Government of the People's Republic of Bangladesh

Bangladesh Steel & Engineering Corporation (BSEC)

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

Establishment of Environment Friendly Ship Recycling Industry at Taltali, Barguna

December 2024

Innovate Engineering and Development

Contents

List of Figures

List of Tables

ABBREVIATIONS

BOD	Biochemical Oxygen Demand
BSBA	Bangladesh Ship Breakers Association
BC	Basel Convention
B	Beam, Breadth
COD	Chemical Oxygen Demand
CA	Competent Authority
DASR	Document of Authorization for Ship Recycling
DWT	Dead Weight Tonnage
DO	Dissolved Oxygen
DoE	Department of Environment
DoF	Department of Fisheries, Ministry of Fisheries and Livestock, Government of Bangladesh
EIA	Environmental Impact Assessment
ETP	Effluent Treatment Plant
EU	European Union
EUSRR	EU Ship Recycling Regulation
EC	Electrical Conductivity
ECR	Environmental Conservation Rules, Bangladesh 1997
EIA	Environmental Impact Assessment
EFSRI	Environment Friendly Ship Recycling Industry
FO	Fuel Oil
GT	Gross Tonnage
GPS	Global Positioning System
Hst	Height from water surface to top of ship
Hkt	Height from keel to top of ship
HEPA	High Efficiency Particulate Air Filter
HHWL	Highest High-Water Level
HKC	Hong Kong Convention
HTL	High Tide Level
HW	Hazardous Waste
HEPA	High Efficiency Particulate Air Filter
HWL	High Water Level
HKC	Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships, May 2009
IHM	Inventory of Hazardous Materials
IMO	International Maritime Organization
INCI	Incineration
ILO	International Labour Organization
Loa	Length overall
L_{pp}	Length between perpendiculars
LDT	Light Displacement Tones
LO	Lubrication Oil
LPG	Liquefied Petroleum Gas
LTL	Low Tide Level
LWL	Low Water Level
MW	Mega Watt
MoEFCC	Ministry of Environment, Forest and Climate Change
MoI	Ministry of Industries, Government of Bangladesh
NGO	Non-government organization
NHW	Non-Hazardous Waste
NOC	No Objection Certificate
OECD	Organization for Economic Co-operation and Development

PCB	Polychlorinated Biphenyl
PPE	Personal Protective Equipment
PPM	Parts Per Million
PM	Particulate Matter, maybe qualified according to size,
PM10	particulate matter less than 10micrometres in size
PAH	Polycyclic Aromatic Hydrocarbons
POPs	Persistent Organic Pollutants
PAPs	Project Affected Persons
SBRI	Ship Breaking and Recycling Industry
SME	Small and Medium-sized Enterprises
SPM	Suspended Particulate Matter
SoC	Statement of Compliance
SRF	Ship Recycling Facility
SRP	Ship Recycling Plan
SRDI	Soil Resources Development Institute, Ministry of Agriculture, Dhaka
TBT	Tributyl Tin – antifouling agent
TDS	Total Dissolved Solids
TOR	Terms of Reference
TSDF	Treatment Storage Disposal Facility
T_{FL}	Full-loaded draft
T_B	Ballasted ship draft
UNEP	United Nations Environment Programme
USD	United States Dollars
VHF	Very High Frequency
VLCC	Very Large Crude Carrier
YPSA	Young People in Social Action

1. Executive Summary

Bangladesh Steel & Engineering Corporation (BSEC) of the Government of Bangladesh (GoB) is planning to establish an environment-friendly ship recycling industry in Taltali upazila of Barguna district. An Environmental Impact Assessment EIA is being carried out to determine the possible impacts of the proposed ship breaking-recycling facility in order to identify necessary mitigation measures.

