation measures suggested. A detailed monitoring plan has been prepared as part of the EMP. The focus areas of monitoring cover air, surface water quality, groundwater

quality, noise, soil erosion, soil and groundwater contamination, occupational health and safety, community health and safety. The reporting requirements along with the follow up actions in case of deviation from the norms have been detailed in the EMP. The frequency has also been set in consideration of the likely impacts.

The construction phase of the Project will have an important role in the socio-economic development of the area, whereas the operation phase of the Project will play an important role by supplying gas in the region. A reliable and expanded gas supply will support future economic development of dependant sectors like industry and manufacturing enabling them to operate and compete.

Based on the analysis conducted in this environmental and social assessment, it is concluded that overall the Project will result in moderate to major positive socio-economic benefits and the potential negative environmental and social impacts that have been identified as mostly short-term and localised in nature, and can be minimized adequately through good design, appropriate application of mitigation measures and regular supervision of implementation.

Annex 1

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Annex 2

EHS Standards

EHS Standards

The relevant environmental standards (national as well as international) as applicable to the proposed Project are presented in the following tables:

Stack Emission Limits

Parameter	Unit	Bangladesh*	World Bank**
PM ₁₀	mg/Nm ³	150	50 (liquid fuel)
SO ₂		-	N/A (natural gas)
		-	Use less than 0.5% sulphur fuel (liquid fuel)
NO _x	mg/Nm ³	-	N/A (natural gas)
	mg/Nm ³	40 ppm	152 (74 ppm) – liquid fuel
Dry Gas, Excess O ₂ content	%		51 (25 ppm) – natural gas
	%		15 (natural gas)
			15 (liquid fuel)

Note:

* Schedule 11 (Standards for Gaseous Emission from Industries or Projects) of the Environmental Conservation Rules, 1997.

** Emission Guidelines for Combustion Turbines, WB/IFC EHS Guidelines for Thermal Power Plants (Source: EU (LCP Directive 2001/80/EC October 23 2001), EU (Liquid Fuel Quality Directive 1999/32/EC, 2005/33/EC), US (NSPS for Stationary Combustion Turbines, Final Rule – July 6, 2006).

Ambient Air Quality Standards

Parameter	Bangladesh**		WHO***	
	(µg/m ³)	Annual (µg/m ³)	(µg/m ³)	Annual (µg/m ³)
SPM (24 hourly)	200	-	-	-
PM ₁₀ (24 hourly)	150	50	50	20
PM _{2.5} (24 hourly)	65	15	25	10
SO ₂ (24 hourly)	365	80	20	-
NO _x (24 hourly)	-	100	-	40
CO (8 hourly)	10,000	-	10,000	-

Note:

** The Bangladesh National Ambient Air Quality Standards have been taken from the Environmental Conservation Rules, 1997 which was amended on 19th July 2005 vide S.R.O. No. 220-Law/2005.

*** WHO Ambient Air Quality Guideline Values (2005 and 2000), which are also being referred in the World Bank and IFC's General EHS Guidelines (2007)

Standards for Inland Surface Water

Best Practice based classification	pH	BOD mg/l	DO mg/l	Total Coliform nos/100 ml
a. Source of drinking water for supply only after disinfecting	6.5 – 8.5	2 or less	6 or above	50 or less
b. Water use for recreational activity	6.5 – 8.5	3 or less	5 or more	200 or less
c. Source of drinking water for supply after conventional treatment	6.5 – 8.5	6 or less	6 or more	5000 or less
d. Water usable by fisheries	6.5 – 8.5	6 or less	5 or more	-
e. Water usable by various process and cooling industries	6.5 – 8.5	10 or less	5 or more	5000 or less
f. Water usable for irrigation	6.5 – 8.5	10 or less	5 or more	1000 or less

* The Bangladesh Standards for Inland Surface Water have been taken from Schedule 3 (Standards for Water) of the Environmental Conservation Rules, 1997.

Notes: In water used for pisciculture, maximum limit of presence of ammonia as Nitrogen is 1.2 mg/l.

Electrical conductivity for irrigation water – 2250 mmhoms/cm (at a temperature of 25°C);

Sodium less than 26%; boron less than 0.2%.

Standards for Drinking water

Sl No.	Parameter	Unit	ECR,1997*	WHO, 2011**
1	Aluminium	mg/l	0.2	
2	Ammonia (NH ₃)	mg/l	0.5	
3	Arsenic	mg/l	0.05	0.01
4	Barium	mg/l	0.01	
5	Benzene	mg/l	0.01	0.01
6	BOD5 20°C	mg/l	0.2	
7	Boron	mg/l	1.0	2.4
8	Cadmium	mg/l	0.005	0.003
9	Calcium	mg/l	75	
10	Chloride	mg/l	150 – 600*	
11	Chlorinated alkanes carbon tetrachloride	mg/l	0.01	
	1.1 Dichloroethylene	mg/l	0.001	
	1.2 Dichloroethylene	mg/l	0.03	
	Tetrachloroethylene	mg/l	0.03	
	Trichloroethylene	mg/l	0.09	
12	Chlorinated phenols- pentachlorophenol	mg/l	0.03	
	2.4.6 trichlorophenol	mg/l	0.03	
13	Chlorine (residual)	mg/l	0.2	
14	Chloroform	mg/l	0.09	
15	Chromium (hexavalent)	mg/l	0.05	
16	Chromium (total)	mg/l	0.05	0.05
17	COD	mg/l	4	
18	Coliform (faecal)/E. coli	n/100 ml	0	Must not be detectable in any

Sl No.	Parameter	Unit	ECR,1997*	WHO, 2011**
				100 ml sample
19	Coliform (total)	n/100 ml	0	
20	Color	Hazen unit	15	
21	Copper	mg/l	1	2
22	Cyanide	mg/l	0.1	
23	Detergents	mg/l	0.2	
24	DO	mg/l	6	
25	Fluoride	mg/l	1	1.5
26	Hardness (as CaCO ₃)	mg/l	200 – 500	
27	Iron	mg/l	0.3 – 1.0	
28	Kjeldahl Nitrogen (total)	mg/l	1	
29	Lead	mg/l	0.05	0.01
30	Magnesium	mg/l	30 – 35	
31	Manganese	mg/l	0.1	
32	Mercury	mg/l	0.001	0.006
33	Nickel	mg/l	0.1	0.07
34	Nitrate	mg/l	10	50
35	Nitrite	mg/l	<1	3
36	Odor	mg/l	Odorless	
37	Oil and grease	mg/l	0.01	
38	pH	mg/l	6.5 – 8.5	
39	Phenolic compounds	mg/l	0.002	
40	Phosphate	mg/l	6	
41	Phosphorus	mg/l	0	
42	Potassium	mg/l	12	
43	Radioactive materials (gross alpha activity)	Bq/l	0.01	
44	Radioactive materials (gross beta activity)	Bq/l	0.1	
45	Selenium	mg/l	0.01	0.04
46	Silver	mg/l	0.02	
47	Sodium	mg/l	200	
48	Suspended particulate matters	mg/l	10	
49	Sulphide	mg/l	0	
50	Sulphate	mg/l	400	
51	Total dissolved solids	mg/l	1000	
52	Temperature	°C	20-30	
53	Tin	mg/l	2	
54	Turbidity	JTU	10	
55	Zinc	mg/l	5	

* The Bangladesh Standards for Drinking Water have been taken from Schedule 3 (Standards for Water) of the Environmental Conservation Rules, 1997.

** Guidelines for Drinking Water Quality, WHO, 2011.

Effluent Standards/ Guidelines

Parameter	Unit	Bangladesh*	WB/IFC**
pH	-	6.0 to 9.0	6.0 to 9.0
Total Suspended Solids (TSS)	mg/l	150	50 mg/l
Oil and grease	mg/l	10	10 mg/l
Total residual chlorine	mg/l	-	0.2 mg/l
Chromium (total)	mg/l	0.5	0.5 mg/l
Copper	mg/l	0.5	0.5 mg/l
Iron	mg/l	2.0	1.0 mg/l
Zinc	mg/l	5.0	1.0 mg/l
Lead	mg/l	0.1	0.5 mg/l
Cadmium	mg/l	0.5	0.1 mg/l
Mercury	mg/l	0.01	0.005 mg/l
Arsenic	mg/l	0.2	0.5 mg/l
Temperature increase at the edge of the mixing zone	°C	40 (summer) 45 (winter)	Site specific requirement to be established by the EA. Elevated temperature areas due to discharge of once-through cooling water (e.g., 1 Celsius above, 2 Celsius above, 3 Celsius above ambient water temperature) should be minimized by adjusting intake and outfall design through the project specific EA depending on the sensitive aquatic ecosystems around the discharge point.

Note:

- * Schedule 10 (Standards for Waste from Industrial Units or Projects Waste) of the Environmental Conservation Rules, 1997.
- ** Effluent Guidelines, WB/IFC EHS Guidelines for Thermal Power Plants.

Standards for Sewage Discharge

Parameter	Unit	Standard Limit (Bangladesh)*
BOD	mg/l	40
Nitrate	mg/l	250
Phosphate	mg/l	35
Suspended Solid	mg/l	100
Temperature	°C	30
Coliform	No./100 ml	1000

Notes:

- (1) This limit shall be applicable to discharges into surface and inland waters bodies.
- (2) Sewage shall be chlorinated before final discharge.

* Schedule 9 (Standards for Sewage Discharge) of the Environmental Conservation Rules, 1997

Noise Level Standards/ Guidelines

Category of Area/ Receptor	Bangladesh*		WHO***	
	Day (dB(A))	Night (dB(A))	Day (dB(A))	Night (dB(A))
Silent Zone	50	40	55	45
Residential Area	55	45	55	45
Mixed Area	60	50	-	-
Commercial Area	70	60	70	70
Industrial Area	75	70	70	70

Note:

* The Bangladesh National Ambient Noise Standards have been taken from Schedule 4 (Standards for Sound) of the Environmental Conservation Rules, 1997.

** Guidelines values are for noise levels measured out of doors. Source: Guidelines for Community Noise, World Health Organization (WHO), 1999.

*** As per IFC EHS noise level guidelines, Noise impacts should not exceed the levels presented in the above table or result in a maximum increase in background levels of 3 dB at the nearest receptor location off-site.

**** In Bangladesh standard day time is defined from 6.00 to 21.00 hrs and night time is from 21.00 to 6:00 hrs, whereas in WHO guidelines, day time is defined from 7.00 to 22.00 hrs and night time is from 22.00 to 7:00 hrs.

Annex 3

Ambient Air Quality Monitoring Results

Ambient Air Quality Monitoring Results

Location	Monitoring Date	Concentration ($\mu\text{g}/\text{m}^3$)			
		PM ₁₀	PM _{2.5}	SO _x	NO _x
AQ 1(Light House, Ali Fakir Deil)	02-Oct-16	65.62	26.41	3.98	12.76
	11-Oct-16	53.22	19.23	3.02	10.42
	16-Oct-16	60.42	21.53	3.18	14.58
	23-Oct-16	57.35	23.25	4.13	15.72
	29-Oct-16	52.19	20.18	3.34	12.42
	04-Nov-16	55.43	18.67	4.2	14.09
AQ2 (Pachar Para, Dakshin Dhurung)	04-Oct-16	76.31	34.72	5.47	21.63
	11-Oct-16	62.24	30.55	4.9	18.25
	16-Oct-16	66.71	32.15	5.21	23.43
	23-Oct-16	69.21	39.42	4.98	22.67
	29-Oct-16	60.12	36.37	5.48	24.76
	04-Nov-16	63.53	30.79	5.97	20.41
AQ3 (Kata Para, Lemshikhali)	05-Oct-16	70.54	39.66	4.34	18.41
	12-Oct-16	57.34	35.23	4.05	12.53
	17-Oct-16	63.29	37.54	4.27	14.76
	25-Oct-16	65.43	32.12	4.32	16.45
	30-Oct-16	58.76	28.35	3.26	13.67
	05-Nov-16	62.98	34.25	4.53	15.43
AQ4 (Ismail Haji Para, Kaiyarbil)	07-Oct-16	82.5	40.95	5.61	24.24
	12-Oct-16	67.65	32.43	4.23	17.34
	17-Oct-16	74.24	42.13	5.21	21.43
	25-Oct-16	70.23	40.24	4.78	25.51
	30-Oct-16	69.34	35.24	4.01	20.56
	05-Nov-16	72.67	37.43	5.14	25.35
AQ5 (Uttar Masjid Para, Uttar Dhurung)	08-Oct-16	85.43	47.71	5.75	29.14
	14-Oct-16	76.23	43.23	5.13	32.34
	21-Oct-16	70.45	40.43	4.78	27.53
	27-Oct-16	77.28	46.43	5.02	26.85
	01-Nov-16	72.34	39.54	4.67	23.56
	06-Nov-16	78.34	44.67	5.36	30.23
AQ6 (Uttar Mogdil Para, Boroghop)	10-Oct-16	67.32	35.32	4.03	23.63
	14-Oct-16	63.57	30.12	3.28	24.53
	21-Oct-16	68.34	34.23	4.14	26.32
	27-Oct-16	56.74	28.43	3.52	20.14
	01-Nov-16	60.21	33.25	3.11	18.54
	06-Nov-16	63.25	35.76	4.24	24.13

Annex 4

Ambient Noise Monitoring Results

Ambient Noise Monitoring Results

Hour	Hourly Leq					
	NL1	NL2	NL3	NL4	NL5	NL6
1:00-1:59 AM	43.4	46.5	43.9	43.9	42.2	44.5
2:00-2:59 AM	43.7	43.9	43.9	44.3	42.1	44.4
3:00-3:59 AM	44.0	46.4	44.6	43.9	42.7	43.8
4:00-4:59 AM	44.1	44.9	46.3	44.3	42.0	45.0
5:00-5:59 AM	44.8	46.0	47.5	44.6	43.1	44.7
6:00-6:59 AM	46.2	49.7	49.2	50.8	45.7	51.3
7:00-7:59 AM	47.1	51.8	50.0	53.0	44.6	54.1
8:00-8:59 AM	46.7	52.6	48.8	54.2	45.1	56.0
9:00-9:59 AM	47.2	56.5	49.1	55.2	46.5	54.5
10:00-10:59 AM	48.1	52.2	48.6	56.9	47.3	55.2
11:00-11:59 AM	47.8	53.8	48.9	55.3	48.3	55.2
12:00-12:59 PM	47.6	56.6	48.9	56.3	46.7	56.2
13:00-13:59 PM	48.7	56.4	51.1	55.4	47.8	54.5
14:00-14:59 PM	49.1	56.1	48.9	54.6	47.5	54.1
15:00-15:59 PM	48.9	55.8	48.6	55.5	48.1	54.9
16:00-16:59 PM	48.4	54.2	50.4	55.4	46.9	55.1
17:00-17:59 PM	47.6	52.5	51.9	54.7	46.2	55.4
18:00-18:59 PM	47.8	50.7	52.6	52.2	42.5	56.1
19:00-19:59 PM	48.1	48.9	46.5	51.9	42.5	52.6
20:00-20:59 PM	45.9	47.9	44.4	49.2	44.8	47.3
21:00-21:59 PM	44.3	45.2	45.3	48.3	45.5	45.2
22:00-22:59 PM	44.4	46.3	43.7	44.9	44.7	44.9
23:00-23:59 PM	43.7	46.3	44.0	44.6	42.6	44.2
00:00-00:59 AM	43.6	46.3	43.8	44.9	42.5	45.5

Annex 5

Checklist of Flora in the Study Area

Checklist of Flora in the Study Area

S No	Scientific Name	Bengali Name	Family
Trees			
1	<i>Acacia auriculiformis</i>	Akashi	Mimosaceae
2	<i>Acacia mangium</i>	Akashi	Mimosaceae
3	<i>Acacia nilotica</i>	Babul, Baul	Mimosaceae
4	<i>Albizia lebbek</i>	Sirish	Mimosaceae
5	<i>Alstonia scholaris</i>	Chatim	Apocynaceae
6	<i>Areca catechu</i>	Supari	Arecaceae
7	<i>Artocarpus heterophyllus</i>	Kathal	Moraceae
8	<i>Avicennia alba</i>	Dulia baen	Verbenaceae
9	<i>Avicennia officinalis</i>	Baro baen	Verbenaceae
10	<i>Avicennia officinalis</i>	Baro baen	Verbenaceae
11	<i>Bambusa vulgaris</i>	Bangla bans	Poaceae
12	<i>Bombax ceiba</i>	Simul tula	Bombacaceae
13	<i>Borassus flabellifer</i>	Tal	Arecaceae
14	<i>Calophyllum inophyllum</i>	Hundal	Clusiaceae
15	<i>Casuarina equisetifolia</i>	Jaw, Popan	Casuarinaceae
16	<i>Ceriops decandra</i>	Goran	Lythraceae
17	<i>Citrus aurantifolia</i>	Kagazi lebu	Rutaceae
18	<i>Citrus limon</i>	Lebu	Rutaceae
19	<i>Cocos nucifera</i>	Narkel	Arecaceae
20	<i>Dalbergia sissoo</i>	Sishoo	Fabaceae
21	<i>Delonix regia</i>	Krisnachura	Caesalpiniaceae
22	<i>Dillenia indica</i>	Chalta	Dilleniaceae
23	<i>Eucalyptus camaldulensis</i>	Eucalyptus	Myrtaceae
24	<i>Excoecaria agallocha</i>	Geowa	Euphorbiaceae
25	<i>Ficus benghalensis</i>	Bat	Moraceae
26	<i>Ficus religiosa</i>	Asath, Jil	Moraceae
27	<i>Gmelina arborea</i>	Gamar	Verbenaceae
28	<i>Lepisanthes rubiginosa</i>	Aul	Sapindaceae
29	<i>Leucaena leucocephala</i>	Ipil, Telikorai	Mimosaceae
30	<i>Magnolia champaca</i>	Chapa	Magnoliaceae
31	<i>Mangifera indica</i>	Aam	Anacardiaceae
32	<i>Melia azederach</i>	Ghora nim	Meliaceae
33	<i>Mimusops elengi</i>	Bakul	Sapotaceae
34	<i>Phoenix sylvestris</i>	Khejur	Arecaceae
35	<i>Pithecellobium dulce</i>	Natai,	Mimosaceae
36	<i>Pongamia pinnata</i>	Kerenja	Fabaceae
37	<i>Saraca asoca</i>	Asok	Caesalpiniaceae
38	<i>Senna siamea</i>	Minjiri	Caesalpiniaceae
39	<i>Spondias pinnata</i>	Amra	Anacardiaceae
40	<i>Sterculia foetida</i>	Keron	Sterculiaceae
41	<i>Swietenia mahagoni</i>	Mehagoni	Meliaceae
42	<i>Syzygium cuminii</i>	Butigajam	Myrtaceae

S No	Scientific Name	Bengali Name	Family
43	<i>Tamarindus indica</i>	Tetul	Caesalpiniaceae
44	<i>Terminalia arjuna</i>	Arjun	Combretaceae
45	<i>Terminalia catappa</i>	Katbadam	Combretaceae
46	<i>Thespesia populnea</i>	Correa Balai	Malvaceae
47	<i>Ziziphus mauritiana</i>	Barai	Rhamnaceae
Shrubs			
1	<i>Bougainvillea spectabilis</i>	Baganbilas	Nyctaginaceae
2	<i>Calotropis gigantea</i>	Akand	Asclepiadaceae
3	<i>Calotropis procera</i>	Akand	Asclepiadaceae
4	<i>Carica papaya</i>	Cokia, Papa	Caricaceae
5	<i>Carissa carandas</i>	Kormocha	Apocynaceae
6	<i>Clerodendrum inerme</i>	Bandulpata	Verbenaceae
7	<i>Gardenia jesminoides</i>	Gondoraj	Rubiaceae
8	<i>Hibiscus rosa-sinensis</i>	Latkonjaba	Malvaceae
9	<i>Lantana camara</i>	Khutus kanta	Verbenaceae
10	<i>Lawsonia inermis</i>	Methi	Lythraceae
11	<i>Pandanus foetidus</i>	Angjadakanta	Pandanaceae
12	<i>Ricinus communis</i>	Veron, Verenda	Euphorbiaceae
13	<i>Rosa centifolia</i>	Golap	Rosaceae
14	<i>Suaeda maritima</i>	Sagorsuda	Chenopodiaceae
15	<i>Vitex negundo</i>	Nishinda	Verbenaceae
16	<i>Woodfordia fruticosa</i>	Rangkat	Lythraceae
Herbs and Climbers			
1	<i>Ipomoea pes-caprae</i>	Chhagol kuri	Convolvulaceae
2	<i>Alternanthera sessilis</i>	Sachishak	Amaranthaceae
3	<i>Alternanthera philoxeroides</i>	Helencha,	Amaranthaceae
4	<i>Amaranthus spinosus</i>	Kantamairra	Amaranthaceae
5	<i>Bacopa monnieri</i>	Brammishak	Scrophulariaceae
6	<i>Boerhavia repens</i>	Punarnava	Nyctaginaceae
7	<i>Celosia argentea</i>	Thenthenna	Amaranthaceae
8	<i>Centella asiatica</i>	Thankuni	Apiaceae
9	<i>Colocasia esculenta</i>	Kachu	Araceae
10	<i>Cucurbita maxima</i>	Mistikumra	Cucurbitaceae
11	<i>Cynodon dactylon</i>	Dublakher	Poaceae
12	<i>Cyperus compressus</i>	Chancha	Cyperaceae
13	<i>Cyperus rotundus</i>	Nagarmutha	Cyperaceae
14	<i>Eclipta prostrata</i>	Kalakeccha,	Asteraceae
15	<i>Enhydra fluctuans</i>	Hinchashak	Asteraceae
16	<i>Hydrilla verticillata</i>	Kureli	Hydrocharitaceae
17	<i>Hygrophila auriculata</i>	Alicha	Acanthaceae
18	<i>Hygroryza aristata</i>	Jonglidhan	Poaceae
19	<i>Lemna perpusilla</i>	Guri fena	Lemnaceae
20	<i>Mimosa pudica</i>	Lajjabati	Mimosaceae
21	<i>Musa paradisiaca</i>	Attakola	Musaceae
22	<i>Ocimum basilicum</i>	Tulsi	Lamiaceae

S No	Scientific Name	Bengali Name	Family
23	<i>Ocimum tenuiflorum</i>	Tulsi	Lamiaceae
24	<i>Phragmites karka</i>	Nolkhagra	Poaceae
25	<i>Phyllanthus niruri</i>	Vuiamla	Euphorbiaceae
26	<i>Pistia stratiotes</i>	Futihena	Araceae
27	<i>Porteresia coarctata</i>	Dhani ghas	Poaceae
28	<i>Saccharum spontaneum</i>	Kasful,	Poaceae
29	<i>Sesuvium portulacastrum</i>	Sagornunia	Aizoaceae
30	<i>Eichhornia crassipes</i>	Kachuripana	Pontederiaceae
31	<i>Abutilon indicum</i>	Junka	Malvaceae
32	<i>Aeluropus lagopoides</i>	Nona Kher	Poaceae
33	<i>Centrostachys aquatica</i>	Thuas	Amaranthaceae
34	<i>Spirodela polyrhiza</i>	Fena	Lemnaceae

Annex 6

Details of Floral Survey

Details of Floral Survey

Grid No.	Land Use Types	Trees	Shrubs	Herbs
G1	Agricultural	<i>Acacia auriculiformis</i> , <i>Acacia mangium</i> <i>Acacia nilotica</i> , <i>Albizia lebeck</i> , <i>Alstonia scholaris</i> , <i>Areca catechu</i> , <i>Artocarpus heterophyllus</i> , <i>Bambusa</i> <i>vulgaris</i> , <i>Borassus flabellifer</i> , <i>Cocos nucifera</i> , <i>Dalbergia</i> <i>sissoo</i> , <i>Mangifera indica</i> , <i>Phoenix sylvestris</i> , <i>Samanea</i> <i>saman</i> , <i>Tamarindus indica</i>	<i>Calotropis procera</i> , <i>Carica papaya</i> , <i>Ricinus communis</i>	<i>Celosia argentea</i> , <i>Centella asiatica</i> , <i>Colocasia esculenta</i> <i>Cyperus rotandus</i> , <i>Mimosa pudica</i>
	Homestead plantation	<i>Samanea saman</i> , <i>Acacia auriculiformis</i> , <i>Eucalyptus sp.</i> , <i>Pongamia pinnata</i> , <i>Acacia nilotica</i> , <i>Ziziphus mauritiana</i> , <i>Switenia mahogani</i> , <i>Casuarina equisetifolia</i> , <i>Phoenix</i> <i>sylvestris</i> , <i>Mangifera indica</i> , <i>Tamarindus indica</i> , <i>Areca</i> <i>catech</i>	<i>Bougainvillea spectabilis</i> , <i>Calotropis procera</i> , <i>Carica papaya</i> , <i>Clerodendrum inerme</i> , <i>Hibiscus rosa-sinensis</i> , <i>Lantana camara</i> , <i>Lawsonia inermis</i> , <i>Rosa centifolia</i> ,	<i>Amaranthus spinosus</i> , <i>Boerhavia repens</i> , <i>Celosia</i> <i>argentea</i> , <i>Colocasia esculenta</i> , <i>Cucurbita maxima</i> , <i>Cynodon dactylon</i> , <i>Cyperus rotandus</i> , <i>Eclipta prostrata</i> <i>Mimosa pudica</i> , <i>Musa paradisiaca</i> , <i>Nelumbo nucifera</i> , <i>Ocimum tenuiflorum</i> , <i>Phragmites karka</i>
	Casuarina plantation	<i>Casuarina equisetifolia</i>	<i>Calotropis procera</i>	-
G2	Agricultural	<i>Acacia auriculiformis</i> , <i>Acacia mangium</i> <i>Acacia nilotica</i> , <i>Albizia lebeck</i> , <i>Alstonia scholaris</i> , <i>Bambusa vulgaris</i> , <i>Borassus flabellifer</i> , <i>Cocos nucifera</i> <i>Samanea saman</i> , <i>Acacia auriculiformis</i> , <i>Azadirachta</i> <i>indica</i> , <i>Eucalyptus sp.</i> , <i>Pongamia pinnata</i> , <i>Switenia</i> <i>mahogani</i> , <i>Casia siamea</i> , <i>Gmelina arborea</i> , <i>Casuarina</i> <i>equisetifolia</i> , <i>Phoenix sylvestris</i> , <i>Areca catechu</i> , <i>Borassus</i> <i>flabellifer</i>	<i>Calotropis procera</i> , <i>Lantana camara</i> , <i>Ricinus</i> <i>communis</i>	<i>Celosia argentea</i> , <i>Cynodon dactylon</i> , <i>Cyperus rotandus</i>
	Homestead plantation	<i>Samanea saman</i> , <i>Acacia auriculiformis</i> , <i>Azadirachta</i> <i>indica</i> , <i>Eucalyptus sp.</i> , <i>Pongamia pinnata</i> , <i>Switenia</i> <i>mahogani</i> , <i>Casia siamea</i> , <i>Gmelina arborea</i> , <i>Casuarina</i> <i>equisetifolia</i> , <i>Phoenix sylvestris</i> , <i>Areca catechu</i> , <i>Borassus</i> <i>flabellifer</i>	<i>Calotropis procera</i> , <i>Ricinus communis</i> , <i>Rosa centifolia</i> , <i>Vitex</i> <i>negundo</i> , <i>Woodfordia fruticosa</i>	<i>Colocasia esculenta</i> , <i>Cucurbita maxima</i> , <i>Cynodon</i> <i>dactylon</i> , <i>Cyperus compressus</i> , <i>Eclipta prostrata</i> , <i>Enhydra fluctuans</i> , <i>Mimosa pudica</i> , <i>Musa paradisiaca</i> , <i>Ocimum basilicum</i>
	Casuarina plantation	<i>Casuarina equisetifolia</i>	-	-
G3	Agricultural	<i>Acacia auriculiformis</i> , <i>Acacia nilotica</i> , <i>Albizia lebeck</i> , <i>Alstonia scholaris</i> , <i>Areca catechu</i> , <i>Cocos nucifera</i> , <i>Mangifera indica</i>	<i>Calotropis procera</i> , <i>Carica papaya</i> ,	<i>Cynodon dactylon</i> , <i>Musa paradisiaca</i> , <i>Ocimum basilicum</i>
	Homestead plantation	<i>Samanea saman</i> , <i>Acacia auriculiformis</i> , <i>Acacia manjiam</i> , <i>Eucalyptus sp.</i> , <i>Pongamia pinnata</i> , <i>Acacia nilotica</i> , <i>Ziziphus mauritiana</i> , <i>Casia siamea</i> , <i>Gmelina arborea</i> , <i>Casuarina equisetifolia</i> , <i>Phoenix sylvestris</i> , <i>Bambusa sp.</i> , <i>Cocos nucifera</i> , <i>Mangifera indica</i> , <i>Tamarindus indica</i> , <i>Areca catechu</i> , <i>Artocarpus heterophyllus</i>	<i>Bougainvillea spectabilis</i> , <i>Calotropis gigantea</i> , <i>Carica papaya</i> , <i>Gardenia jesminoides</i> , <i>Hibiscus rosa-sinensis</i> , <i>Lantana camara</i> , <i>Ricinus communis</i> , <i>Rosa</i> <i>centifolia</i>	<i>Amaranthus spinosus</i> , <i>Boerhavia repens</i> , <i>Celosia</i> <i>argentea</i> , <i>Centella asiatica</i> , <i>Colocasia esculenta</i> , <i>Cucurbita maxima</i> , <i>Cynodon dactylon</i> , <i>Mimosa pudica</i> , <i>Musa paradisiaca</i> , <i>Ocimum tenuiflorum</i> , <i>Phragmites</i> <i>karka</i> , <i>Phyllanthus niruri</i>
	Casuarina plantation	<i>Casuarina equisetifolia</i> , <i>Acacia auriculiformis</i>	-	-
G4	Agricultural	<i>Acacia auriculiformis</i> , <i>Bambusa vulgaris</i>	<i>Calotropis procera</i>	<i>Cynodon dactylon</i> , <i>Celosia agrentea</i>

Grid No.	Land Use Types	Trees	Shrubs	Herbs
	Homestead plantation	<i>Samanea saman</i> , <i>Acacia auriculiformis</i> , <i>Acacia manjiam</i> , <i>Eucalyptus</i> sp., <i>Pongamia pinnata</i> , <i>Acacia nilotica</i> , <i>Ziziphus mauritiana</i> , <i>Leucaena leucocephala</i> , <i>Swietenia mahogani</i> , <i>Tectona grandis</i> , <i>Casia siamea</i> , <i>Gmelina arborea</i> , <i>Casuarina equisetifolia</i> , <i>Cocos nucifera</i> , <i>Mangifera indica</i> , <i>Tamarindus indica</i> , <i>Areca catechu</i> , <i>Artocarpus heterophyllus</i>	<i>Calotropis gigantea</i> , <i>Carica papaya</i> , <i>Lantana camara</i> , <i>Ricinus communis</i>	<i>Boerhaavia repens</i> , <i>Celosia argentea</i> , <i>Cynodon dactylon</i> , <i>Mimosa pudica</i> , <i>Musa paradisiaca</i>
G5	Agricultural	<i>Borassus flabellifer</i> , <i>Cocos nucifera</i> , <i>Dalbergia sissoo</i> , <i>Mangifera indica</i>	<i>Calotropis gigantea</i>	<i>Celosia argentea</i> , <i>Colocasia esculenta</i> , <i>Cucurbita maxima</i> , <i>Cynodon dactylon</i> , <i>Mimosa pudica</i>
	Homestead plantation	<i>Samanea saman</i> , <i>Acacia auriculiformis</i> , <i>Acacia mangium</i> , <i>Acacia nilotica</i> , <i>Sterculia foetida</i> , <i>Swietenia mahagoni</i> , <i>Syzygium cuminii</i> , <i>Tamarindus indica</i> , <i>Terminalia arjuna</i> , <i>Thespesia populnea</i> , <i>Phoenix sylvestris</i> , <i>Bambusa</i> sp., <i>Cocos nucifera</i> , <i>Mangifera indica</i> , <i>Tamarindus indica</i> , <i>Areca catechu</i> , <i>Artocarpus heterophyllus</i>	<i>Calotropis gigantea</i> , <i>Calotropis procera</i> , <i>Carica papaya</i> , <i>Carissa carandas</i> , <i>Clerodendrum inerme</i> , <i>Gardenia jesminoides</i> , <i>Hibiscus rosa-sinensis</i> , <i>Lantana camara</i> , <i>Lawsonia inermis</i> , <i>Ricinus communis</i> , <i>Rosa centifolia</i> , <i>Suaeda maritima</i> , <i>Vitex negundo</i> , <i>Woodfordia fruticosa</i>	<i>Alternanthera sessilis</i> , <i>Alternanthera philoxeroides</i> , <i>Amaranthus spinosus</i> , <i>Bacopa monnieri</i> , <i>Celosia argentea</i> , <i>Centella asiatica</i> , <i>Colocasia esculenta</i> , <i>Cucurbita maxima</i> , <i>Cynodon dactylon</i> , <i>Cyperus rotandus</i> , <i>Eclipta prostrata</i> , <i>Mimosa pudica</i> , <i>Musa paradisiaca</i> , <i>Ocimum tenuiflorum</i> , <i>Phragmites karka</i> , <i>Abutilon indicum</i> , <i>Alternanthera sessilis</i> , <i>Heliotropium curassavicum</i> , <i>Monochoria hastata</i>
G6	Agricultural	<i>Acacia auriculiformis</i> , <i>Acacia mangium</i> , <i>Acacia nilotica</i> , <i>Albizia lebbeck</i> , <i>Alstonia scholaris</i> , <i>Areca catechu</i> , <i>Artocarpus heterophyllus</i> , <i>Bambusa vulgaris</i> , <i>Borassus flabellifer</i> , <i>Cocos nucifera</i> , <i>Dalbergia sissoo</i> , <i>Mangifera indica</i> , <i>Phoenix sylvestris</i> , <i>Samanea saman</i> , <i>Tamarindus indica</i>	<i>Calotropis gigantea</i> , <i>Calotropis procera</i> , <i>Carica papaya</i> , <i>Carissa carandas</i> , <i>Clerodendrum inerme</i> , <i>Rosa centifolia</i> , <i>Suaeda maritima</i> , <i>Vitex negundo</i> , <i>Woodfordia fruticosa</i>	<i>Alternanthera sessilis</i> , <i>Alternanthera philoxeroides</i> , <i>Amaranthus spinosus</i> , <i>Bacopa monnieri</i> , <i>Celosia argentea</i> , <i>Centella asiatica</i> , <i>Colocasia esculenta</i> , <i>Cucurbita maxima</i> , <i>Cynodon dactylon</i> , <i>Cyperus rotandus</i> , <i>Eclipta prostrata</i>
	Homestead plantation	<i>Acacia auriculiformis</i> , <i>Acacia mangium</i> , <i>Albizia lebbeck</i> , <i>Alstonia scholaris</i> , <i>Areca catechu</i> , <i>Artocarpus heterophyllus</i> , <i>Casuarina equisetifolia</i> , <i>Citrus aurantifolia</i> , <i>Citrus limon</i> , <i>Cocos nucifera</i> , <i>Dalbergia sissoo</i> , <i>Delonix regia</i> , <i>Dillenia indica</i> , <i>Eucalyptus camaldulensis</i> , <i>Ficus benghalensis</i> , <i>Ficus religiosa</i> , <i>Gmelina arborea</i> , <i>Mangifera indica</i> , <i>Saraca asoca</i> , <i>Cassia siamea</i> , <i>Samanea saman</i> , <i>Spondias pinnata</i> , <i>Sterculia foetida</i> , <i>Swietenia mahagoni</i> , <i>Syzygium cuminii</i> , <i>Tamarindus indica</i> , <i>Terminalia arjuna</i> , <i>Thespesia populnea</i> , <i>Ziziphus mauritiana</i>	<i>Calotropis gigantea</i> , <i>Calotropis procera</i> , <i>Carica papaya</i> , <i>Carissa</i> , <i>Vitex negundo</i> , <i>Woodfordia fruticosa</i> , <i>Clerodendrum inerme</i> , <i>Lawsonia inermis</i> , <i>Ricinus communis</i> , <i>Rosa centifolia</i> , <i>Suaeda maritima</i>	<i>Alternanthera sessilis</i> , <i>Alternanthera philoxeroides</i> , <i>Amaranthus spinosus</i> , <i>Bacopa monnieri</i> , <i>Celosia argentea</i> , <i>Centella asiatica</i> , <i>Colocasia esculenta</i> , <i>Cucurbita maxima</i> , <i>Cynodon dactylon</i> , <i>Cyperus rotandus</i> , <i>Mimosa pudica</i> , <i>Musa paradisiaca</i> , <i>Ocimum tenuiflorum</i> , <i>Phragmites karka</i> , <i>Abutilon indicum</i> , <i>Alternanthera sessilis</i>
G9	<i>Casuarina</i> plantation	<i>Casuarina equisetifolia</i>	-	<i>Ipomea flos-aquae</i>
	Agricultural	<i>Acacia auriculiformis</i> , <i>Acacia mangium</i> , <i>Acacia nilotica</i> , <i>Albizia lebbeck</i> , <i>Alstonia scholaris</i> , <i>Areca catechu</i> , <i>Artocarpus heterophyllus</i> , <i>Bambusa vulgaris</i> , <i>Borassus flabellifer</i> , <i>Cocos nucifera</i> , <i>Dalbergia sissoo</i> , <i>Mangifera indica</i> , <i>Phoenix sylvestris</i> , <i>Samanea saman</i> , <i>Tamarindus indica</i>	<i>Calotropis gigantea</i> , <i>Calotropis procera</i> , <i>Carica papaya</i> , <i>Carissa</i> , <i>Ricinus communis</i> , <i>Rosa centifolia</i>	<i>Celosia argentea</i> , <i>Cynodon dactylon</i> , <i>Cyperus rotandus</i> , <i>Musa paradisiaca</i> , <i>Ocimum tenuiflorum</i>

Grid No.	Land Use Types	Trees	Shrubs	Herbs
G10	Homestead plantation	<i>Samanea saman</i> , <i>Acacia auriculiformis</i> , <i>Acacia manjiam</i> , <i>Azadirachta indica</i> , <i>Eucalyptus sp.</i> , <i>Pongamia pinnata</i> , <i>Acacia nilotica</i> , <i>Ziziphus mauritiana</i> , <i>Swietenia mahogani</i> , <i>Tectona grandis</i> , <i>Casia siamea</i> , <i>Gmelina arborea</i> , <i>Casuarina equisetifolia</i> , <i>Bambusa sp.</i> , <i>Cocos nucifera</i> , <i>Mangifera indica</i> , <i>Tamarindus indica</i> , <i>Areca catechu</i> , <i>Borassus flabellifer</i> , <i>Artocarpus heterophyllus</i>	<i>Calotropis gigantea</i> , <i>Calotropis procera</i> , <i>Carica papaya</i> , <i>Hibiscus rosa-sinensis</i> , <i>Lantana camara</i> , <i>Lawsonia inermis</i> , <i>Ricinus communis</i> , <i>Rosa centifolia</i> , <i>Vitex negundo</i> , <i>Woodfordia fruticosa</i>	<i>Alternanthera sessilis</i> , <i>Alternanthera philoxeroides</i> , <i>Amaranthus spinosus</i> , <i>Bacopa monnieri</i> , <i>Celosia argentea</i> , <i>Centella asiatica</i> , <i>Colocasia esculenta</i> , <i>Cucurbita maxima</i> , <i>Cynodon dactylon</i> , <i>Cyperus rotandus</i> , <i>Mimosa pudica</i> , <i>Musa paradisiaca</i> , <i>Ocimum tenuiflorum</i> , <i>Phragmites karka</i> , <i>Eichhornia crassipes</i> , <i>Abutilon indicum</i> , <i>Alternanthera sessilis</i>
	Casuarina plantation	<i>Casuarina equisetifolia</i>	-	<i>Celosia argentea</i> , <i>Cynodon dactylon</i>
	Agricultural	<i>Acacia auriculiformis</i> , <i>Acacia mangium</i> , <i>Acacia nilotica</i> , <i>Albizia lebbek</i> , <i>Alstonia scholaris</i> , <i>Areca catechu</i> , <i>Artocarpus heterophyllus</i> , <i>Cocos nucifera</i> , <i>Dalbergia sissoo</i> , <i>Mangifera indica</i> , <i>Phoenix sylvestris</i> , <i>Samanea saman</i> , <i>Tamarindus indica</i>	<i>Calotropis gigantea</i> , <i>Calotropis procera</i> , <i>Carica papaya</i> , <i>Lantana camara</i> , <i>Ricinus communis</i> , <i>Rosa centifolia</i>	<i>Alternanthera sessilis</i> , <i>Alternanthera philoxeroides</i> , <i>Celosia argentea</i> , <i>Centella asiatica</i> , <i>Colocasia esculenta</i> , <i>Cynodon dactylon</i> , <i>Mimosa pudica</i> , <i>Musa paradisiaca</i> , <i>Ocimum tenuiflorum</i>
	Homestead plantation	<i>Acacia auriculiformis</i> , <i>Acacia mangium</i> , <i>Acacia nilotica</i> , <i>Albizia lebbek</i> , <i>Alstonia scholaris</i> , <i>Areca catechu</i> , <i>Artocarpus heterophyllus</i> , <i>Cocos nucifera</i> , <i>Eucalyptus camaldulensis</i> , <i>Ficus benghalensis</i> , <i>Ficus religiosa</i> , <i>Gmelina arborea</i> , <i>Leucaena leucocephala</i> , <i>Mangifera indica</i> , <i>Melia azedarach</i> , <i>Mimusops elengi</i> , <i>Phoenix sylvestris</i> , <i>Pithecellobium dulce</i> , <i>Pongamia pinnata</i> , <i>Samanea saman</i> , <i>Spondias pinnata</i> , <i>Swietenia mahagoni</i> , <i>Syzygium cumini</i>	<i>Bougainvillea spectabilis</i> , <i>Calotropis gigantea</i> , <i>Calotropis procera</i> , <i>Carica papaya</i> , <i>Carissa carandas</i> , <i>Clerodendrum inerme</i> , <i>Gardenia jesminoides</i> , <i>Hibiscus rosa-sinensis</i> , <i>Lantana camara</i> , <i>Lawsonia inermis</i> , <i>Pandanus foetidus</i> , <i>Ricinus communis</i> , <i>Rosa centifolia</i> , <i>Vitex negundo</i> , <i>Woodfordia fruticosa</i>	<i>Alternanthera sessilis</i> , <i>Alternanthera philoxeroides</i> , <i>Amaranthus spinosus</i> , <i>Bacopa monnieri</i> , <i>Boerhavia repens</i> , <i>Celosia argentea</i> , <i>Colocasia esculenta</i> , <i>Cucurbita maxima</i> , <i>Cynodon dactylon</i> , <i>Cyperus compressus</i> , <i>Cyperus rotandus</i> , <i>Eclipta prostrata</i> , <i>Mimosa pudica</i> , <i>Musa paradisiaca</i> , <i>Ocimum basilicum</i> , <i>Ocimum tenuiflorum</i> , <i>Phragmites karka</i> , <i>Phyllanthus niruri</i>
G11	Riparian vegetation	<i>Dalbergia sissoo</i> , <i>Alstonia scholaris</i> , <i>Syzygium cumini</i> , <i>Cocos nucifera</i>	<i>Lantana camara</i> , <i>Ricinus communis</i> , <i>Suaeda maritima</i>	<i>Alternanthera sessilis</i> , <i>Alternanthera philoxeroides</i> , <i>Porteresia coarctata</i> , <i>Saccharum spontaneum</i> , <i>Sesuvium portulacastrum</i>
	Agricultural	<i>Acacia auriculiformis</i> , <i>Acacia mangium</i> , <i>Acacia nilotica</i> , <i>Albizia lebbek</i> , <i>Alstonia scholaris</i> , <i>Areca catechu</i> , <i>Artocarpus heterophyllus</i> , <i>Bambusa vulgaris</i> , <i>Borassus flabellifer</i> , <i>Cocos nucifera</i> , <i>Dalbergia sissoo</i> , <i>Mangifera indica</i> , <i>Phoenix sylvestris</i> , <i>Samanea saman</i> , <i>Tamarindus indica</i>	<i>Calotropis gigantea</i> , <i>Calotropis procera</i> , <i>Carica papaya</i> , <i>Carissa</i> , <i>Ricinus communis</i>	<i>Celosia argentea</i> , <i>Cynodon dactylon</i> , <i>Cyperus rotandus</i> , <i>Musa paradisiaca</i>
	Homestead plantation	<i>Samanea saman</i> , <i>Acacia auriculiformis</i> , <i>Acacia manjiam</i> , <i>Azadirachta indica</i> , <i>Eucalyptus sp.</i> , <i>Pongamia pinnata</i> , <i>Acacia nilotica</i> , <i>Ziziphus mauritiana</i> , <i>Swietenia mahogani</i> , <i>Tectona grandis</i> , <i>Casia siamea</i> , <i>Gmelina arborea</i> , <i>Casuarina equisetifolia</i> , <i>Phoenix sylvestris</i> , <i>Cocos nucifera</i> , <i>Mangifera indica</i> , <i>Tamarindus indica</i> , <i>Areca catechu</i> , <i>Borassus flabellifer</i> , <i>Artocarpus heterophyllus</i>	<i>Bougainvillea spectabilis</i> , <i>Calotropis gigantea</i> , <i>Calotropis procera</i> , <i>Carica papaya</i> , <i>Carissa carandas</i> , <i>Clerodendrum inerme</i> , <i>Gardenia jesminoides</i> , <i>Hibiscus rosa-sinensis</i> , <i>Lantana camara</i> , <i>Ricinus communis</i> , <i>Rosa centifolia</i> , <i>Vitex negundo</i> , <i>Woodfordia fruticosa</i>	<i>Alternanthera sessilis</i> , <i>Boerhavia repens</i> , <i>Celosia argentea</i> , <i>Colocasia esculenta</i> , <i>Cucurbita maxima</i> , <i>Cynodon dactylon</i> , <i>Cyperus compressus</i> , <i>Cyperus rotandus</i> , <i>Eclipta prostrata</i> , <i>Mimosa pudica</i> , <i>Musa paradisiaca</i> , <i>Ocimum basilicum</i> , <i>Ocimum tenuiflorum</i> , <i>Phragmites karka</i> , <i>Phyllanthus niruri</i>

Grid No.	Land Use Types	Trees	Shrubs	Herbs
G12	Agricultural	<i>Acacia auriculiformis</i> , <i>Acacia mangium</i> <i>Acacia nilotica</i> , <i>Bambusa vulgaris</i> , <i>Borassus flabellifer</i> , <i>Cocos nucifera</i> , <i>Dalbergia sissoo</i> , <i>Mangifera indica</i> , <i>Phoenix sylvestris</i> , <i>Samanea saman</i> , <i>Tamarindus indica</i>	<i>Calotropis procera</i> , <i>Carica papaya</i> , <i>Gardenia</i> <i>jesminoides</i> , <i>Hibiscus rosa-sinensis</i> , <i>Lantana</i> <i>camara</i> , <i>Ricinus communis</i> , <i>Rosa centifolia</i>	<i>Celosia argentea</i> , <i>Colocasia esculenta</i> , <i>Cyperus</i> <i>compressus</i> , <i>Cyperus rotandus</i> , <i>Mimosa pudica</i> , <i>Musa</i> <i>paradisiaca</i> , <i>Ocimum basilicum</i> , <i>Ocimum tenuiflorum</i>
	Homestead plantation	<i>Samanea saman</i> , <i>Acacia auriculiformis</i> , <i>Acacia mangium</i> , <i>Azadirachta indica</i> , <i>Eucalyptus</i> sp., <i>Pongamia pinnata</i> , <i>Acacia nilotica</i> , <i>Ziziphus mauritiana</i> , <i>Leucaena</i> <i>leucocephala</i> , <i>Swietenia mahogani</i> , <i>Tectona grandis</i> , <i>Casuarina equisetifolia</i> , <i>Phoenix sylvestris</i> , <i>Bambusa</i> sp., <i>Cocos nucifera</i> , <i>Mangifera indica</i> , <i>Tamarindus indica</i> , <i>Areca catechu</i> , <i>Borassus flabellifer</i> , <i>Artocarpus</i> <i>heterophyllus</i>	<i>Calotropis gigantea</i> , <i>Calotropis procera</i> , <i>Carica papaya</i> , <i>Carissa carandas</i> , <i>Hibiscus</i> <i>rosa-sinensis</i> , <i>Lantana camara</i> , <i>Lawsonia</i> <i>inermis</i> , <i>Ricinus communis</i> , <i>Rosa centifolia</i> , <i>Vitex negundo</i> , <i>Woodfordia fruticosa</i>	<i>Alternanthera sessilis</i> , <i>Alternanthera philoxeroides</i> , <i>Celosia argentea</i> , <i>Centella asiatica</i> , <i>Colocasia esculenta</i> , <i>Cucurbita maxima</i> , <i>Cynodon dactylon</i> , <i>Cyperus</i> <i>rotandus</i> , <i>Eclipta prostrata</i> , <i>Mimosa pudica</i> , <i>Musa</i> <i>paradisiaca</i> , <i>Ocimum tenuiflorum</i> , <i>Phragmites karka</i> , <i>Abutilon indicum</i> , <i>Alternanthera sessilis</i>
	Casuarina plantation Riparian Vegetation	<i>Casuarina equisetifolia</i> <i>Alstonia scholaris</i> , <i>Syzygium cumini</i> , <i>Cocos nucifera</i>	- <i>Lantana camara</i> , <i>Ricinus communis</i> ,	- <i>Alternanthera sessilis</i> , <i>Alternanthera philoxeroides</i> , <i>Porteresia coarctata</i> , <i>Saccharum spontaneum</i> , <i>Sesuvium</i> <i>portulacastrum</i>
G15	Agricultural	<i>Acacia auriculiformis</i> , <i>Acacia mangium</i> <i>Acacia nilotica</i> , <i>Albizia lebeck</i> , <i>Alstonia scholaris</i> , <i>Areca catechu</i> , <i>Artocarpus heterophyllus</i> , <i>Bambusa</i> <i>vulgaris</i> , <i>Borassus flabellifer</i> , <i>Cocos nucifera</i> , <i>Dalbergia</i> <i>sissoo</i> , <i>Mangifera indica</i> , <i>Phoenix sylvestris</i> , <i>Samanea</i> <i>saman</i> , <i>Tamarindus indica</i>	<i>Calotropis gigantea</i> , <i>Calotropis procera</i> , <i>Carica papaya</i> , <i>Lantana camara</i> , <i>Ricinus</i> <i>communis</i> , <i>Rosa centifolia</i>	<i>Alternanthera sessilis</i> , <i>Celosia argentea</i> , <i>Centella</i> <i>asiatica</i> , <i>Colocasia esculenta</i> , <i>Cucurbita maxima</i> , <i>Cynodon dactylon</i> , <i>Cyperus rotandus</i> , <i>Eclipta prostrata</i> , <i>Mimosa pudica</i> , <i>Musa paradisiaca</i> , <i>Ocimum</i> <i>tenuiflorum</i> , <i>Phragmites karka</i> , <i>Alternanthera sessilis</i>
	Homestead plantation	<i>Acacia auriculiformis</i> , <i>Acacia mangium</i> <i>Acacia nilotica</i> , <i>Areca catechu</i> , <i>Artocarpus</i> <i>heterophyllus</i> , <i>Bambusa vulgaris</i> , <i>Casuarina equisetifolia</i> <i>Ceriops decandra</i> , <i>Cocos nucifera</i> , <i>Dalbergia sissoo</i> , <i>Delonix regia</i> , <i>Dillenia indica</i> , <i>Eucalyptus</i> <i>camaldulensis</i> , <i>Ficus benghalensis</i> , <i>Ficus religiosa</i> , <i>Gmelina arborea</i> , <i>Leucaena leucocephala</i> , <i>Mangifera</i> <i>indica</i> , <i>Phoenix sylvestris</i> , <i>Pithecellobium dulce</i> , <i>Samanea</i> <i>saman</i> , <i>Spondias pinnata</i> , <i>Swietenia mahagoni</i> , <i>Syzygium cumini</i>	<i>Hibiscus rosa-sinensis</i> , <i>Lantana camara</i> , <i>Calotropis gigantea</i> , <i>Calotropis procera</i> , <i>Carica papaya</i> , <i>Carissa carandas</i> , <i>Ricinus</i> <i>communis</i> , <i>Rosa centifolia</i> , <i>Vitex negundo</i> , <i>Woodfordia fruticosa</i>	<i>Alternanthera sessilis</i> , <i>Alternanthera philoxeroides</i> , <i>Celosia argentea</i> , <i>Centella asiatica</i> , <i>Cynodon dactylon</i> , <i>Cyperus rotandus</i> , <i>Eclipta prostrata</i> , <i>Mimosa pudica</i> , <i>Musa paradisiaca</i> , <i>Ocimum tenuiflorum</i> , <i>Phragmites</i> <i>karka</i> , <i>Abutilon indicum</i> , <i>Alternanthera sessilis</i>
G16	Agricultural	<i>Acacia auriculiformis</i> , <i>Acacia mangium</i> <i>Acacia nilotica</i> , <i>Albizia lebeck</i> , <i>Alstonia scholaris</i> , <i>Areca catechu</i> , <i>Artocarpus heterophyllus</i> , <i>Bambusa</i> <i>vulgaris</i> , <i>Borassus flabellifer</i> , <i>Cocos nucifera</i> , <i>Dalbergia</i> <i>sissoo</i> , <i>Mangifera indica</i> , <i>Phoenix sylvestris</i> , <i>Samanea</i> <i>saman</i> , <i>Tamarindus indica</i>	<i>Hibiscus rosa-sinensis</i> , <i>Lantana camara</i> , <i>Calotropis gigantea</i> , <i>Calotropis procera</i> , <i>Carica papaya</i> , <i>Ricinus communis</i>	<i>Mimosa pudica</i> , <i>Musa paradisiaca</i> , <i>Alternanthera</i> <i>sessilis</i> , <i>Alternanthera philoxeroides</i> , <i>Cyperus rotandus</i> , <i>Ocimum tenuiflorum</i> , <i>Phragmites karka</i>

Grid No.	Land Use Types	Trees	Shrubs	Herbs
	Homestead plantation	<i>Acacia auriculiformis</i> , <i>Acacia mangium</i> , <i>Alstonia scholaris</i> , <i>Cocos nucifera</i> , <i>Dalbergia sissoo</i> , <i>Delonix regia</i> , <i>Dillenia indica</i> , <i>Eucalyptus camaldulensis</i> , <i>Ficus benghalensis</i> , <i>Ficus religiosa</i> , <i>Gmelina arborea</i> , <i>Mangifera indica</i> , <i>Melia azedarach</i> , <i>Phoenix sylvestris</i> , <i>Pithecellobium dulce</i> , <i>Pongamia pinnata</i> , <i>Cassia siamea</i> , <i>Samanea saman</i> , <i>Swietenia mahagoni</i> , <i>Syzygium cuminii</i> , <i>Tamarindus indica</i> , <i>Terminalia arjuna</i> , <i>Ziziphus mauritiana</i>	<i>Calotropis gigantea</i> , <i>Calotropis procera</i> , <i>Carica papaya</i> , <i>Carissa carandas</i> , <i>Hibiscus rosa-sinensis</i> , <i>Lantana camara</i> , <i>Lawsonia inermis</i> , <i>Ricinus communis</i> , <i>Rosa centifolia</i> , <i>Suaeda maritima</i> , <i>Vitex negundo</i> , <i>Woodfordia fruticosa</i>	<i>Alternanthera sessilis</i> , <i>Alternanthera philoxeroides</i> , <i>Amaranthus spinosus</i> , <i>Bacopa monnieri</i> , <i>Celosia argentea</i> , <i>Centella asiatica</i> , <i>Colocasia esculenta</i> , <i>Cucurbita maxima</i> , <i>Cynodon dactylon</i> , <i>Cyperus rotandus</i> , <i>Eclipta prostrata</i> , <i>Mimosa pudica</i> , <i>Musa paradisiaca</i> , <i>Ocimum tenuiflorum</i> , <i>Phragmites karka</i> , <i>Abutilon indicum</i> , <i>Alternanthera sessilis</i>
	Riparian Vegetation	<i>Samanea saman</i> , <i>Acacia auriculiformis</i> , <i>Alstonia scholaris</i> , <i>Syzygium cumini</i> , <i>Cocos nucifera</i>	<i>Lantana camara</i> , <i>Ricinus communis</i> ,	<i>Alternanthera sessilis</i> , <i>Alternanthera philoxeroides</i> , <i>Porteresia coarctata</i> , <i>Saccharum spontaneum</i> , <i>Sesuvium portulacastrum</i>
G18	Agricultural	<i>Acacia auriculiformis</i> , <i>Acacia mangium</i> , <i>Acacia nilotica</i> , <i>Albizia lebbek</i> , <i>Alstonia scholaris</i> , <i>Areca catechu</i> , <i>Artocarpus heterophyllus</i> , <i>Bambusa vulgaris</i> , <i>Borassus flabellifer</i> , <i>Cocos nucifera</i> , <i>Dalbergia sissoo</i> , <i>Mangifera indica</i> , <i>Phoenix sylvestris</i> , <i>Samanea saman</i> , <i>Tamarindus indica</i>	<i>Calotropis gigantea</i> , <i>Calotropis procera</i> , <i>Carica papaya</i> , <i>Lantana camara</i> , <i>Ricinus communis</i> , <i>Rosa centifolia</i> , <i>Suaeda maritima</i> , <i>Vitex negundo</i>	<i>Alternanthera sessilis</i> , <i>Alternanthera philoxeroides</i> , <i>Amaranthus spinosus</i> , <i>Celosia argentea</i> , <i>Cynodon dactylon</i> , <i>Cyperus rotandus</i> , <i>Eclipta prostrata</i> , <i>Mimosa pudica</i> , <i>Musa paradisiaca</i> , <i>Ocimum tenuiflorum</i> , <i>Phragmites karka</i> , <i>Abutilon indicum</i> , <i>Alternanthera sessilis</i>
	Homestead plantation	<i>Samanea saman</i> , <i>Acacia auriculiformis</i> , <i>Acacia mangium</i> , <i>Azadirachta indica</i> , <i>Eucalyptus sp.</i> , <i>Acacia nilotica</i> , <i>Ziziphus mauritiana</i> , <i>Leucaena leucocephala</i> , <i>Swietenia mahogani</i> , <i>Tectona grandis</i> , <i>Casia siamea</i> , <i>Gmelina arborea</i> , <i>Casuarina equisetifolia</i> , <i>Phoenix sylvestris</i> , <i>Bambusa sp.</i> , <i>Cocos nucifera</i> , <i>Mangifera indica</i> , <i>Tamarindus indica</i>	<i>Hibiscus rosa-sinensis</i> , <i>Lantana camara</i> , <i>Calotropis gigantea</i> , <i>Calotropis procera</i> , <i>Ricinus communis</i> , <i>Rosa centifolia</i> , <i>Vitex negundo</i> , <i>Woodfordia fruticosa</i>	<i>Alternanthera sessilis</i> , <i>Alternanthera philoxeroides</i> , <i>Celosia argentea</i> , <i>Centella asiatica</i> , <i>Cynodon dactylon</i> , <i>Cyperus rotandus</i> , <i>Eclipta prostrata</i> , <i>Mimosa pudica</i> , <i>Musa paradisiaca</i> , <i>Ocimum tenuiflorum</i> , <i>Phragmites karka</i> , <i>Abutilon indicum</i> , <i>Alternanthera sessilis</i>
G22	Agricultural	<i>Acacia auriculiformis</i> , <i>Acacia mangium</i> , <i>Acacia nilotica</i> , <i>Albizia lebbek</i> , <i>Alstonia scholaris</i> , <i>Areca catechu</i> , <i>Artocarpus heterophyllus</i> , <i>Bambusa vulgaris</i> , <i>Borassus flabellifer</i> , <i>Cocos nucifera</i> , <i>Dalbergia sissoo</i> , <i>Mangifera indica</i> , <i>Phoenix sylvestris</i> , <i>Samanea saman</i> , <i>Tamarindus indica</i>	<i>Hibiscus rosa-sinensis</i> , <i>Lantana camara</i> , <i>Calotropis gigantea</i> , <i>Calotropis procera</i> , <i>Ricinus communis</i> , <i>Rosa centifolia</i> ,	<i>Celosia argentea</i> , <i>Centella asiatica</i> , <i>Cynodon dactylon</i> , <i>Cyperus rotandus</i> , <i>Eclipta prostrata</i> , <i>Mimosa pudica</i> , <i>Musa paradisiaca</i> , <i>Ocimum tenuiflorum</i> , <i>Abutilon indicum</i> , <i>Alternanthera sessilis</i>
	Homestead plantation	<i>Acacia auriculiformis</i> , <i>Acacia mangium</i> , <i>Albizia lebbek</i> , <i>Alstonia scholaris</i> , <i>Areca catechu</i> , <i>Artocarpus heterophyllus</i> , <i>Casuarina equisetifolia</i> , <i>Cocos nucifera</i> , <i>Dalbergia sissoo</i> , <i>Delonix regia</i> , <i>Dillenia indica</i> , <i>Eucalyptus camaldulensis</i> , <i>Ficus benghalensis</i> , <i>Ficus religiosa</i> , <i>Gmelina arborea</i> , <i>Mangifera indica</i> , <i>Melia azedarach</i> , <i>Phoenix sylvestris</i> , <i>Pithecellobium dulce</i> , <i>Pongamia pinnata</i> , <i>Saraca asoca</i> , <i>Cassia siamea</i> , <i>Samanea saman</i> , <i>Spondias pinnata</i> , <i>Swietenia mahagoni</i> , <i>Syzygium cuminii</i> , <i>Tamarindus indica</i> , <i>Terminalia</i>	<i>Bougainvillea spectabilis</i> , <i>Calotropis gigantea</i> , <i>Calotropis procera</i> , <i>Carica papaya</i> , <i>Carissa carandas</i> , <i>Hibiscus rosa-sinensis</i> , <i>Lantana camara</i> , <i>Lawsonia inermis</i> , <i>Pandanus foetidus</i> , <i>Ricinus communis</i> , <i>Rosa centifolia</i> , <i>Vitex negundo</i> , <i>Woodfordia fruticosa</i>	<i>Alternanthera sessilis</i> , <i>Alternanthera philoxeroides</i> , <i>Amaranthus spinosus</i> , <i>Bacopa monnieri</i> , <i>Boerhavia repens</i> , <i>Celosia argentea</i> , <i>Colocasia esculenta</i> , <i>Cucurbita maxima</i> , <i>Cynodon dactylon</i> , <i>Cyperus compressus</i> , <i>Cyperus rotandus</i> , <i>Eclipta prostrata</i> , <i>Mimosa pudica</i> , <i>Musa paradisiaca</i> , <i>Ocimum basilicum</i> , <i>Ocimum tenuiflorum</i> , <i>Phragmites karka</i> , <i>Phyllanthus niruri</i>

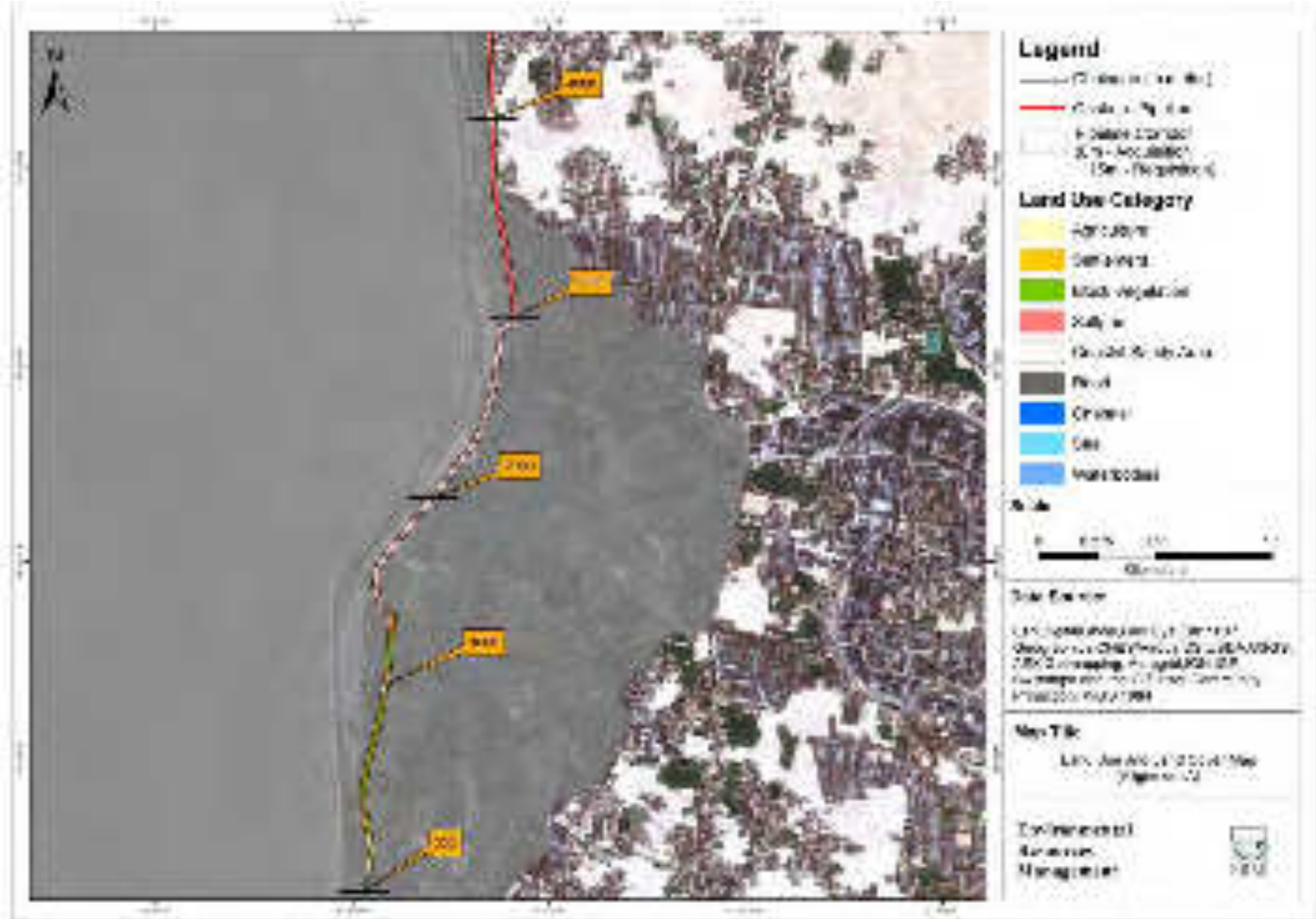
Grid No.	Land Use Types	Trees	Shrubs	Herbs
	Riparian Vegetation	<i>arjuna, Ziziphus mauritiana</i>		
	Mangrove Plantation	<i>Acacia auriculiformis, Alstonia scholaris, Syzygium cumini, Cocos nucifera</i>	<i>Lantana camara, Ricinus communis, Suaeda maritima</i>	<i>Alternanthera sessilis, Alternanthera philoxeroides, Sesuvium portulacastrum</i>
	Mangrove Plantation	<i>Avicennia alba, Avicennia officinalis</i>	<i>Suaeda maritima</i>	<i>Porteresia coarctata, Saccharum spontaneum, Sesuvium portulacastrum</i>
G24	Agricultural	<i>Acacia auriculiformis, Acacia mangium, Acacia nilotica, Albizia lebbeck, Alstonia scholaris, Areca catechu, Artocarpus heterophyllus, Bambusa vulgaris, Borassus flabellifer, Cocos nucifera, Dalbergia sissoo, Mangifera indica, Phoenix sylvestris, Samanea saman, Tamarindus indica</i>	<i>Calotropis procera, Carica papaya, Carissa carandas, Hibiscus rosa-sinensis, Lantana camara, Ricinus communis</i>	<i>Celosia argentea, Colocasia esculenta, Cucurbita maxima, Cynodon dactylon, Cyperus rotandus, Eclipta prostrata, Mimosa pudica, Musa paradisiaca</i>
	Homestead plantation	<i>Acacia auriculiformis, Acacia mangium, Albizia lebbeck, Alstonia scholaris, Areca catechu, Artocarpus heterophyllus, Casuarina equisetifolia, Cocos nucifera, Dalbergia sissoo, Delonix regia, Dillenia indica, Eucalyptus camaldulensis, Ficus benghalensis, Ficus religiosa, Melia azedarach, Phoenix sylvestris, Pithecellobium dulce, Pongamia pinnata, Saraca asoca, Cassia siamea, Samanea saman, Swietenia mahagoni, Syzygium cumini, Tamarindus indica, Terminalia arjuna, Ziziphus mauritiana</i>	<i>Bougainvillea spectabilis, Calotropis gigantea, Calotropis procera, Carica papaya, Carissa carandas, Hibiscus rosa-sinensis, Lantana camara, Lawsonia inermis, Ricinus communis, Rosa centifolia, Vitex negundo, Woodfordia fruticosa</i>	<i>Alternanthera sessilis, Alternanthera philoxeroides, Amaranthus spinosus, Bacopa monnieri, Boerhavia repens, Celosia argentea, Colocasia esculenta, Cucurbita maxima, Cynodon dactylon, Cyperus compressus, Cyperus rotandus, Eclipta prostrata, Ocimum tenuiflorum, Phragmites karka, Phyllanthus niruri</i>
	Mangrove Plantation	<i>Avicennia officinalis, Sonneratia apetala</i>	<i>Suaeda maritima</i>	<i>Sesuvium portulacastrum</i>
	Mangrove Plantation	<i>Avicennia officinalis</i>	<i>Suaeda maritima</i>	<i>Sesuvium portulacastrum, Porteresia coarctata</i>

Annex 7

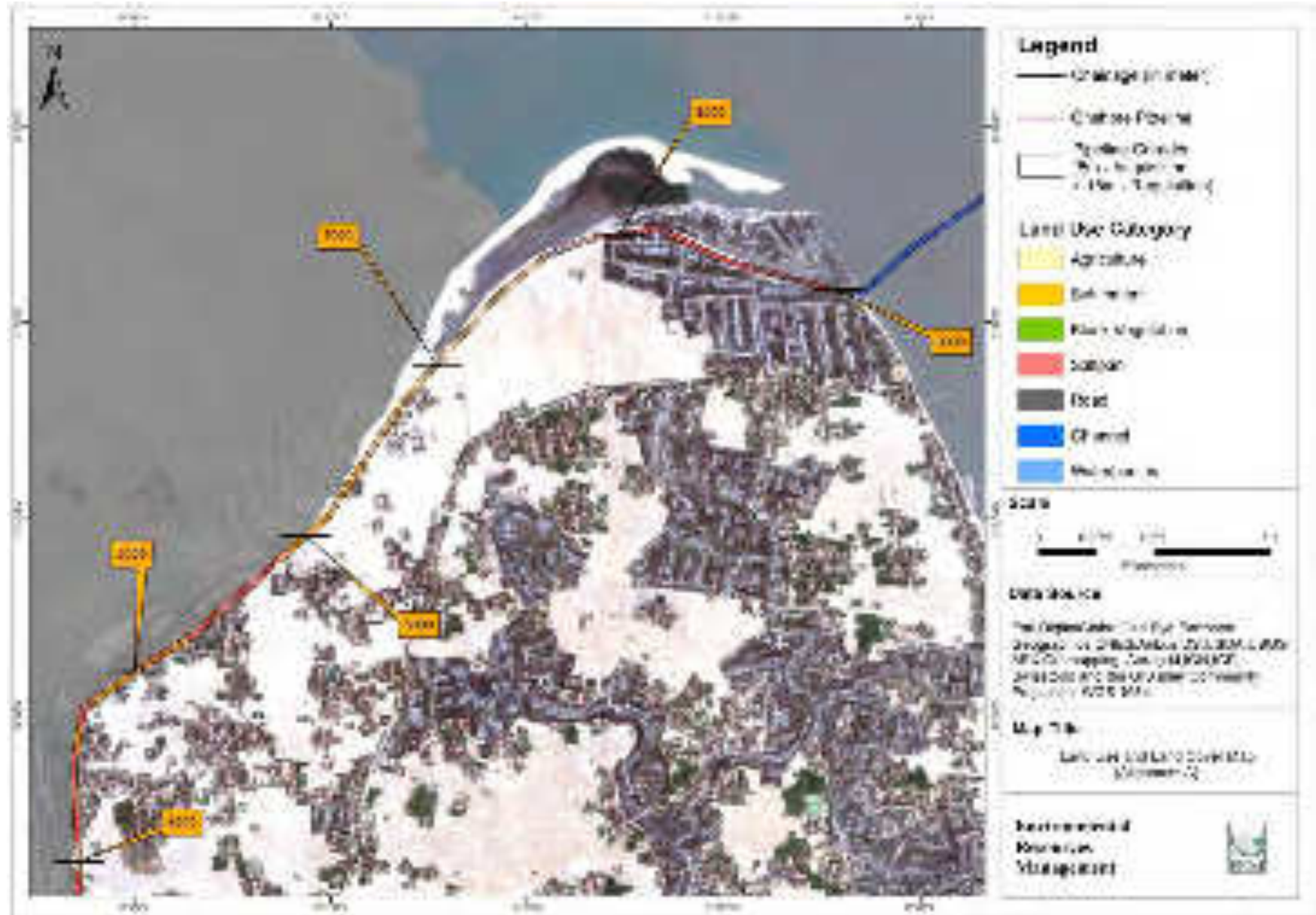
Pipeline Route Alternatives – Landuse Maps

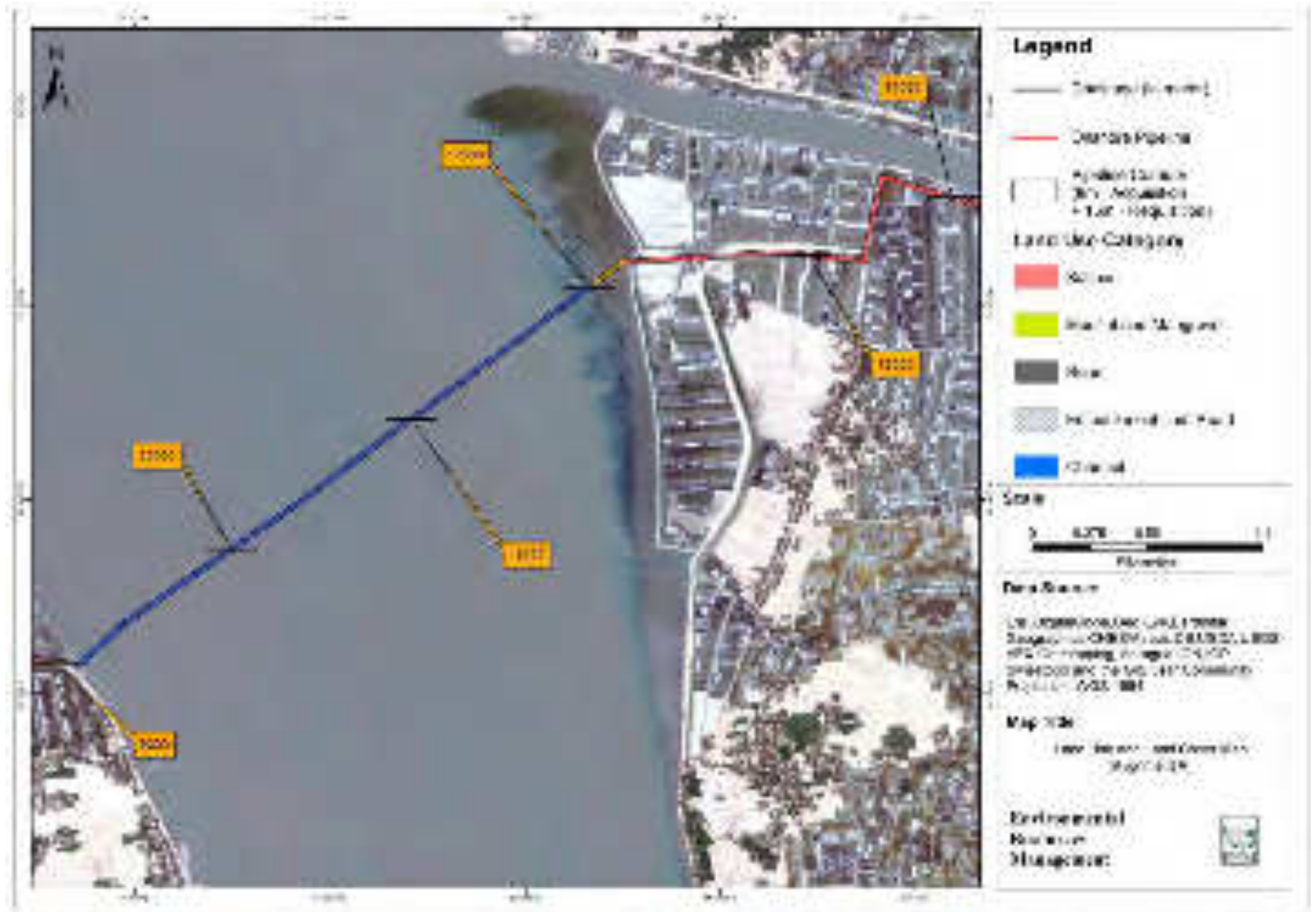
Pipeline Route Alternatives - Landuse Maps