1.1 Laws, Rules, Regulations, Conventions

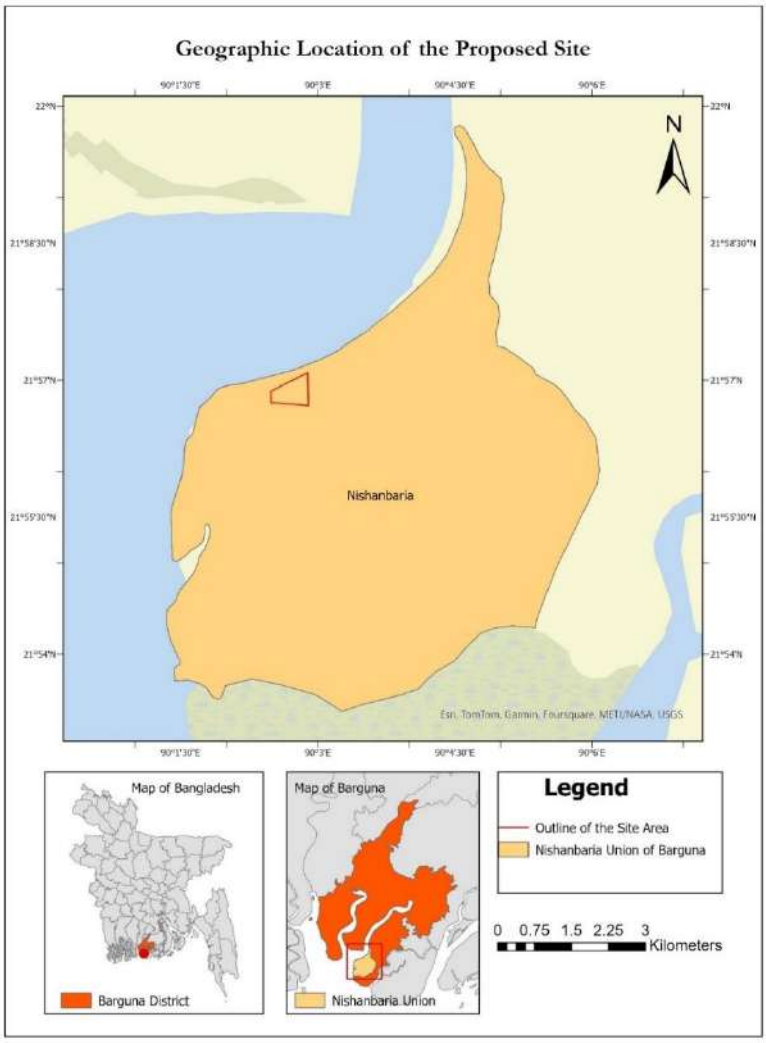
- National Environmental Policy 2018
- Bangladesh Biodiversity Law 2017
- The National Water Policy 1999
- National Agriculture Policy 1999
- Environment Conservation Act 1995 (amended in 2000, 2002, & 2010)
- Bangladesh Water Act 2013
- The Forest Act 1927 (Amendment 2000)
- Environmental Conservation Rules 2023
- Noise Pollution (Control) Rules 2006
- Air Pollution (Control) Rules 2022
- Solid Waste Management Regulations 2021
- EIA Guidelines for Industries
- Air Pollution Prevention Guidelines
- The Ship Breaking and Recycling Rules 2011
- Bangladesh Ship Recycling Act 2018
- Basel Convention
- Hong Kong Convention
- EU Ship Recycling Regulation

1.2 Project Description

The project plans to establish the shipbreaking/recycling industry in an environmentally friendly way. The site is situated at the estuary of Baleshwar, Bishkhali and Burishwar rivers.

1.1.1 Site Location

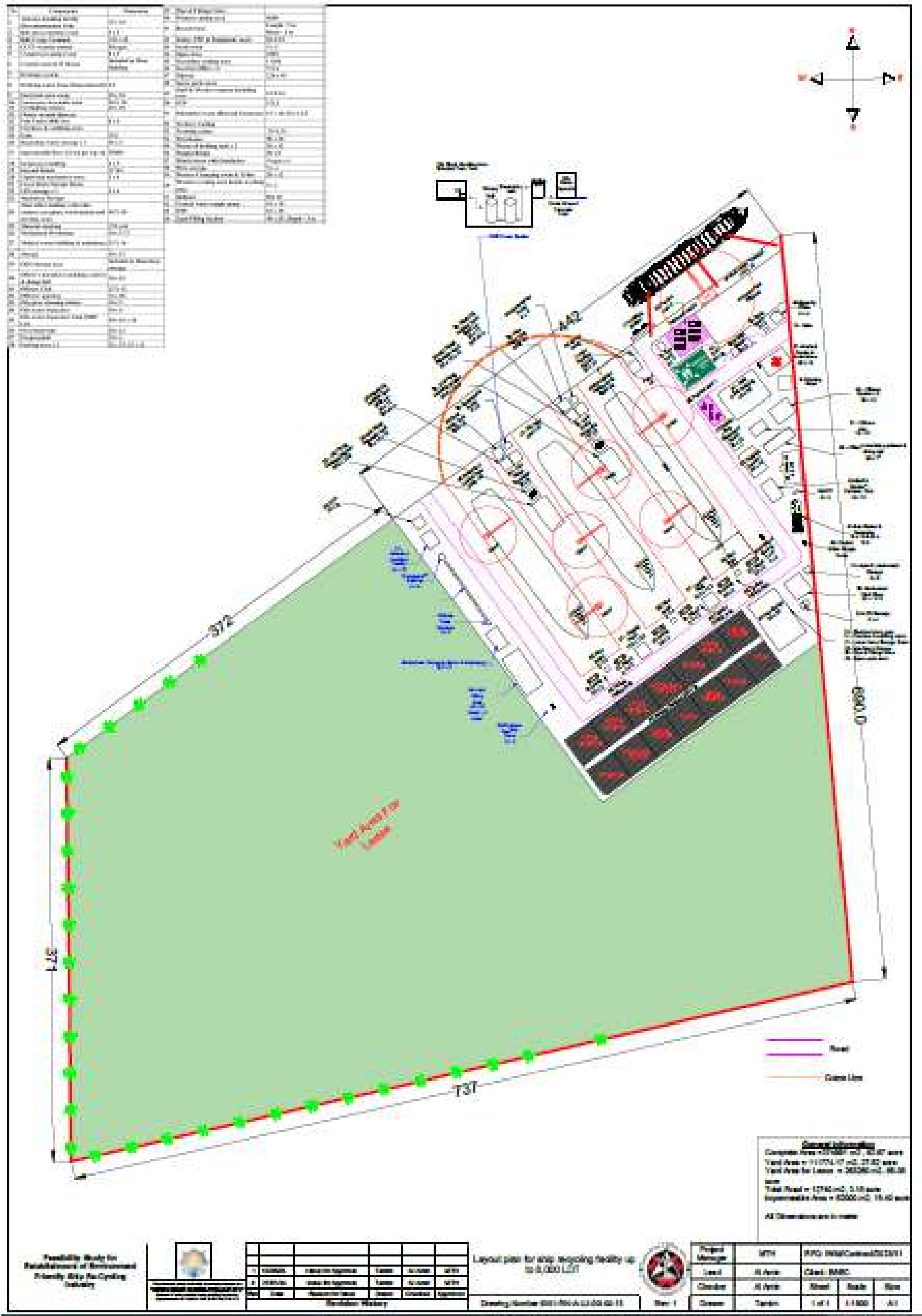
The selected site for the facility is in Nishabaria Union of Taltali upazila in Barguna district within the Barishal division of Bangladesh. The area is on the bank of the Payra River, approximately 2.5 km inland from the sea. The proximity to the Bay of Bengal makes it a very ideal location for such an industry as it will be very convenient to bring over the ships for breaking at the facility through the big river from the sea. A GIS map of the proposed site is as follows:



1.1.2 Project Design

Selected method of ship-breaking at the yard will be Slipway, with consideration for construction of three slipway facilities. Each slipway will have a dimension of 45m width and 220m length. The slipway platform will host steel cradle on steel railways imbedded in its concrete foundation and will be inclined at 1:25 gradient extending from shoreline to sea. The proposed design of slipway can accommodate ship sizes up to 30,000 DWT.

Other supporting equipment for hulling and cutting includes service barges, winch, heavy lifting cranes and cutting tools. There also will be storage facilities for scrapped and waste materials and magnet or wheel crane and excavators for handling scrapped materials. The slipway and associated system will be hosted in impermeable concrete pavement with proper drainage system. Following is layout plan:


372
442
371
737
690.0
Road
Crane Line
Layout plan for ship recycling facility up to 8,000 LDT

There will be following supporting operational facilities within the compound:

- Administration office
- Vehicle parking areas
- Equipment parking area
- Medical Centre
- Workshop
- Training rooms
- Safety room
- Officer's dormitory
- Security post
- Electric distribution system
- Fresh water supply system
- Drinking water system
- Firefighting system
- Other auxiliary facilities: weighbridge for truck, Scale room, light masts, worker's change rooms, rest shelters, restrooms, canteen.

1.3 Baseline Environmental and Social Condition

Baseline environmental condition of the site area has been studied to understand possible impacts from the project.

1.1.3 Geology

The site area in within Barguna district, located in south-western Bangladesh, within the coastal region. The land mass type is mostly consisting of tidal deltaic deposit.

1.1.4 Environmental Sensitivity

The site area is very close to environmentally sensitive and protected areas. It is only about 18 km distant from the Sundarbans. Moreover, the Tengragiri area, which is also a protected forest area is only 5.5 km away. Close proximity to the river and the Bay of Bengal also makes this site critical to local and national ecology and biodiversity.

1.1.5 Wildlife

1.1.6 Flora, Fauna, Wildlife, Biodiversity

Barguna district is situated in the south-western part of Bangladesh. This is a flat low-lying land with lots of rivers and estuarine creeks, having regular low and high tides. The Bay of Bengal is just down south of this district.

Similar to other districts in the region, Barguna also has lots of agricultural production. The cropping pattern is largely inclusive of Rice, beans, dal, mustard, chilies, sweet potato, potato, tobacco, and vegetables.

Flora and Fauna found in the site area are common. Presence of any endangered species is not encountered. Aquatic fauna has more importance in this area. Fish is the major and most important aquatic fauna of the project area. In addition to capturing fisheries in rivers, the ponds and burrow pits within the area are also utilized for fish culture. There are also recorded movements of turtles and dolphins.

The presence of any wildlife has not been known to be existing in the proposed project site area. But there are some wild animals' presence at Tengragiri.

1.1.7 Air Quality

Air Quality was tested at 6 locations. All parameters are within standards of Bangladesh.

1.1.8 Noise level

Current noise levels at the site are within standard limits. Highest recorded was 67 dB.

1.1.9 Water Quality

There is abundance of Water in the region but sometimes with issues like salinity, arsenic. For the study, tests have been conducted for both surface water and groundwater. Some parameters of water exceed Bangladesh standards, especially in surface water, revealing presence of pollutants.

1.1.10 Weather, Climate, Hydrology

The area has very active hydrology due to being situated amidst large water bodies. There is considerable amount of rain during monsoon season. The site partly falls within a basin.

1.1.11 Natural Disasters

The area is highly prone to cyclones, storm surge, and erosion. There are also risks of some flooding. Climate change and sea level rise further increases the vulnerability of the site.