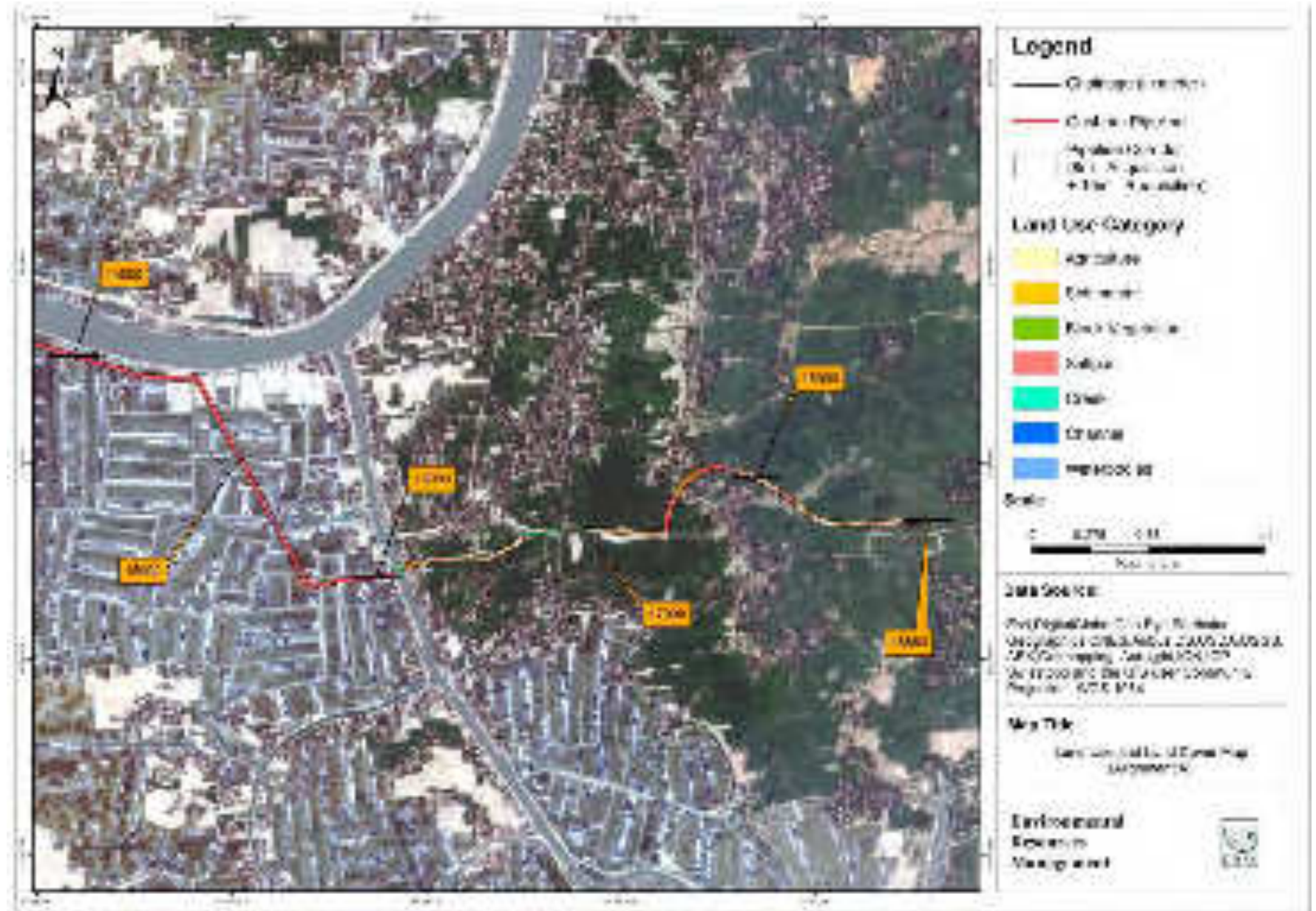
Alignment A - Sheet 1 of 4



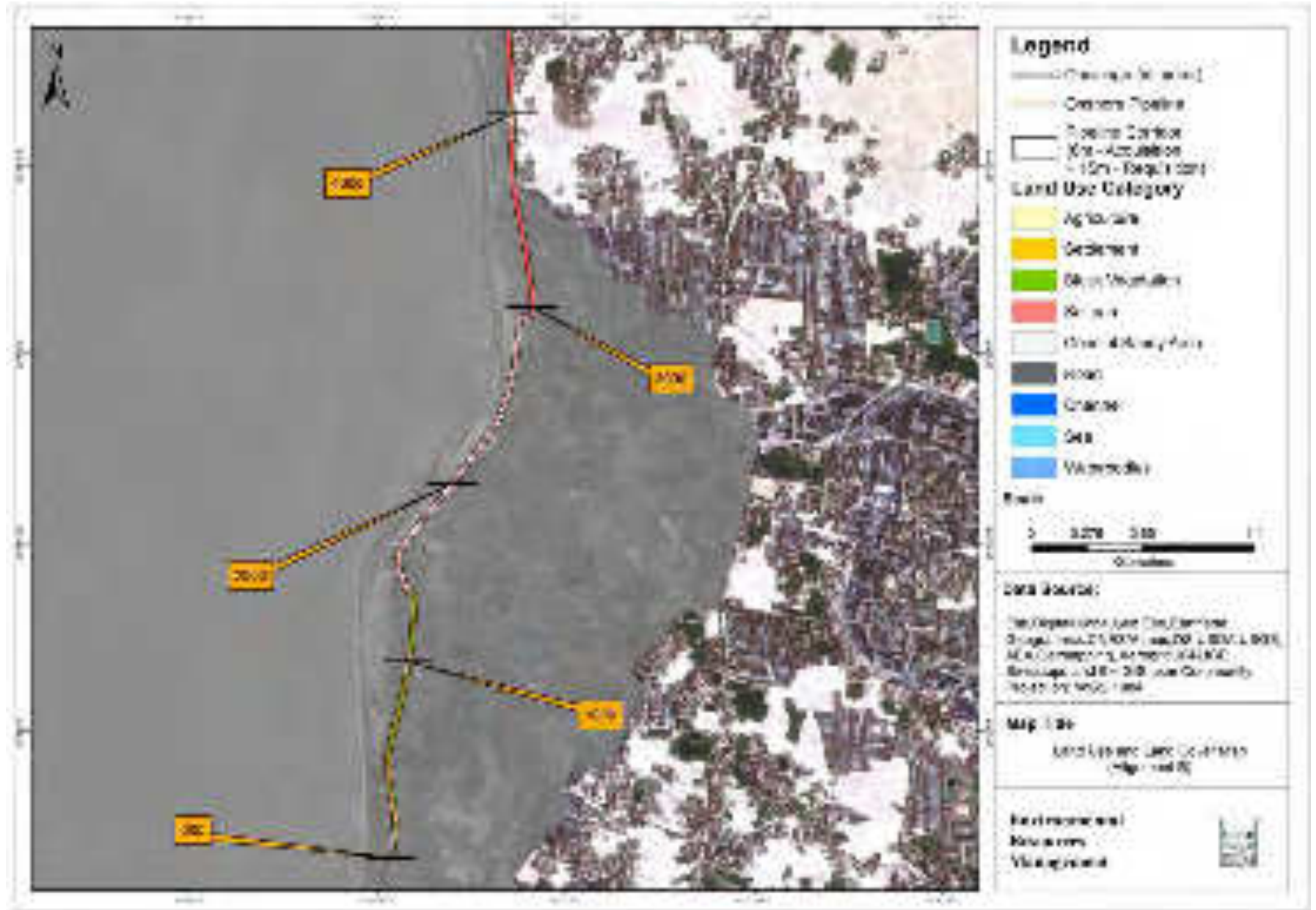
Alignment A - Sheet 2 of 4



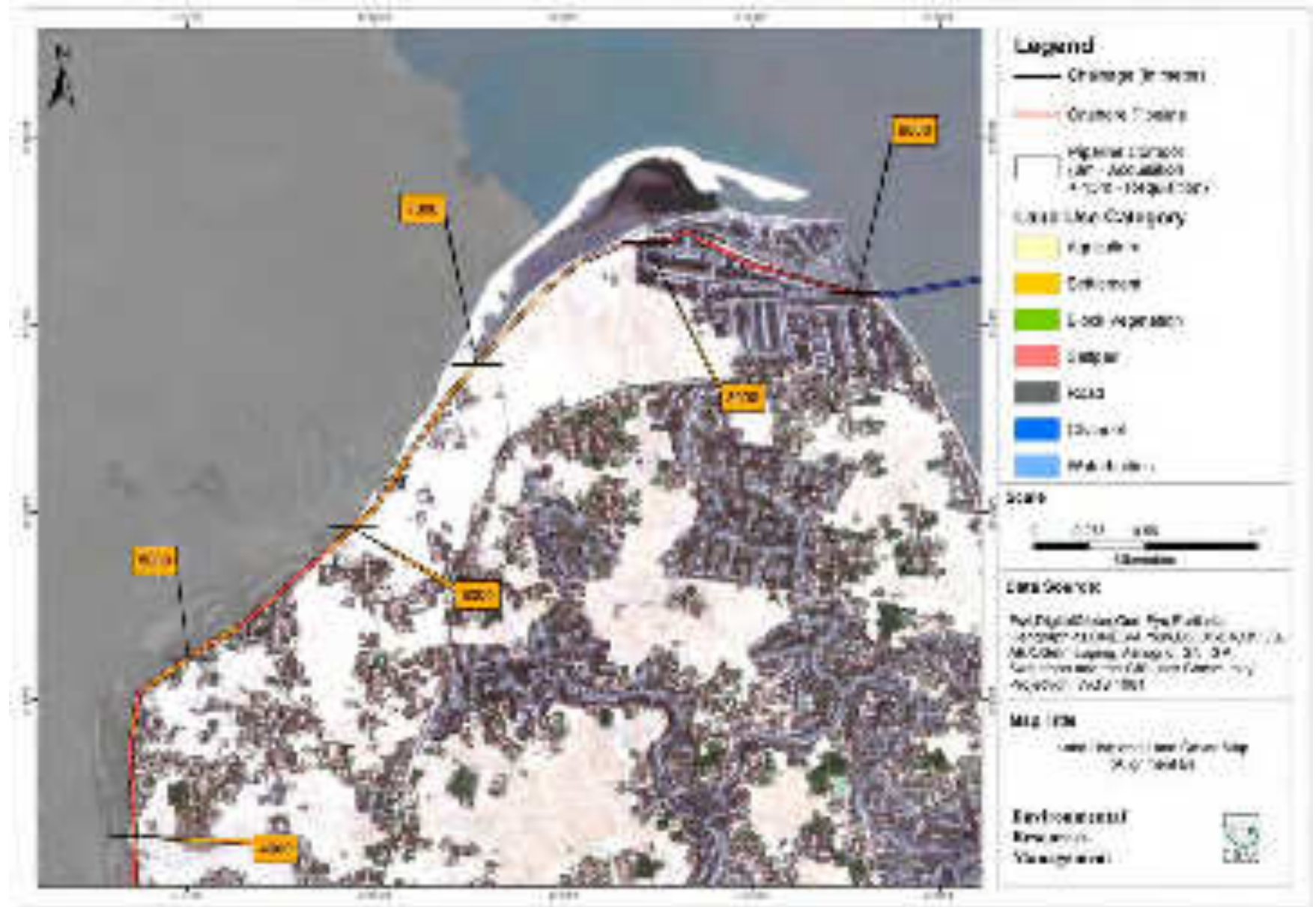




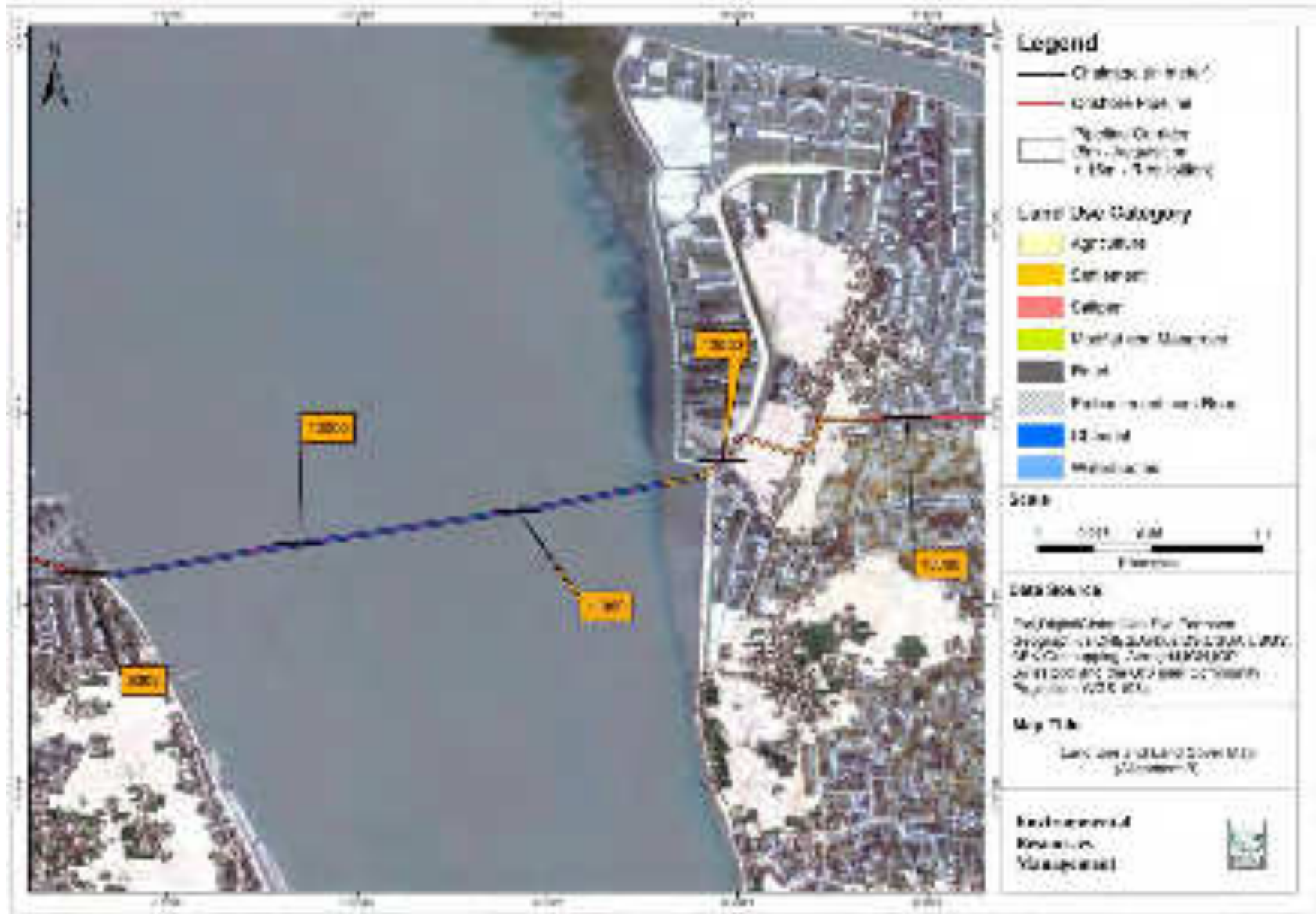
Alignment B - Sheet 1 of 4

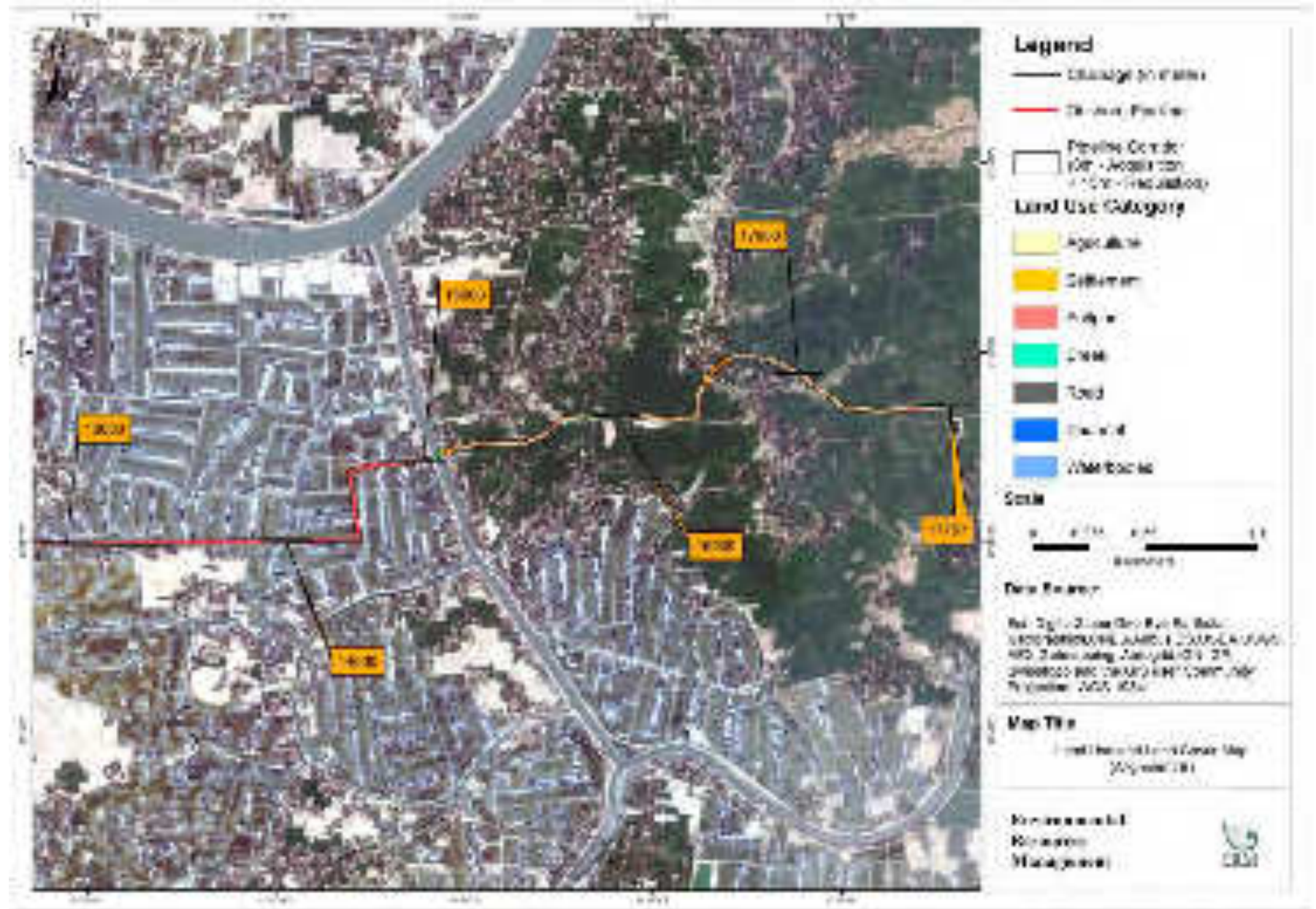


Alignment B - Sheet 2 of 4

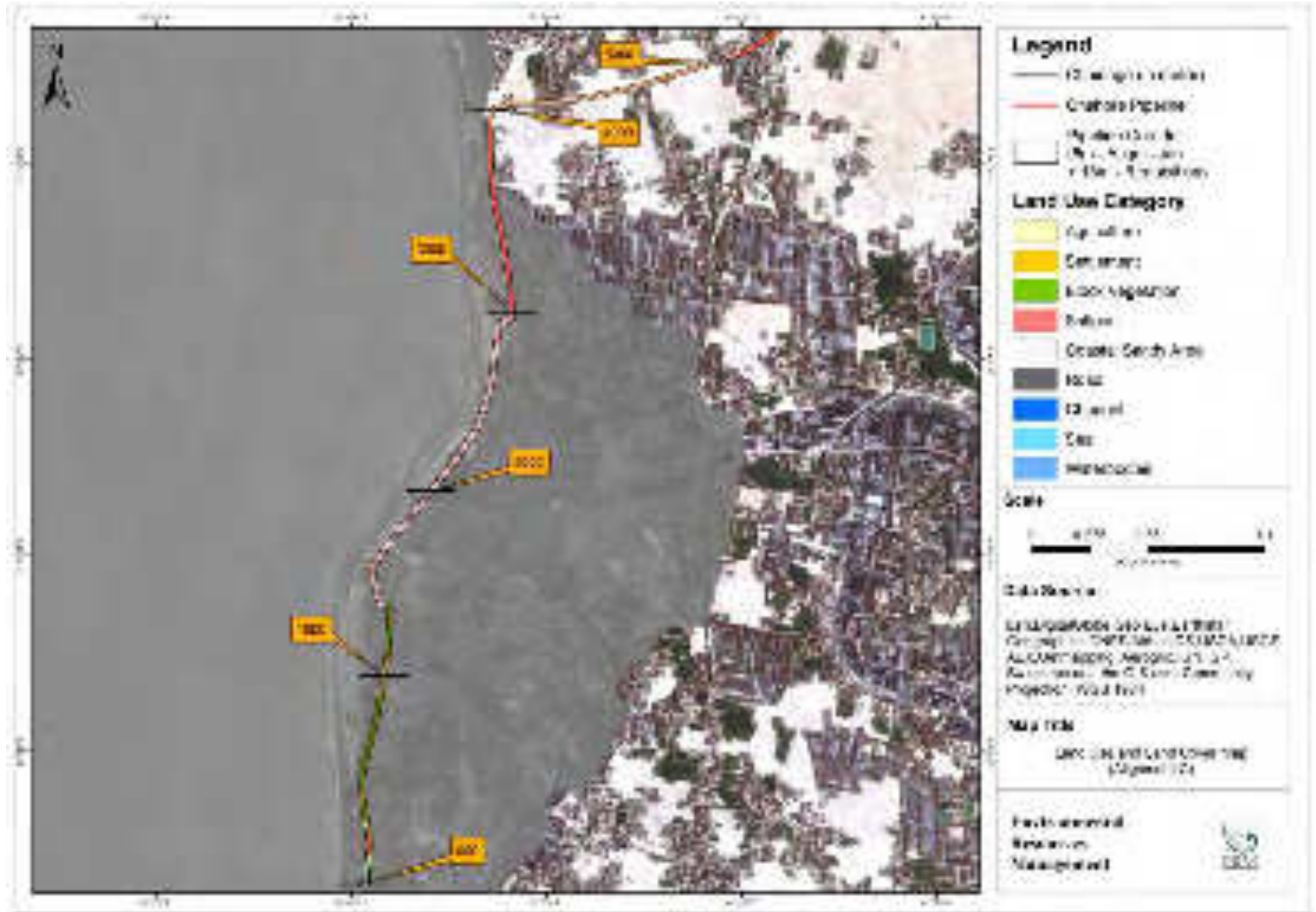


Alignment B - Sheet 3 of 4

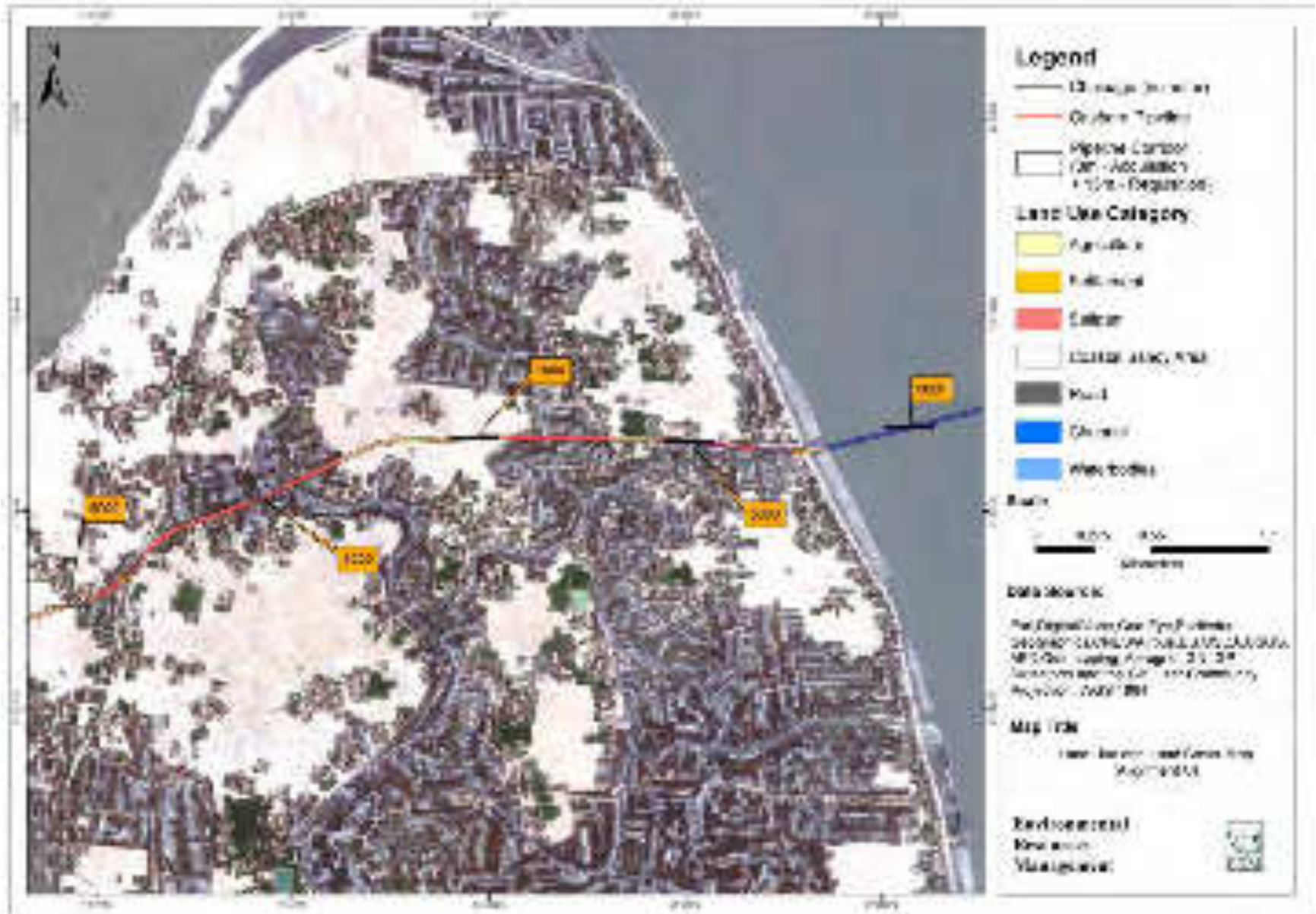




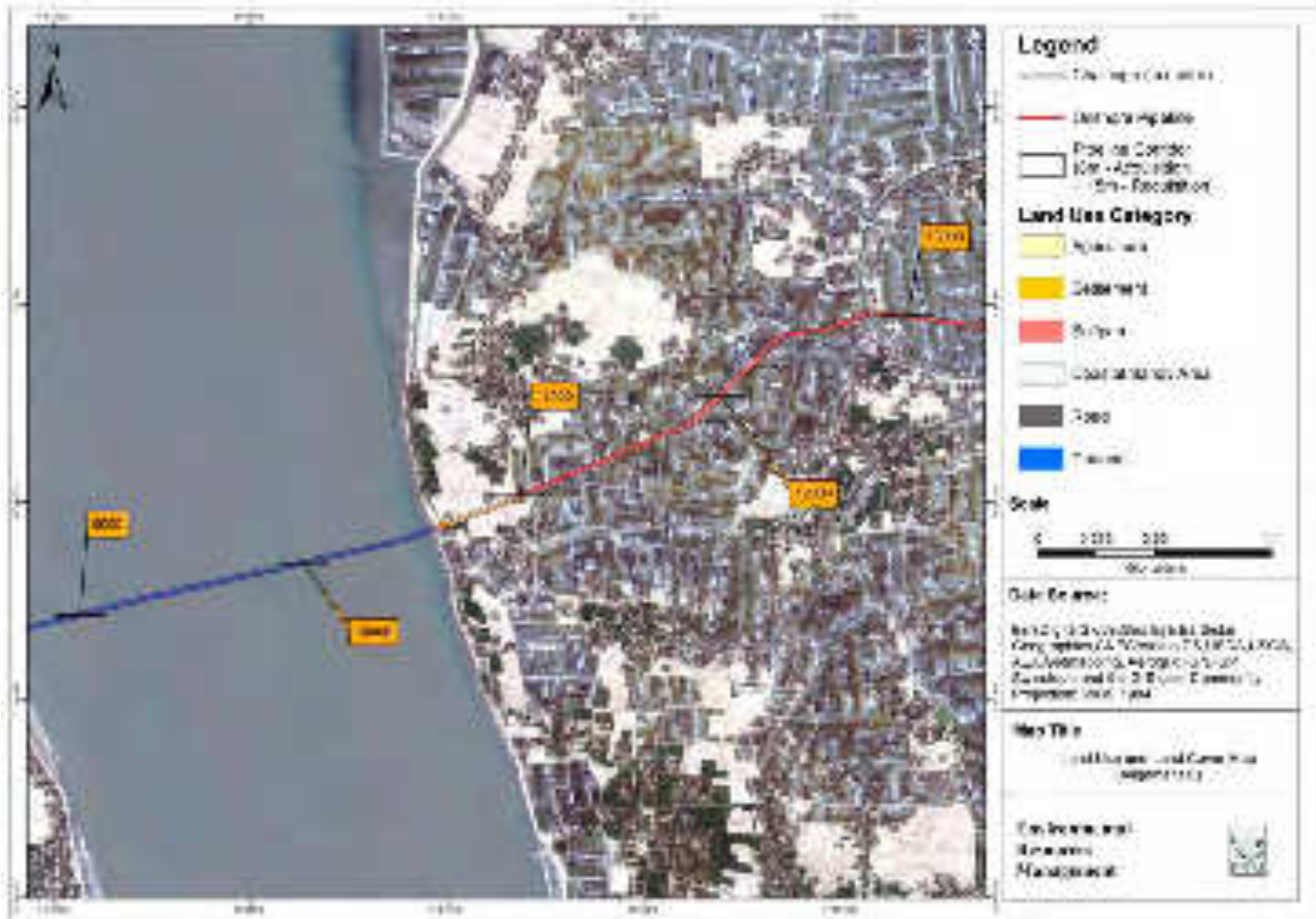
Alignment C - Sheet 1 of 4

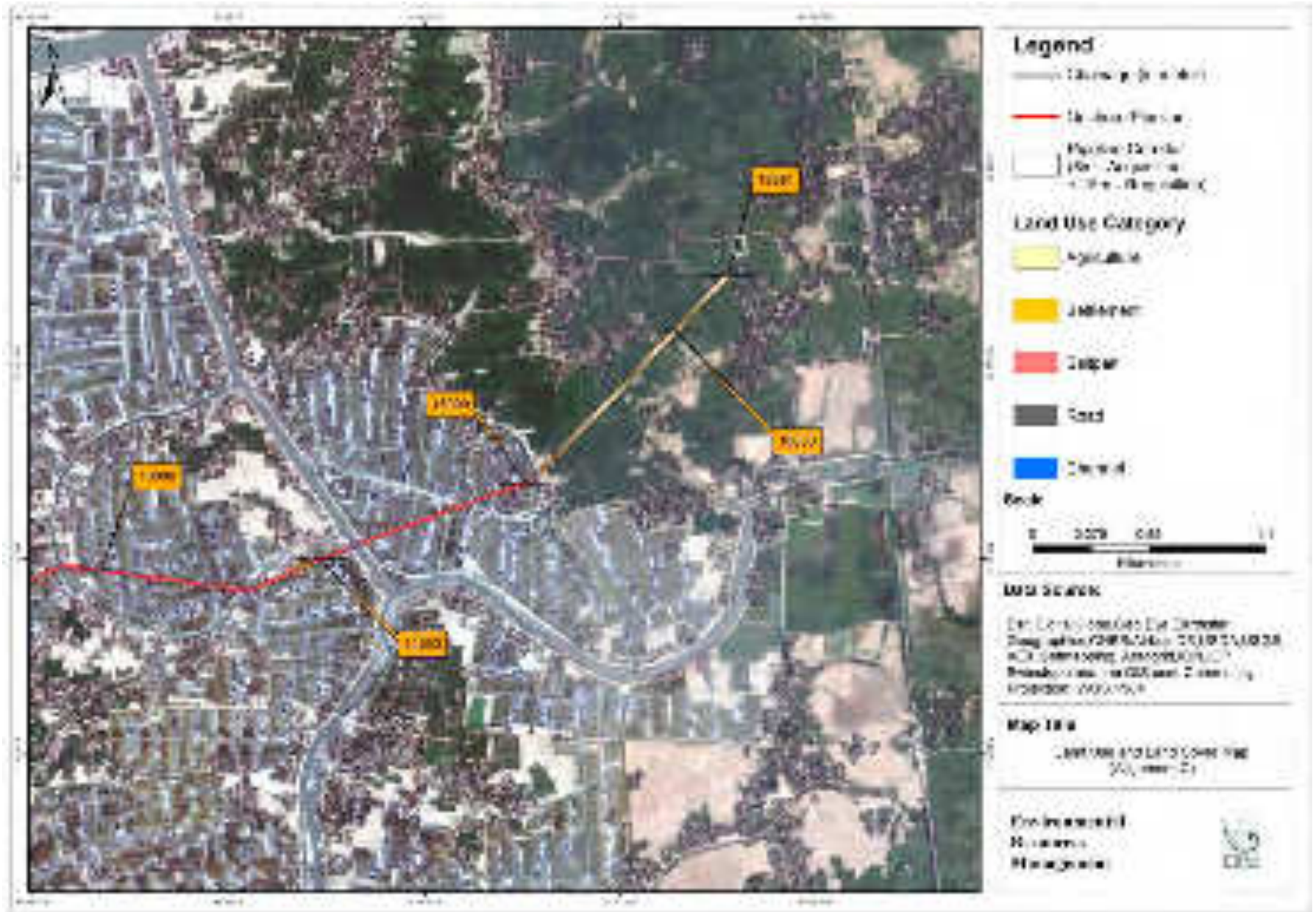


Alignment C - Sheet 2 of 4

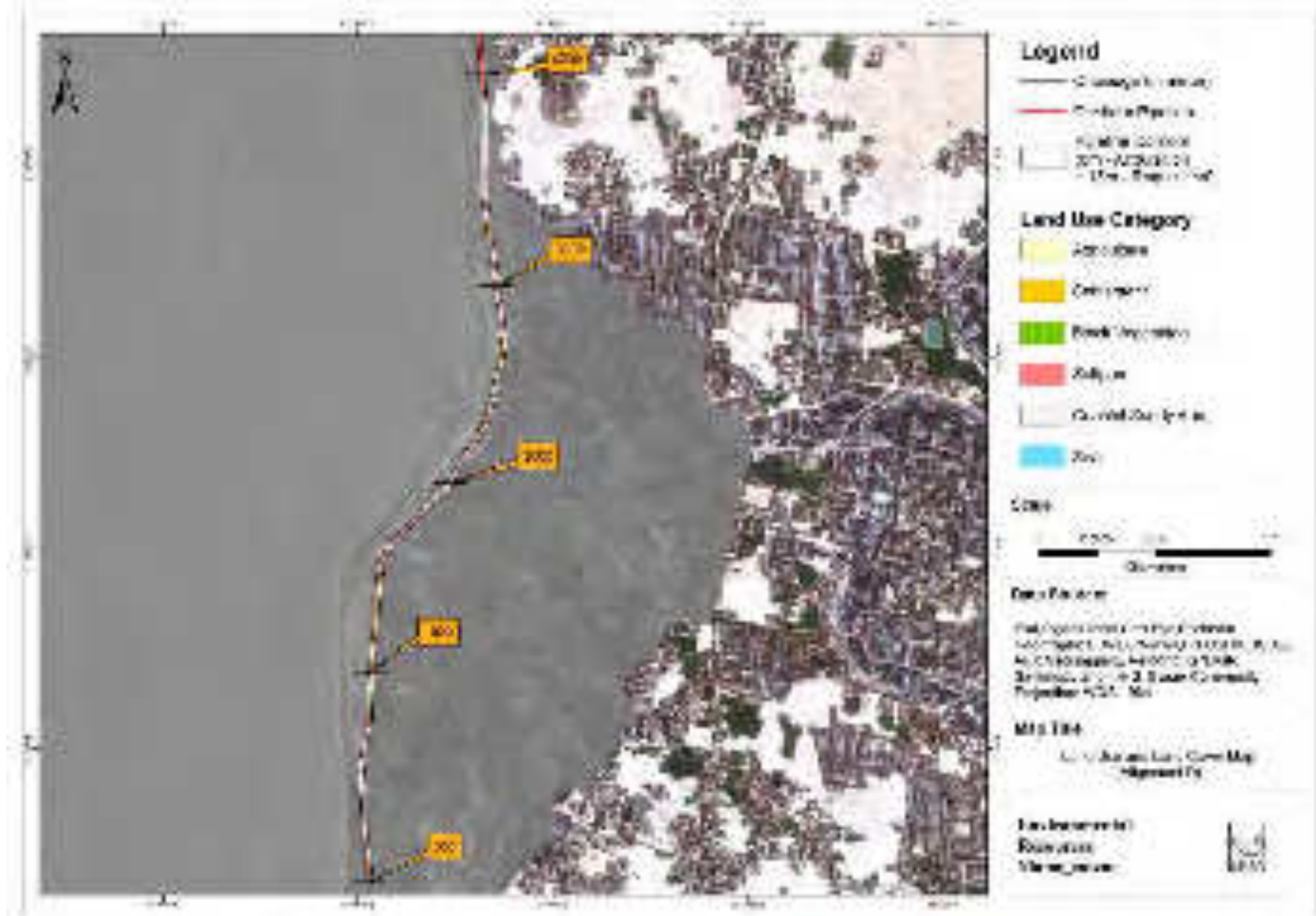


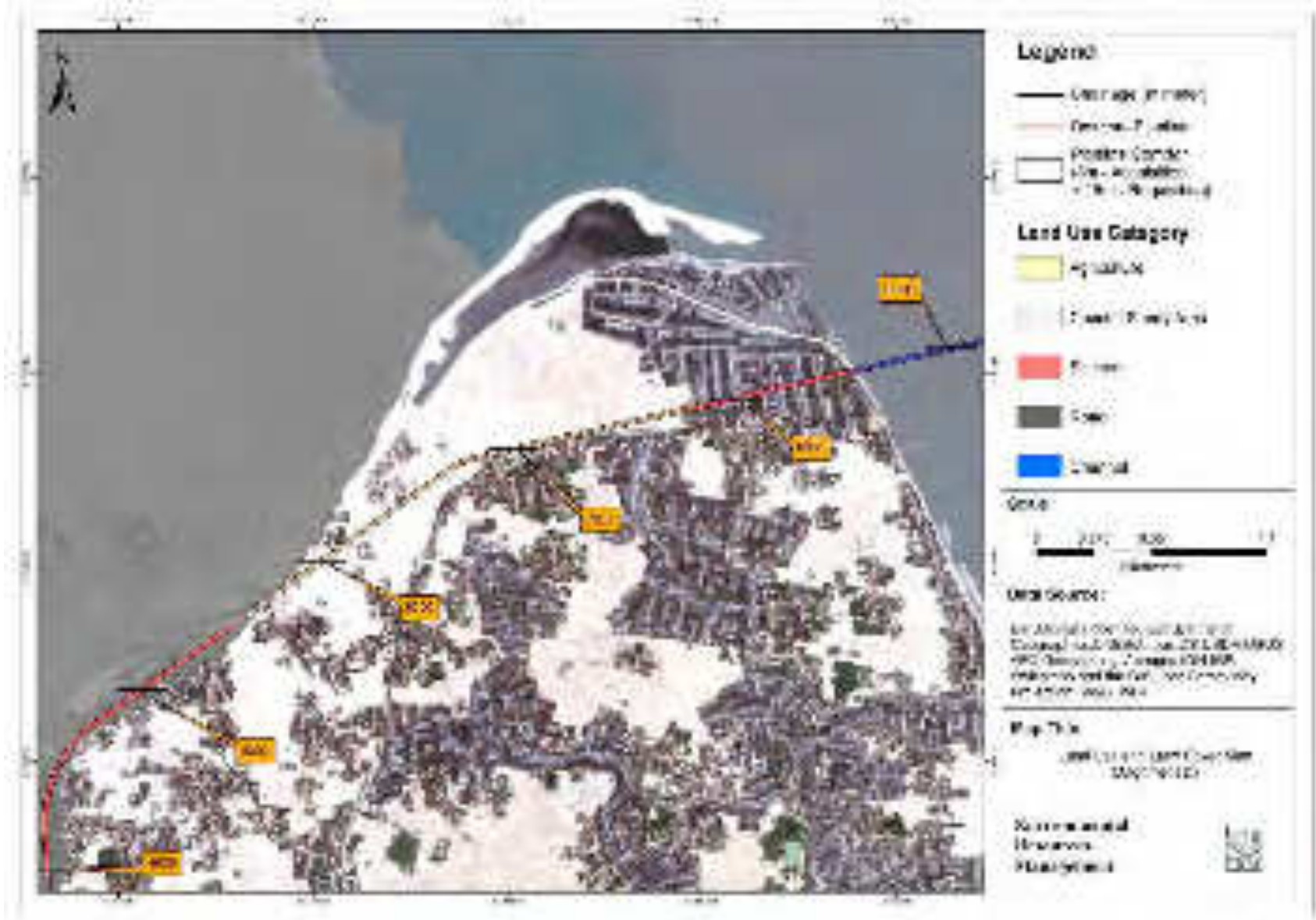
Alignment C - Sheet 3 of 4



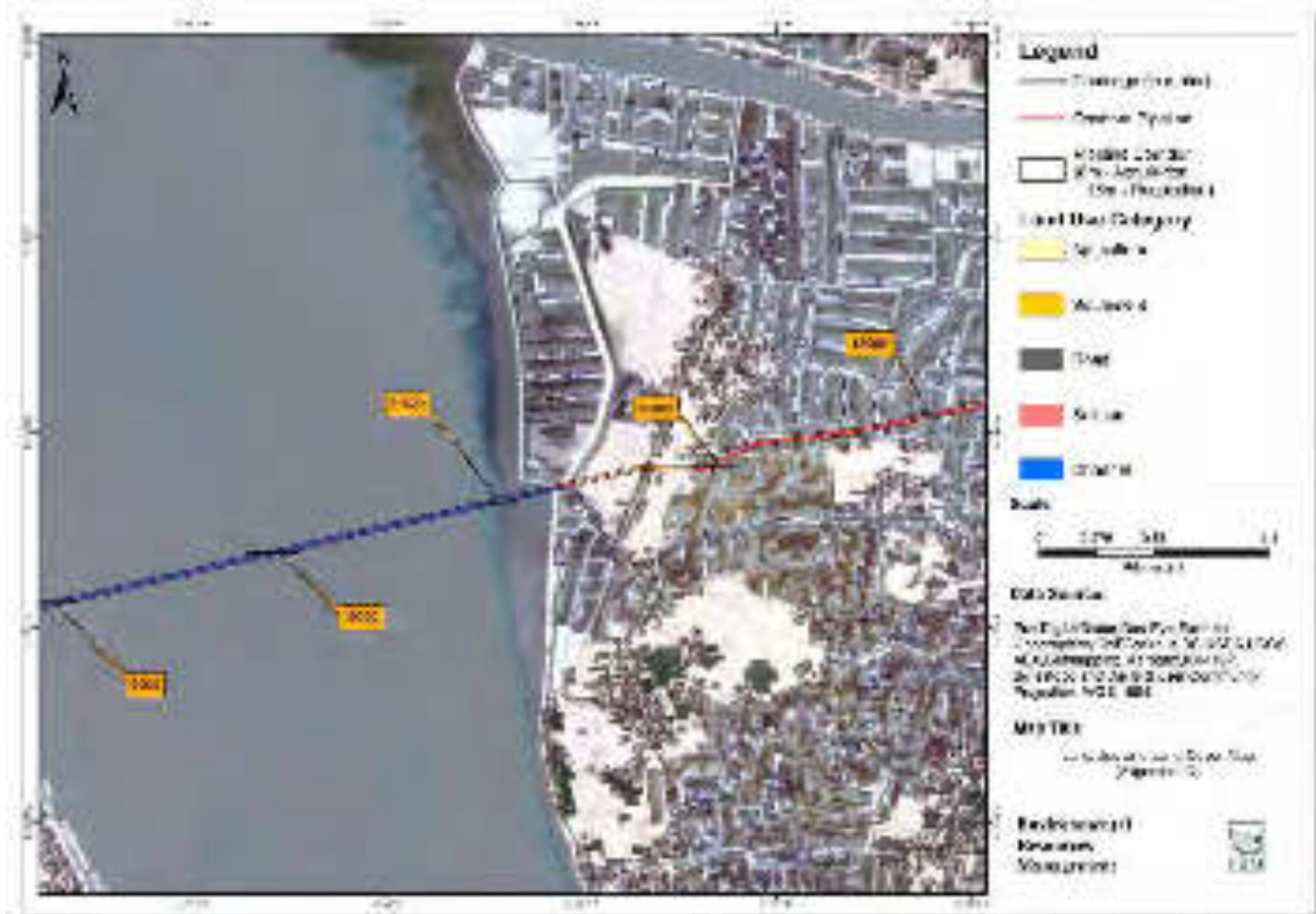


Alignment D - Sheet 1 of 4

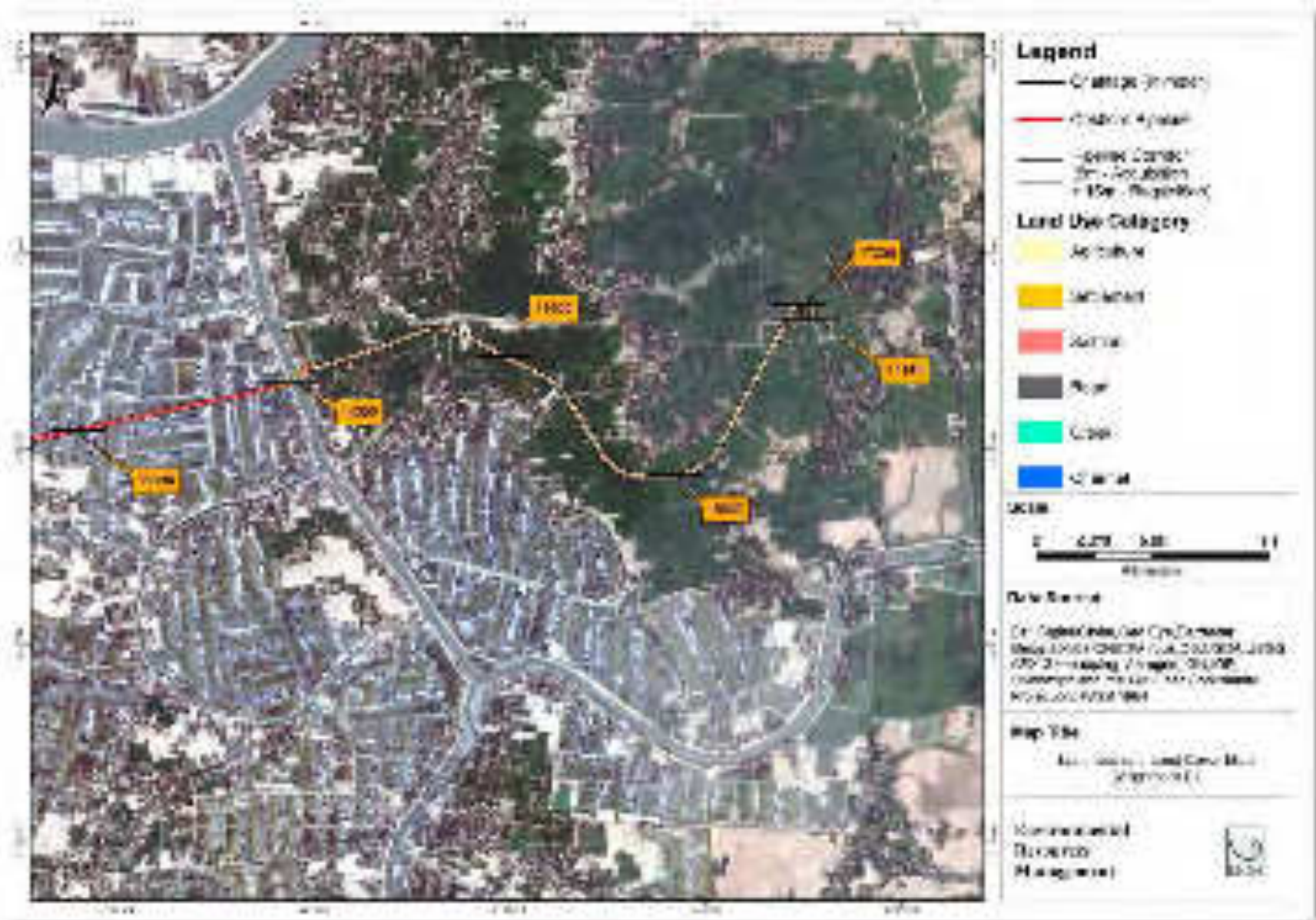




Alignment D - Sheet 3 of 4



Alignment D - Sheet 4 of 4



Annex 8

Stakeholder Consultation - Minutes

Stakeholder Consultation-District Administration

A	Project Title:	ESIA Study, Kutubdia LNG Project
B	Stakeholder Title:	Dy. Commissioner (DC)
<p>Note: This document provides a working summary of the main facts captured during the consultation/ key informant interview held and should not be treated as formal minutes. It is therefore deliberately not exhaustive or chronological. Its purpose is to record significant information/ feedback and not intended for official review or approval.</p>		
C	Basic details:	
	Location:	DC Office, District Commissionerate, Cox's Bazar
	Date	23.08.2016
D	Attended By	
	Sr.	Name
	1.	Md. Ali Hussain
	2.	Sibbir Ahamed
	3.	Dhritiman Ray
	4.	Naval K Chaudhary
	5.	Soumi Ghosh
	6.	Tauhidul Hasan
		Designation
		DC, Cox's Bazar
		Reliance Power, Bangladesh
		ERM
		ERM
		ERM
		EQMS
E	Purpose of Consultation	
	<ul style="list-style-type: none"> - Information sharing and Collection - Assessing Impact Perception - Involving in Mitigation Planning 	
F	Key Points Discussed:	
	<ul style="list-style-type: none"> • This meeting was held to appraise the DC of the initiation of the IEE & ESIA study for the Kutubdia LNG Project • DC Office cannot enter into any type of contract with a private agency; hence, Reliance Power has to sign a contract with the concerned ministry (MoPEMR) before any land acquisition can be initiated. The DC described how the land acquisition process is initiated : <ul style="list-style-type: none"> • Once an agreement is entered on with the Project Proponent, the Ministry can forward the proposal to DC Office for reviewing; • DC Office will then examine schedule of land (mouza/khatian/Dag No.) and establish ownership; • In case of government land the DC will ask for a settlement proposal (leasing of land); • In case of private land the DC will initiate land acquisition. • The DC stressed on the need to protect the sea and land and advised to collect information on cyclone, storm surge, high tide along with meteorological and hydrogeological information. • For GTCL (gas grid) in Moheshkhali Anwara stretch, acquisition of private land has been carried out through DC Office (for pipeline laying) • All Government land (khas) belongs to the DC. This includes canal, road, river, grazing land and reclaimed land. For all cases DC sends the proposals to the Land Department for verification. • Coastal areas planted with mangroves have been classified as protected forest. 	

Stakeholder Consultation-District Administration

A	Project Title:	ESIA Study, Kutubdia LNG Project
B	Stakeholder Title:	Additional Dy. Commissioner (ADC)
<p>Note: This document provides a working summary of the main facts captured during the consultation/ key informant interview held and should not be treated as formal minutes. It is therefore deliberately not exhaustive or chronological. Its purpose is to record significant information/ feedback and not intended for official review or approval.</p>		
C	Basic details:	
	Location:	ADC Office, District Commissionerate, Cox's Bazar
	Date	14.11.2016
D	Attended By	
	Sr.	Name
	1.	Mr. Md. Anwarul Naser
	2.	Rahul Srivastava
	3.	Abhishek Roy Goswami
	4.	Soumi Ghosh
	5.	Souvik Basu
E	Purpose of Consultation	
	<ul style="list-style-type: none"> - Information sharing and Collection - Assessing Impact Perception - Involving in Mitigation Planning 	
F	Key Points Discussed:	
	<p>Land Requirement for Reliance Power</p> <ul style="list-style-type: none"> • Reliance Power has to select the land first and accordingly submit a formal proposal to the Land Office • After getting the formal proposal from Reliance Power , the Land Office can react on the issue • The land rights will first be checked • If it is Khas (Govt.) Land then it will be a permanent settlement between Land Ministry, Govt. of Bangladesh and Reliance Power • If the land has been eroded and at least before 30 years and no claim has been established in between, it will then considered as govt. land as per "State Acquisition and Tenancy Act 1950". Accordingly a permanent settlement between Reliance Power and Land Ministry. Govt. of Bangladesh can be effected. • If it is eroded land but not before 30 years and before acquisition any claim on this land parcel appears - it will then be considered as private land and the acquisition will be initiated as per "Acquisition and Requisition of Immovable Property Ordinance, 1982". • There are no legal rights of the community on any reclaimed land if the erosion has happened before 30 years and thereafter the land has been reclaimed by the community for some specific use. • Sub-Registry Office of Land Office at Upazila level records the data regarding land erosion. <p>Land Price</p> <ul style="list-style-type: none"> • Land Ministry, Govt. of Bangladesh will decide the rent for Khas (Govt.) land through a process of permanent settlement between Govt. of Bangladesh and Reliance Power • If it involves private land acquisition, then last 12 month average land price will be considered • Private land price will be arrived at by considering last 12 month's land price and multiplied by 1.5 	

Stakeholder Consultation- Fishery Department, Cox's Bazar

A	Project Title:	ESIA Study, Kutubdia LNG Project
B	Stakeholder Title:	District Fishery Department
<p>Note: This document provides a working summary of the main facts captured during the consultation/ key informant interview held and should not be treated as formal minutes. It is therefore deliberately not exhaustive or chronological. Its purpose is to record significant information/ feedback and not intended for official review or approval.</p>		
C	Basic details:	
	Location:	District Fishery Office Cox's Bazar
	Date	23.08.2016 and 14.11.2016
D	Attended By	
	Sr.	Name
		Designation
	Meeting held on 23.08.2016	
	1.	Amitosh Sen
		District Fishery Officer
	2.	Dhritiman Ray
		ERM
	3.	Soumi Ghosh
		ERM
	4.	Tauhidul Hasan
		EQMS
	Meeting held on 14.11.2016	
	1.	Amitosh Sen
		District Fishery Officer
	2.	Rahul Srivastava
		ERM
	3.	Abhishek Roy Goswami
		ERM
	4.	Soumi Ghosh
		ERM
E	Purpose of Consultation	
	<ul style="list-style-type: none"> - Information Collection regarding fishing - Assessing Impact Perception - Involving in Mitigation Planning 	
F	Key Points Discussed:	
	<ul style="list-style-type: none"> • There is an ongoing program of Govt. of Bangladesh for registration of fishermen and issuing them fishermen identity cards (FID cards) • Till date 7116 fishermen have been registered in Kutubdia, out of which 2464 fishermen have been issued FIDs • FIDs are issued only to Bangladeshi citizens having National Identity Cards (NIDs) and only to adult fishermen (age > 18 years) • So actual number of fishermen are expected to be around 20% higher • Minimum 8 months of involvement in fishing in a year is required for being considered as a fisherman, • In future in absence of FIDs, coast guards may prevent from fishing in the seas • There is also an ongoing systems for registration of boats; registration of boats is by Marine Mercantile Dept. (MMD) located in Chittagong • The fees required for registration of boats is based on engine capacity of the boats • Two types of fishing is prevalent in this region - day fishing and deep sea fishing • Day fishing is with boats with engine capacity less than 30 HP • Deep sea fishing involves a trip of 7-15 days and with boats of engine capacity around 50-70 HP • The most common fish net that is used in this region is Behundi (marine setbag net) 	

Stakeholder Consultation- Bangladesh Small & Cottage Industries Corporation (BSCIC)

A	Project Title:	ESIA Study, Kutubdia LNG Project	
B	Stakeholder Title:	Bangladesh Small & Cottage Industries Corporation (BSCIC)	
<p><i>Note: This document provides a working summary of the main facts captured during the consultation/ key informant interview held and should not be treated as formal minutes. It is therefore deliberately not exhaustive or chronological. Its purpose is to record significant information/ feedback and not intended for official review or approval.</i></p>			
C	Basic details:		
	Location:	BSCIC office Cox's Bazar (Salt Office)	
	Date	23.08.2016	
D	Attended By		
	Sr.	Name	Designation
	1.	Md. Shameem Alom	Coordination Officer, BSCIC, Cox's Bazar
	2.	Ridwanu Rashid	Coordination Officer, BSCIC, Cox's Bazar
	3.	Dhritiman Ray	ERM
4.	Soumi Ghosh	ERM	
E	Purpose of Consultation		
	<ul style="list-style-type: none"> - Information Collection regarding salt Cultivation - Assessing Impact Perception - Involving in Mitigation Planning 		
F	Key Points Discussed:		
	<ul style="list-style-type: none"> • Frequent cyclonic storms and sea water surge into the Kutubdia Island over the years has caused infertility of the island soil - this has prompted island residents to opt for salt cultivation. This region earlier used to have mostly agricultural land. • Salt cultivation is done for almost 6 months in a year between November and May. • Salt cultivation is mainly carried out on both sides of 'Pilat Kata Khal' (inland channel) within Kutubdia Island. Water from Bay of Bengal is channelized to the Kata Khal through several sluice gates from the Kutubdia Channel. • In Kutubdia Island 7000 acres of land is under salt cultivation with around 4600 salt cultivators • The salt cultivators take land on lease / 'barga' for 6 months for salt cultivation. Salt is sold through middlemen. • There are no local markets in Kutubdia for selling salt and it proves costlier for the cultivators to take the salt and sell it in Chittagong markets. In most cases the salt cultivators take loan from the middlemen for leasing out land and hence there is an arrangement between them that the salt will be sold only to them. • Apart from salt cultivation, people on the island also earn their livelihood through fishing, paddy cultivation and working as daily labourers. • The number of salt cultivators is not same every year. If the yield is better in one year then the number of salt cultivators increases the next year, almost by 10%. • Unlike other areas such as Moheshkhali, in Kutubdia all the salt cultivators are from the island itself. 		

Stakeholder Consultation- District Forest Office

A	Project Title:	ESIA Study, Kutubdia LNG Project
B	Stakeholder Title:	District Forest Officer
<p>Note: This document provides a working summary of the main facts captured during the consultation/ key informant interview held and should not be treated as formal minutes. It is therefore deliberately not exhaustive or chronological. Its purpose is to record significant information/ feedback and not intended for official review or approval.</p>		
C	Basic details:	
	Location:	District Forest Office
	Date	23.08.2016
D	Attended By	
	Sr.	Name
	1.	Md. Ali Kabir
	2.	G M Mohammad Kabir
	3.	Dhritiman Ray
	4.	Soumi Ghosh
	5.	Naval K Chaudhary
	6.	Tauhidul Hasan
E	Purpose of Consultation	
	<ul style="list-style-type: none"> - Information sharing - Information collection regarding forest - Assessing Impact Perception - Involving in Mitigation Planning 	
F	Key Points Discussed:	
	<ul style="list-style-type: none"> • Kutubdia Island has coastal afforestation zones and social forestry areas. • Casuarina trees have been planted by the department as part of the Social Forestry measure on the sea facing side of the island. Community people are involved in maintenance and protection of the plants. • The coastal afforestation programmes are undertaken on Khas land (Government land) – in such cases the land is not owned by the Forest Department • Forest Department had planted casuarina trees under the coastal afforestation program in Kutubdia Island – however during the recent cyclonic event (Roanu) in May 2016, a large of these trees was uprooted. • In case of participatory community afforestation programs, the community generally looks after the plantation for a period of 10 years, after which the trees are sold through tendering. 45 % of the total sale goes to the community, 45% of the share goes to Forest Department and 10% is used for refunding of Social Forestry. • For acquiring Social Forestry land for any project, the project proponent has to take permission from District Commissioner and pay the compensation which is decided based on the age of the trees. • The Forest Department has planted mangrove species along the south eastern part of the Island especially around Boroghop Ghat. The species of mangrove planted include Keora (Sonneratia apetala) and Byne (Avicennia sp.) • The Forest Department has not carried out any wildlife survey / study in the Kutubdia Island. • The Forest Department suggested interacting with Marineliflife Alliance (an NGO), who have been working on a ‘Sea Turtle Project’ along this entire coastline together with the Forest Department and the World Bank. 	

Stakeholder Consultation- Department of Environment (DOE), Cox's Bazar

A	Project Title:	ESIA Study, Kutubdia LNG Project
B	Stakeholder Title:	Department of Environment (DOE), Cox's Bazar
<p><i>Note: This document provides a working summary of the main facts captured during the consultation/ key informant interview held and should not be treated as formal minutes. It is therefore deliberately not exhaustive or chronological. Its purpose is to record significant information/ feedback and not intended for official review or approval.</i></p>		
C	Basic details:	
	Location:	DOE regional office Cox's Bazar
	Date	25.08.2016
D	Attended By	
	Sr.	Name
	1.	Sarder Shariful Islam
		Assistant Director, Department of Environment (DoE), Cox's Bazar
	2.	Naval K Chaudhary
		ERM
	3.	Tauhidul Hasan
		EQMS
E	Purpose of Consultation	
	<ul style="list-style-type: none"> - Information sharing - Information collection regarding Environmental Clearance Process - Assessing Impact Perception - Involving in Mitigation Planning 	
F	Key Points Discussed:	
	<ul style="list-style-type: none"> • Monitoring of the projects is being done by different offices of the DoE: <ul style="list-style-type: none"> • Green & Orange 'A' Category Projects: District Office • Orange 'B' Category Projects: Divisional Office • Red Category Projects: Head Office • Application for site clearance (IEE) needs to be submitted to District Office of DoE in three copies along with application fee as per Environmental Conservation Rules, 1997. • Processing of site clearance application in District and Divisional Offices will take minimum 2 weeks and as the project will be falling in Red Category and hence, the final clearance will be issued by the DoE Head Office only. • Due to limited infrastructure and resources, the District Office is not involved in regular environmental monitoring in the District. However, Divisional Office at Chittagong provides support as need arises. The District Office does carryout some water testing. • No secured landfill for disposal of solid and/or hazardous wastes is currently available in Cox's Bazar District. The Cox's Bazar Municipal Corporate is having a dumping ground for municipal waste; however, this is not designed scientifically. • The DoE is currently developing four landfills and treatment sites in Bangladesh, which are at (a) Gazipur; (b) Narayanganj; (c) Rangpur; and (d) Cox's Bazar. Out of these Narayanganj facility is completed and operational, whereas other three sites will be commissioned by mid- 2017. • At present, Cox's Bazar district is not having any sewage treatment plant and hazardous waste disposal site. However, the Cox's Bazar Development Authority has taken into consideration the development of a sewage treatment plant, which is currently in initial planning and approval phase. • Nearest hazardous waste incineration facility is available at Chittagong Port Authority. • Cox's Bazar is not having any waste oil/ used oil and lubricant processing facility. At present, such waste oil/ lubricant is being collected by local businessmen and sold to reprocessing facilities in Chittagong region. • No coastal zone management authority exists. However, coastal area security is being looked by Coast Guards. • The proposed site is away from any ecological sensitive location; however, the project can have impact on aquatic flora and fauna due to hot/ cold water discharges. • Any destruction to mangroves to be avoided during project construction or operations. • No major development is currently planned in Kutubdia. However, Bangladesh Navy has taken site clearance for a submarine station to be located between Magnama Ghat and Ujantia in Pekua Upazila. This facility will use the Kutubdia channel as well. 	

Stakeholder Consultation-Upazila Administration

A	Project Title:	ESIA Study, Kutubdia LNG Project	
B	Stakeholder Title:	Upazila Nirbahi Officer, Kutubdia	
<p>Note: This document provides a working summary of the main facts captured during the consultation/ key informant interview held and should not be treated as formal minutes. It is therefore deliberately not exhaustive or chronological. Its purpose is to record significant information/ feedback and not intended for official review or approval.</p>			
C	Basic details:		
	Location:	UNO Office, Kutubdia Upazila	
	Date	24.08.2016 and 15.11.2016	
D	Attended By		
	Sr.	Name	Designation
	1.	Mr. Salehin Tanvir Gazi	UNO & AC (Land) In charge, Kutubdia