1.1.12 Demography

The total population of Barguna district as of census 2022 is 1,010,531 (male: 494,738, female; 515,723). The distribution of population varies considerably among the 6 upazilas:

Upazila	Amtali	Bamna	Barguna Sadar	Betagi	Patharghata	Taltali
Population	214,436	78,942	294,350	125,464	177,875	119,394

Taltali is the second least populous upazila of Barguna. Local demographic information of Taltali upazila is as follows[1]:

Population	Male	Female	Total
	61,144	58,250	119,394
Number of Households		29,005	
Household Size		4.03	
Literacy Rate	Male	Female	Total Average
	82.40%	79.06%	80.77%

[1] Source: Bangladesh Bureau of Statistics census 2022

1.4 Impacts from the Project

The project will have impact on the site area during pre-construction, during construction, and post-construction/operation phases.

Parameter	Pre-construction	Construction	Operation	Type
green indicates positive impacts		*orange indicates negative impacts*		
Environmental Impacts				
Geology and Geography	▪ Land use change ▪ Land cover change ▪ Dust from Materials stacking	▪ Dust from construction activities ▪ Increased traffic and movement on the landmass	▪ Impact on river channel due to river bank protection/river training works ▪ Erosion on opposite bank	Unavoidable
Environmental Sensitive Areas	▪ Dust, noise from preparatory activities ▪ Increased population density in the region	▪ Dust, noise, emission from construction ▪ Increased traffic movement in the region	▪ Adverse impact on wildlife sanctuaries from exposure harmful substances from the ▪ Adverse impact on natural forestry from contamination of pollutants	Potential
Air quality	▪ Dust, and emission from preparatory activities	▪ Dust, and emission from construction	▪ Dust generation from industrial works including harmful particles like paint, rust ▪ Air quality degradation from spreading of toxic and hazardous materials. ▪ Fumes from waste oils ▪ Emission from equipments	Unavoidable
Vibration	Vibration from preparatory activities, primary from trucks	Vibration generated by construction equipment and heavy vehicles	Vibration generated from ship breaking, scrap metal handling, heavy equipment and vehicles	Unavoidable
Noise	Noise from preparatory activities	Noise from construction, and increased vehicular movements	Noise from industrial activities, and increased vehicular and waterway movements	Unavoidable

Hydrology	▪ Filling of ponds ▪ Obstruction to some water flow	Obstruction of some water flow	Increased use of water channel(s)	Unavoidable
Surface water	Pollution of water channels from waste materials	▪ Pollution of water channels from solid and liquid wastes from construction Filling up of local small waterbodies like ponds	▪ Pollution from movement of ships ▪ Pollution from leakage of solid and untreated liquid wastes ▪ Contamination from leakage of toxic/hazardous waste	Potential
Ground water	Change in water extraction pattern	▪ Oil leakage, Sewage leakage	▪ Contamination from Oil leakage, Sewage leakage ▪ Pollution from seepage of untreated liquid waste	Potential
Soil and Sediment	Increased erosion	Contamination from waste materials generated during construction period	▪ Contamination from Oil leakage, sewage leakage, heavy metals ▪ Pollution from soild and liquid wastes including toxic/ hazardous wastes ▪ Degradation from disposal of industrial/chemical wastes, affecting agriculture ▪ Salinity intrusion from embankment damage/breach ▪ Contamination of river bed/sediment from pollutants, heavy metal ▪ Disturbance to the benthos on the river bed	Potential
Flora	About 808 nos. trees will be cut.	Trees in the locality may be	Some trees will be planted	Unavoidable

		affected by dust, emissions		
Fauna	About 808 nos. trees will be cut, risking habitation of bids in the area.	Loss of habitats for some small animal species.	Habitation of some aquatic species including fish, dolphin, turtles may be disturbed by ships movement, pollution, and industry operation.	Potential
Biodiversity, Wildlife and Natural Habitat	Disturbance to aquatic habitat from noise, pollution.	Disturbance to and aquatic and amphibian habitats from noise, pollution, increased movements.	Disturbance to, or loss of aquatic and amphibian habitats from noise, pollution, increased movements.	Potential
Impact from natural disasters	▪ Displacement of construction materials ▪ Increased accidents ▪ Increased erosion	▪ Displacement of construction materials ▪ Increased accidents ▪ Increased erosion ▪ Displaced construction materials causing accidents	▪ Displacement of harmful substances by high wind, rain water, storm surge ▪ Pollution of surrounding areas ▪ Increased accidents ▪ Increased need for shelters ▪ Increased risk of damage from disaster to the area due to different in protection measures	Possible
Environmental Pollution	Waste generation from dismantling existing structures	○ Waste generation including construction wastes, industrial wastes, ○ Solid wastes from site ○ Liquid wastes ○ Emission from equipment	○ Waste generation including hazardous and toxic wastes ○ Solid wastes from the facility ○ Harmful liquid wastes ○ Emission of gas from equipment, ships ○ Residual oils, chemical substances,	Potential