	2.	Mr. Md. Aktar Hossain	Chairman, Lesmikhali Union Parishad
	3.	Mr. Jalal Ahamed	Chairman, Kaiyarbil Union Parishad
	4.	Mr. Saiyad Ahamed Choudhuri	Chairman, Dakshin Dhurung Union Parishad
	5.	Mr. A.S.M. Sharriar	Chairman, Uttar Dhurung Union Parishad
	6.	Shajid Mhamood	Kutubdia Upazila Land Office
	7.	Rahul Srivastava	ERM
	8.	Abhishek Roy Goswami	ERM
	9.	Soumi Ghosh	ERM
	10.	Souvik Basu	ERM
11.	Tauhidul Hasan	EQMS	
E	Purpose of Consultation		
	<ul style="list-style-type: none"> - Information sharing - Information collection regarding land and livelihood - Assessing Impact Perception - Involving in Mitigation Planning 		
F	Key Points Discussed:		
	<p>Land Requirement for Reliance Power</p> <ul style="list-style-type: none"> • A formal proposal need to be submitted by a project proponent to the land office • On the basis of a duly approved proposal, the process for land uptake will be initiated. • The land rights will be examined • In case of Khas (Govt.) Land a permanent settlement can be effected between Land Ministry, Govt. of Bangladesh and Reliance Power • In case of private land acquisition provisions of "Acquisition and Requisition of Immovable Property Ordinance, 1982" will be followed. <p>Land Price</p> <ul style="list-style-type: none"> • Land Ministry, Govt. of Bangladesh will decide the rent for Khas (Govt.) land under permanent settlement between Govt. of Bangladesh and Reliance Power • If it is Private land acquisition then last 12 month average land price will considered • Private land price will be arrived at by considering last 12 month land price multiplied by 1.5 <p>Livelihood</p> <ul style="list-style-type: none"> • Majority of the population is dependent in fishing for earning their livelihood • Fisher man are involved both in deep sea fishing and daily fishing • Other than fishing, salt production is also a major livelihood activity • Few people are also involved in agriculture and fish drying activity • Most of agricultural lands are monocropped and fully dependent on rain • Paddy is the main agricultural produce of the area. In addition vegetable sand frits like water melon are also produced from this area. 		

Stakeholder Consultation-Upazila Fishery Office

A	Project Title:	ESIA Study, Kutubdia LNG Project	
B	Stakeholder Title:	Upazila Fishery Officer, Kutubdia	
<p>Note: This document provides a working summary of the main facts captured during the consultation/ key informant interview held and should not be treated as formal minutes. It is therefore deliberately not exhaustive or chronological. Its purpose is to record significant information/ feedback and not intended for official review or approval.</p>			
C	Basic details:		
	Location:	Upazila Fishery Office, Kutubdia Upazila	
	Date	24.08.2016	
D	Attended By		
	Sr.	Name	Designation
	1.	Nasim Al Mahmood	Upazila Fisheries Officer
	2.	Md. Javed Iqbal	Marine Fishery Officer
	3.	Dhritiman Ray	ERM
	4.	Naval K Chaudhary	ERM
	5.	Soumi Ghosh	ERM
6.	Tauhidul Hasan	EQMS	
E	Purpose of Consultation		
	<ul style="list-style-type: none"> - Information sharing - Information collection regarding fishing activity - Assessing Impact Perception - Involving in Mitigation Planning 		
F	Key Points Discussed:		
	<ul style="list-style-type: none"> • Two rounds of registration of fisher men have been undertaken in Kutubdia - 5716 fishermen have been registered under Phase I while 1228 fishermen have been registered under Phase II. • Both mechanised as well as non-mechanised boats are in use in the Kutubdia Upazila. It is understood that at present approx. 150-200 boats mechanised boats (Danish boat/tempo boat and medium/large size wooden boats) are presently operating from this island; the number of non-motorised boats wooden boats in use is much higher (approx. 800 boats) • Two separate form of fishing are practiced including daily fishing (which continues for maximum of 1 to 1.5 days) and deep sea fishing (continues at a stretch for 10-12 days); Around 80% of the fisher men are involved in day fishing • Type of fishing gear commonly used include Hundara Jal, Behundi Jal • Fishermen use push net, beach side seine net, shrimp net, etc. • In Dakshin Dhurung and Kaiyabil unions, 876 and 260 fishermen have received FIDs • Fishermen use the entire stretch of the coast for anchoring the boats, venturing in the seas and also for drying of their nets. • There is no fish landing site on the island as the fish catch is sold off in the high sea. • Commercially the fish drying activities are carried out towards the south-eastern part of the island; it is done privately and without any association with the Fisheries Department. 		

Stakeholder Consultation-Upazila Agriculture office

A	<i>Project Title:</i>	ESIA Study, Kutubdia LNG Project	
B	<i>Stakeholder Title:</i>	Sub. Asst. Agriculture Officer, Kutubdia	
<p><i>Note: This document provides a working summary of the main facts captured during the consultation/ key informant interview held and should not be treated as formal minutes. It is therefore deliberately not exhaustive or chronological. Its purpose is to record significant information/ feedback and not intended for official review or approval.</i></p>			
C	<i>Basic details:</i>		
	<i>Location:</i>	Upazila Agriculture Office, Kutubdia Upazila	
	<i>Date</i>	24.08.2016	
D	<i>Attended By</i>		
	<i>Sr.</i>	<i>Name</i>	<i>Designation</i>
	1.	Md. Monir	Sub. Asst. Agriculture Officer, Kutubdia
	2.	Dhritiman Ray	ERM
	3.	Naval K Chaudhary	ERM
	4.	Soumi Ghosh	ERM
5.	Tauhidul Hasan	EQMS	
E	<i>Purpose of Consultation</i>		
	<ul style="list-style-type: none"> - Information sharing - Information collection regarding agriculture activity - Assessing Impact Perception - Involving in Mitigation Planning 		
F	<i>Key Points Discussed:</i>		
	<ul style="list-style-type: none"> • Total area of the Kutubdia Upazila is 15,102 Ha of which area under cultivation is 5465 Ha. • Some of the regions in this Upazila are triple cropped with Rabi, Kharif I (Aash) and Kharif II (Amon) • Single cropped area is 250 Ha, double cropped area is 1670 Ha while the triple cropped area is 2500 Ha • Farmers are being given identity cards - Krishi Upakaran Sahayata Card • At present there are 13,740 farmers who are involved in cultivation of paddy and vegetables • Farmers are classified as landless, marginalised, small, medium and big - based on the agricultural land holding size • Net cropped area in Dakshin Dhurung Union Parishad is 680 Ha while that in Kaiyabil Union Parishad is 360 Ha • Due to frequent cyclonic events and sea water surge, more and more agricultural lands are becoming infertile and getting converted for salt cultivation. 		

Stakeholder Consultation-Upazila Education office

A	Project Title:	ESIA Study, Kutubdia LNG Project	
B	Stakeholder Title:	Asst. Upazila Education Officer, Kutubdia	
<p>Note: This document provides a working summary of the main facts captured during the consultation/ key informant interview held and should not be treated as formal minutes. It is therefore deliberately not exhaustive or chronological. Its purpose is to record significant information/ feedback and not intended for official review or approval.</p>			
C	Basic details:		
	Location:	Upazila Education Office, Kutubdia Upazila	
	Date	24.08.2016	
D	Attended By		
	Sr.	Name	Designation
	1.	Omar Farukh	Asst. Upazila Education Officer, Kutubdia
	2.	Dhritiman Ray	ERM
	3.	Soumi Ghosh	ERM
E	Purpose of Consultation		
	<ul style="list-style-type: none"> - Information sharing - Information collection regarding Educational Status and Educational Infrastructure - Assessing Impact Perception - Involving in Mitigation Planning 		
F	Key Points Discussed:		
	<ul style="list-style-type: none"> • The literacy rate of Kutubdia Upazila is 71%. • The department has focused on 100% enrolment of children and has achieved enrolling almost 95% of the children into schools. • Three types of educational systems are in practice – general school, madrasa and vocational institutions • For graduate / post graduate education, students have to visit Chittagong • Details on educational Infrastructure available in Kutubdia Upazila was shared with ERM • Dropout rate among boys are more especially during winter. They get involved into fish drying activity during this period as it is an easy source of earning money. 		

Stakeholder Consultation-Upazila Health Complex

A	Project Title:	ESIA Study, Kutubdia LNG Project	
B	Stakeholder Title:	Medical Officer, Upazila Health Complex, Kutubdia	
<p><i>Note: This document provides a working summary of the main facts captured during the consultation/ key informant interview held and should not be treated as formal minutes. It is therefore deliberately not exhaustive or chronological. Its purpose is to record significant information/ feedback and not intended for official review or approval.</i></p>			
C	Basic details:		
	Location:	Upazila Health Complex, Kutubdia Upazila	
	Date	24.08.2016	
D	Attended By		
	Sr.	Name	Designation
	1.	Dr. Abdulah Hassa	Medical Officer, Upazila Health Complex, Kutubdia
	2.	Dhritiman Ray	ERM
	3.	Soumi Ghosh	ERM
E	Purpose of Consultation		
	<ul style="list-style-type: none"> - Information sharing - Information collection regarding morbidity status and health Infrastructure - Assessing Impact Perception - Involving in Mitigation Planning 		
F	Key Points Discussed:		
	<ul style="list-style-type: none"> • The Upazila Health Complex has three departments – Out Patient Department (OPD), 31 bedded indoor facility and an emergency ward. • There are 3 Medical Officers (MOs) at the Upazila Health Complex along with one Family Welfare Councillor and one UHNFO. • At Union Parishad level there are Family Welfare Centers. • It was reported by the MO that diarrhoea and respiratory tract infections are some of the common diseases among the population of the island • Usually after natural disasters people suffer from water borne diseases. • There are no ambulance service available on the island • Inorder to reach out to all the community people, 12 Community Clinics are held by the health department, 2 each for 6 Union Parishads. • Immunization camps are held regularly 		

Stakeholder Consultation- Bangladesh Meteorological Dept., Station Kutubdia

A	Project Title:	ESIA Study, Kutubdia LNG Project	
B	Stakeholder Title:	Observer, Bangladesh Meteorological Dept. (BMD), Station Kutubdia	
<p><i>Note: This document provides a working summary of the main facts captured during the consultation/ key informant interview held and should not be treated as formal minutes. It is therefore deliberately not exhaustive or chronological. Its purpose is to record significant information/ feedback and not intended for official review or approval.</i></p>			
C	Basic details:		
	Location:	Observatory of BMD at Kutubdia	
	Date	24.08.2016	
D	Attended By		
	Sr.	Name	Designation
	1.	Humayun Kabir	Observer, Bangladesh Meteorological Dept., Station Kutubdia
	2.	Dhritiman Ray	ERM
	3.	Naval K Chaudhary	ERM
	4.	Soumi Ghosh	ERM
5.	Tauhidul Hasan	EQMS	
E	Purpose of Consultation		
	<ul style="list-style-type: none"> - Information sharing - Information collection regarding Meteorological data - Assessing Impact Perception - Involving in Mitigation Planning 		
F	Key Points Discussed:		
	<ul style="list-style-type: none"> • Meteorological parameters such as temperature, humidity, wind speed, wind direction, barometric pressure, cloud cover and rainfall are manually recorded at this weather station at Kutubdia. • This station however does not record specific data on special weather events (such as cyclones, storm surges, tidal flows, etc.) • Recent information collected on select meteorological parameters was discussed and informed to the ERM team. 		

Stakeholder Consultation- Bangladesh Water Development Board, Kutubdia

A	Project Title:	ESIA Study, Kutubdia LNG Project	
B	Stakeholder Title:	Elton Section Officer & Mongsa Thaymarma, Surveyor, Water Development Board, Kutubdia	
<p><i>Note: This document provides a working summary of the main facts captured during the consultation/ key informant interview held and should not be treated as formal minutes. It is therefore deliberately not exhaustive or chronological. Its purpose is to record significant information/ feedback and not intended for official review or approval.</i></p>			
C	Basic details:		
	Location:	Water Development Board Office, Kutubdia Upazila	
	Date	24.08.2016	
D	Attended By		
	Sr.	Name	Designation
	1.	Elton	Section Officer, Water Development Board, Kutubdia
	2.	Mongsa Thaymarma	Surveyor, Water Development Board, Kutubdia
	3.	Dhritiman Ray	ERM
4.	Soumi Ghosh	ERM	
E	Purpose of Consultation		
	<ul style="list-style-type: none"> - Information sharing - Information collection regarding embankment protection - Assessing Impact Perception - Involving in Mitigation Planning 		
F	Key Points Discussed:		
	<ul style="list-style-type: none"> • The Upazila, which is an island is surrounded by 40 km bund (embankment) • The height of the embankment ranges from 6.5 -7 m from the ground level. • The width at the base of the embankment ranges from 45 to 150 m at different locations whereas the width of the top of the embankment is 2.5 m. • The Water Development Board has a plan to upgrade and reconstruct some portions of the embankment that has been damaged due to Ruanu Cyclone (May 2016) 		

Stakeholder Consultation- Coastal Forest Department, Kutubdia

A	<i>Project Title:</i>	ESIA Study, Kutubdia LNG Project
B	<i>Stakeholder Title:</i>	Range Officer, Coastal Forest Department, Kutubdia
<p><i>Note: This document provides a working summary of the main facts captured during the consultation/ key informant interview held and should not be treated as formal minutes. It is therefore deliberately not exhaustive or chronological. Its purpose is to record significant information/ feedback and not intended for official review or approval.</i></p>		
C	<i>Basic details:</i>	
	<i>Location:</i>	Upazila Forest Range Office, Kutubdia Upazila
	<i>Date</i>	24.08.2016 and 16.11.2016
D	<i>Attended By</i>	
	<i>Sr.</i>	<i>Name</i>
		<i>Designation</i>
	Meeting Held on 24.08.2016	
	1.	Asit Kumar Ray
		Range Officer, Coastal Forest Department, Kutubdia
	2.	Dhritiman Ray
		ERM
	3.	Naval K Chaudhary
		ERM
	4.	Soumi Ghosh
		ERM
	5.	Tauhidul Hasan
		EQMS
	Meeting Held on 16.11.2016	
	1.	Asit Kumar Ray
		Range Officer, Coastal Forest Department, Kutubdia
	2.	Abhishek Roy Goswami
		ERM
	3.	Rahul Srivastava
		ERM
E	<i>Purpose of Consultation</i>	
	<ul style="list-style-type: none"> - Information sharing - Information collection regarding forest and wildlife of the island - Assessing Impact Perception - Involving in Mitigation Planning 	
F	<i>Key Points Discussed:</i>	
	<ul style="list-style-type: none"> • Total protected forest area (Gazetted forest land) in Kutubdia Upazila is 867.19 acres • Dakhin Dhurung and Kaiyarbil unions, where the project is located, have no protected / reserve forest lands. • However in both the unions, a total of 30 Ha. were under social forestry, of which 14 Ha. were lost during the recent Ruanu cyclone. • For acquiring any land that is either under Protected or Reserve Forest under Kutubdia Upazila, application has to be filed with the DFO (Coastal), Chittagong Division for permission. • For areas that are under social forestry, applications are to be filed with the DC who will then place it with the Forest Department for valuation of the trees that may be required to be felled for the project. Felling of such trees will necessitate approval from local level DFO, Chittagong Coastal Forest Division and at the central level from Chief Conservator of Forests, Dhaka and may require NOC from the Forest Department. • It was informed by the Range Officer that in the south western part of the island turtles comes for nesting; migratory birds also visit this portion of the island during the winter season. Crocodiles and Kamots (sharks) have also occasionally been sited on the coastal beaches of the island (especially in the northern portion of the Kutubdia Channel). 	

Stakeholder Consultation-Dakshin Dhurung Union

A	Project Title:	ESIA Study, Kutubdia LNG Project	
B	Stakeholder Title:	Union Member of Dakshin Dhurung Union	
<p><i>Note: This document provides a working summary of the main facts captured during the consultation/ key informant interview held and should not be treated as formal minutes. It is therefore deliberately not exhaustive or chronological. Its purpose is to record significant information/ feedback and not intended for official review or approval.</i></p>			
C	Basic details:		
	Location:	Union Office, Dakshin Dhurung, Union	
	Date	16.11.2016	
D	Attended By		
	Sr.	Name	Designation
	1.	All union Member of Dakshin Dhurung Union	
	2.	Soumi Ghosh	ERM
	3.	Souvik Basu	ERM
E	Purpose of Consultation		
	<ul style="list-style-type: none"> - Information sharing - Information collection regarding land and livelihood - Assessing Impact Perception - Involving in Mitigation Planning 		
F	Key Points Discussed:		
	<ul style="list-style-type: none"> • All land along the sea shore is not owned by the Government. • Present sea shore was eroded only before 10 years • Villagers are still using this land for various purpose like vegetable cultivation, drying of fishing nets, maintenance of boats, etc. • Major livelihood activates of the union are fishing, agriculture, and salt cultivation • Health infrastructure is not so good in the union. People are sole dependent on Upazila Health Complex • Villagers are very positive about industrial development in the island as industrial development can create livelihood activity for the local people. • Only concern is industrial pollution will destroy the environment of the island • Industry should not pollute sea and channel water as most of people in the island are dependent on fishing • Electricity is not available in the union and that is one of the major problems in this union. • Salt water ingression due to broken earthen embankment is major problem. • Also expect some help form industry in supporting local infrastructure like road development, health infrastructure development, embankment protection etc. 		

Stakeholder Consultation-Fisherman Community of Dakshin Dhurung Union

A	<i>Project Title:</i>	ESIA Study, Kutubdia LNG Project	
B	<i>Stakeholder Title:</i>	Fisherman Community of Dakshin Dhurung Union	
<p><i>Note: This document provides a working summary of the main facts captured during the consultation/ key informant interview held and should not be treated as formal minutes. It is therefore deliberately not exhaustive or chronological. Its purpose is to record significant information/ feedback and not intended for official review or approval.</i></p>			
C	<i>Basic details:</i>		
	<i>Location:</i>	Union Office, Dakshin Durung, Union	
	<i>Date</i>	17.11.2016	
D	<i>Attended By (Attendance Sheet Attached)</i>		
	<i>Sr.</i>	<i>Name</i>	<i>Designation</i>
	1.	Fishermen of Ali Fakir Deil Fisherman Colony	
	2.	Fisherman from Dakshin Dhurung Jelepara	
	3.	Madanyearpala Fisherman Community	
	4.	Soumi Ghosh	ERM
	5.	Souvik Basu	ERM
E	<i>Purpose of Consultation</i>		
	<ul style="list-style-type: none"> - Collection of information regarding fisherman community, fishing activity, fish catch, fishing gear, fishing boat, marketing of fish, Fish drying activity, aquaculture 		
F	<i>Key Points Discussed:</i>		
	<ul style="list-style-type: none"> • Maximum fishermen (around 4000) are residing in 3 fishermen colonies within Dakshin Dhurung Union; most of them reside in the settlements at Dakshin Dhurung Jelepara, Ali Fakhir Deil, Madniyar Para (around 2200 to 2300 fisherman) • Around 500 fishermen are also residing in Kaiyabil and Bindapara • Majority of the fisherman in this island is residing in Boroghop Union • Kutubdia fisherman federation was from under a UNDP funded program during 2003-2006 through involvement of seven NGOs. • Fishing activity is continuing around the year. It is restricted only between October and November. • There are three type of boats generally used for fishing activity i.e. industrial trawlers, mechanical boats and small mechanical fishing boats • Industrial trawlers and small mechanical boats are used for deep sea fishing activity • 20 to 35 fisher man per boat is usually engaged in deep sea fishing activity while 8 to 10 fisherman per boat is involved in day fishing. • Almost 6 month a year all boat are involved in Hilsa fishing. This is the prime fish catch for all fishermen. • In Kutubdia Channel near Gondapara, located north of the Kutubdia Island is located the main breeding center for hilsa fish in Bangladesh • A deep sea fishing boat generally has a fish catch worth of around 4 to 6 lakh BDT in one trip while in case of a day fishing boat, the fish catch is worth around 0.5 to 1.5 Lakh BDT. • One deep sea fishing trip is continued for 15 days and they move upto 300 km south west inside the sea • Three category of personnel are generally involved in a fishing boat i.e. Sailors, Engine Drivers and Fishermen • All of them are the contractual worker of the boat owner • Annual contract value of sailor, engine driver and fisher man is in the range of 4 to 8 lakh, 1 to 1.5 lakh, 0.9 – 1.2 lakh respectively • Day fishing boat sells their fish catch to the trader in Kutubdia channel near Sekhkhali and Banskhali • Deep sea boat sells their fish catch in Chittagong and Cox Bazar • Type of fishing nets used in this area includes Boro Behundi jal, Choto Behundi jal, Phad jal, Ilish jal, etc. • The most common fish net is Behundi (marine setbag net) • There are seventy fishing ground where fisherman from Kutubdia usually catch 		

fish. These are:

- Aat Bam
- Baro Bam
- Aathero Bam
- Guliddar
- Balaya
- Purba Sonar Char
- Paschim Sonar Char
- Mohipur Chara
- Halud Phari
- Phatara
- Nalya
- Lamarpata
- Mangala
- Adha Mangala
- Golpasan
- Jhautala

Photodocumentation



FGD with Fishermen Community of Dakhin Dhurung Union

ATTENDANCE SHEET
Focus Group Discussion (FGD)

Environmental and Social Impact Assessment (ESIA) Study
 For

FBCU LNG Exported Project at Kutubdia Upalla

Date: 17.03.2017 Time: 08.00 AM Location: District Dharmapuri

No.	Name	Address / Phone Number	Signature
1	Mr. N. S. S. S. S.	6/10, Street No. 10, 0112-12345	[Signature]
2	Mr. N. S. S. S. S.	10, Street No. 10, 0112-12345	[Signature]
3	Mr. N. S. S. S. S.	10, Street No. 10, 0112-12345	[Signature]
4	Mr. N. S. S. S. S.	10, Street No. 10, 0112-12345	[Signature]
5	Mr. N. S. S. S. S.	10, Street No. 10, 0112-12345	[Signature]
6	Mr. N. S. S. S. S.	10, Street No. 10, 0112-12345	[Signature]
7	Mr. N. S. S. S. S.	10, Street No. 10, 0112-12345	[Signature]
8	Mr. N. S. S. S. S.	10, Street No. 10, 0112-12345	[Signature]
9	Mr. N. S. S. S. S.	10, Street No. 10, 0112-12345	[Signature]
10	Mr. N. S. S. S. S.	10, Street No. 10, 0112-12345	[Signature]
11	Mr. N. S. S. S. S.	10, Street No. 10, 0112-12345	[Signature]
12	Mr. N. S. S. S. S.	10, Street No. 10, 0112-12345	[Signature]
13	Mr. N. S. S. S. S.	10, Street No. 10, 0112-12345	[Signature]
14	Mr. N. S. S. S. S.	10, Street No. 10, 0112-12345	[Signature]
15	Mr. N. S. S. S. S.	10, Street No. 10, 0112-12345	[Signature]
16	Mr. N. S. S. S. S.	10, Street No. 10, 0112-12345	[Signature]
17	Mr. N. S. S. S. S.	10, Street No. 10, 0112-12345	[Signature]
18	Mr. N. S. S. S. S.	10, Street No. 10, 0112-12345	[Signature]
19	Mr. N. S. S. S. S.	10, Street No. 10, 0112-12345	[Signature]
20	Mr. N. S. S. S. S.	10, Street No. 10, 0112-12345	[Signature]

Stakeholder Consultation-Fisherman Community of Boroghop Union

A	Project Title:	ESIA Study, Kutubdia LNG Project
B	Stakeholder Title:	Fisherman Community of Boroghop Union
<p>Note: This document provides a working summary of the main facts captured during the consultation/key informant interview held and should not be treated as formal minutes. It is therefore deliberately not exhaustive or chronological. Its purpose is to record significant information/feedback and not intended for official review or approval.</p>		
C	Basic details:	
	Location:	Village Community Centre, Dakshin Amjakhali
	Date	18.11.2016
D	Attended By (Attendance Sheet Attached)	
	Sr.	Name
	1.	Fishermen Community of Boro Kaibartapara
	2.	Fisherman community of Dakhsin Amjakhali
	3.	Fisherman community of Uttar Amjakhali
	4.	Fisherman Community of Nayajelepara
	5.	Fisherman Community of Ajamcolony
	6.	Fisherman Community of Uttar Boroghop
	7.	Sabbir Ahamed
	8.	Soumi Ghosh
	9.	Souvik Basu
E	Purpose of Consultation	
	<ul style="list-style-type: none"> - Collection of information regarding fisherman community, fishing activity, fish catch, fishing gear, fishing boat, marketing of fish, Fish drying activity, aquaculture 	
F	Key Points Discussed:	
	<ul style="list-style-type: none"> - Majority of the fishermen are residing in Boroghop Union. 70% to 80% population is dependent on fishing - There are 6 fishermen colonies in Boroghop Union. These include - Uttar Amjakhali, Dakshin Amjakhali, Boeo Kaibortopara, Naya Jelepara, Ajamcolony, Uttar Boroghop - Number of Fishermen in these colonies: <ul style="list-style-type: none"> ▪ Uttar Amajakhli-150 to 200 Fishermen ▪ Dakshin Amajakhli: 800-1000 Fishermen ▪ Boro Kaibartapara: 400-500 Fishermen ▪ Naya Jelepara: 40-50 Fishermen ▪ Ajam Colony: 300-350 Fishermen ▪ Uttar Boroghop: 400-500 Fishermen - Fishing activity is continuing around the year. It is restricted only between October and November. - There are four types of fishing activity - Daily fishing, Ice Fishing, Deep Sea Fishing and Foot fishing - Daily Fishing: one day fishing activity. Starts early morning and continues upto next day early morning. 7 to 8 person are involved in this type of fishing in one boat. Fishing is usually done 25-50 km from the west coastline. - Daily Fishing with ice: The fishing boats fish for 4-5 days in the sea with 8-12 fishermen onboard. Fishing is usually done 50-75 km from the west coastline. - Deep Sea Fishing: From the onset of monsoon till spring (July/ August to March/ April), for a period of 9-10 months - fishermen go for deep-sea fishing. Trawlers are used for deep-sea fishing and they usually go upto the Indian boarder in the west and southwest for fishing (ranging from 70 	

to 300 km). The fishermen fish for 12 to 15 days in each trip; in a month's time they can complete about two trips

- The deep-sea fishing is based on the lunar calendar and the cycle revolves round the new moon cycle and full moon cycle. Fish catch is usually more during the full moon ('Purnima') and new moon ('Amavashya'). In each fishing trawler about 25 - 35 fishermen goes for fishing in the deep sea.
- Foot Fishing: Use of any type of motorized and non-motorized boat is not required for this type of fishing. Foot fishing can be done standing on the coast line or at the bank of a water body or at less depth water near the coast line. Fishermen of Kutubdia use push nets and shrimp nets to catch shrimps and shrimp fry during their lean fishing periods.
- Type of fishing net used in this area include Boro Behundi jal, Choto Behundi jal, Phad jal and Ilish jal
- The most common fish net is Behundi (marine setbag net)
- Fish drying unit are locally called as Sutkimahal. These units are mainly located western side of the embankment.
- Fish drying process start in October and November and ends at March and April
- Aquaculture practices are mainly concentrated in Uttar Dhurung Union

Other information regarding general fishing practices and on fisher men communities are similar to what has been mentioned in the minutes for the Stakeholder consultation conducted with the fishermen community in Dakshin Dhurung Union and hence has not been repeated.

Photodocumentation



FGD with Fishermen Community of Boroghon Union

ATTENDANCE SHEET
Focus Group Discussion (FGD)

Environmental and Social Impact Assessment (ESIA) Study
for

ESRI & LNG Terminal Project at Daishaha Upazila

Uttar Am Shiksha
Kulap, Panchagarh District
Date: 17/11/2017, Time: 11:00 AM
Facilitator: Benadip Datta

Sl. No.	Name	Address/Location	Signature
01	অবৈষ্ণবী দেবী	পূর্ব (কমল) পাড়া	অবৈষ্ণবী দেবী
02	সায়মা	"	সায়মা
03	সুজাতা খান্না	উত্তর পাড়াখান্না	সুজাতা
04	সুজাতা খান্না	"	সুজাতা
05	সুজাতা খান্না	দক্ষিণ পাড়াখান্না	সুজাতা খান্না
06	সুজাতা খান্না	"	সুজাতা খান্না
07	সুজাতা খান্না	"	সুজাতা খান্না
08	সুজাতা খান্না	উত্তর পাড়া	সুজাতা
09	সুজাতা খান্না	দক্ষিণ পাড়াখান্না	সুজাতা খান্না
10	সুজাতা খান্না	"	সুজাতা খান্না
11	সুজাতা খান্না	উত্তর পাড়াখান্না	সুজাতা খান্না
12	সুজাতা খান্না	দক্ষিণ পাড়াখান্না	সুজাতা খান্না
13	সুজাতা খান্না	উত্তর পাড়াখান্না	সুজাতা খান্না
14	সুজাতা খান্না	"	সুজাতা খান্না
15	সুজাতা খান্না	দক্ষিণ পাড়াখান্না	সুজাতা খান্না
16	সুজাতা খান্না	উত্তর পাড়া	সুজাতা

Uttarakhand
Village Resource Centre

12/11/2016

Bareilly

क्र.	विषय नाम	सर्व विवरण	संकेत
01	बनारस बाग	"	बनारस बाग
02	बनारस बाग	"	बनारस बाग
03	बनारस बाग	"	बनारस बाग
04	बनारस बाग	"	बनारस बाग
05	बनारस बाग	"	बनारस बाग
06	बनारस बाग	"	बनारस बाग
07	बनारस बाग	"	बनारस बाग
08	बनारस बाग	"	बनारस बाग
09	बनारस बाग	"	बनारस बाग
10	बनारस बाग	"	बनारस बाग
11	बनारस बाग	"	बनारस बाग
12	बनारस बाग	"	बनारस बाग
13	बनारस बाग	"	बनारस बाग
14	बनारस बाग	"	बनारस बाग
15	बनारस बाग	"	बनारस बाग
16	बनारस बाग	"	बनारस बाग
17	बनारस बाग	"	बनारस बाग
18	बनारस बाग	"	बनारस बाग
19	बनारस बाग	"	बनारस बाग
20	बनारस बाग	"	बनारस बाग
21	बनारस बाग	"	बनारस बाग
22	बनारस बाग	"	बनारस बाग
23	बनारस बाग	"	बनारस बाग
24	बनारस बाग	"	बनारस बाग
25	बनारस बाग	"	बनारस बाग
26	बनारस बाग	"	बनारस बाग
27	बनारस बाग	"	बनारस बाग
28	बनारस बाग	"	बनारस बाग
29	बनारस बाग	"	बनारस बाग
30	बनारस बाग	"	बनारस बाग

Uthala Anzakhali Village Resource Center 17/0/2012 Gaurang Union

১০	নাগরিক সীমানা কাঠের চত্বর কাঠকাটা	শ্রীমতী
১১	কম্পিউটার ল্যাব সিআইডি	শ্রীমতী
১২	কম্পিউটার সিস্টেম সিআইডি	শ্রীমতী
১৩	কম্পিউটার সিস্টেম সিআইডি	শ্রীমতী
১৪	কম্পিউটার সিস্টেম সিআইডি	শ্রীমতী
১৫	কম্পিউটার সিস্টেম সিআইডি	শ্রীমতী

Stakeholder Consultation-Fisherman Community of Ali Akbar Deil Union

A	Project Title:	ESIA Study, Kutubdia LNG Project	
B	Stakeholder Title:	Fisherman Community of Ali Akabar Deil Union	
<p><i>Note: This document provides a working summary of the main facts captured during the consultation/ key informant interview held and should not be treated as formal minutes. It is therefore deliberately not exhaustive or chronological. Its purpose is to record significant information/ feedback and not intended for official review or approval.</i></p>			
C	Basic details:		
	Location:	Union Office, Ali Akbar Deli Union	
	Date	18.11.2016	
D	Attended By(Attendance Sheet Attached)		
	Sr.	Name	Designation
	1.	Fishermen Community of Waider Baperpara	
	2.	Fisherman community of Ali Akdar Deil Jele Para	
	3.	Sabbir Ahamed	Reliance Bangladesh
	4.	Soumi Ghosh	ERM
E	Purpose of Consultation		
	<ul style="list-style-type: none"> - Collection of information regarding fisherman community, fishing activity, fish catch, fishing gear, fishing boat, marketing of fish, Fish drying activity, aquaculture 		
F	Key Points Discussed:		
	<ul style="list-style-type: none"> • Fishing is main livelihood activity of the minority community mainly Hindus • The Muslim population has started adopting fishing as a means of livelihood only recently in the last 15-20 years • Ali Akabar Deil Jele Para is mainly a Hindu fishermen colony • All the fisherman of this union are concentrated in Ali Akbar Deil Jelepara and Waider Baper para • Fishing activity is continuing around the year. It is restricted only between October and November. • Aquaculture is not practices in Ali Akbar Deil. It's practice is mainly concentrated in Uttar Dhurung Union • Major problem of the fisherman in this union is boat anchoring during cyclone. Fishermen anchor their boat inside the Kutubdia Channel during cyclones. Travel cost increases because of this. They need a safe anchor point in their Union. <p><i>Other information regarding general fishing practices and on fisher men communities are similar to what has been mentioned in the minutes for the Stakeholder consultation conducted with the fishermen community in Dakshin Dhurung Union and hence has not been repeated.</i></p>		

Photodocumentation



FGD with Fishermen Community of Ali Akabar Deil Union

ATTENDANCE SHEET
Public Group Discussion (PGD)

Environmental and Social Impact Assessment (ESIA) Study
For

LNG & LNG Terminal Project at Kutubdia Upazila

At: *Ab. Albar Dali*
Date: *17.01.2017* (Time) *Ab. Albar Dali*

Sl. No	Name	Address/Location	Signature
1	<i>শ্রী মতিনুর রহমান</i>	<i>সদর দফতর, সরকারি স্কুল, কাটুড়িয়া</i>	<i>শ্রী মতিনুর রহমান</i>
	<i>মহাম্মদ হোসেন</i>	<i>ফার্মা</i>	<i>মহাম্মদ হোসেন</i>
	<i>শ্রী রফিকুল ক্বারী</i>	<i>৩৫১৫০৩৪১৩৩ -</i>	<i>শ্রী রফিকুল ক্বারী</i>
	<i>মাসুম হোসেন</i>	<i>৫</i>	<i>মাসুম হোসেন</i>
	<i>শ্রী সুলতানুল ক্বারী</i>	<i>৬</i>	<i>শ্রী সুলতানুল ক্বারী</i>
	<i>(মহাম্মদ হোসেন)</i>		<i>মহাম্মদ হোসেন</i>
	<i>অবল কাউন্সিল</i>		<i>অবল কাউন্সিল</i>
	<i>বাংলাদেশ</i>		<i>বাংলাদেশ</i>
	<i>শ্রী সুলতানুল ক্বারী</i>		<i>শ্রী সুলতানুল ক্বারী</i>
	<i>শ্রী সুলতানুল ক্বারী</i>		<i>শ্রী সুলতানুল ক্বারী</i>
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	<i>শ্রী সুলতানুল ক্বারী</i>		<i>শ্রী সুলতানুল ক্বারী</i>
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	<i>শ্রী সুলতানুল ক্বারী</i>		<i>শ্রী সুলতানুল ক্বারী</i>

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Stakeholder Consultation-Fisherman Community of Uttar Dhurung Union

A	Project Title:	ESIA Study, Kutubdia LNG Project	
B	Stakeholder Title:	Fisherman Community of Uttar Dhurung Union	
<p><i>Note: This document provides a working summary of the main facts captured during the consultation/ key informant interview held and should not be treated as formal minutes. It is therefore deliberately not exhaustive or chronological. Its purpose is to record significant information/ feedback and not intended for official review or approval.</i></p>			
C	Basic details:		
	Location:	Union Office, Uttar Dhurung Union	
	Date	19.11.2016	
D	Attended By (Attendance Sheet Attached)		
	Sr.	Name	Designation
	1.	Fishermen Community of Akbar Bolipara	
	2.	Fisherman community of Char Dhurung Jelepara	
	3.	Fisherman Community of Chullarpara	
	4.	Soumi Ghosh	ERM
5.	Souvik Basu	ERM	
E	Purpose of Consultation		
	<ul style="list-style-type: none"> - Collection of information regarding fisherman community, fishing activity, fish catch, fishing gear, fishing boat, marketing of fish, Fish drying activity, aquaculture 		
F	Key Points Discussed:		
	<ul style="list-style-type: none"> • Fishing and salt cultivation are two major livelihood activities of this union • Most of agricultural land have converted to saltpans due to inundation with saline waters • Salt water ingress ion is the main problem of this union due to the broken earthen embankment • Fish drying units are locally called as Sutkimahal. These units are mainly located western side of the embankment. • Fish drying process start in October and November and ends at March and April • There are two type of fish drying process -Horizontal Drying and Vertical Drying • The processors having their own drying houses (Sutki Mahal) and earn 100,000 Tk to 200,000 Tk per season while the laborers involved earn around 3000 Tk. per month • About, 5-6 laborers work in each Sutki Mahal. • Local processors sell their dried fish to mobile assembler, who is known as Mahajan. • There are some aquaculture farms present in this union. • The farms mainly cultivate shrimps • Consultation revealed that 7 to 8 families usually form a group and take on lease around 20 to 22 gonda of low lying land near the extended sea shore for Tk 10,000 per season for 7 to 8 months and fill that land with saline water channelized from sea. • They also invest 20,000 to 25,000 Tk for purchasing 80,000-100,000 shrimplets (seeds), among which 20,000 to 25,000 shrimplets die. • Remaining seeds grow to the size of 100-120 gram in 3 to 4 month time. <p><i>Other information regarding general fishing practices and on fisher men communities are similar to what has been mentioned in the minutes for the Stakeholder consultation conducted with the fishermen community in Dakshin Dhurung Union and hence has not been repeated.</i></p>		

Photodocumentation



FGD with Fishermen Community in Uttar Dhurung Union

ATTENDANCE SHEET
Focus Group Discussion (FGD)

Environmental and Social Impact Assessment (ESIA) Study
for

ERL & LNG Terminal Project at Kutubdia Upazila

ধর্মপাড়া উপজেলা পরিষদ অফিসে ১৯/০৩/১৭ তারিখে পরিচালিত ফোকাস গ্রুপ আলোচনায় উপস্থিত সদস্যদের তালিকা

Sl. No.	Name	Address and Phone Number	Signature
০১	মুহাম্মদ হোসেন	১/১০/১০/১০, মৌলভীবাজার ১৩১-৬২০০৮-১০০	
০২	মুহাম্মদ হোসেন	১/১০/১০/১০, মৌলভীবাজার ১৩১-৬২০০৮-১০০	
০৩	মুহাম্মদ হোসেন	১/১০/১০/১০, মৌলভীবাজার ১৩১-৬২০০৮-১০০	
০৪	মুহাম্মদ হোসেন	১/১০/১০/১০, মৌলভীবাজার ১৩১-৬২০০৮-১০০	
০৫	মুহাম্মদ হোসেন	১/১০/১০/১০, মৌলভীবাজার ১৩১-৬২০০৮-১০০	
০৬	মুহাম্মদ হোসেন	১/১০/১০/১০, মৌলভীবাজার ১৩১-৬২০০৮-১০০	
০৭	মুহাম্মদ হোসেন	১/১০/১০/১০, মৌলভীবাজার ১৩১-৬২০০৮-১০০	
০৮	মুহাম্মদ হোসেন	১/১০/১০/১০, মৌলভীবাজার ১৩১-৬২০০৮-১০০	
০৯	মুহাম্মদ হোসেন	১/১০/১০/১০, মৌলভীবাজার ১৩১-৬২০০৮-১০০	
১০	মুহাম্মদ হোসেন	১/১০/১০/১০, মৌলভীবাজার ১৩১-৬২০০৮-১০০	
১১	মুহাম্মদ হোসেন	১/১০/১০/১০, মৌলভীবাজার ১৩১-৬২০০৮-১০০	
১২	মুহাম্মদ হোসেন	১/১০/১০/১০, মৌলভীবাজার ১৩১-৬২০০৮-১০০	
১৩	মুহাম্মদ হোসেন	১/১০/১০/১০, মৌলভীবাজার ১৩১-৬২০০৮-১০০	
১৪	মুহাম্মদ হোসেন	১/১০/১০/১০, মৌলভীবাজার ১৩১-৬২০০৮-১০০	
১৫	মুহাম্মদ হোসেন	১/১০/১০/১০, মৌলভীবাজার ১৩১-৬২০০৮-১০০	

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V/A/R Datasheet

No.	Activity Name	Activity Description	Activity Location
01	Construction of Access Road	Construction of access road from the main road to the site.	Access Road
02	Construction of Compound Wall	Construction of compound wall around the site.	Compound Wall
03	Construction of Office Building	Construction of office building for site operations.	Office Building
04	Construction of Warehouse	Construction of warehouse for storage of materials.	Warehouse
05	Construction of Water Treatment Plant	Construction of water treatment plant for site water supply.	Water Treatment Plant
06	Construction of Sewerage Treatment Plant	Construction of sewerage treatment plant for site wastewater.	Sewerage Treatment Plant
07	Construction of Stormwater Drainage System	Construction of stormwater drainage system for site runoff.	Stormwater Drainage System
08	Construction of Road Network	Construction of road network for site access and transport.	Road Network
09	Construction of Power Distribution System	Construction of power distribution system for site electricity supply.	Power Distribution System
10	Construction of Telecommunication System	Construction of telecommunication system for site communication.	Telecommunication System
11	Construction of Fire Fighting System	Construction of fire fighting system for site fire safety.	Fire Fighting System
12	Construction of Security System	Construction of security system for site safety and protection.	Security System
13	Construction of Environmental Monitoring System	Construction of environmental monitoring system for site environmental management.	Environmental Monitoring System
14	Construction of Social Infrastructure	Construction of social infrastructure for site community development.	Social Infrastructure
15	Construction of Health and Safety System	Construction of health and safety system for site worker protection.	Health and Safety System
16	Construction of Quality Management System	Construction of quality management system for site project quality control.	Quality Management System
17	Construction of Risk Management System	Construction of risk management system for site project risk mitigation.	Risk Management System
18	Construction of Stakeholder Engagement System	Construction of stakeholder engagement system for site project communication.	Stakeholder Engagement System
19	Construction of Project Management System	Construction of project management system for site project coordination.	Project Management System
20	Construction of Financial Management System	Construction of financial management system for site project budgeting.	Financial Management System
21	Construction of Human Resource Management System	Construction of human resource management system for site project staffing.	Human Resource Management System
22	Construction of Information Management System	Construction of information management system for site project data management.	Information Management System
23	Construction of Legal and Compliance System	Construction of legal and compliance system for site project regulatory adherence.	Legal and Compliance System
24	Construction of Environmental Impact Assessment System	Construction of environmental impact assessment system for site project environmental impact evaluation.	Environmental Impact Assessment System
25	Construction of Social Impact Assessment System	Construction of social impact assessment system for site project social impact evaluation.	Social Impact Assessment System
26	Construction of Health and Safety Assessment System	Construction of health and safety assessment system for site project health and safety evaluation.	Health and Safety Assessment System
27	Construction of Quality Assessment System	Construction of quality assessment system for site project quality evaluation.	Quality Assessment System
28	Construction of Risk Assessment System	Construction of risk assessment system for site project risk evaluation.	Risk Assessment System
29	Construction of Stakeholder Assessment System	Construction of stakeholder assessment system for site project stakeholder evaluation.	Stakeholder Assessment System
30	Construction of Project Assessment System	Construction of project assessment system for site project overall evaluation.	Project Assessment System

Stakeholder Consultation-Key Informant Interview of Fisherman Community

A	<i>Project Title:</i>	ESIA Study, Kutubdia LNG Project	
B	<i>Stakeholder Title:</i>	Key Informant Interview of fisherman community	
<p><i>Note: This document provides a working summary of the main facts captured during the consultation/ key informant interview held and should not be treated as formal minutes. It is therefore deliberately not exhaustive or chronological. Its purpose is to record significant information/ feedback and not intended for official review or approval.</i></p>			
C	<i>Basic details:</i>		
	<i>Location:</i>	Union Office, Uttar Dhurung Union	
	<i>Date</i>	19.11.2016	
D	<i>Attended By</i>		
	<i>Sr.</i>	<i>Name</i>	<i>Designation</i>
	1.	Nasima Akhtar	Secretary, Kutubdia Fisherman Federation
	2.	Soumi Ghosh	ERM
	3.	Souvik Basu	ERM
E	<i>Purpose of Consultation</i>		
	<ul style="list-style-type: none"> - Collection of information regarding fisherman community, fishing activity, fish catch, fishing gear, fishing boat, marketing of fish, Fish drying activity, aquaculture 		
F	<i>Key Points Discussed:</i>		
	<ul style="list-style-type: none"> • Kutubdia Fisherman Federation was started in the year 2003 • It was a UNDP Funded Project • Seven NGOs were involved in this Project. They formed a consortium. • 32 Society was formed under this federation. Total around 6000 fisher men were involved with these 32 societies • Main agenda of this federation is improvement of Socio Economic condition of fishermen • All societies had their own Bank account • Fishermen deposited money in these accounts for future use • They could also take money on credit for their own purposes • This federation also trained the family member of the fisherman family on various other livelihood opportunities • This activities of the federation continued till 2006 but thereafter it was discontinued 		

Stakeholder Consultation-Local Community

A	Project Title:	ESIA Study, Kutubdia LNG Project	
B	Stakeholder Title:	Local community of Dakshin Dhurung	
<p>Note: This document provides a working summary of the main facts captured during the consultation/ key informant interview held and should not be treated as formal minutes. It is therefore deliberately not exhaustive or chronological. Its purpose is to record significant information/ feedback and not intended for official review or approval.</p>			
C	Basic details:		
	Location:	Ali Fakir Deil, Dakshin Dhurung Union	
	Date	19.11.2016	
D	Attended By		
	Sr.	Name	Designation
	1.	Local Community of Ali Fakir Deil Village	
	2.	Soumi Ghosh	ERM
	3.	Souvik Basu	ERM
E	Purpose of Consultation		
	<ul style="list-style-type: none"> - Information Collection - Assessing Impact Perception - Involving in Mitigation Planning 		
F	Key Points Discussed:		
	<ul style="list-style-type: none"> • The study area comprises primarily of single cropped agricultural land as irrigation facility is not available. • Only individual level pond irrigation is present for a few land parcels • As per local community, original embankment was about 100-200 m towards west of the present bund. The land which holds the present embankment was under cultivation and also under private ownership. This land parcel was eroded nearly 10 year back. Location of the present bund was used as an airstrip during the British period. • Presently villagers use the reclaimed lands (existing beach portions) for various purposes like boat maintenance, drying of fishing nets, repairing of fishing nets, cultivation of water melon and vegetable etc. • There is an anchorage point about 100 m north of the existing lighthouse. This point is in use by the fishermen of the village. About 100-150 boats are anchored here. • Most of the boats are motorized and go out for fishing for 3-4 days at a stretch in sea. • There is a ship navigation channel upto the Chittagong port which is about 6-7 km from the shore. • During low tide the fishing boats goes west of the navigation channel and during high tide it goes east of the navigation channel. • During cyclonic weather the fishermen keep their boats in the Kutubdia Channel. • The original embankment was about 100-200 m towards west of the present bund. The present embankment area was under cultivation and under private ownership • There are around 8-10 huts just along the bund towards the southern side of the potential site. They are part of the Kaiyarbil Union. • Cultural sites: <ul style="list-style-type: none"> - There was a mazhar that has been washed off. - On the beach side just north of the present lighthouse there was a graveyard which has been washed off and is presently demarcated by four wooden posts. It is not in use. - Cultural Heritage properties within Island include (i) Ek Hatia Fakir Mosque, established in 1904, (ii) Tomb of Kutub Aulia (iii), Kalarma Mosque - The Ek Hatia Fakir Mosque is located close to the Project site • Consultations revealed that only a few households were engaged in agricultural activities and majority are engaged in fishing activity • Lands are mostly used for growing crops for self-consumption. • Due to frequent cyclonic events and sea water surge, more and more agricultural lands are becoming infertile and getting converted for salt cultivation. 		

- People are very positive about the industrial development as it will create some livelihood opportunity for local people however they also very apprehensive about the pollution which might result from the industrial activity.
- Water supply is not present in the village. Villagers totally are dependent on tube well for their requirements for drinking and other household activity.
- Electricity is not present in the Dakhin Dhurung and Kaiyarbil union. People expect some help for the project proponent on this aspect.
- Union level health facility is present in Dakhin Dhurung and Kaiyarbil union but it is not enough to cater to the health related need of the local people. People are totally dependent on Upazila Health Complex for their health issues.
- In Kutubdia Upazila, salt harvesting is one of the primary livelihood options of the island population.
- Salt cultivation is done for almost 6 months in a year between November and May.
- It is mainly done at the central part of the island on both sides of the Filate Kata Khal.
- There are 4600 salt cultivators in the whole Upazila
- There are no local markets in Kutubdia for selling salt and it proves costlier for the cultivators to take the salt and sell it in Chittagong markets. In most cases the salt cultivators take loan from the middlemen for leasing out land and hence there is an arrangement between them that the salt will be sold only to them.
- Most of agricultural land is mono cropped or bicropped.
- Paddy is the main agricultural produce of the area. In addition vegetables are also grown
- Community are not interested in agriculture due to less profit. So that most of agricultural land is converted in to salt pan for earning more profit.

Stakeholder Consultation-NGOs

A	<i>Project Title:</i>	ESIA Study, Kutubdia LNG Project	
B	<i>Stakeholder Title:</i>	Marinelife Alliance – an NGO	
<p><i>Note: This document provides a working summary of the main facts captured during the consultation/ key informant interview held and should not be treated as formal minutes. It is therefore deliberately not exhaustive or chronological. Its purpose is to record significant information/ feedback and not intended for official review or approval.</i></p>			
C	<i>Basic details:</i>		
	<i>Location:</i>	Cox’s Bazar	
	<i>Date</i>	23.08.2016	
D	<i>Attended By</i>		
	<i>Sr.</i>	<i>Name</i>	<i>Designation</i>
	1.	M Zahirul Islam	Principal Investigator, Marinelife Alliance
	2.	Dhritiman Ray	ERM
	3.	Naval K Chaudhary	ERM
	4.	Soumi Ghosh	ERM
5.	Tauhidul Hasan	EQMS	
E	<i>Purpose of Consultation</i>		
	<ul style="list-style-type: none"> - Information Collection - Assessing Impact Perception - Involving in Mitigation Planning 		
F	<i>Key Points Discussed:</i>		
	<ul style="list-style-type: none"> • Marinelife Alliance (an NGO), is working on a project on ‘Conservation of Sea Turtle in Bangladesh Coastal and Marine Territory’ together with the Forest Department and the World Bank. • They have been working on this project for the last 6 years on the Bangladesh coastline between St. Martin to Kuakatta. • Turtles have been found to visits various sandy beaches along this coastline for nesting and foraging. The species that have been recorded from this region include Olive Ridley Turtle, Green Turtle and Hawksbill Turtle. • Marinelife Alliance has set up sea turtle conservation stations in different islands to protect the turtle eggs from poaching and stray animals and help with the hatching process. • The Sonadia Island is the most sensitive location and more than 50% of the total turtles that visit this region are found nesting in Sonadia. • In Kutubdia, the turtle sites are located along the sandy beaches on the extreme south tip of the island in Ali Akbar Deil Union. The turtles have not been found to visit the northern beaches or other parts of the island, where human interference is more. • Over the years the number of turtles visiting Kutubdia for nesting has gradually reduced. • Marinelife Alliance has set up Turtle Conservation Center in Syed Para, Madher Para within the Kutubdia Island. • The nesting season is usually between October and March with hatching usually occurring during May. • In addition to turtles winter birds are also found to visit the southern tip of the Kutubdia Island. 		

Annex 9

Corporate Social Responsibility (CSR) Plan

Corporate Social Responsibility

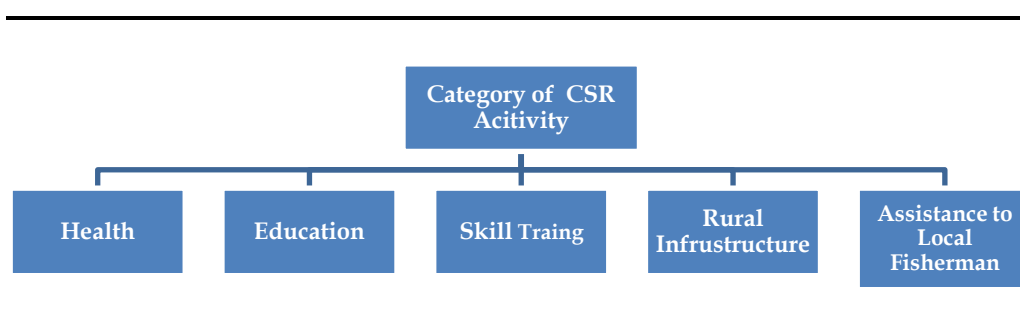
Corporate Social Responsibility (CSR) is important for maximising the project benefits for its key stakeholders and local community. This contributes to establish good relationship with them, obtain and maintain social license to operate.

In this regard, the subsequent sections discuss the community need based CSR plan on the outcomes of the community consultation and the socio-economic overview of the region.

Potential Areas of CSR Intervention

The activities that have been proposed on the basis of professional judgement and feedback received during community consultations are categorized into four major categories:

Figure 10.1 *Categories of Community Need*



Health

The healthcare facilities in the vicinity include 1 primary health centres in the Ali Fakir Deil and availability of one doctor but not on regular basis and there is no in house treatment facility available in this health centre. This primarily caters to the preliminary treatment, immunisation program, mother and child care and family planning issues. Community consultations indicated that the villagers visited Upazila Health Complex at Boroghop which is about 6 kilometres from the place.

To improve the health care facilities the following activities can be undertaken:

1. **Conducting periodic health clinics:** RBLTL can provide doctor's facilitation service to the community people by conducting bi-monthly health clinics in the two villages-Ali Fakir deil and Bindapara with the help of their in house Medical Officer;
2. **Providing ambulance service:** RBLTL can aid access to quick medical care by improving the provision of ambulance to the local villages. The RBLTL unit can make available the telephone numbers of the ambulance service available with the Plant to the community to reduce their communication problems;

3. **Health Care through convergence:** RBLTL in collaboration with the local health care facility centres, especially at the Upazila level, can come up with provisions by adding beds for the patients in the rural hospital. These beds can be kept reserved for the villagers of Ali Fakir Deil and Bindapara. BSL can also conduct eye camps, immunisation camps (e.g. Hepatitis B, C and other communicable diseases) and blood donation camps. ;
4. **Undertaking health awareness camps:** RBLTL can undertake health awareness camps specifically with a focus on improving the maternal and child health, family planning with the general community and on health and hygiene, hand washing with school children.
5. **Conducting school health check-up and eye check-up camps:** RBLTL also can conduct school health check-up and eye check-up camps for the students of primary schools and secondary school located within the vicinity, twice in a year

Education

The literacy profile of the study areas indicate that - average literacy rate of Dakshin Dhurung and Kaiyabil union observed as 30.4% and 21.6% which is lower than the district literacy rate. Community consultations indicated that literacy level among the older generations are comparatively low than the younger generations.

The study area possesses necessary educational infrastructure to cater to the educational needs of the rural population. All study area villages reported to have at least a primary school within their boundaries, and a secondary and senior secondary school is located in union level and Upazila level. Focus Group Discussions (FGDs) with the community members indicated that although sufficient educational infrastructure is available in the region there are many incidents of school dropouts especially at upper-primary level and at the secondary level due to various reasons; one of the main reason being that the students and their families are not able to bear the cost of the education related to purchasing of text books and other study materials. Other reason is involvement of child labour in fishing activity.

Community consultation reveals that following activities related to education can be helpful for the community:

1. **Improving infrastructure facilities at the government schools:** RBLTL can work towards improving the educational infrastructure as well as civic infrastructure in the local government higher secondary school and primary schools in consultation with the school authority (based on RBLTL's preference). This may include improving the sports facilities, classrooms, establishment of computer labs/science labs etc.
2. **Providing financial assistance to the children of low-income and vulnerable families:** The low-income families in the area are those families that fall below the national poverty line that may impact their ability to pay for their child's education. The vulnerable families (women headed families, families with differentially able person) may also be subjected to similar situations related

to child's education. To promote literacy among the low-income groups and children belonging to vulnerable families, RBLTL can implement a scholarship programme that provides assistance in payment of school fees and provides books/stationary to these children (it is recommended that such a monetary aid be paid in kind or through direct transfers);

3. **Library facility within the community:** RBLTL can consider for providing resources for setting up a library in the one of the two villages under area of influence if the community provides a suitable place. Specific course-related resources for the students can be provided in the library ranging from school level to graduation level, such as copies of textbooks and article readings held on 'reserve' (meaning that they are loaned out only on a short-term basis, usually a matter of hours).

Skill Training

Employment profile of the study area indicates that most of the community people are engaged in both fishing or allied activities.