			heavy metals onboard the ships	
Socio-economic impacts				
Economy	Work opportunities	▪ Work opportunities ▪ Business opportunities	▪ Work opportunities ▪ Business opportunities ▪ Possibility of new business creation ▪ Regional and national economic improvement	Unavoidable
Land acquisition	▪ Acquisition of land ▪ Resettlement of people ▪ About 200 households may be affected	Access restriction of local people to the site area including roads	People being forced to adopt to alternate roads, routes	Unavoidable
Livelihood	▪ Removal of local market ▪ Removal of small local shops ▪ Loss of agricultural lands ▪ Loss of grazing lands ▪ Disruption to fishing activities	▪ Work opportunities ▪ Business opportunities	▪ Disturbance to fishing activities by ships movement ▪ Destruction of fish habitat and migration from pollution ▪ Work opportunities ▪ Business opportunities	Unavoidable
Education	▪ Displacement/Re-location of educational facility that are within site area	Disturbance to nearby academic institutions	Disturbance to nearby academic institutions	Unavoidable
Labor influx	▪ Friction or conflict between local people and outside labor ▪ Increased risk of infectious diseases from external workers			Potential
Health and Safety	▪ Some safety risks	▪ Occupational safety risks from construction works ▪ Risk of fire incidents	▪ Occupational safety risks from ship breaking activities including accidents, fall from height	Potential

		during construction works	▪ Health risks from hazardous materials ▪ Risks of fire or explosion ▪ Long term health issues like hearing loss	
			▪ Reduction global pollution from recycle of end-of-life ships ▪ Reduction in Greenhouse gas emissions	
Pollution induced social impacts	▪ Pollution of soil affecting agriculture ▪ Pollution of river affecting fisheries	▪ Pollution of soil may affect agriculture ▪ Pollution of river may affect fisheries ▪ Dust, emission, increased traffic may affect livestock	▪ Pollution of soil may affect agriculture ▪ Pollution of river may affect fisheries ▪ Pollution of groundwater may affect public health ▪ Dust, emission, increased traffic may affect livestock	Potential
Sensitive Public Place	▪ Loss of access to graveyard or resettlement of graveyard ▪ Loss of access to mosque			Unavoidable

1.5 Mitigation Measures

Serial No.	Impact Parameters	Negative Impacts	Mitigation Measures
		Pre-construction	
1)	Geology and Geography	• Land use change • Land cover change • Dust from Materials stacking	• Cover loose construction materials
2)	Noise	• Noise from preparatory activities	• Activities should be scheduled in daytime.
3)	Air quality	• Dust, and emission from preparatory activities	• Minimize dust by spraying water • Cover loose construction materials

4)	Surface water	• Pollution of water channels from waste materials	• Prevent dumping of ant waste into waterbodies
5)	Ground water	• Change in water extraction pattern	•
6)	Environmental Sensitive Areas	• Dust, noise from preparatory activities • Increased population density in the region	• Consult with Forest Department office(s) prior to initiating works
7)	Soil	• Increased erosion	• Preparatory works shall be carried out during dry season
8)	River bed/ Sediment	• Increased erosion	•
9)	Flora	• About 808 nos. trees will be cut.	• Trees can be cut in phases, based on site specific needs than cutting all trees at once
10)	Fauna	• About 808 nos. trees will be cut, risking habitation of bids in the area.	• Forest Department shall be consulted for discovery of any bid nest or other habitats
11)	Biodiversity, Natural Habitat	• Disturbance to aquatic habitat from noise, pollution.	• Minimize the tree removal during the bird breeding season (February-July). If works must be continued during the bird breeding season, • A nest survey shall be conducted by a qualified biologist prior to commence of works to identify and located active nests. •
12)	Natural Calamity Induced Catastrophe	• Displacement of construction materials • Increased accidents • Increased erosion	• A flood risk study of the site shall be carried out to determine flood quantities within the plant area and to estimate peak flood to determine the peak flow for the return period of 25 years.
13)	Economy	• Work opportunities	• Provide some opportunities to local people.
14)	Land Acquisition and Resettlement	• Acquisition of land • Resettlement of people • About 200 households may be affected	• Land acquisition and resettlement plan has to be prepared • Proper compensation and other necessary support have to be allocated in accordance with Resettlement Plan (RP)
15)	Livelihood	• Removal of local market • Removal of small local shops • Loss of agricultural lands • Loss of grazing lands • Disruption to fishing activities	• A compensation program for employment of affected households may be undertaken.
16)	Education	• Displacement/Re-location of educational facility that are within site area	• Consult with the affected madrasa to determine

			amicable solution to their relocation
17)	Labor Influx	• Friction or conflict between local people and outside labors	• Stakeholder consultation and disclosure of the facility plan
18)	Pollution induced social issues	• Pollution of soil affecting agriculture • Pollution of river affecting fisheries	• Keep an option for people to submit any complaints • Compensate for any damage caused by facility activity
19)	Sensitive Public Place	• Loss of access to graveyard or resettlement of graveyard • Loss of access to mosque	• Consult the local community, users of these places to find out an amicable solution for relocation or allow restricted access
		Construction Phase	
20)	Geology and Geography	• Dust from construction activities • Increased traffic and movement on the landmass	• Minimize dust by spraying water • Cover loose construction materials
21)	Noise	• Noise from construction, and increased vehicular movements	• Maximum allowable noise level regulation shall be maintained for areas near mosque, school, residences and other sensitive locations • Construction works near residential areas should during in daytime only, • Measures shall be taken to lower noise from equipment
22)	Air quality	• Dust, and emission from construction	• Minimize dust by spraying water • Cover loose construction materials • Prepare and follow a traffic plan • Regular maintenance of machines to reduce emission • Limit construction activities within day time
23)	Surface water	• Pollution of water channels from solid and liquid wastes from construction • Filling up of local small waterbodies like ponds	• Rainfall run-off from the construction site need to be captured to prevent deposal into natural waterbodies • Wastewater shall be collected, re-used and/or disposed of off-site after oil/grease removal and settlement of suspended solids. • Site-specific management plan needs to prepared before starting the work at Payra River for the ecological sensitivity.
24)	Ground water	• Oil leakage, • Sewage leakage	• Extraction of groundwater shall be from optimum location to minimize impact on local tubewells

			• Areas of oil and liquid wastes shall be made impermeable to prevent leakage • Pollution prevention plan will be prepared and followed to prevent groundwater from contamination and protection of aquifer cross contamination.
25)	Soil	• Contamination from waste materials generated during construction period	• Proper waste disposal practice shall be adhered to including: • Only dumping organic or kicten waste in pits on the ground. • Prevent spillage of oil.
26)	River bed/ Sediment	• Contamination from waste materials generated during construction period	• Construction works shall be carried out with caution to avoid disposing wastes into river(s)
27)	Environmental Sensitive Areas	• Dust, noise, emission from construction • Increased traffic movement in the region	• Minimize dust by spraying water • Cover loose construction materials • Prepare and follow a traffic plan • Regular maintenance of machines to reduce emission • Limit construction activities within day time
28)	Flora	• Trees in the locality may be affected by dust, emissions	• Plant some trees at empty spaces
29)	Fauna	• Loss of habitats for some small animal species.	• Limit the construction works within the designated sites allocated to the contractors. • Minimize the tree removal during the bird breeding season (February-July). • Minimize the release of oil, oil wastes or any other substances harmful to migratory birds to any waters or any areas frequented by migratory birds. • Provide adequate knowledge to the workers regarding protection of flora and fauna, and relevant government regulations and punishments for illegal poaching
30)	Biodiversity, Natural Habitat	• Disturbance to and aquatic and amphibian habitats from noise, pollution, increased movements.	• Limit the construction works within the designated sites allocated to the contractors.
31)	Natural Calamity Induced Catastrophe	• Displacement of construction materials • Increased accidents • Increased erosion • Displaced construction materials causing accidents	• Disaster preparedness including construction and maintenance of embankment with bank/shore protection

32)	Economy	• Work opportunities • Business opportunities	• Allocate some work to the local poor and affected people during recruitment. • Gender equity and equal wage have to be ensured.
33)	Livelihood	• Work opportunities • Business opportunities	• Provision shall be kept for economic opportunities to be accessed by local people
34)	Education	• Disturbance to nearby academic institutions	• Minimize construction activity during day time, limit construction activity within designated areas
35)	Labor Influx	• Friction or conflict between local people and contractor(s), outside labors	• Engage a communication officer to maintain liaison with local community • Keep an option for people to submit any complaints • Train and inform labors about being cautious regarding mixing with local communities
36)	Pollution induced social issues	• Pollution of soil may affect agriculture • Pollution of river may affect fisheries • Dust, emission, increased traffic may affect livestock	• Keep an option for people to submit any complaints • Compensate for any damage caused by facility activity
		Operation Phase	
37)	Geology and Geography	• Impact on river channel due to river bank protection/river training works • Erosion on opposite bank	• Monitoring of the river bank erosion pattern • Take protective measures to reduce erosion risk
38)	Noise	• Noise from industrial activities, and increased vehicular and waterway movements	• Maximum allowable noise level regulation shall be maintained for areas near mosque, school, residences and other sensitive locations • Construction works near residential areas should during in daytime only, • Measures shall be taken to lower noise from equipment • Ships movement shall be limited to 10 PM
39)	Air	• Dust generation from industrial works including harmful particles like paint, rust • Air quality degradation from spreading of toxic and hazardous materials. • Fumes from waste oils • Emission from equipment	• Minimize dust by spraying water • Maintain cover for toxic pollutants generating activities • Regular maintenance of tools, and equipment • Regular monitoring of air quality
40)	Surface Water	• Pollution from movement of ships	• Prevention of oil spills/leakage into natural water bodies by removing oil residues inside