Consultations also indicated that the community members (specifically youth) are interested in obtaining paid employment in the proposed project. In this context following activity can be undertaken:

1. **Identification of skill gaps and need assessment:** RBLTL can undertake a skill gap and need assessment study in the project vicinity to identify the key skills that are available within the community and those that are useful to the company's operations. In case of gaps, and need of special trainings as expressed by the youths, RBLTL can initiate focused skill based trainings for the interested community youths selected in consultation with the concerned union and provide them with the opportunity of working for the company;
2. **Manpower planning:** RBLTL to start manpower planning and assess the availability of skilled local youth in the area of influence who can either be directly recruited or be trained for future requirement during the operations phase. RBLTL can consider providing skill training to Graduate and Post Graduate youths as future manpower during the operational phase.
3. **Providing skill based trainings as the support services:** RBLTL can also undertake skill based trainings for enhancing skills of the interested community members (specifically youth) that are required in maintaining ancillary services. This may include vehicle maintenance/ repair work etc. RBLTL can collaborate with Bangladesh Industrial and Technical Assistance Center (BITAC) located at Chittagong in this regard.

Rural Community Infrastructure

Stakeholder consultation with the community people and Union representatives revealed that brick soling road from Ali Fakir Deil light house to Dakshin Dhurung Union office is a major problem in the area of influence and mitigation of this problem needs priority. Community consultation reveals that, metal road with some solar power street light are two infrastructural needs of the local people.

RBLTL can take the initiative together with Dakshin Dhurung union in solving this problem.

Assistance to Local Fisher Man

Ali Fakir Deil has traditional fishing communities whereas some of fishermen are also lived in Bindapara village. Fishing is the key income generating activity of these villages.

Community consultation reveals that fishing activity required high investment both in terms of boat and fishing net. Investment on fishing nets itself ranges from 8000 to 25000 BDT. Those who use motor boats need more quantities of net which is a huge burden on the fishermen. In this context RBLTL can help to fisherman by providing fishing net to the poor fisherman in Ali Fakir Deil and Binda Para.

Schedule for Implementation of CSR Activities

The aforementioned activities can be undertaken on both long term and short term basis. An indicative timeline for the activities is suggested in **Table 1**. The key considerations for preparation of the schedule were:

- Immediate need for the activities;
- Nature of benefits of the activities; and
- Cost implications

It must be noted that certain activities will be an ongoing affair as they will have significant community benefits and relatively limited cost implications. These activities include provision of educational material support for students to help them continue their studies, conducting periodic health clinics, provision of ambulance facilities, undertaking periodic health camps, and undertaking health awareness camps.

Activities that bear higher cost implications, specifically infrastructure related activities, will need to be carried out in a phased manner. **Table 1** provides an indicative period when these can be undertaken (however it must be noted that not all the activities need to be undertaken in the same period).

Table 1 *Indicative Schedule for Implementation of CSR Activities*

Sl. No.	Community Investment/CSR Activity	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10	Year 11	Year 12	Year 13	Year 14	Year 15
1	Health															
1.1	Conducting health clinics in project area at regular intervals															
1.2	Providing ambulance service															
1.3	Health Care through convergence															
1.4	Undertaking health awareness camps															
1.5	Conducting school health check-up and eye check-up camps for the students															
2	Education															
2.1	Improving infrastructure facilities at the government schools															
2.2	Providing financial assistance to the children of low-income and vulnerable families															
2.3	Library facility within the community															
3	Skill Training															
3.1	Identification of skill gaps and need assessment															
3.2	Manpower planning															
3.3	Providing skill based trainings as the support services															
4	Rural Community Infrastructure															
5.	Assistance to Local Fisher Man															

Yearly Budgetary Allocation of CSR activities

RBLTL can spend 2% of the net profits of the company made during the immediately preceding financial years on its CSR activities. CSR Budget shall be allocated for each financial year with the approval of the Board of Director. Every endeavour should be made to spend the entire annual CSR budget in that year itself. However, the unspent CSR amount, if any, would be carry forward to the next year. Details of CSR activity Budget presented in *Table 2*

Table 2 *CSR Activity Budget*

Sl.no	Unit	Target	Amount in Lacs BDT
1.	Health		
1.1	Conducting health clinics in project area at regular intervals	24 Health Camp	24.00
1.2	Providing ambulance service		1.00
1.3	Health Care through convergence	10 Beds	10.00
1.4	Undertaking health awareness camps	10 Awareness Camp	5.00
1.5	Conducting school health check-up and eye check-up camps for the students	4 Health Camp at Two School	2.00
2	Education		
2.1	Improving infrastructure facilities at the government schools	2 School/Year	2.00
2.2	Providing financial assistance to the children of low-income and vulnerable families	10 Student/Year	5.00
2.3	Library facility within the community	2	2.00
3	Skill Training		
3.1	Identification of skill gaps and need assessment		5.00
3.2	Manpower planning	-	-
3.3	Providing skill based trainings as the support services		5.00
4	Rural Community Infrastructure		
4.1	Road Development from Light house to Dakshin Dhurung Union		30.00
4.2	Street lighting		10.00
5.	Assistance to Local Fisher Man	10 Nets/ Year	2.00

Annex 10

Standard Operating Procedures (SOPs)

1 STANDARD OPERATING PROCEDURE FOR OCCUPATIONAL HEALTH AND SAFETY

1.1 PURPOSE

Occupational health and safety (OSH) issues are an important part of quality management, risk management. At present there are no laws governing the occupational health and safety practices in industry in Bangladesh but as a good practice the Environmental, Health and Safety guidelines for Liquefied Natural Gas (LNG) facility provided by the IFC have been considered for developing the Standard Operating Practices (SOP). However The Factories Act, 1965 and the Factories Rules 1979 would also apply as per requirement. The Standard Operational Practice would help in integrating occupational Health and Safety element in all managerial development processes, i.e. corporate strategy, human resources and organisational development and also help to develop better, healthier and more competitive workplaces within the LNG facility.

1.2 SCOPE

The Standard Operating Practice is a guide to prevention of occupational risk and integrates good practice for workers working in FSU and LNG facility, focusing on the most significant risks in this sector. The SOP targets to ensure that the international best practices in the Occupational Health Safety (OHS) are integrated into the RBLTL Operations.

IFC EHS guideline for LNG facility had indicated that the five primary causes of the injury among worker working in FSU and LNG facility include: Fire and explosion, Roll-over, Contact with cold surfaces, Chemical hazards, and Confined spaces. Other than that there are six common cause of injury among the worker working in any industrial facility include: Slips trips and falls, work place stress, work place violence, handling of hazards chemical, electrical shocks and bad ergonomics practices.

1.3 PROCEDURE

The procedures below define the standard procedures which should be followed to prevent the common causes of injury to the healthcare givers.

1.3.1 Procedure for Preventing Fire and Explosions

Fire and explosion hazards at LNG facilities may result from the presence of combustible gases and liquids, oxygen, and ignition sources during loading and unloading activities, and / or leaks and spills of flammable products. Possible ignition sources include sparks associated with the buildup of static electricity, lightning, and open flames. The accidental release of LNG may generate the formation of an evaporating liquid pool, potentially resulting in a

pool fire and / or the dispersion of a cloud of natural gas from pool evaporation.

The procedures detail out the precautions which needs to be followed by the facility and it's all employees across different departments of the LNG facility during any fire or Explosion event. The safeguards to the followed include:

- LNG facilities should be designed, constructed, and operated according to international standards¹ for the prevention and control of fire and explosion hazards, including provisions for safe distances between tanks in the facility and between the facility and adjacent buildings²;
- Implementing safety procedures for loading and unloading of product to transport systems (e.g. rail and tanker trucks, and vessels³), including use of failsafe control valves and emergency shutdown and detection equipment (ESD/D);
- Preparation of a formal fire response plan supported by the necessary resources and training, including training in the use fire suppression equipment and evacuation. Procedures may include coordination activities with local authorities or neighbouring facilities.⁴
- Prevention of potential ignition sources such as:
 - Proper grounding to avoid static electricity build up and lightning hazards (including formal procedures for the use and maintenance of grounding connections);⁵
 - Use of intrinsically safe electrical installations and non-sparking tools;⁶
 - Implementation of permit systems and formal procedures for conducting any hot work during maintenance activities,⁷ including proper tank cleaning and venting,
 - Application of hazardous area zoning for electrical equipment in design;
- Facilities should be properly equipped with fire detection and suppression equipment that meets internationally recognized technical specifications for the type and amount of flammable and combustible materials stored at the facility. Examples of fire suppression equipment may include mobile / portable equipment such as fire extinguishers, and specialized vehicles. Fixed

¹ An example of good practice includes the US National Fire Protection Association (NFPA) Code 59A: Standard for the Production, Storage, and handling of Liquefied Natural Gas (LNG) (2006) and EN 1473. Further guidance to minimize exposure to static electricity and lightening is available in API Recommended Practice: Protection Against Ignitions Arising out of Static, Lightning, and Stray Currents (2003)

² If adequate spacing between the areas cannot be ensured, blast walls should be considered to separate process areas from other areas of the facility and/or strengthening of buildings should be considered

³ See Liquefied Gas Handling Principles on Ships and in Terminals - 3rd edition (2000), Society of International Gas Tanker and Terminal Operators Ltd (SIGGTO) and US EPA Code of Federal Regulations (CFR) 33 CFR Part 127:

⁴ Emergency preparedness and response are addressed in the General EHS Guidelines of IFC

⁵ For example, see Chapter 20, ISGOTT (1995)

⁶ For example, see Chapter 20, ISGOTT (1995)

⁷ Control of ignition sources is especially relevant in areas of potential flammable vapor-air mixtures such as within vapor space of tanks, within vapor space of rail / truck tankers during loading / unloading, near vapor disposal / recovery systems, near discharge vents of atmospheric tanks, in proximity to a leak or spill.

fire suppression may include the use of foam towers and large flow pumps. The installation of halon-based fire systems is not considered good industry practice and should be avoided. Fixed systems may also include foam extinguishers attached to tanks, and automatic or manually operated fire protection systems at loading / unloading areas. Water is not suitable for fighting LNG fires as it increases the vaporization rate of LNG.¹

- All fire systems should be located in a safe area of the facility, protected from the fire by distance or by fire walls;
- Explosive atmospheres in confined spaces should be avoided by making spaces inert;
- Protection of accommodation areas by distance or by fire walls. The ventilation air intakes should prevent smoke from entering accommodation areas;
- Implementation of safety procedures for loading and unloading of product to transport systems (e.g. ship tankers, rail and tanker trucks, and vessels), including use of failsafe control valves and emergency shutdown equipment/structures;
- Preparation of a fire response plan supported by the necessary resources to implement the plan;
- Provision of fire safety training and response as part of workforce health and safety induction / training, including training in the use fire suppression equipment and evacuation, with advanced fire safety training provided to a designated firefighting team;

1.3.2 *Procedure for Preventing Roll-Over*

Storage of large quantities of LNG in tanks may lead to a phenomenon known as “roll-over”. Roll-over may occur if LNG stratifies into layers of different densities within the storage tank, resulting in pressures that, in the absence of properly operating safety-vent valves, could cause structural damage.

Recommended measures to prevent roll over include the following:

- Monitor LNG storage tanks for pressure, density, and temperature all along the liquid column;
- Consider installation of a system to recirculate the LNG in within the tank;
- Install pressure safety valves for tanks designed to accommodate roll over conditions;
- Install multiple loading points at different tank levels to allow for the distribution of LNG with different densities within the tank to prevent stratification.

1.3.3 *Procedure for Preventing Contact with Cold Surface*

Storage and handling of LNG may expose personnel to contact with very low temperature product. Plant equipment that can pose an occupational risk due low temperatures should be adequately identified and protected to reduce accidental contact with personnel. Training should be provided to educate

¹ Good practice examples include the US National Fire Protection Association (NFPA) Standard 59A or other equivalent standards.

workers regarding the hazards of contact with cold surfaces (e.g. cold burns), and personal protective equipment (PPE) should be provided as necessary. The recommended Personal Protective Equipment (PPE) for handling cryogenics includes a full-face shield over safety glasses, loose-fitting thermal insulated or leather gloves, long sleeved shirts and trousers without cuffs. Gloves should be loose fitting to allow quick removal if liquid should be spilled inside. Gloves are not made to permit the hands to be immersed in a cryogenic liquid. They will only provide short-term protection from accidental contact with the liquid. No metal jewellery rings watches etc. should be worn on hands or wrist while transferring cryogenic liquids.

1.3.4 *Procedure for Prevention of Chemical Hazards*

The design of the onshore facilities should reduce exposure of personnel to chemical substances, fuels, and products containing hazardous substances. Use of substances and products classified as very toxic, carcinogenic, allergenic, mutagenic, teratogenic, or strongly corrosive should be identified and substituted by less hazardous alternatives, wherever possible. For each chemical used, a Material Safety Data Sheet (MSDS) should be available and readily accessible on the facility.

Facilities should be equipped with a reliable system for gas detection that allows the source of release to be isolated and the inventory of gas that can be released to be reduced. Blowdown of pressure equipment should be initiated to reduce system pressure and consequently reduce the release flow rate. Gas detection devices should also be used to authorize entry and operations into enclosed spaces. Liquefaction facilities with gas treatment operations may have the potential for releases of hydrogen sulphide (H₂S). Wherever H₂S gas may accumulate, the following measures should be considered:

- Development of a contingency plan for H₂S release events, including all necessary aspects from evacuation to resumption of normal operations;
- Installation of monitors set to activate warning signals whenever detected concentrations of H₂S exceed 7 milligrams per cubic meter (mg/m³). The number and location of monitors should be determined based on an assessment of plant locations prone to H₂S emissions and occupational exposure;
- Provision of personal H₂S detectors to workers in locations of high risk of exposure along with self-contained breathing apparatus and emergency oxygen supplies that is conveniently located to enable personnel to safely interrupt tasks and reach a temporary refuge or safe haven;
- Provision of adequate ventilation of occupied buildings and of adequate safety systems (e.g. airlocks, ventilation shut down by gas detection) to avoid accumulation of hydrogen sulfide gas;
- Workforce training in safety equipment use and response in the event of a leak.

1.3.5

Procedure for Working in Confined Spaces

Confined space hazards, as in any other industry sector, are potentially fatal to workers. Confined space entry by workers and the potential for accidents may vary among LNG terminal facilities depending on design, on-site equipment, and infrastructure. Confined spaces may include storage tanks, secondary containment areas, and storm water / wastewater management infrastructure. Confined spaces can occur in enclosed or open structures or locations. Serious injury or fatality can result from inadequate preparation to enter a confined space or in attempting a rescue from a confined space. Recommended management approaches include:

- Engineering measures should be implemented to eliminate, to the degree feasible, the existence and adverse character of confined spaces.
- Permit-required confined spaces should be provided with permanent safety measures for venting, monitoring, and rescue operations, to the extent possible. The area adjoining an access to a confined space should provide ample room for emergency and rescue operations.
- Access hatches should accommodate 90% of the worker population with adjustments for tools and protective clothing. The most current ISO and EN standards should be consulted for design specifications;
- Prior to entry into a permit-required confined space:
 - Process or feed lines into the space should be disconnected or drained, and blanked and locked-out.
 - Mechanical equipment in the space should be disconnected, de-energized, locked-out, and braced, as appropriate.
 - The atmosphere within the confined space should be tested to assure the oxygen content is between 19.5 percent and 23 percent, and that the presence of any flammable gas or vapor does not exceed 25 percent of its respective Lower Explosive Limit (LEL).
 - If the atmospheric conditions are not met, the confined space should be ventilated until the target safe atmosphere is achieved, or entry is only to be undertaken with appropriate and additional PPE.
- Safety precautions should include Self Contained Breathing Apparatus (SCBA), life lines, and safety watch workers stationed outside the confined space, with rescue and first aid equipment readily available.
- Before workers are required to enter a permit-required confined space, adequate and appropriate training in confined space hazard control, atmospheric testing, use of the necessary PPE, as well as the serviceability and integrity of the PPE should be verified. Further, adequate and appropriate rescue and / or recovery plans and equipment should be in place before the worker enters the confined space.

1.3.6

Procedure for preventing Slips Trips and fall

Slips/trips/falls is very common scenario in any industrial facility due to water is spilled on the floor and road accidentally, electrical cords run across pathways, and/or if any equipment block passageways. To prevent such situations the following precautions can be undertaken:

- Provide safe clean-up of spills, and keep walkways free of obstruction.

- Keep floors clean and dry. In case water / liquid has been spilled, the area should be cordoned off by using “Caution Wet Floor “ sign till the area is cleaned.
- Keep access to exits clear and unobstructed at all times (Exit Routes, to be marked as per the Fire Safety Plan),
- Provide ceiling or floor outlets for equipment to ensure that power cords do not run across pathways,
- Mark mobile equipment (e.g., stools) with a bright color, or a taped "X", making them more visible and distinguishable from the floor. Tape used for marking should be washable and durable,
- Keep aisles and passageways sufficiently wide for easy movement at all times. Temporary electrical cords that cross aisles should be taped or anchored to the floor,
- Eliminate cluttered or obstructed work areas either by reorganising equipment or by allocating more space ,
- Use prudent housekeeping procedures such as cleaning only one side of a passageway at a time, and provide good lighting for stairwells, to help reduce accidents,
- Provide adequate lighting especially during night hours.
- Instruct workers to use the handrail on stairs, to avoid undue speed. When employees carry heavy load they/ supervisor should instruct them, to maintain an unobstructed view of the stairs ahead of them. In case the load is bulky the employee should request the supervisor for help to manage the bulky load,
- Eliminate uneven floor surfaces. In case of unevenness of floor the same should be clearly marked on the floor using reflective tapes, and
- Promote safe work in cramped working spaces. Avoid awkward positions, and use equipment that makes lifts less awkward.

1.3.7

Procedure to prevent against Work Place Stress

All hospital employees by analysis the Injury Log, are exposed to work place stress and burnout, due to factors such as shift work, long hours, fatigue, and intense emotional situations. These situations may also increase a person's risk for cardiovascular disease, psychological disorders, workplace injury, and other health problems. Even though early warning signs e.g., headaches, sleep disturbances, difficulty concentrating, job dissatisfaction, and low morale are visible and need to be identified by the Heads of the Department and HR Department, efforts should be made to educate employees and management about job stress.

The hospital should undertake programs to address workplace stress, to:

- Carry out stress management programmes every year or more often, as warranted, to improve the ability of workers to cope with difficult work situations. It should teach workers about the nature and sources of stress, the effects of stress on health, and personal skills to reduce stress (e.g., time management or relaxation exercises).
- Arrange for counselling of employees on an annual basis, for work and personal problems and or stress as they would affect the work performance.

In addition to the personal level stress management RBLTL shall also adapt its policies and procedures to ensure that employees can manage stress. This would include Organizational Change Programs to make necessary change in the company policies and procedures to reduce organizational sources of stress. It involves identifying aspects of work which have excessive workload, conflicting expectations. The policies and procedures of the organisation thus need to be redesigned to reduce or eliminate the identified stress factors.

Possible solutions include:

- Redesigning the workload in line with workers' capabilities and resources.
- Giving workers opportunities to participate in decision making and actions affecting their jobs.

1.3.8 *Procedure for Protection against Work Place Violence*

The work place related violence would be primarily handled by Security Staff and the procedures covered in the SOP on Security. However, employees are at times faced with violent situations especially with respect to the families of patients. Though the Security staff would be called in to handle the situation the following measures need to be undertaken so that the staffs are not harmed even if the mob turns violent.

- The staff should be provided the necessary training to recognize and diffuse violent situations and patients and:
 - Be alert for potential violence and suspicious behaviour and report it the Security and ask for support.
 - Be trained to identify the warning signs of increasing anger/violence e.g., pacing and/or restlessness, clenched fist, increasingly loud speech, excessive insistence, threats, cursing etc. They should escalate the incident to the security staff when required.
- Appropriate engineering controls should also be used to provide security such as:
 - Installing concealed panic buttons in areas of the staff locations or near the door where it can be easily be reached by the staff. These buttons could notify hospital security of an impending violent or unpleasant situation and they can take necessary actions, adequate lighting and video surveillance, and
 - Limit access to certain areas by implementing a waiting room area with controlled access. The access of the public to these areas can only be through the waiting room.
- Use of metal detectors on any person entering the hospital. This acts as a deterrent.
- Attach furniture and equipment to the floor especially in areas of the hospital which are identified as high risk zones, so that they cannot be used as weapons.

1.3.9 *Procedure for Safe Handling of Hazardous Chemicals*

The exposure to hazardous chemical which is use in the facility can cause several risk example burns, irritation etc. to prevent such accidents happening the following measures should be undertaken:

- The employees who are handling hazardous chemicals should be communicated in writing regarding the hazards related to handling of the chemicals. This hazard communication should ensure that the employees are made aware of the hazardous chemicals they are exposed to in the workplace. They should not only be provided with Material Safety Data Sheet of all the chemicals but also the hazards explained to them.
- The workers should be provided training on warning labels, and access to Material Safety Data Sheets (MSDSs). They should also be trained in potential chemical hazards and controls (engineering controls, work practices, Personal Protective Equipment) necessary to prevent hazards from the chemical in the work area.
- Supervisors should ensure that the employee follow all MSDS instructions regarding safe handling, storage, and disposal of hazardous chemicals.

1.3.10 *Procedure to Prevent Electrical Shocks*

Faulty electrical equipment/machinery or wiring, damaged receptacles and connectors, unsafe work practices (such as trailing an electrical extension cord across the workspace, not using proper insulation and sockets, no notice etc.) can lead to electrical hazards including electric shock, electrocutions fires, and explosions. To prevent such incidents the following precaution should be maintained:

- Ensure, through regular maintenance by trained personnel that electrical equipment are free from recognized hazards (insulation integrity, Interrupting rating, circuit impedance and other characteristics, deteriorating agents),
- Ensure that only certified equipment are used or installed,
- Sufficient access and working space shall be provided and maintained around all electric equipment to permit ready and safe operation and maintenance of such equipment. Ensure that all electrical services are properly grounded,
- Tag out and remove from service all damaged receptacles and portable electrical equipment,
- Repair all damaged receptacles and portable electrical equipment before placing them back into service ,
- Ensure that employees are trained not to plug or unplug energized equipment when their hands are wet and to the extent possible to do so with the power switched off
- Employees associated with the use and maintenance of the equipment should wear personnel protection and electrical protective equipment,
- Ensure the use of ground-fault circuit interrupters (GFCI's) on all 15- and 20-ampere receptacles.
- All temporary electrical connection shall be done by trained and authorised electricians and the persons so deployed shall necessarily have the electrical license from the concerned Government authority.
- A safe lockout and tagging procedure shall be established prior to work on or near electrical equipment or lines, mechanical, pressure systems, and lines or equipment containing dangerous or hazardous material.
- A safe lockout and tagging procedures is an operating procedures by which a person, acting individually or as a member of a maintenance crew, may have a machine or part of a machine or equipment removed from and hold out of service until released by that person. A tag indicating "Danger! Do not

Operates" or the equivalent shall be placed at the power source of the equipment being serviced and wherever feasible such equipment shall be disconnected from the power source.

- Power shall be turned off, tagged, and locked in the open position at the master switch or at the main breaker.

1.3.11 Procedure for Good Ergonomic Practices in Administrative Departments

Employees in administrative roles especially working at administrative office would be using a computer intensively for long hours, can develop musculoskeletal disorders (MSD) of the hand/arm, shoulder, neck, and back. Good ergonomic practice which need to be adopted include ergonomically designed workstation layout which would allow to:

- Employees should have adequate space to arrange materials and supplies in front of the body so they can be easily reached with the elbows in close to the torso.
- Employees should be provided with adjustable, supportive padded chairs, that support the forearms, legs, and low back. Arm rests should allow the elbows to hang normally at the side of the body.
- Employees should be provided space so that the monitor can be arranged in such a way that it can be viewed slightly below, (about 20 degrees), horizontal eye level and can be seen without looking up, or leaning forward.
- Employees should be provided with engineering controls to limit awkward positions, (e.g., provide headsets for employees to use when answering phones).
- RBLTL should ensure that the employees are able to use a keyboard, which includes an adjustable mouse support that can be easily reached from a keying position. Employees should be able to keep wrists straight while typing and use wrist pads to rest on when not typing.

1.4 RESPONSIBILITIES

While it is the responsibility of RBLTL to provide a safe and comfortable working environmental to all the staff by developing engineering controls, provide PPE's, carry out training and raising awareness of the staff to ensure that they follow the precaution and reduce workplace or occupational injuries, it is equally important that the employees also follow the instruction provided in each of the procedures.

1.5 MONITORING FRAMEWORK

To review the implementation of the Occupational health and Safety SOP the following monitoring indicators can be initially considered and presented in **Table 1.1**. However these may be reviewed and changed as per the requirement in due course as mentioned in the Environment Health & Safety Management System.

Table 1.1 *Monitoring Indicator for Occupation Health and Safety*

Sl. No.	Monitoring Indicator	Monitoring Mechanism
1.	Use of personnel protective equipment (gloves, gowns, face masks)	Interview of the personnel, Visual observation
2.	Injury log book	Analysis of the Injury Log
3.	Availability of hand washing facility	Interview, Visual observation
4.	Obstruction free walk way and exit route	Visual observation
5.	Use of signage e.g., “Caution Wet Floor “ while cleaning floor	Interview, Visual observation
6.	Marking of mobile equipment for more visible and distinguishable from the floor	Visual observation
7.	Adequate lighting arrangement	Visual observation
8.	Training of staff to control and defuse violent situations	Interview, Document Review
9.	Engineering controls to defuse violent situations e.g., panic buttons, metal detectors, limiting access to certain areas	Interview, Visual observation
10.	Stress management programmes	Interview with employees, Document Review
11.	Counselling of employees	Interview with employees, Document Review
12.	Facilities e.g., differential height stools, footrest bar, height-adjustable work tables, anti-fatigue mats etc. near surgical area.	Interview, Visual observation
13.	Regular maintaining of electrical equipment by trained personnel	Interview, Document Review

1.6 REFERENCES

The Occupational Health and Safety procedures would be governed by the following:

- Environmental Health and Safety Guidelines for Liquefied Natural Gas (LNG) Facilities- International Finance Corporation (IFC)
- The Factories Act, 1965 and the Factories Rules 1979

1.7 RECORD

RBLTL should maintain record of all injury or illness in the injury log. The Occupational Health Safety Committee’s review of the Injury Log would also be maintained as minutes of meeting.

1.8 REVIEW & UPDATE

This Standard shall be reviewed annually after the annual audit and relevance with regard to implications for the RBLTL, such as:

- New or changing global commitments;
- Evolving regulatory requirements; and
- Changes to international standards and guidelines.

If such changes are identified, a brief Addendum to the Standard shall be prepared outlining the change and its key requirements.

Form I: Template of Injury Log

Identification of person				Injury Case			Classify the Case				No. of days the injured or ill worker was		Check the "Injury" column or choose one type of illness:					
Case No	Employee Name	Department	Job title	Date of Injury /Illness	Location of Injury / Illness	Describe injury or illness, parts of body affected, and object / substance that directly injured or made person ill	Death	Days Away from Work	Job transfer of Restriction	Other Recordable Cases	Away from Work	On job transfer or restriction	Injury	Illness	Musco-skeletal disorder	Communicable Disease	Hearing loss	All other illnesses

STANDARD OPERATING PROCEDURE FOR FIRE PROTECTION AND MANAGEMENT

2.1 PURPOSE

This section outlines the procedure for the management of fire emergencies and evacuation plans during the operations phase. The main objective of the Emergency Response Plan (ERP) is to ensure that activities are carried out to the following priorities:

- Safeguard lives;
- Safeguard existing activities at Kutubdia Island;
- Provide response to emergency situations using an effective communication network and organized procedures;
- Protect the company or Third Party assets
- Maintain the company image/reputation
- Resume normal activities

Personnel involved in dealing with fire emergency situations shall follow these priorities while making decisions and developing strategies.

2.2 SCOPE

The ERP covers the emergency response that needs to be applied to both onshore and offshore elements of the project, excluding the FSU. Emergency response at the FSU shall be managed through a separate document therefore only the framework is covered in this section. For the FSU, a HSSE bridging document shall be developed to be used in conjunction with this document, as well as the Emergency Response Plan of the FSU.

2.3 EMERGENCY RESPONSE TEAM COMPOSITION

The emergency response onsite will be mediated by RBLTL through two dedicated team's viz. the First Intervention Team (FIT) and Emergency Response Team (ERT). The roles and responsibilities of key team members have been outlined below.

Incident Controller

The shift operation supervisor is the incident controller and will be leading the response team until the emergency is totally brought under control. The incident controller takes control of an incident and manages directly or appoints personnel to positions. He assumes control of the organization and maintains command with site personnel.

- Assess the situation;
- Appoint, brief and task personnel;

- Establish Incident control point (ICP);
- Initiate Incident action plan (IAP);
- Manage emergency operations at the incident site;
- Plan, execute, review and re-assess fire-fighting operations continuously;
- Maintain safe environment; and
- Record actions taken during course of incident control

Field Operators

Shift Field Operators are part of the First Intervention team (FIT) and will act in emergency response operations as per instructions of the incident controller. They will act in ensuring

- Timely alert;
- Isolation of release;
- Evacuation of personnel;
- Rescue and relief work; and
- Fire-fighting operations, where instructed

Panel Operator

The Panel Operator also has a role on the FIT with the responsibility to maintain:

- Prompt isolation of effected area of plant;
- Maintaining internal communication with emergency site, Duty Manager, port control room etc.; and
- Acting on incident controller's instructions

In case of an emergency, the Shift Security supervisor will report to the Shift Operation supervisor immediately together with the Shift Security guards, as an Auxiliary Support Team.

Emergency Response Team

In case of prolonged or serious emergencies, RBLTL shall have a strong back up team. The ERT will be assisting the FIT in the following areas:

- Handle communication both Internal/External;
- Devise strategies to control the emergency situation - plan, organize, implement via incident controller and evaluate the results;
- Read drawings, issue guidelines to incident controller;
- Arrange logistics; identify potential needs, suppliers of service, material. Secure agreements, resource hiring etc.;
- Food, transport, replacement of site personnel, alternate duty roster in case of prolonged emergencies;
- Handling of journalists, media, public (in line with protocol with the RBLTL);
- Implement the plan jointly as supporting team, external aid arrangements;

- Maintain a log of events and recording the sequence of actions taken; and
- Inform and Coordinate with Country Crisis Management Team (CCMT)

The minimum composition of the ERT is at least one manager, one discipline engineer (duty engineer), one technician from all disciplines and one administration co-coordinator. The following functions are the responsibility of the ERT:

- *Planning/Intelligence*: Gathers all information regarding the incident, any impact on other parts of the process and possible evolution
- *Incident Operation*: Manages the practical aspects of incident control, implements the action plan, provides a practical input to it, establishes a structure of actors, identifies additional practical resources, relays current information regarding the incident back to the Incident Manager
- *Safety Advice*: Evaluates the adequacy of response to incident, advises the Incident Controller about response strategy and tactics.
- *Logistics support*: Provides and maintains personnel, materials, facilities and services as and when requested by Incident Controller.

Responsibilities of FSU crew

The shift pilots, teams at FSU, Kutubdia landfall point with the support of district administration and human resources from onshore will be responsible for executing emergency plan in the event of emergency situation.

Public Relations and Emergency Coordination with Local Government

RBLTL shall have designated and trained site personnel who will interact with press, public, govt. and media briefing during any emergency. No employee or contractor would interact directly with above agencies without permission of Emergency Response Controller (ERC).

Country Crisis Management Team (CCMT)

Country crisis management team of RBLTL will also provide support to ERT at site.

Mutual Aid / External Help Arrangements

As part of mutual aid scheme, RBLTL hopes to enter in agreements with Govt. machinery like nearest fire station in Chakaria, police station and neighboring industries at Kutubdia to share emergency resources and equipment in case of serious crisis. However, the decision of seeking external assistance will be taken by duty manager on advice of ERT and CCMT.

Fire Department

The Incident controller should make contact with the senior fire officer upon his arrival. The senior fire officer commands the fire-fighting and rescue operation. A representative should remain with the senior fire officer to provide guidance and advice about the LNG station.

2.4 PROCEDURE

2.4.1 Procedure for LNG Fire and Gas Cloud

It is the responsibility of the emergency site commander to take situational decision. LNG spill is most credible when LNG is being transferred from LNGC to FSU by Ship to Ship Transfer using hoses or in case of a collision between LNG Carrier and FSU storage tanks. The following actions will be adopted in case of LNG Fire.

- Spot and immediately isolate the leak/spill i.e. source of Hydrocarbon;
- Evacuate the area and rescue people, if any;
- Use water spray on vapour cloud to ensure effective dispersion of vapour cloud;
- Cool the surroundings by water screens. Only water-cooling of surroundings to be maintained to stop secondary fires and structures overheating as in the case of FSU. The FSU will have fire water facilities designed as per classification society requirements;
- Standby vessel with firefighting capability can be used for providing cooling water requirements

In order to regulate/control fires, fire alarms will be adopted on basis of locations with potential fire scenarios. Gas alarms shall be installed across all the locations with a potential to have a gas leak. The installation of automatic shutdown upon detection by these alarms will be considered, depending upon the reliability of the gas detector and the scenario. An all-clear siren shall be installed for use to indicate all clear after an emergency. Other alarm systems would include the following:

- Shipboard emergency alarms;
- Adverse weather / rough sea condition warnings;
- Emergency shut-down ESD alarms

2.5 FIRE EXTINGUISHER

When a cryogenic liquid such as LNG is suddenly heated by contacting a warm liquid such as water, violent boiling of the LNG can occur, resulting in localized overpressure releases. For this reason, most of the water base agents are not only ineffective, but their application on an LNG spill can worsen the fire. The only known agents that have demonstrated the ability to completely extinguish LNG fires are the dry chemicals.

- **Sodium Bicarbonate Base:** This agent, which is the dry chemical first developed, has been largely replaced by the more effective potassium bicarbonate base material in the oil and gas industry.
- **Mono ammonium Phosphate Base:** This agent is approximately as effective as the sodium bicarbonate base material on flammable liquids and vapors. It has the added advantage of being an effective extinguishing agent in Class A (ordinary combustibles) fires.
- **Potassium Bicarbonate Base (Purple-K):** This agent has been shown to be more effective than the sodium bicarbonate base material and has become the standard dry chemical in high intensity fire applications.

STANDERD OPERATING PROCEDURE FOR HANDLING STORAGE, TRANSPORTATION AND MANAGEMENT OF HAZARADUS AND E-WASTE

3.1 PURPOSE

The Hazardous Waste Handling & Management Policy of RBLTL coordinates all facets of hazardous waste management in accordance with Environmental Health and safety Guideline for Waste Management of IFC.

The purpose of this procedure is to take measures to manage hazardous waste in environmentally sound manner and to work in conjunction with Environment Policy for proper collection, transport, treatment, storage and disposal of hazardous and E-waste.

3.2 DEFINITION

Hazardous Waste: Hazardous waste means any waste which by reason of any of its physical, chemical, reactive, toxic, flammable, explosive or corrosive characteristics causes danger or is likely to cause danger to health or environment, whether alone or when in contact with other wastes or substances.

E-Waste: E-waste comprises of wastes generated from used electronic devices and house hold appliances which are not fit for their original intended use and are destined for recovery, recycling or disposal.

3.3 SCOPE

Scope of this document has been defined to consider hazardous waste (e.g., waste oil, sludge ,oil filter, oil soaked cotton, rags etc.); e-waste (e.g., electronic appliances such as mobile phones, computers, printing machine, electronic medical equipment etc.); In case of any change or modification in the operation of RBLTL, waste inventory and this SOP shall be updated.

3.4 PROCEDURE

3.4.1 Procedure for Management of Hazardous Waste

- RBLTL shall identify and shall keep inventory of different type of hazardous waste (refer *Table 3.1*) generated from its operation;

Table 3.1 Type of Hazardous Waste

Sl. No.	Hazardous Waste
1	Used oil and waste oil
2	Empty barrels/containers contaminated with hazardous chemicals /wastes Contaminated cotton rags or other cleaning materials
3	Mercury-switches
4	Activated glass cullets from cathode-ray tubes and other activated glass and PCB-capacitors

- For storing of hazardous waste, RBLTL shall follow following process:
 - The storage area should be provided with concrete floor;
 - The storage area floor should be provided with secondary containment;
 - Proper slopes as well as collection pit to be provided in the storage area to collect wash water and the leakages/spills etc.;
 - In case of leakage/spills, following procedure should be followed:
 - At the foremost, to try and eliminate the source of the spill by adopting any of the following measures e.g. i) up-righting drums or other containers, ii) closing valves, or other similar actions;
 - Prevent the oil from spreading or entering drains by absorbing flowing oil or diking the area with sand bags, jute/cotton mats, or berms;
 - Spread absorbent material e.g., sawdust over the surface of the spill from the perimeter of the spill to its center; and
 - Contaminated absorbents containing diesel fuel etc., shall be stored in drums and disposed off as hazardous waste.
 - Storage area should be provided with the flameproof electrical fittings;
 - Automatic smoke, heat detection system should be provided in the sheds;
 - Adequate firefighting systems (ABC type fire extinguisher) should be provided for the storage area; and
 - The Storage area shall be designed in such a way that the floor level is at least 150 mm above the maximum flood level.
- RBLTL shall make an agreement with scientific hazardous waste treatment storage and disposal facility and handover hazardous waste to that facility on regular basis.
- RBLTL shall provide the transporter of the hazardous waste with the relevant information e.g., nature of the wastes and measures to be taken in case of an emergency and shall label the hazardous and other wastes containers.
- RBLTL shall maintain a register to record all accident /incident during handling hazardous waste.
- All the workers involved in handling hazardous waste should be equipped with personnel protective equipment (gloves and boots).

3.4.2 Procedure for Management of E-waste

- RBLTL shall identify and shall keep inventory of different type of electronic waste generated from its operation;
- For storing of e-waste, RBLTL shall follow following process:

- E-waste should be stored in an area that is weatherproof and restricted for unauthorised person;
 - E-waste should be stored away from any storm water drains.
 - Sorting areas shall be regularly cleaned and at the end of the day the facility must be swept;
 - Make sure e-wastes are collected regularly or taken to a recycler on time;
 - Different e-waste items shall be stored separately in different container/ designated storage area and there should be no mixing of different kinds of e-waste;
 - All the container/ designated storage area shall be clearly labelled;
- RBLTL shall channelize e-waste through collection centre or dealer of authorised producer or through designated take back service provider of the producer ⁽¹⁾ to authorised dismantler or recycler;
 - RBLTL shall ensure that end-of-life ⁽²⁾ electrical and electronic equipment are not mixed with e-waste containing radioactive material;

3.5

RESPONSIBILITIES REGARDING HAZARDOUS WASTE HANDLING STORAGE AND TRANSPORTATION

Sl. No.	Process	Responsibility	Deviational Response
1	Waste oil and sludge should be collected to be pumped into drums, labelled and stored in its designated place	Operation / Maintenance Engineer	Respective Department
2	Oil soaked cottons generated during maintenance of equipment should be collected and stored at designated place.	Operation / Maintenance Engineer	Maintenance to ensure proper collection
3	Maintain Inventory of hazardous waste generated and stored at identified place.	Stores in charge / Head Environment	NIL
4	Agency approved by MPPCB/CPCB to purchase and reprocess the HW. All the containers shall be leak proof. License validity to be checked	Stores in charge / Head Environment	Leaking drums or tankers should not be permitted for waste oil transportation.
5	At the security gate, check if the tanker is having the following: <ul style="list-style-type: none"> a) Driver has valid heavy vehicle license and is trained to transport hazardous cargo. b) Vehicle has a valid Exhaust Emission Check sticker. c) Vehicle has valid fitness certificate. 	Security Guard	If any one of the requirements is not met, the tanker should be sent back by the security guard after information to Head-Environment/ Stores in charge.
6	Taking empty weight of tanker	Stores in charge	NIL
7	Pre load checks:	Operation	NIL

(1) Agency authorised by the producer of the electronic item who take back the 'end-of-life' (the time when the product is intended to be discarded by the user) electronic item.

(2) 'end-of-life' of the product means the time when the product is intended to be discarded by the user

Sl. No.	Process	Responsibility	Deviational Response
	a) Ignition of the vehicle should be off and batteries are disconnected/isolated	Engineer/HW Storage yard In-charge	
	b) Portable fire extinguishers DCP/Foam type should be kept nearby		
	c) Dip is taken to ascertain that the container/barrel is empty.		
8	The barrel should be marked "Waste Oil". Then load the barrels on the vehicle and tighten properly to avoid any turbulence and formation of vapours.	Stores in charge/HW Storage yard In-charge	NIL
9	Issue of non-returnable gate pass	Station Director / Stores in charge	NA
10	Security checks at the gate for valid gate pass for materials going out.	Security guard	Inform Stores in charge if any deviation is noticed

3.6 **RESPONSIBILITIES REGARDING HAZARDOUS WASTE HANDLING STORAGE AND TRANSPORTATION**

Sl. No.	Process	Responsibility
1	Collection, Storage & transfer of E-Waste at designated places	- IT/Admin/User Department Representative
2	Disposal of e-waste through PCB authorized recycler	- IT / Admin /MM User Department Representative
3	Overall Supervision & verification of e-Waste Management	- EHS/IT/Admin/MM/User Department Head

3.7 **MONITORING FRAMEWORK**

- Inventory of e-waste and hazardous waste

3.8 **REFERENCES**

- Environmental Health and Safety Guideline for Waste Management of the World Bank Group

3.9 **REVIEW & UPDATE**

This Standard shall be reviewed annually to determine its accuracy and relevance with regard to implications for the RBLTL, such as:

- New or changing global commitments;
- Evolving regulatory requirements; and
- Changes to international standards and guidelines.

If such changes are identified, a brief Addendum to the Standard shall be prepared outlining the change and its key requirements. The Management Procedure shall be revised in accordance to the procedures laid down in the ESHS MS Manual.

**FORMAT FOR MAINTAINING RECORDS OF HAZARDOUS
AND E- WASTES**

Date	Type of waste with category	Total quantity (Metric Tonnes)	Method of Storage	Method of Disposal

Date.....

**Signature
Designation**

**FORMAT FOR REPORTING ACCIDENT RELATED TO HAZARDOUS
WASTE AND E-WASTE**

1. The date and time of the accident :
2. Sequence of events leading to accident :
3. Details of hazardous and other wastes involved in accident :
4. The date for assessing the effects of the accident on health or the environment :
5. The emergency measures taken :
6. The steps taken to alleviate the effects of accidents :
7. The steps take to prevent the recurrence of such an accident :

Date:
Place:

Signature:
Designation:

Annex 11

Draft Resettlement Framework

Draft Resettlement Framework

Document Stage: Draft

February, 2016

Bangladesh: Liquefied Natural Gas (LNG) Storage and Re-gasification Facility / Terminal

Abbreviations

ADB	Asian Development Bank
ADC	Additional Deputy Commissioner
AP	Affected Person
ARIPO	The Acquisition and Requisition of Immovable Property Ordinance, 1982
CBO	Community Based Organisation
CCL	Cash Compensation under Law
CTMS	Custody Transfer Metering system
DC	Deputy Commissioner
DDR	Due Diligence Report
DP	Displaced Person
EA	Executing Agency
EM	Entitlement Matrix
ESIA	Environmental Social Impact Assessment
FSU	Floating Storage Unit
GRC	Grievance Redress Committee
GRM	Grievance Redress Mechanism
GTCL	Gas Transmission Company Limited
HH	Household
IR	Involuntary Resettlement
LNG	Liquid Natural Gas
MOL	Ministry of Land
NOC	No Objection Certificate
NPIRR	Draft National Policy on Involuntary Resettlement and Rehabilitation
ORF	Onshore Regasification Facility
PVT	Project Valuation Team
RF	Resettlement Framework
RP	Resettlement Plan
SPS	Safeguard Policy Statement
UNO	Upazila Nirbhahi Officer

Glossary

Affected Person (AP) includes any person, affected households (AHs), firms or private institutions who, on account of changes that result from the Project will have their (i) standard of living adversely affected; (ii) right, title, or interest in any house, land (including residential, commercial, agricultural, forest, and/or grazing land), water resources, or any other moveable or fixed assets acquired, possessed, restricted, or otherwise adversely affected, in full or in part, permanently or temporarily; and/or (iii) business, occupation, place of work or residence, or habitat adversely affected, with or without displacement.

Assistance means support, rehabilitation and restoration measures extended in cash and/or kind over and above the compensation for lost assets.

Compensation includes payments in cash or kind for assets acquired or affected by a Project at replacement cost or current market value.

Cut-off date refers to the date after which eligibility for compensation or resettlement assistance will not be considered. Date of service of notice under Section 3 of Land Acquisition Ordinance is considered to be the cut-off date for recognition of legal compensation and the start date of carrying out the census/inventory of losses is considered as the cut-off date for eligibility of resettlement benefits.

Displaced persons refers displaced persons are those who are physically displaced (relocation, loss of residential land, or loss of shelter) and/or economically displaced (loss of land, assets, access to assets, income sources, or means of livelihoods) as a result of (i) involuntary acquisition of land, or (ii) involuntary restrictions on land use or on access to legally designated parks and protected areas.

Encroachers include those people who extend attached private land into public land or who extend their use of titled land in to adjacent non titled land before the cut-off-date. Encroachers will not be eligible for compensation for land assets for the affected area which is an extension to their existing titled land.

Entitlements include the range of measures comprising cash or kind compensation, relocation cost, income restoration assistance, transfer assistance, income substitution, and business restoration which are due to AHs, depending on the type and degree /nature of their losses, to restore their social and economic base.

Household: A household includes all persons living and eating together (sharing the same kitchen and cooking food together as a single-family unit).

Inventory of losses includes assets listed during the survey/census as a preliminary record of affected or lost assets.

Khas land refers to state-owned land which the Government is entitled to both lease and give away to citizens of the country who do not own land. Khasland is considered an important livelihood source for the extreme poor and can generate livelihoods, particularly those with low quality, under-sized and flood prone land.

Non-titled holders refers to persons who have no recognisable rights or claims to the land that they are occupying and includes people using private or public land without permission, permit or grant i.e., those people without legal title to land and/or structures occupied or used by them. ADB's policy explicitly states that such people cannot be denied resettlement assistance.

Orphan Sites is that land located outside of the normal compensation area but is made uneconomic by occupation or acquisition part of that plot. It is eligible for compensation. Compensation may be determined based on reviewing of the land parcel by Revenue Department or any Valuation Committee on cases to case basis if any land owner lodges a request.

Parcha is a record of rights of a land owner.

Project Proponent means the Reliance Bangladesh LNG Terminal Limited

Relocation means displacement or physical moving of the APs from the affected area to a new area/site and rebuilding homes, infrastructure, provision of assets, including productive land/employment and re-establishing income, livelihoods, living and social systems.

Replacement cost refers to the value of assets to replace the loss at current market price, or its nearest equivalent, and is the amount of cash or kind needed to replace an asset in its existing condition, without deduction of transaction costs or for any material salvaged. The calculation of full replacement cost will consider; (i) transaction costs; (ii) interest accrued, (iii) transitional and restoration costs; and (iv) other applicable payments, if any.

Resettlement refers to mitigation of all the impacts associated with land acquisition including restriction of access to, or use of land, acquisition of assets, or impacts on income generation as a result of land acquisition.

Structures include all buildings including primary and secondary structures including houses and ancillary buildings, commercial enterprises, living quarters, community facilities and infrastructures, shops, businesses, fences, and walls.

Vulnerable Households include households that are (i) households that are headed by women with dependents, (ii) household heads with disabilities, (iii) households falling under the generally accepted indicator for poverty, (iv) elderly households who are landless and with no other means of support,

indigenous peoples or ethnic minority households and (v) landless households or severely affected households. No households of indigenous population or ethnic minority are affected by the Project.

1 PROJECT DESCRIPTION

Reliance Power Limited through its subsidiary in Bangladesh, Reliance Bangladesh LNG Terminal Limited (RBLTL) plans to establish a LNG storage and re-gasification facility of up to 5 million tonnes per annum (MMTPA) capacity, including onshore receiving facility (ORF) at *Kutubdia* Island in *Cox's Bazar* District of Bangladesh. The land based facilities are planned in *Dakshin Dhurung* and *Kaiyabil* Unions of *Kutubdia Upazila*.

LNG Facility will include the following:

- Twin Jetty with topside facility
- FSU with a storage capacity 145,000-216,000 m³
- Cryogenic Pipeline of ~ 30 " on motorable trestle
- Onshore Regasification Facility (ORF) of 750 MMSCFD capacity with an option of building a 185,000 m³ (gross capacity) LNG tank later
- Onshore receiving facility (ORF) including Custody Transfer Metering system (CTMS); and
- Spur Pipeline upto 36" (High pressure i.e. 70-100 bar g) to transport gas from ORF to Valve station 2 (at Napura) of Moheshkhali- Anwara Pipeline

It is to be noted here that the *Kutubdia Upazila* entirely comprises of the *Kutubdia* Island. LNG will be brought by LNG carriers of sizes ranging from 125,000 m³ to 263,000 m³ capacity. LNG carriers will unload LNG to the FSU (moored to Jetty) with hard arms / soft arms wherein they are stored in membrane tanks.

2 SCOPE AND NATURE OF RESETTLEMENT IMPACT

LNG Storage and Regasification Terminal and its ancillary facilities include 40 acres land based facility for Onshore Regasification Facility (ORF); cryogenic pipeline on motorable trestle of 2.4 km length from the LNG receiving vessel to the ORF; onshore underground gas pipeline of 17 km (33.6 acres)¹ will be laid from Onshore Receiving Facility (ORF) to connect to the proposed national gas grid of GTCL (*Moheshkhali Anwara* section) at *Banskhali* and Terminal Station at Valve 2. These physical infrastructure works would require technically suitable lands parcels that will be both government and private land. The government land may be required to be transferred on lease basis or issuance of 'no objection certificate' (NOC) from the concern government department based on the application of land by the Project Proponent. The private land may be either acquired through land acquisition

¹ The pipeline route will have a dimensional requirement of land of 17,000 m x 8 m as per the gas pipeline RoW of Bangladesh; land requirement 33.6 acres.

process which may lead to physical and economic displacement of people or may be through negotiated settlement based on 'willing buyer, willing sellers' mode. Such displacement may result in economic and social distress, including the loss of housing, productive lands, income sources and livelihoods as well as social tension. The vulnerable and poor are more likely to be disproportionately affected, resulting in long-term hardship and impoverishment. The following table 1 provides the land ownership details of the project components.

Table 1: Type of Land Ownership for the Project Components

Project Component	Land Ownership		Total Land (acres)
	Govt. land (%)	Private land (%)	
Land Based Facility	13.2%	86.8%	40
Onshore Underground Pipeline	17.7%	82.3%	33.6
Terminal Station at Valve 2		100%	1.85

Source: Information received from Reliance Power

Best designed projects often minimize resettlement impacts by avoiding or minimizing number of persons affected by physical relocation, loss of land or disturbance of income generating activities. Although the program guidelines point to minimizing or avoiding involuntary resettlement, especially of the poor / vulnerable groups considering techno-economic, environmental and other social factors in subproject design, land acquisition and resettlement may not be eliminated altogether from the Program, and some relatively small areas may be required for the construction of project components. The Project may require private land acquisition.

Table 2: Potential Social Impacts

Type of losses	Likely Impacts
Loss of private land (Agricultural land, homestead land or salt pans)	Physical displacement of land owners, tenants, leaseholders / sharecroppers
Loss of government land	Physical displacement of encroachers
Loss of residential structure and other attached assets	Physical displacement of legal titleholders; tenants and lease holders and encroachers
Loss of standing trees and crops	Loss of income and livelihood of titleholders, sharecroppers, lease holders;
Temporary loss of land	Temporary physical or economic displacement of titleholders, tenants, leaseholders, encroachers, sharecroppers, workers of salt pans, agricultural laborers
Loss of livelihood	Economic displacement of land owners, tenants and leaseholders / sharecroppers
Partial loss of income due to disruption of access to fishing areas	Localized impact on shoreline fishing and daily fishing, deep-sea fishing access routes

Should households or any other affected person or entity require resettlement, support for relocation, compensation for the loss of assets and assistance with

income restoration will be provided, according to **the provisions laid down for land acquisition, resettlement and rehabilitation in The Acquisition and Requisition of Immovable Property Ordinance, 1982 and its subsequent amendments in 1993 and 1994 in Bangladesh and the ADB's Safeguard Policy Statement (SPS), 2009.**

3 LEGAL FRAMEWORK

This Resettlement Framework (RF) is based on The Acquisition and Requisition of Immovable Property Ordinance (ARIPO), 1982 and its subsequent amendments in 1993 and 1994 and the ADB SPS 2009.

National Laws and Regulations of Bangladesh

The basic principles for the compensation of property in Bangladesh are founded in Articles 42 and 47 of the Constitution. The current legislation governing land acquisition in Bangladesh is the Acquisition and Requisition of Immovable Property Ordinance 1982 (ARIPO) and subsequent amendments during 1993-1994. The Ordinance requires that compensation be paid for (i) land and assets permanently acquired (including standing crops, trees, houses); and (ii) any other damages caused by such acquisition. The Deputy Commissioner (DC) determines the market price of assets based on the approved government procedure.

The first step in acquiring land is an application to the Ministry of Land (MOL) through the concerned project ministry requesting requisition and transfer of the land or the movable property in question. A detailed statement specifying whether the land mentioned in the application is needed for public or private purpose, the area of the land, sketch-map and purpose for which it could be used should be submitted as well. The MOL examines the application and sends it to the concerned DC for necessary action. The DC then authorizes the Additional Deputy Commissioner (ADC) related to land to prepare and execute a plan of action for requisition. The DC in turn issues a public notice for land requisition and at that time aims to settle matters relating to payment of compensation to the owner(s) of the property or other person(s) entitled to compensation, as well as attempt to settle any other related issues. When a movable property is required temporarily for a public purpose or in the public interest, the DC may obtain requisition by an order in writing. In case of requisition of movable property as well, compensation shall be paid to the owner or owners of the property determined in accordance with legal provisions. Also, in case of requisition of movable property, the decision taken by the government is deemed to be final. Any contravention or attempts to contravene an order, or obstruction to the enforcement of an order, is punishable with imprisonment for a term that may extend to three months, or with a fine which may extend to three thousand taka, or with both.

The Deputy Commissioners (DC) in all cases, determine "market value" of acquired assets on the date of notice of acquisition (notice under Section 3 of

the Ordinance). The DCs then add premium of the assessed value for cash compensation under law (CCL) of all acquired assets due to compulsory acquisition. The CCL paid for land is generally less than the “market value” as owners customarily report lower values during registration to avoid and/or pay fewer taxes. If land acquired has standing crops cultivated by tenant / sharecroppers 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. Places of worship, graveyard and cremation grounds are not to be acquired for any purpose. The law requires that the salvaged materials upon payment of compensation will be auctioned out by the Government.

ADB Safeguard Policy Statement, 2009

The objectives of SPS with regard to involuntary resettlement are:(i) to avoid involuntary resettlement wherever possible; (ii) to minimize involuntary resettlement by exploring project and design alternatives; (iii) to enhance, or at least restore, the livelihoods of all displaced persons in real terms relative to pre-project levels; and (iv) to improve the standards of living of the displaced poor and other vulnerable groups. The SPS covers physical displacement (relocation, loss of residential land, or loss of shelter) and economic displacement (loss of land, assets, access to assets, income sources, or means of livelihoods) as a result of (i) involuntary acquisition of land, or (ii) involuntary restrictions on land use or on access to legally designated parks and protected areas. It covers displaced persons whether such losses and involuntary restrictions are full or partial, permanent or temporary.

For any ADB operation requiring involuntary resettlement, resettlement planning is an integral part of project design, from the early stages of the project cycle, taking into account the following basic principles:

- a. Involuntary resettlement (IR) will be avoided or minimized as much as possible and where IR is unavoidable, displaced persons (DPs) will be compensated full replacement cost¹ for their losses;
- b. Improve, or at least restore the livelihoods of all DPs and provide physically and economically displaced persons with needed assistance.
- c. Carry out meaningful consultations with affected persons, host communities, and concerned nongovernment organizations. Inform all displaced persons of their entitlements and resettlement options. Develop procedures in a transparent, consistent, and equitable manner if land acquisition is through negotiated settlement to ensure that those people who enter into negotiated settlements will maintain the same or better income and livelihood status.
- d. Ensure that displaced persons without titles to land or any recognizable legal rights to land are eligible for resettlement assistance and compensation for loss of non-land assets.

¹ The replacement cost is based on the following elements – fair market value, transaction costs, interest accrued, transitional and restoration costs and other applicable payments, if any. Where market conditions are absent or in a formative stage, the borrower/client needs to consult the displaced persons and host population to obtain adequate information about recent transactions, land value, by types, land titles, land use, cropping pattern and crop production, availability of land in the project area and other related information.

- e. Prepare and disclosure a resettlement plan elaborating on displaced persons' entitlements, the income and livelihood restoration strategy, institutional arrangements, monitoring and reporting framework, budget, and time-bound implementation schedule.
- f. Conceive and execute involuntary resettlement as part of a development project or program. Include the full costs of resettlement in the presentation of project's costs and benefits. Pay compensation and provide other resettlement entitlements before physical or economic displacement. Monitor and assess resettlement outcomes, their impacts on the standards of living of displaced persons, and whether the objectives of the resettlement plan have been achieved by taking into account the baseline conditions and the results of resettlement monitoring. Disclose monitoring reports.

Gaps between ARIPO and ADB SPS, 2009

The Acquisition and Requisition of Immovable Property Ordinance (ARIPO), 1982 and its subsequent amendments in 1993 and 1994 are followed for acquisition and requisition of properties required for the development project. The provisions of this law do not cover the requirements of the ADB involuntary resettlement policy. The table below identifies the key gaps between ARIPO and ADB SPS, 2009.

Table 3: Gaps Analysis between GoB, ARIPO and ADB SPS, 2009

Issues	GoB, ARIPO	ADB SPS, 2009	Measures to bridge Gaps provided in RF
Payment of compensation	Land is handed over to the project proponent once payment of awards has been declared, and not necessarily before all the affected people are compensated.	Requires affected persons to be compensated prior to start of civil work	Land will be handed over to the project proponent to initiate project activities only after payment of full compensation at replacement cost
Valuation of land	ARIPO determines the land price as the average market value during last 12 months of the land parcel from date of publication of the notice under section 3. Tax is deducted from the total land value and 50 percent premium is added	Valuation of land and assets are to be at replacement cost	Replacement costs will be independently assessed, and in case of gaps with government valuation, additional top up payments, in cash or kind will be provided to affected people receive ensure replacement costs for their land and assets.
Valuation of structure	As per law the structural cost is determined by deducting construction profit, overhead charge, value added tax (VAT) and depreciation, plus 50 percent premium is added	Structural cost will be assessed at replacement cost of assets without taking into consideration any depreciation cost	
Eligibility criteria	Eligibility of non-title holders are not recognized for compensation under the law	Non-title holders are eligible for compensation for loss of assets and livelihood	Loss of assets (except land) and livelihood will be compensated and livelihood restored.
Relocation assistance	No provision for relocation assistance	Affected households to be assisted in the relocation process	Affected households (HHs) and businesses will receive relocation assistance in the form of additional lumpsum as well as support by the project proponent in identifying and negotiating as alternative place to stay/ resettlement site.
Economic displacement	No compensation for loss of income	Compensate for loss of income and improve or at least restore the livelihoods of all displaced persons	All economically affected people will be compensated for loss of income and supported to at least restore and preferably improve their livelihoods.
Consultation/disclosure	ARIPO does not emphasize on consultation/disclosure	Affected Persons (APs) must be consulted during project design and resettlement plan preparation; disclosure of the resettlement plan (RP) including documentation of the consultation in an accessible place and languages understandable by the APs and other stakeholders. All documents must be disclosed locally and on the ADB website.	Extensive consultations have been carried out during design and the ESIA stage; consultations with APs and other stakeholders must be done during the RP preparation and its implementations. RP along with the Entitlement Matrix (EM) must be disclosed locally and also on the website of ADB and project proponent.
Safeguarding needs of vulnerable groups	ARIPO does not have any especial provision or assistance for vulnerable groups	RP must have provisions for vulnerable groups	Special assistance measures for vulnerable groups will be provided

Acknowledging the gaps in the current legislations to address the full impacts on affected people from involuntary land acquisition, the Ministry of Land (MOL), Government of Bangladesh with technical assistance from ADB has prepared a Draft National Policy on Involuntary Resettlement and Rehabilitation (NPIRR). The draft policy awaits approval of the cabinet. According to NPIRR affected and displaced persons will be treated with dignity and assisted in an equitable manner that safeguards their welfare and livelihoods irrespective of title, gender and ethnicity. NPIRR recognises that:

- All those displaced involuntarily by development projects must be resettled and rehabilitated in a productive manner.
- People who are resettled must be able, through income and livelihood restoration programmes and other support as may be required, to restore or improve their living standards.
- Cash compensation shall be paid at replacement value for assets acquired for the project, for which those displaced can establish prior ownership and /or use rights. Similarly, affected persons and/ or on government leased land will be eligible for compensation for loss of access to land and sites.
- In addition to cash compensation and resettlement, a benefit sharing strategy will be considered in projects where feasible.
- Cultural and customary rights of people affected by projects are to be protected, particularly those belonging to ethnic minorities.
- Gender equality and equity in all stages and processes of resettlement and rehabilitation will be fully respected.
- Affected persons will be informed and consulted in transparent manner, including formal disclosure of projects and mitigation measures.
- Vulnerable groups including landless/ informal settlers, poor women headed households, physically challenged people, elderly and those falling below the national defined poverty line, are entitled to additional benefits and assistance in a manner that addresses their specific needs related to socio-economic vulnerability.
- In case of sensitive projects or projects with large resettlement components, the project authorities will form independent panels of expert for annual review of resettlement.

4 PROPOSED LEGAL & POLICY COMMITMENTS OF THE EXECUTING AGENCY

The proposed project will cover both government and private land. The Project Proponent shall apply for the government land transfer on lease basis or issuance of No Objection Certificate (NOC) from the Revenue Department of the Government of Bangladesh (GOB). For private land the Project Proponent may either acquire through land acquisition process which may lead to physical and economic displacement of people or may be through negotiated settlement based on 'willing buyer, willing sellers' mode.

For land acquisition the Executing Agency (EA), Reliance Bangladesh LNG Terminal Limited will follow the existing The Acquisition and Requisition of Immovable Property Ordinance (ARIPPO), 1982 and its subsequent

amendments in 1993 and 1994 for land acquisition and hand over the estimated land price to the government for disbursement to the affected land losers. The EA will also finalise the process of transaction and transfer of *khas* land involved in the project with the Deputy Commissioner (DC)/ Ministry of Land. The EA will compensate the affected or displaced persons in compliance with the ARIPO and the ADB safeguard policies as defined in this Resettlement Framework (RF). The EA will provide compensation of replacement value as defined in the entitlement matrix in this framework.

Also the following core safeguard principles will govern the project:

- (i) Carrying out consultations with APs/DPs, host communities informing all APs/DPs of their entitlements and resettlement options and ensuring their participation in designing of resettlement programs.
- (ii) Vulnerable groups, including households headed by women, the elderly, the differentially abled, and indigenous groups, non-title holder below poverty line families, and those living below poverty line (BPL) will be given special assistance to improve their socioeconomic status and also ensure their inclusion in the consultation process.
- (iii) Where the resettlement impacts are unavoidable, the APs should be assisted in improving and restoring their livelihoods.
- (iv) Ensure that displaced persons without titles or any recognizable legal rights to land are eligible for resettlement assistance and compensation for loss of non-land assets. Absence of formal title to land should not be a bar to policy entitlements.
- (v) Compensation for all lost assets acquired or affected is based on the principle of replacement cost to be determined by a Valuation Committee formed under the District Collector will determine the replacement cost.
- (vi) All payments, including compensation for the loss of land, assets, structures, trees, income, and common properties will be made prior to physical or economic displacement and the commencement of civil works construction under close monitoring and supervision.
- (vii) Preparation of a draft resettlement plan (RP) detailing the entitlements of APs/DPs, the income and livelihood restoration strategy, institutional arrangements, monitoring and reporting framework, budget, and time-bound implementation schedule.
- (viii) Disclose the draft RP, including documentation of the consultation process in a timely manner to APs and other stakeholders. Disclose the final RP and other documents such as the monitoring reports to APs and other stakeholders; and to be approved by ADB prior to awarding contract.
- (ix) For purchase of land parcels through negotiated settlement socio-economic profile of the land sellers to be conducted and the process is to be certified by an independent third party.

5 ELIGIBILITY CRITERIA

All displaced persons will be entitled to compensation and resettlement assistance. Eligibility to receive compensation and other assistance will be limited by the cut-off-date. The cut-off-date for compensation under the law (ARIPO) is considered for those identified at the time of serving notice under section - 3. The cut-of date for eligibility for resettlement assistance under Resettlement Plan is the commencement date of the census-cum socio-economic survey applicable for land-user groups, encroachers and fishermen. The absence of legal title will not bar displaced or affected persons from suitable compensation and assistance.

Structures located on non-titled land, *khas* land (government land) or requisitioned private land, if displaced, will be entitled for compensation under the project. Vulnerable displaced persons/ households will qualify for additional assistance to facilitate the relocation and restoration of their livelihoods.

Non-vulnerable households with affected structures will be entitled to compensation for structures and assistance for shifting and reconstruction of the same.

6 ENTITLEMENT MATRIX

The Entitlement Matrix is based on the Acquisition and Requisition of Immovable Property Ordinance 1982 and its subsequent amendment in 1994 and the ADB Safeguard Policy Statement, 2009. The matrix describes the units of entitlements for compensating lost assets and different resettlement benefits. Cash compensation under the Law for lost assets (land, tree, structure) will be accorded to the owners through the DC office as per replacement cost as assessed through legal procedure. The resettlement benefit for indirect losses and the difference between the replacement value and the cash compensation under the law will be paid by the Executing Agency. The displaced households will be allowed to take all salvage materials of structures, trees and crops free of cost. Reliance Bangladesh LNG Terminal Limited will form a committee with local government representatives and local academicians, local key person and RP implementing agency and representative from affected people for disbursing the compensation.

The Resettlement Plan will also cover the compensation for income loss of the fishermen (practicing shoreline fishing or daily fishing not far from the coastline near the project site for the Land Based Facility and the Trestle) and plan for improvement or atleast restoration the livelihoods of the fishermen. In absence of proper market conditions the Project Proponent shall consult the affected persons and host population to obtain adequate information about income and other related information on accessibility to fishing grounds.

The Entitlement Matrix is presented in the following table.

Table 4: Entitlement Matrix

S. No.	Type of Loss	Entitled Person	Compensation
1	Loss of agricultural land	Legal owner(s) of land	<ul style="list-style-type: none"> • Cash Compensation under Law ¹(CCL)as per ARIPO and cash grant to cover the difference between cash compensation under law and the replacement cost²of land • Stamp duty and registration cost incurred for replacement land purchase a the replacement value • Option to be compensated if remaining land is no longer viable • Additional compensation for vulnerable households³
2	Loss of salt cultivation land	Legal owner(s) of land	<ul style="list-style-type: none"> • Cash Compensation under Law (CCL) as per ARIPO and cash grant to cover the difference between cash compensation under law and the replacement cost of land • Stamp duty and registration cost incurred for replacement land purchase a the replacement value • Option to be compensated if remaining land is no longer viable⁴
3	Loss of houses (shelter)	Legal owner(s) of structures	<ul style="list-style-type: none"> • Cash compensation equivalent to replacement value of structure (or part of structure). Compensation will not take into account depreciation value. • Option to be compensated for entire structure if remaining structure is no longer viable. • Rights to salvage materials from structure • Provision of all taxes, registration costs, and other fees incurred for replacement structure. • Shifting allowance based on actual cost of moving (e.g., truck hire, equipment, etc.) • One month rental allowance. • One time allowance for utility services such as gas supply and electricity connection. • Additional compensation for vulnerable households. • Assistance in finding alternate location.

¹ Cash Compensation under Law includes Mouza Rate plus the 50 % premium as per the ARIPO

² The rate of compensation for acquired housing, land and other assets will be calculated at full replacement costs. Where market conditions are absent or in a formative stage, the EAs will consult with the displaced persons to obtain adequate information about recent land transactions, land value by types, land titles, landuse, cropping patterns and crop production, availability of land in the project area and region and other related information. The EA will also collect baseline data on housing, house types, and construction materials. Qualified and experienced experts will undertake the valuation of the acquired assets.

³ Vulnerable households/DPs may include (i) households that are headed by women with dependents, (ii) household heads with disabilities, (iii) households falling under the generally accepted indicator for poverty, (iv) elderly households who are landless and with no other means of support, indigenous peoples or ethnic minority households and (v) landless households or severely affected households.

⁴This compensation will be provided for 'Orphan land parcel' - it is that land located outside of the normal compensation area but is made uneconomic by occupation or acquisition part of that plot. It is eligible for compensation. Compensation may be determined based on reviewing of the land parcel by Revenue Department or any Valuation Committee on cases to case basis if any land owner lodges a request

S. No.	Type of Loss	Entitled Person	Compensation
4	Loss of structures	Tenant(s) and leaseholder(s)	<ul style="list-style-type: none"> • equivalent • Cash compensation equivalent to replacement value of structure (or part of structure) if the structure is constructed by them DP. Compensation will not take in to account depreciation value. • Rights to salvage materials from structure. • Provision of all taxes, registration costs, and other fees incurred for replacement structure. • Shifting allowance based on actual cost of moving (e.g., truck hire, equipment, etc.). • One month rental allowance. Additional compensation for vulnerable households. • Assistance in finding alternate location.
5	Loss of houses (shelter)	Non-titled holders - Displaced Persons residing as encroachers on embankment (Water Development Board, Government land)	<ul style="list-style-type: none"> • Cash compensation equivalent to replacement value of structure (or part of structure) constructed by the DP. • Compensation will not take in to account depreciation value. • Rights to salvage materials from structure. • Provision of all taxes, registration costs, and other fees incurred for replacement structure. • Shifting allowance based on actual cost of moving (e.g., truck hire, equipment, etc.). • One month rental allowance. • Additional compensation for vulnerable households. • Assistance in finding alternate location.
6	Loss of timber and fruit bearing trees	Legal owners and non-titled users of the land as determined by DC	<ul style="list-style-type: none"> • 60 days advance notice to harvest standing seasonal crops, if harvest is not possible, cash compensation for crops (or share of crops) equivalent to prevailing market price. • Cash compensation for perennial crops and fruit bearing trees based on annual net product market value multiplied by remaining productive years. • Cash compensation equivalent to prevailing market price of timber for non-fruit trees.
7	Loss of standing crops	Cultivator (person who planted the crops) whether land owner, sharecropper, lessee unauthorised occupant of the land	<ul style="list-style-type: none"> • 60 days advance notice to harvest standing seasonal crops, if harvest is not possible, cash compensation for crops (or share of crops) equivalent to prevailing market price. • Cash compensation for perennial crops and fruit bearing trees based on annual net product market value multiplied by remaining productive years. • Cash compensation equivalent to prevailing market price of timber for non-fruit trees.

S. No.	Type of Loss	Entitled Person	Compensation
8	Loss of Commercial Structure (if any)	Legal Owner (s) of structures	<ul style="list-style-type: none"> • Cash compensation equivalent to replacement value of structure (or part of structure). Compensation will not take into account depreciation value. • Option to be compensated for entire structure if remaining structure is no longer viable. • Rights to salvage materials from structure • Provision of all taxes, registration costs, and other fees incurred for replacement structure. • Shifting allowance based on actual cost of moving (e.g., truck hire, equipment, etc.) • One month rental allowance. • One time allowance for utility services such as gas supply and electricity connection. • Additional compensation for vulnerable households. • Assistance in finding alternate location.
9	Loss of income	Regular employees/ wage earners of agricultural fields/ salt pans affected by land acquisition identified during census	<ul style="list-style-type: none"> • 60 days advance notice. • Assistance in finding alternate location. • One time assistance for lost income based on replacement cost. • Shifting allowance and cost of reestablishing business elsewhere (cost of truck hire, equipment, etc.). • Training allowance in the form of cash equivalent to short term training course. • Additional compensation for vulnerable households. • Consideration for project employment.
10	Loss of income	Any salt cultivator operating in the land at the time of issuance of notice under section 3 and /or during census	<ul style="list-style-type: none"> • 60 days advance notice. • Assistance in finding alternate location. • One time assistance for lost income based on replacement cost. • Shifting allowance and cost of reestablishing business elsewhere (cost of truck hire, equipment, etc.). • Training allowance in the form of cash equivalent to short term training course. • Additional compensation for vulnerable households. • Consideration for project employment.
11	Temporary impact during construction - loss of land and crops and salt	Owner(s) with legal title, tenant(s), leaseholder(s), sharecropper(s), encroacher(s),	<ul style="list-style-type: none"> • 60 days advance notice. • Restoration of affected land. • Rental fees by the EA or contractor for the period of using the land and crop compensation in case of agricultural land.

S. No.	Type of Loss	Entitled Person	Compensation
12	pans Temporary loss of livelihood	squatter(s) Business owner (s), tenant (s), leaseholder(s), employee(s), agricultural worker(s), and farmer(s) whose income is affected	<ul style="list-style-type: none"> • 60 days advance notice. • Provision of temporary access where possible. • Provision of alternative sites for continued economic activity where possible. • Where provision of alternative sites is not feasible, a one-time assistance for lost income for period of disruption. • Compensation for agricultural losses. • Restoration of affected land, structure, utilities, common property resource.
13	Loss of fish stock (aquaculture)	Legal owner of the pond/waterbody and lessee right holder socially recognised	<ul style="list-style-type: none"> • Legal owner will get compensation for land area - Cash compensation under the Law (CCL) as per ARIPO and cash grant to cover the difference between cash compensation under law and the replacement cost of land • Cash grant as transition allowance equivalent to 1 year income from the land for titled/ non-titled /lease holder or users as determined during socio-economic census and verified by the PVT
14	Loss of income due to impeded access to fishing	Fishermen Community	<ul style="list-style-type: none"> • Financial compensation ¹of loss of income incurred as a result of the Project until fishing or alternative income is secured • Compensation of assets that can no longer be used at fair market price • Specific training programs for fishermen on deep sea-fishing to address a trend of depletion of resources within territorial waters • Fund for local area development initiatives focusing on the fishermen community

¹ The SPS covers economic displacement (loss of land, assets, access to assets, income sources, or means of livelihoods) as a result of involuntary restrictions also.

7 NEGOTIATED SETTLEMENT

ADB's Safeguard policy on negotiated settlement encourages acquisition of land and other assets through a negotiated settlement wherever possible based on consultation with affected persons including those without title to assets. This safeguard element, negotiated settlement, would help to avoid expropriation and eliminate the need to use governmental authority for eviction or to remove people forcibly. This policy offers an adequate and fair price for land and other assets to the APs/DPs. The policy encourages acquisition of land and other assets through a negotiated settlement wherever possible based on meaningful consultation¹ with APs including those without title to assets.

In the case of a negotiated settlement, an independent external party will be engaged by the EA to document the negotiation and settlement processes. Mechanisms for calculating the replacement cost of land and other assets affected due to the program implementation should be duly recorded and maintained during the negotiated settlement through a meaningful consultation. Terms of Reference for independent third party validation and certification is provided in *Enclosure 1*.

The process of negotiation involves the following steps: (i) negotiation will take place when there is a 'willing buyer/willing seller'; (ii) verification of the voluntary status of land acquisition will have to be carried out by a third party; (iii) consultation with the AP has to be carried out and documented; (iv) the minimum negotiated price to start negotiations will not be below the valuation of land based on the market value of land as mentioned in the Entitlement Matrix; (v) socio-economic survey of the land sellers need to be carried out to assess their socio-economic profile and presence of any vulnerability (vi) consent letter from the land sellers are to be obtained that stating that no coercion was involved and bargaining power of the parties are involved (vii) all the safeguards as mentioned in the RF have to be followed (viii) all negotiations have to be carried out in a transparent manner and validated by a third party; (ix) in case of failure of negotiations, Land Acquisition process has to be implemented and compensation will be paid according to the ARIPO as outlined in the Entitlement Matrix of the RF and (x) the entire process has to be documented. Enclosure 1 outlines the Terms of Reference for the Independent Third Party for Negotiated Purchase.

¹A process that (i) begins early in the project preparation stage and is carried out throughout the project cycle; (ii) provides timely disclosure of information that is understandable and accessible to APs; (iii) is undertaken in an atmosphere free of intimidation or coercion; (iv) is gender inclusive and responsive to the needs of disadvantaged and vulnerable groups; and (v) enables the incorporation of all relevant views of APs and other stakeholders into decision making, such as project design and mitigation measures.

Social Impact Assessment Survey

The Social Impact Assessment (SIA) will determine the magnitude of displacement and prospective losses, identify vulnerable groups for targeting, ascertain costs of resettlement, and prepare a resettlement plan for implementation to mitigate land acquisition and involuntary resettlement related issues triggered in each subproject. The Project Proponent will undertake surveys for each identified sub-project, based on preliminary technical design. The SIA surveys will be based on preliminary technical designs of the sub-project (which may include any or a combination of the following: water supply, sanitation and sewerage). As part of the social impact assessment, the Program will identify individuals and groups who may be differentially or disproportionately affected by the project because of their disadvantaged or vulnerable status. Where such individuals and groups are identified, the EA will propose and implement targeted measures so that adverse impacts do not fall disproportionately on them and they are not disadvantaged in relation to sharing the benefits and opportunities resulting from development. The purpose of the census is to register and document the status of the potentially affected population within the sub-project impact area/impact zone. The census will cover 100 percent of APs. The census will provide a demographic overview of the population, and will cover people's assets and main sources of livelihood.

Resettlement Plan

The project proponent will prepare a resettlement plan (RP), if the proposed project will have involuntary resettlement impacts. The resettlement plan will be based on the social impact assessment and through meaningful consultation with the affected persons. A resettlement plan will include measures to ensure that the displaced persons are (i) informed about their options and entitlements pertaining to compensation, relocation, and rehabilitation; (ii) consulted on resettlement options and choices; and (iii) provided with resettlement alternatives. During the identification of the impacts of resettlement and resettlement planning, and implementation, the EA will pay adequate attention to gender concerns, including specific measures addressing the need of female headed households, gender-inclusive consultation, information disclosure, and grievance mechanisms, to ensure that both men and women receive adequate and appropriate compensation for their lost property and resettlement assistance, if required, as well as assistance to restore and improve their incomes and living standards. The resettlement plan will specify the income and livelihoods restoration strategy, the institutional arrangements, the monitoring and reporting framework, the budget, and the time-bound implementation schedule.

RPs will be prepared based on the results of the census and socio-economic survey; the database on APs should be completed before RP preparation. RPs will comply with the principles outlined in this RF that are governed by the involuntary resettlement safeguards and will have to be approved by ADB prior to contract award. Disbursement of compensation payments and entitlements must be made prior to displacement.

RPs comprising the Entitlement Matrix, compensation and rehabilitation options among others shall be brought to the notice of APs and host communities. The specific resettlement-related activities to be performed, such as SIA, census and socio-economic survey, resettlement planning, public consultation, development of mitigation and income restoration measures, implementation of RPs, and monitoring and evaluation, and their subproject implementation schedule, will all be detailed in the resettlement planning document. The RPs will be prepared and notified to the public, through information disclosure workshops and other means such as posters and/or resettlement booklets, notices in the local government offices etc.