		• Pollution from leakage of solid and untreated liquid wastes • Contamination from leakage of toxic/hazardous waste	ships with MDS before breaking works. • Cutting works and equipment maintenance works to be undertaken only inside dedicated concrete-floor cutting area. • Oily parts to be stored inside dedicated concrete-floor storage area. • Monitoring of Water Quality
41)	Ground Water	• Contamination from Oil leakage, Sewage leakage • Pollution from seepage of untreated liquid waste	• Oil use or extraction areas shall be impermeable concrete-floor. • Rainfall runoff shall be prevented from draining without treatment. • Monitoring of water quality.
42)	Soil	• Contamination from Oil leakage, sewage leakage, heavy metals • Pollution from soild and liquid wastes including toxic/ hazardous wastes • Degradation from disposal of industrial/chemical wastes, affecting agriculture • Salinity intrusion from embankment damage/breach	• Oil use or extraction areas shall be impermeable concrete-floor. • Harmful wastes shall be contained at all stages. • Metal scraps shall not be stored directly on the ground but with some barriers •
43)	River bed/ Sediment	• Contamination from Oil leakage, sewage leakage, heavy metals • Pollution from soild and liquid wastes including toxic/ hazardous wastes • Degradation from disposal of industrial/chemical wastes, heavy metals • Disturbance due to dredging in future	• Facility operation shall be done carefully to avoid disposing wastes into river(s) • Dredging shall be done in accordance with environmental regulations
44)	Environmental Sensitive Areas	• Adverse impact on wildlife sanctuaries from exposure harmful substances from the • Adverse impact on natural forestry from contamination of pollutants	• Adopt to the best practices for waste management • Maintain cautionary measures to avoid any leakage of waste materials outside compound • Ensure proper disposal or recycle of wastes by choosing suitable concrete safe storage location or complaint vendors
45)	Flora	• Some trees will be planted	• Plant and maintain trees
46)	Fauna	• Habitation of some aquatic species including fish, dolphin, turtles may be disturbed by ships movement, pollution, and industry operation.	• implementation code of conducts to workers, including no catching or hunting fish and wildlife, and no consumption of wildlife products. • Training and awareness on the importance of biological

			diversity, and its relationships with sustainable development.
47)	Biodiversity, Natural Habitat	• Disturbance to, or loss of aquatic and amphibian habitats from noise, pollution, increased movements.	• Minimize the release of oil, oil wastes or any other substances harmful to migratory birds to any waters or any areas frequented by migratory birds. • Provide adequate knowledge to the workers regarding protection of flora and fauna, and relevant government regulations and punishments for illegal poaching.
48)	Natural Calamity Induced Catastrophe	• Displacement of harmful substances by high wind, rain water, storm surge • Pollution of surrounding areas • Increased accidents • Increased need for shelters	• Maintenance of disaster risk reduction infrastructures • Monitoring of river banks for erosion • Liaison with early warning providers • Periodic drills for fire, evacuation, emergency site management • Identify shelter areas
49)	Economy	• Work opportunities • Business opportunities • Possibility of new business creation	• Allocate some work to the local poor and affected people during recruitment. • Gender equity and equal wage have to be ensured.
50)	Livelihood	• Disturbance to fishing activities by ships movement • Destruction of fish habitat and migration from pollution • Work opportunities • Business opportunities	• Some quota for work opportunities of local people can be provisioned.
51)	Education	• Disturbance to nearby academic institutions	• Maintain liaison with educational institutions that maybe affected
52)	Labor Influx	• Friction or conflict between local people and facility employees	• Engage a communication officer to maintain liaison with local community • Keep an option for people to submit any complaints • Train and inform facility personnel about being cautious regarding mixing with local communities

53)	Pollution induced social issues	• Pollution of soil may affect agriculture • Pollution of river may affect fisheries • Pollution of groundwater may affect public health • Dust, emission, increased traffic may affect livestock	• Keep an option for people to submit any complaints • Compensate for any damage caused by facility activity

1.6 Environmental Management Plan

Environmental Management Plan (EMP) actions are as follows;

Phase	Impacts requiring Mitigation	Management Plan	Responsibility
Pre-construction phase	Land acquisition	Coordination with DC office to ensure timely payment of affected people	BSEC
	Resettlement	Allow necessary time to affected people for removing their houses and other properties	BSEC
	Cutting trees	• Consult forest department before cutting down trees, and • Contact forest department if any wildlife or bird presence	BSEC, Contractor
	Dust, Noise from preparation	• Fencing of site area before commencing any activities, • Water spraying system need to be made available • Covering of loose materials like sand with tarpaulin or similar sheets	Contractor
	Cutting Embankment	• Consult with BWDB before cutting existing embankment and any other hydraulic structure • Consult BWDB for the protection requirements of the area	BSEC, Contractor
Construction phase	Dust Reduction	• Onsite dust suppression measures for dust catchment and reduction of dust should be implemented. In this case, spray water, mist and good-quality equipment	Contractor

		should be used during construction. • Heavy machines like excavator, soil compactor, sand-filling trucks, drilling apparatus should be effectively used so that dust propagation is minimum	
	Noise Reduction	• Noise reduction efforts will be made in the forms of : • Covering parts of noise generating Equipment (e,g. Rock/brick breaking machine) • Operating some loud noise creating equipment within enclosed rooms (e.g. generator) • Use of ear mufs mandatorily for workers engaged during construction should be practiced	Contractor
	Emission	• Regular maintenance of Equipment to reduce emission • Use Gas-free masks, and respirators should be mandatorily used by workers during construction work	Contractor
	Solid and Liquid waste	• Industrial wastes like oil and lubricants, metals type substances shall be sold to outside vendors for backward linkage uses • Local bio-degradable wastes can be dumped in pits or landfilled • Proper sanitation practices must be maintained to avoid any risk of fecal contamination • Toilets must be installed at least 10m away from tubewells or other water sources,	Approved/Certified Waste Contractor