Gender Impacts and Mitigation Measures

Female-headed households are considered a vulnerable group as per this RF. Any negative impacts of a subproject on female-headed households will be treated on a priority basis. The resettlement plan will formulate measures to ensure that socio-economic conditions, needs and priorities of women are identified and the process of land acquisition and resettlement does not disadvantage women. It will ensure that gender impacts are adequately addressed and mitigated. Women's focus groups discussions will be conducted to address specific women's issues. During disbursement of compensation and provision of assistance, priority will be given to female-headed households. Also ownership in the name of the wife will be provided in case of non-female-headed HHs.

Mandatory Actions to Address IR and Livelihood Impacts

The following table outlines the mandatory activities to be undertaken by the Project Proponent for the preparation of the Resettlement Plan which also includes the livelihood restoration component both for land taken through land acquisition or through negotiated settlement.

Table 5: Mandatory Actions for RP

Sl. No.	Mandatory Actions
Land Acquisition as per ARIPO	
1.	Conducting Census and Socio-economic survey to ascertain the exact number of Affected Persons (APs), their socio-economic profile
2.	Preparation to Asset Inventory for loss of structure and other asstes due to project implementation within project footprint
3.	Mapping of entitlements of the project affected persons/ households

Sl. No.	Mandatory Actions
	through consultations with APs, key informants based on the impacts assessed
4.	Preparation of Draft Resettlement Plan (RP) stating the type of impact, entitlements and the resettlement cost
5.	Formation of Grievance Redress Cell at the RP formulation stage and register and start addressing the complaints and grievances of the APs, host community
5.	Disclosure of the draft RP
6.	If any feedback is received, RP is to be updated accordingly and disclosed.
7.	RP placed for ADB approval
8.	RP to be updated at any point when there may be a requirement for change in project design
8.	Compensation paid out based on the RP before commencement of the project civil work.
9.	Appointment of the External Monitoring Agency by the Project Proponent for providing monitoring report on the implementation of the Resettlement Plan
10.	Land formally handed over to the Project Proponent by the Government
Negotiated Settlement	
1.	Consultation with the AP has to be carried out and documented
2.	Socio-economic survey of the land sellers need to be carried out to assess their socio-economic profile and presence of any vulnerability
3.	Consent letter from the land sellers are to be obtained that stating that no coercion was involved and bargaining power of the parties are involved
4.	All negotiations have to be carried out in a transparent manner and validated through a Third Party Evaluation
5.	Preparation of a Due Diligence Report (DDR) and submission to ADB for approval

9 INCOME RESTORATION & RELOCATION

Income Restoration

Each AP/DP whose income or livelihood is affected by any project component will be assisted to improve or at least restore this income to its pre-project level. For vulnerable households, their living standards will be improved to national levels, including the provision of access to basic utilities and public services. Income restoration schemes will be designed in consultation with APs, and considering their resource base and existing skills. Eligible APs will be identified based on the 100 percent census of the APs and will conduct a training need's assessment in consultation with the APs so as to develop an appropriate income restoration program. The affected persons can also be converged with the Community Development Programmes of the Project Proponent for their income restorations. Vulnerable households will get special assistance in this regard.

Income restoration activities are of two types (i) short-term; and (ii) long-term. Short-term income restoration activities are intended to restore AP's income in

the period immediately before and after relocation focusing on relocation, and providing short-term allowances such as (i) subsistence/transitional allowance; and (ii) shifting assistance. Long-term options depend on the degree of disruption to the economic activity. All vulnerable APs would be eligible for income restoration options. These will be derived from detailed socio-economic survey information, conducted as a part of the RP, and may include provision of income generating assets and/or training to operate them.

Relocation

The sub-projects will try, to the extent possible, avoid or minimize any displacement or relocation of the APs in spirit of the ADB SPS, 2009 and ARIPO. In accordance with ADB's SPS, should there be any physical displacement or resettlement, the existing social and cultural institutions of affected persons (resettled populations) and host populations will be supported to the maximum extent possible. Resettled population will be economically and socially integrated into host communities so that adverse impacts on the latter are minimized. Concerns of affected persons and host communities will be understood through consultations and systematically recorded and addressed in the resettlement plan. In addition, benefits of the project will be extended to host communities to ensure integration; the resettlement plan will explain how integration with host populations will be achieved.

In the event that physical relocation is required the project will ensure that:

- a) shifting assistance, resettlement assistance and subsistence allowance, as required, will be provided to all relocated/physically displaced families
- b) relocation sites will be disclosed to the APs for endorsement, along with their facilities;
- c) affected families can choose between independent or assisted relocation by the project; and
- d) alternate houses will be provided to the APs before demolition (if required). In situations when alternate houses are not ready, rental assistance will have to be provided until the alternate house is ready. Relocation has to be completed before the start of project works.

10 CONSULTATION PARTICIPATION & DISCLOSURE

Consultation Participation

Meaningful stakeholder consultation and participation shall be made part of the project preparation and implementation strategy. The primary objective of consultation participation is continuing involvement of affected persons and various stakeholders throughout the project process to promote understanding and fruitful solutions to address the local needs of the communities and issues pertaining to resettlement and other issues related to the subproject.

Consultation, participation and disclosure will ensure that information is provided and feedback on proposed subproject design is sought early, right from the project preparation phase, so that the views and/or preferences of stakeholders including potential beneficiaries and affected people can be adequately considered at each stage of project preparation, processing, and implementation.

By addressing stakeholder needs, there is greater awareness of the benefits and “ownership” of the project among stakeholders, which in turn contribute to sustainability. Relevant information about any major changes to project scope will be shared with beneficiaries, affected persons, vulnerable groups, and other stakeholders. Consultation to be carried out through three tire project implementation – starting from designing phase - to optimize designs and minimize social impacts.

Key stakeholders to be consulted are:

- i. Project affected persons
- ii. elected representatives of Union Parishads, community leaders, and representatives of community-based organizations;
- iii. Chairman of Union Parishads, Upazila Nirbhahi Officer (UNO), Kutubdia Upazila
- iv. Local NGOs; Resident Welfare Associations (RWAs), community groups, women’s groups
- v. Deputy Commissioner, Cox’s Bazar District, ADC (Revenue), Cox’s Bazar District and Land Acquisition Department officials.
- vi. local government and relevant government agency representatives, including local authorities responsible for land acquisition, protection, and conservation of forests and environment, and other relevant government departments;

Several rounds of consultations will be conducted during SIA and RP preparation and implementation. The methodology followed for public consultations will include: (i) informing all the likely APs, ward members, local NGOs and Community Organizations of upcoming meetings, (ii) conducting the meetings and (iii) documenting the minutes of the meetings, noting the list of participants as recorded by signature and filing photographs taken of the consultations. Particular attention will be paid to the needs of the disadvantaged and vulnerable groups, especially those belonging to BPL category, landless, elderly, female-headed households, women, indigenous people, and those without legal title to land. Project agencies to ensure that any views of the APs, particularly vulnerable people, related to the resettlement process are taken into consideration and it is addressed. Project agencies ensure that groups and individuals consulted are informed about the outcome of the decision-making process and confirm how their views were incorporated. Also Gender equality is to be ensured at all level of consultation.

Disclosure

Information will be disseminated to APs/ DPs at various stages, including sub-project initiation phase and during the project implementation period. For the benefit of the community in general and APs in particular, a summary of the RP for each respective town will be made available in local language (Bengali) during consultation meetings and will be disclosed in public places prior to project appraisal. This will enable stakeholders to provide inputs on the resettlement process, prior to the award of civil work contracts.

The RP will be disclosed, detailing information including measurement of losses, detailed asset valuations, entitlements and special provisions, grievance procedures, timing of payments, and displacement schedule. For people those who are illiterate other communication methods will be used, including verbally explaining the disclosed documents with some pictorial illustration in community meetings.

11 GRIEVANCE REDRESS MECHANISM

The implementation of a project is a complex time and labour intensive process involving multitude of lifecycle phases and processes. Over the duration of the project, it encounters numerous instances of conflicts, allegation and dissatisfaction within the working and associated human capital and their interactions. Some of these issues could be related to

- compensation payment,
- improper estimation of affected assets,
- failure to fulfil commitments,
- poor management of construction activities,
- accidents due to inappropriate planning of vehicle movement, and
- Cultural conflicts between migrant workers and local communities etc.

Most of the conflicts and allegations may not appear to be of serious nature but if not managed appropriately from the beginning may snowball into a bigger issue.

In order to manage these risks, an internal mechanism is required to be in place where the aggrieved party/s can lodge their complaints and get it amicably settled prior to approaching the formal mode of solution available to them i.e. access to legal system through courts. In order to provide a formal forum to the aggrieved parties to deal with issues arising out of project, it is proposed that a joint grievance redress mechanism be instituted for both environmental and social related issues.

It is understood that Reliance Power already has a GRM in place. The GRM proposed for the Project will be formulated in alignment with the process and procedure of the existing GRM and will be integrated into the same. The following sub sections provide an understanding of the GRM proposed for the project.

Objectives of the Grievance Redressal Mechanism

The basic objective of the GRM shall be to provide an accessible mechanism to the affected people, community or any stakeholder(s) having a stake in the project to raise their issues and grievances in regards to project functioning.

The fundamental objective of GRM is to resolve any social and environmental related grievances locally in consultation with the aggrieved party to facilitate smooth implementation of project related work activities. The other important objective is to democratize the development process at the local level and to establish accountability towards the stakeholders. The grievance redress mechanism for the internal and external stakeholders (staff, labour, contractor, etc.) of RBLTL is given in *Enclosure 2*.

Grievance Redressal Mechanism for Social Safeguard

As per ADB procedures RBLTL have to establish a project specific Grievance Redress Mechanism (GRM) having suitable grievance redress procedure to receive and facilitate resolution of affected people's concerns, complaints, and grievances related to environmental and social issues. A grievance mechanism will be established within one month from the approval and disclosure of draft Resettlement Plan to allow Project Affected Persons (APs) appealing any disagreeable decision, practice or activity arising from land or other assets compensation. APs will be fully informed of their rights and of the procedures for addressing complaints whether verbally or in writing during consultation, survey, and time of compensation. Care will always be taken to prevent grievances rather than going through a redress process. This can be done through careful land acquisition and resettlement design and implementation, by ensuring full participation and consultation with the APs, and by establishing extensive communication and coordination between the affected communities and local government in general. The RBLTL will ensure that the public, particularly those directly affected by the project components will have the chance to express their legitimate grievance or to file a complaint about the project by setting up a mechanism to address the issues raised. The grievance mechanism should not impede access to the country's judicial or administrative remedies. APs can approach the court of law at any time and independent of grievance redress process. The grievance redressal mechanism for Resettlement for RBLTL project is presented in the *Figure 1*.

As per ADB procedures RBLTL have to establish a grievance redress mechanism (GRM) to voice and resolve social and environmental concerns linked to the project and ensure greater accountability of the project authorities towards all APs. This grievance mechanism will be established within one month from the approval and disclosure of draft Resettlement Plan to allow APs appealing any disagreeable decision, practice or activity arising from land or other assets compensation. APs will be fully informed of their rights and of the procedures for addressing complaints whether verbally or in writing during consultation, survey, and time of compensation. This mechanism is not intended to bypass the government's own legal process, but

is intended to provide a time-bound and transparent mechanism that is readily accessible to all segments of the affected people. The aggrieved party should be free to approach national legal system at any time. All costs involved in resolving the complaints (meetings, consultations, communication and reporting / information dissemination) will be borne by the Project.

Grievance Redress Committee

Grievance Redress Committees will be established to ensure stakeholder participation and will promptly address the concerns and complaints using an understandable and transparent process that is gender responsive, culturally appropriate and readily accessible to the affected persons at no cost. The Grievance Redress Committee (GRC) will have the representation of the following members:

GRC Members

- Representative of RBLTL
- Representative of RP implementing agency
- Representative of the Local Administrative Body
- Local member from Union
- Representative of the APs
- Representative of the Deputy Commissioner

Key Issues of Concern: The GRM will address and cover all issues and policies pertaining to environment, involuntary resettlement and indigenous people. Safeguard Policies related to environment, involuntary resettlement and indigenous people are as follows:

- a) The Environmental safeguards will include requirements on habitat and biodiversity conservation; sustainable management of natural resources; pollution prevention and abatement; occupational and community health and safety; use of hazardous materials and pesticides; greenhouse gas reduction; and conservation of physical cultural resources.
- b) The Involuntary Resettlement safeguards outline requirements for preparing resettlement plans and negotiating land acquisition; adequately compensating and assisting displaced persons; and restoring livelihoods. Draft resettlement plans must be disclosed before the ADB appraises the project.

Grievance Redress Process

There will be three entry points in filing a grievance as follows:

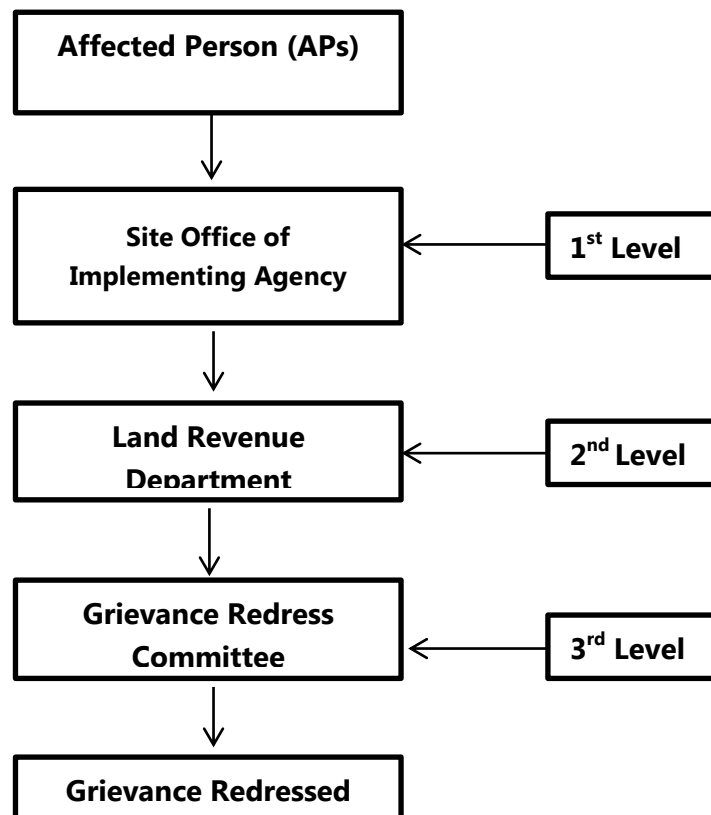
- 1st Level- APs will be informed in writing by the RBLTL through Land Revenue Department, Govt. of Bangladesh of their losses and entitlements. If APs agree with the conditions of entitlements, they can claim for the payments from the RP implementing agency.
- 2nd level - If the APs disagree, contact person from Land Revenue Department can be approached for clarifications. The Land Revenue

Department will respond to queries within two weeks. Grievances raised will be documented providing details on the person, concerns raised, and the action taken by the Land Revenue Department. If the APs are satisfied, the compensation can be claimed from the Land Revenue Department.

- 3rd level – If the APs is not satisfied, Land Department will refer the issue to the GRC who will resolve it within four weeks. A hearing can be called, if needed, to give chance to the APs to present the concern in person.

The grievance redressal mechanism for Resettlement for RBLTL project is presented in the *Figure 1*

Figure 1: Grievance Redressal Mechanism for External Stakeholders



Composition of GRC in RBLTL

The GRM of RBLTL will be one single level of grievance redress mechanism or agency. This agency is called as the Grievance Redress Cell (GRC). GRC has the following representation to ensure fair and timely solution to the grievances:

- RBLTL Site personnel serving as the Community relations officer will also be serving as the Grievance Officer.
- General Manager on behalf of RBLTL management and site manager of site. However in cases the site manager is not available, this role may be deputed to his immediate deputy or any individual with that level of authority;

- Senior contractor personnel as a part of the GRC in case of a contractor labour dispute or issue;
- Community representative as a part of GRC in case of community grievance.

A grieved party can register their grievances with the GRC. The GRC has empowered to take a decision which is to be considered final and binding on RBLTL. However, the decision of the GRC is not binding on the aggrieved person and he or she may take the grievance to the administrative setup in case any grievance channel is available at that level or take a legal course, in case not satisfied with the outcome of GRC decision.

Functional premises of GRC for Grievance Redress

The GRC meetings are held in RBLTL project office at site and the same is widely publicised in project area for the knowledge of general public. The key responsibilities of GRC are as follows:

- Review, consider and resolve grievances related to social and environmental aspects received by the RBLTL Site Office;
- Entertain grievances of indirectly affected persons and/or persons affected during project implementation;
- Resolve grievances within a period of two weeks at the GRC level and communication of the resolution to the aggrieved party;
- The GRC shall not engage in any review of the legal standing of an “complainant” nor shall deal with any matters pending in the court of law;
- Arrive at decisions through consensus, failing which resolution is based on majority vote. Any decision made by the GRC must be within the purview of Environmental Management Plan, Corporate EHS and Social Policies or any such documents of relevance of that matter;
- If needed, may undertake field visits to verify and review the issues, dispute or other relevant matters.

Disclosure of the Grievance Redress Mechanism

Awareness campaigns and workshops will be carried out throughout the project area to ensure that knowledge of the grievance redress procedures is generated. The awareness campaigns to ensure that poor and vulnerable households are made aware of grievance redress procedures and entitlements. The process of existing disclosure mechanism of GRM followed by RBLTL facility, will keep the following aspects in mind:

- The grievance redress process shall be disclosed and the procedures mentioned therein shall be properly disseminated to the identified stakeholders.
- RBLTL shall integrate the grievance redress mechanism as a part of the induction training programme especially those conducted for self-employees and the contractors.

- The disclosure of the information shall clearly mention the name and designation of the grievance redress officials, office location and their respective contact numbers.

Grievance Reporting Procedure & Careful Documentation

An aggrieved person, a group of persons or a community can file grievances without any fear and intimidation. The grievances can be submitted in either in writing or may be submitted orally/ telephonically to the GRC; the whole purpose is to make the GRM easily accessible to the affected population. The decision made by GRC will be communicated to the concerned person/group/community in writing.

The GRC will maintain records of the grievances received, in written and oral form, including the details of the complainant, the subject of the grievance, the appropriate department, and the status of the grievance. A sample recording format is provided in the following table:

Table 4: Sample Recording Format for Grievances Received

S. No	Date	Village	Name of Complainant	Details of Grievance	Concerned Department	Status	Remarks
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Documentation of the complaints is important and must contain name of the complainant, date of receipt of the complaint, address/contact details of the person, location of the problem area, and how the problem was resolved. It needs to be ensured that grievance and complaints related to environmental and social safeguards issues are redressed timely, registration of grievances, related disclosure, and communication with the aggrieved party. Number of cases received by the GRC indicating the types of grievances made in favor of or against the complainants must be accounted.

Monitoring and Evaluation

Like the other project components, GRM will be monitored to ensure that the stakeholders are having no or limited issues with the project and in case there are concerns, they are being adequately addressed as per the mandate. In order to keep track on the effectiveness of GRM, it is the responsibility of the GRC to compile and maintain database on grievances for periodic review. The process of monitoring will include an internal monitoring and an external monitoring process.

The internal monitoring will be undertaken by the GRC, on a regular basis (at least six monthly). This process will allow for a review of the GRM to be undertaken, in terms of the efficacy of the mechanism and the average time taken for the redressal of the grievances received. These monitoring reports will be shared with the senior management of RBLTL.

In addition to the internal monitoring process, the Project will consider engaging an external agency for undertaking monitoring of the GRM on an annual basis. This monitoring process will allow for an assessment to be undertaken of the number and nature of grievances received, the manner in which the grievances were settled and the number of pending grievances. The external monitoring report will also be disclosed to the local community and other identified stakeholders.

12 INSTITUTIONAL ARRANGEMENT

The key stakeholders involved in the Resettlement Plan (RP) are mainly the Executive Agency (RBLTL), the Deputy Commissioner's Office, the Agricultural Marketing Directorate, the Department of Forestry, Public works Department (PWD), ADB and the RP implementing agency. The main task and responsibilities of the institutions are planning, negotiating, consulting, approving, coordinating, implementing, financing, monitoring and evaluating land acquisition and resettlement and rehabilitation. In case of land acquisition and other resettlement impacts – representatives of DC, EA staff, PWD, Forest Department, implementing agency and representatives from affected communities including women and members of vulnerable group will carry out joint verification of the inventory of affected persons and assets acquired to finalize the list for implementation purpose, especially for payments. An external Agency will be hired by EA for monitoring implementation activities of RP.

13 MONITORING & REPORTING

Internal Monitoring

The RP will have the scope of monitoring and reporting. The EA will monitor the regular activities and oversee the timely implementation of RP activities. The EA will evaluate externally once through an independent appointed agency. The EA will thus have the scope of both internal and external monitoring.

The EA will establish a monitoring system internally for collection, analysis, reporting and use of information about the progress of resettlement based on the RP. The EA will gather information on RP implementation covering relevant activities as per schedule. The internal monitoring reports on RP implementation will be included in Project Progress Report (PPR). Besides, semi-annual monitoring reports stipulating all efforts and outcomes will be sought by ADB from the Project Proponent. The report will contain – (i) accomplishment to date, (ii) objectives attained and not attained during the period of reporting, (iii) challenges encountered and (iv) the targets for the six months. Outline of the semi-annual report is given in *Enclosure 3a*.

External Monitoring

An External Monitoring Agency (EMA) will be hired and engaged by the EA to conduct external monitoring under a set Terms of Reference to be developed at detail design stage. The external monitoring agency will be qualified and experienced agency, which will not be involved in RP implementation. The external agency would conduct periodic assessment of the RP implementation and impacts to verify internal monitoring and to suggest adjustments in delivery mechanism and procedures as required. The reports of External Monitoring Agency are to be prepared biannually and submitted to EA and ADB. External monitoring will be in two phases - compliance monitoring and social impact evaluation. Terms of Reference of External Monitoring Agency is given in *Enclosure 3b*.

14 BUDGETING & FINANCING

Detailed budget estimates for RP will be prepared based on the detail designs of the projects and the SIA of the project area. The cost of resettlement activities, relocation and special assistance will be consistent and FGDs, surveys, training, monitoring and evaluation and income restoration must be included in the RP budget.

Budget estimate of RP will be included in the overall project budget. The budget shall include:

- Detailed costs of land acquisition and livelihood and income restoration and improvement;
- Source of funding;
- Administrative and implementation cost;
- Cost for GRM and consultation/ disclosure and
- Monitoring costs.

The Deputy Commissioner (DC) will place cost estimate for the land acquisition to the Project Proponent for transfer of fund (to be provided to the DPs) to the account of DC. The resettlement benefits and assistance such as shifting cost, business/ income restoration allowance will be made available to all DPs irrespective of title as per the policy by the EA. The EA will approve the budget and arrange payment of additional compensation and resettlement grants to DPs/ APs. The EA will ensure that the land acquisition and resettlement budgets are delivered on time to the DC and also ensure that the RP should be submitted to ADB for concurrence, and that fund for compensation and entitlement under RP are fully provided to DPs/ APs prior to award of civil work contract. All resettlement funds will be provided by the Project Proponent based on the financing plan.

Enclosure: 1

**TERMS OF REFERENCE FOR INDEPENDENT THIRD PARTY FOR
NEGOTIATED PURCHASE**

For any negotiated purchase, an external independent entity will observe and document the consultation process and validate the negotiated purchase process as per legal requirement

TOR for Independent Third Party Witness

An independent third party is sought to be appointed to oversee and certify the process of negotiated purchase. The third party shall be briefed about his/her expected role and deliverables by the concerned PIU.

Eligibility: The third party shall be a representative of the community (for example, a leader of the community with formal/legal standing, a representative of a local NGO/CBO with formal and legal standing), without any direct interest in the negotiation process or subproject activity, who is acceptable to each of the concerned parties (PIU/PMU and concerned land owner).

Scope of work: The role of the third party shall be to ensure a fair and transparent process of negotiation/donation. The envisaged scope of work shall entail the following:

- (i) witness and keep a record of meetings held with the concerned parties,
- (ii) ensure there is no coercion involved in the process of negotiated purchase / land donation,
- (iii) ensure that the preferences and concerns of the land owner related to access, selection of site within lands held, etc. are recorded and any stipulated conditions met,
- (iv) ensure that the negotiated purchase agreement is drafted in a fair and transparent manner,
- (v) confirm that the offered/agreed price is fair and meet the market price of the land with similar value and condition in the area,
- (vi) ensure the negotiated purchase does not result any negative impacts to the third party associated with the purchase/donation activity,
- (vii) identify and recommend mitigation measures to land owner / affected third party, if required,
- (viii) ensure that taxes, stamp duties and registration fees for purchased of land are borne by Project Proponent, and
- (ix) submit a certificate as witness to the purchase and transfer process.

Deliverables: The details of the meetings, and certificate/reports as witness to the purchase / donation process and mitigation measures to owner, if any, shall be submitted by the third party to Executive Agency and owner/donor in the local language.

SAMPLE CERTIFICATION FORMATS

This is to certify that Mr./Mrs., (profession, designation, address) is appointed as independent third party to certify the process of negotiated purchase of plot no.....area..... owned by (names of owner), who is a signatory to this certificate. It is also placed on record that none of the signatories to this certificate have any objection to appointment of as third party witness.

Date.....
Officer of KEIP/KMC and land donor
(Names and Signatures)

.....
.....

I,of(address) certify that I was witness to the process of negotiated purchase / land donation (details of plot from land owners names). I certify that:

1. The process of purchase of the said land was transparent; the landowner(s) was/were happy to sell the affected assets for the welfare of the community/subproject activities.
2. The offered price of the land is fair and meets the market price of the land with similar value.
3. No coercion was used in the purchase process.
4. No (formal/informal) third party (associated with the purchase/donation) is negatively affected ¹by the purchase/donation activity
5. Land transfer costs (registration fee and stamp duty) were borne by the government and not by the owner/donor.
6. All concerns expressed by the owner/donor as agreed, were addressed and no pending issues remain.
7. The following mitigation measures were identified and implemented / provided to the land owner/donor.
8. Attached are the minutes of meetings held between project proponents and the land owner/donor, and the agreed price/value of the donated land which I was witness to.
9. Attached are the pictures of the land purchased and pictures of the original land owner(s) of the purchased land.
10. Attached are the information of the socio economic background of the land owner(s)

Signed/

Name

Date:.....Place:.....

¹ Negatively affected defines as permanent loss of/ access to shelter or livelihood support which could cause impoverishment to the affected third party.

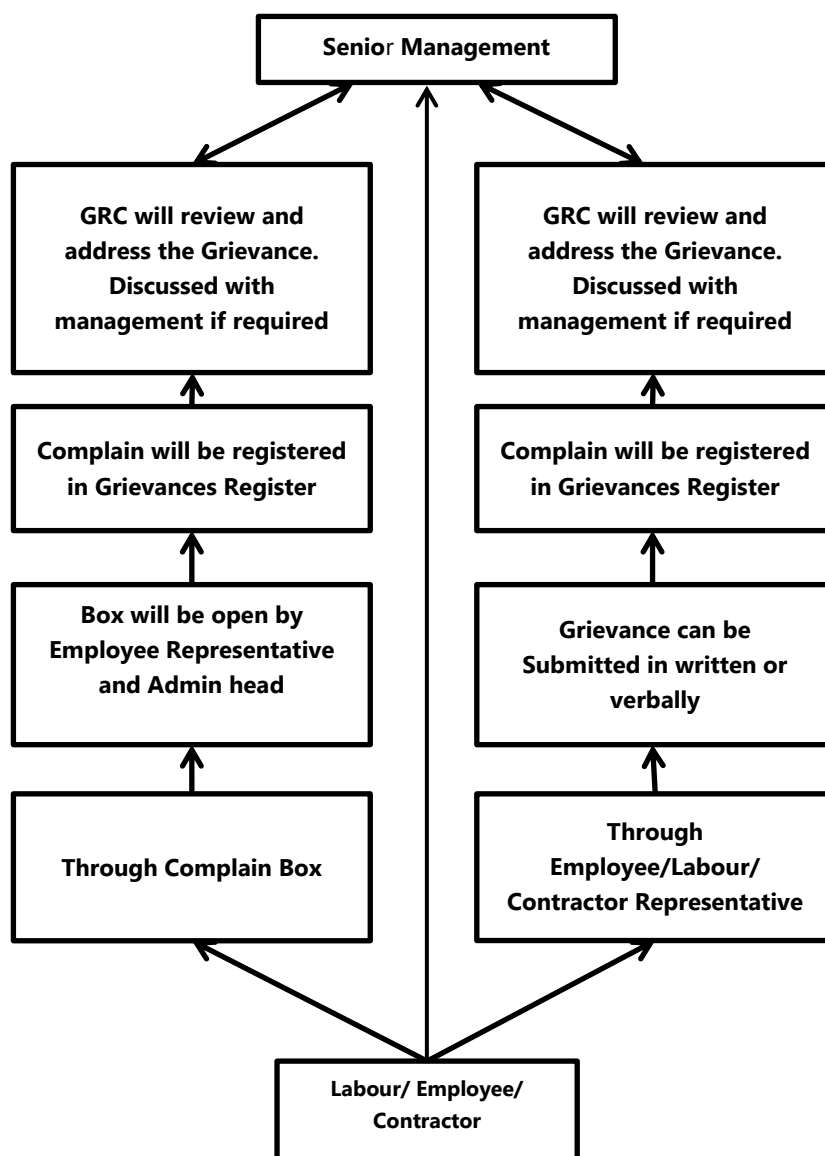
Process of Grievance Redress Mechanism of RBLTL

Reliance Power already has a set grievance redressed mechanism for employee, contractor and community and this new project of Reliance Bangladesh LNG Terminal Limited (RBLTL) will be governed through this existing grievance redressal mechanism.

Grievance Redressal Mechanism for Employees and Contractual Workers

A schematic representation of the grievance redress procedure for employee and contractor will be followed by Reliance Power is shown below in Figure 1.

Figure 1: Existing Grievance Redress Process for the Employee and Contractor



As stated in the above figure, the employees and contractual workers can register their grievances in verbal or written form by communicating their grievances to the compliance personnel or group audit personnel or by dropping the grievance in the complaint box, which will be located at every strategic location of the facility. The GRC will maintain a log of all complaints received in the form of a Grievance Register. Grievance log will help to track

cases, respond to grievances in a timely manner, check the status of complaints and track progress, measure effectiveness, and report on results.

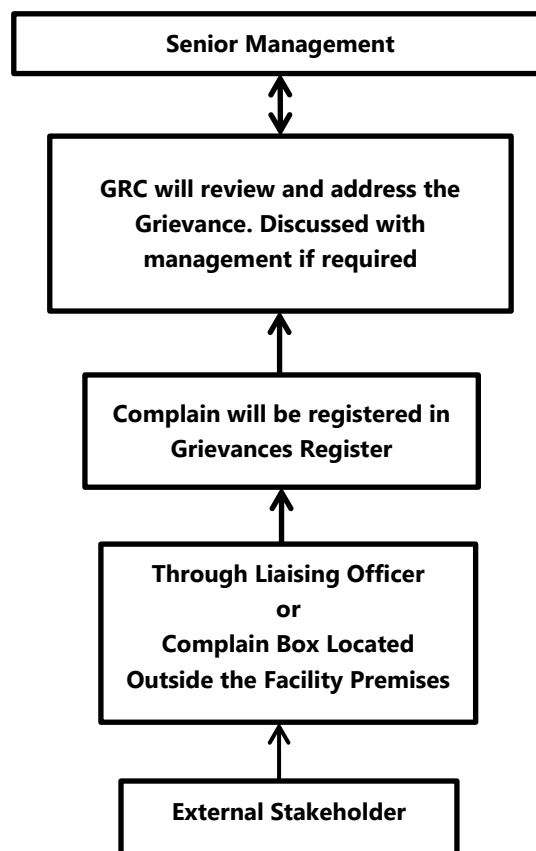
The GRC will then review and investigate the grievance, along with the representatives from the concerned departments, and identify measures to resolve the grievance as appropriate. This could involve provision of information to clarify the situation, undertaking measures to remedy actual problems or compensate for any damage that has been caused, and introduction of mitigation measures to prevent recurrence of the problem in the future. Where a grievance is found to be not a real problem a clear explanation will be provided to the complainant.

On the basis of the investigation, a formal response detailing how the grievance has been resolved will be provided to the complainant within 15 days where possible, and at the most within 4 weeks. Where resolution is delayed the complainant will be provided with regular updates on progress. On the basis of the response, the grievance form will be updated and the grievance will be closed.

Grievance Redressal Mechanism for External Stakeholders

The grievance redressal mechanism for the external stakeholders for RBLTL is presented in the *Figure 2*.

Figure 2: Grievance Redressal Mechanism for External Stakeholders



As can be seen from the above figure,

- The external stakeholders, including the local community, can register their grievances in verbal or written form by communicating their grievances to the Liaison Officer or by dropping the grievance in the complaint box/register, which will be located at the entry gate of the land based facility.
- The GRC will maintain a log of all complaints received in the form of a Grievance Register, as has been discussed above. The process for review and investigation of the grievances will be similar to the process for the employees and contractual workers.
- As part of the review process, the GRC will also undertake site inspections, if required. A site inspection will be undertaken by the factory manager or a member of the GRC. The purpose of the site inspection will be to check the validity and severity of the grievance. The inspection will be undertaken within ten days of receiving the grievance.
- The assigned individual will then work with other relevant members of the GRC and concerned departments to investigate the problem and identify measures to resolve the grievance as appropriate. On the basis of the investigation, a formal response detailing how the grievance has been resolved will be provided to the complainant within 15 days where possible, and at the most within 3 weeks. Where resolution is delayed the complainant will be provided with regular updates on progress.
- On the basis of the response, the grievance form will be updated and the grievance will be closed.

Enclosure 3a

Outline of the Semi-Annual Monitoring Report (Internal Monitoring)

A Social Safeguards Monitoring Report (SMR) is required to review and assess the implementation of social safeguards – preparation and implementation including grievance redress at each subproject level. One SMR should be prepared for each PIU, and consolidated at program level. Its level of detail and comprehensiveness is commensurate with the projects implemented over the reporting period. The report typically should have the following major elements, disclosed on Project Proponent’s websites for public viewing.

- A. Executive Summary
- B. Introduction
- C. Scope of Land Acquisition and Resettlement & Rehabilitation
- D. Policy and Legal Framework
- E. Validation and Verifications of APs
- F. Public Consultations and Disclosure
- G. Grievance Redress
- H. Monitoring and Reporting
- I. Issues and Action Plan

Terms of Reference for Independent/External Monitoring Agency

Introduction

In order to implement the RP properly, independent monitoring by an External Monitoring Agency (EMA), independent of the project, with prior experience in resettlement and rehabilitation of developed induced displacements will be engaged to carry out the external Monitoring & Evaluation (M&E) and reporting of the implementation of the RP.

Objectives

The major objectives of engaging the External Monitoring Agency are to:

- assess the overall approach of resettlement plan implementation activities; - verify the result of internal monitoring;
- assess whether resettlement objectives have been met; especially whether livelihoods and living standards have been restored or enhanced;
- assess resettlement efficiency, effectiveness, impact and sustainability drawing lessons as a guide to future resettlement policy making and planning; and
- ascertain whether the resettlement entitlements were appropriate in meeting the objectives, and whether the objectives were suited to AP conditions.

Specific Tasks

The EMA will carry out periodic review and assessment of resettlement implementation, verification of the results of internal monitoring in the field to assess the achievement of objectives of the RP against the performance impact indicators. A database for monitoring and evaluation, building upon the project's own M&E system, will be developed for external monitoring. It will optionally include maps, charts, photographs of affected property, copies of contracts and land titles, payments, and valuation documents relating to resettlement. The specific tasks of the external monitoring agency will be to:-

- Build up a system of internal monitoring to assess progress in order to fulfill the targets of the RP: budget and time frame, delivery the APs' entitlements, consultation, grievance and mitigation actions;
- Review of internal monitoring and evaluation reports on a regular basis to reach consensus on actions required to improve resettlement performance and implementation;
- Establish a system of external monitoring and evaluation to assess overall achievement of RP implementation;
- Establish monitoring and evaluation reporting methods and reporting requirements;
- Establish a participatory M&E system; and
- Include post evaluation of resettlement to be conducted by the independent monitor after completion of the project.

Monitoring Indicators and Information Needed Indicator Information

Indicator	Information
Basic information on affected household	<ul style="list-style-type: none"> • Location of the HHs HH structure, age, education, skills, occupation and employment pattern • Access to health, education and other social services • Land holdings and pattern of use • Income source and levels • Housing type • Participation level in social activities • Value of all assets forming entitlements and resettlement entitlements
Restoration of living standard	<ul style="list-style-type: none"> • Cost of compensation and entitlements • Undertaking housing option development • Reinstatement of opinion of the community • Replacement of social and cultural elements
Restoration of livelihoods	<ul style="list-style-type: none"> • Creation of employment opportunities for the APs • Sufficient assistance for re-establishment of entrepreneurship development Adequate income substitution allowance • Sufficient transfer and relocation grants • Availability of replacement land • Sufficient compensation and entitlements
Satisfaction	<ul style="list-style-type: none"> • Knowledge of RP procedure and entitlements • Knowledge about the fulfillment of resettlement entitlements • Assessment of living standard and their livelihoods • Knowledge about grievance and mitigation actions
Effectiveness of RP	<ul style="list-style-type: none"> • Sufficient time and budget to meet the objectives of the RP • Support provided to the land speculators • Level of generosity of the entitlements • Identification of the vulnerable groups • Dealing with unforeseen problems by the PIU

Methodology and Approach

The M&E approach will identify and select a set of appropriate indicators and gather information on them to assess the changes and variations. Participation of stakeholders especially the affected persons, women and vulnerable groups, will be ensured in the M&E process. The process will also undertake various formal and informal surveys for impact analysis. Assessment of resettlement efficiency, effectiveness, impact and sustainability will be carried out through the M&E process.

Monitoring Tools

Monitoring tools would include both quantitative and qualitative methods as follows:

Sample household survey: a baseline household survey of representative sample (20% of affected households), disaggregated by gender and vulnerability to obtain information on the key indicators of entitlement delivery, efficiency, effectiveness, impact and sustainability.

Focus Group Discussion (FGD): Consultation with a range of stakeholder groups (local government, resettlement field staff, INGOs, community leaders and APs including women and vulnerable groups).

Key informant interviews: Consultation with individuals like local leaders, village workers or persons with special knowledge or experience about resettlement activities and implementation.

Public Consultation meetings: Public consultation meetings at resettlement sites to elicit information about performance of various resettlement activities.

Structured direct observations: Field observations on status of resettlement implementation, plus individual or group interviews for crosschecking purposes.

Informal surveys/interviews: Informal surveys of APs, host village, workers, resettlement staff, and implementing agency personnel using non-sampled methods.

Case studies: In the case of special issues, in-depth case studies of APs and host populations from various social classes will be undertaken to assess impact of resettlement.

Institutional Arrangements for M&E

Internal monitoring will be carried out by the Resettlement Unit (RU) through their field level offices and implementing NGOs. An independent external monitoring agency will carry out M&E independent of the project. The project supervision consultant under the RU will oversee and monitor safeguard compliance of the Project. The project affected persons, their community and local level NGOs will also participate in the M&E process.

Office of the Project Director

The Project Director (PD) will be responsible for overseeing proper and timely implementation of all activities of the RP. The PD will carry out internal monitoring through the Deputy Director M&E with the help of the implementing organisation. The resettlement unit within the office of the PD will operate and manage implementation of the RP with assistance from an appointed implementing organisation. The RU will establish an M&E Section at the head office headed by a Deputy Director in charge of Monitoring and Evaluation. The M&E Section will have sufficient staff having appropriate skills and capacity, and necessary resources. The Implementing organisation will collect appropriate data from the field and provide feedback to the RU on progress of RP implementation and the day to day problems arising out of the process. The implementing organization will also prepare monthly/quarterly reports on the progress of RP Implementation. The RU of the M&E section will collect information from the project site and incorporate in the form of monthly/quarterly progress of RP implementation and adjust work program where necessary, in case of delays or problems.