		• Toilets shall be at adequate distance from river bank to avoid risk of getting wastes into river • Liquid construction wastes, slurry shall not dumped directly into water channels	
	Increased traffic	• Awareness campaign shall be arranged for local areas • A traffic management plan should be adopted including • Flag man/signalman shall be appointed • Safety signage on boards shall be installed • Walkways shall be segregated for man entry and exit • Road signage shall be effectively used for entry and exit of heavy vehicles	Contractor
	Increased people onsite	• People coming for site work should refrain from making any unnecessary engagement with the local community to avoid local conflict, and commotion • A communication officer should be appointed to maintain liaison with local people • Workers need to be trained and instructed to avoid unnecessary mix with local people	Contractor
	Health and Safety risks	• Maintain provison for Personal Protective Equipment (PPE), Safety boots, Ear muffs/plugs, • Provision of Fire Fighting equipment, on site • Safety goggles and gloves for welding, and electrical works • Regular training on safety, fire fighting, disaster and	Contractor

		emergency management procedures	
	Local Involvement	• Some quota should be provisioned for employing local people	Contractor
Operation phase (During the Scrapping/Dismantling of Ships	Air, Noise, Dust pollution	• Onsite availability of suppression systems like spraying water, and mist should be applied • Covering noisy equipment, and regular maintenance of mechanical equipment for emission control • Taking adequate measures during gas and LPG cutting of ships, secondary plate cutting for ensuring less emission of smoke–surface treatment, and detergent based scrubbing or cleaning of the ferrous and non-ferrous metals for eradication of fumes during cutting should be maintained. • During heavy equipment operations and noisy jobs, proper PPE with a noise barrier mechanism within the yard has to be ensured. Ear muffs/ear plugs should be provided to the engaged staff	Industry
	Increased vehicular and waterway movement	• Maintain traffic management plan for land vehicles, and maintain laison with local people to avoid commotion or unnecessary public intervention. In this case, designated Security officer or Facility supervisor should take the responsibility • Coordinate water movement to minimize the impact on fishing activities • Aware and in advance notification to local	Industry

		fishermen to stop fishing activities during the day of an EOL ship's arrival so that chances of any unforeseen accidents and hazardous situations may be avoided	
	Increased movement and habitation of people	• People coming for site work should refrain from making any unnecessary engagement with local community to avoid local conflict, and the facility should have communication officer to maintain liaison with local people	Industry
	Breaking of ships that will generate harmful pollutants like paint, rust, oil, toxic wastes, human wastes	• Take all possible pre-cautionary measures to confine all toxic and harmful waste within the facility, and regularly dispose of waste materials that are planned to be disposed outside. In this case, as per MEPC guidelines, a detailed mapping for disposal and treatment of hazardous wastes has been elaborated which must be strictly followed to comply with the HKC	Industry
	Health and Safety risks	• Maintain provison for Personal Protective Equipment (PPE), Safety boots, Ear muffs/plugs, Hand gloves, Safety Goggles during work at all times • Ensure that not more than a 4 hour hot work permit is given to only designated cutters • Fire fighting equipment, safety goggles, hazmat suits, training, emergency management plan, disastr prevention, and emergency response	Industry

		during dangerous situation should be adequately practised as drills during regular operations • Standby paramedics with ambulance must be stationed • Regular toolbox meetings should be addressed • All should practise assembling at the emergency points during the advent of any emergency preparedness • Welding gloves, goggles should be strictly worn during all electrical or welding works, and also during performing incineration activities • Hazmat suits/equipment for handling toxic/hazardous wastes • Self contained breathing apparatus (SCBA) must be used during confined space cutting inside of ships, and during rescue and search operations • Proper light and visibility shall be ensured during ship cutting at dark and confined spaces or small places where entry is done by manholes • Proper safety harness shall be fitted during working at height in order to prevent accidents • Multi-gas meters and other safe ship cutting practices shall be strictly followed during gas cutting at ships onboard and especially at the aft part – engine room cutting • Slips and trips should not occur and only designated or marked areas for walkways and vehicular movement plan shall be	

		strictly maintained or followed	
	Accidents	• On site medical facility must be kept operational to treat minor injuries • Treatment plan must be in place for all kidns of injuries including provision of hospitalisations for serious situations • Compensation plan shall be in place for death of any working person during industry related services	Industry, BSEC
	Disaster Management	• Ensure construction of disaster protection measures like embankment and bank/shore protection • Evacuation plan for safety during cyclones/earthquakes, • Identify shelter locations • Prepare emergency facility shut down procedures	Industry, BSEC
	Waste management	• Non-toxic industrial wastes like glass wool (intact), oils and lubricants shall be sold to outside vendors • Organic waste like kitchen waste will be dumped in a pit on the ground • Liquid wastes will be treated in ETP and then incinerated as per guideline or standard • HAZMAT wastes like PCBs, TBTs, ODS, Radioactive substances, and metal chips shall be stored in the HAZMAT rooms designated until disposed of and transferred to the TSDF facility.Rest IHM Part 1 to 3 treatement and storage shall be done as per the MEPC guidleines which are elaborated in this report	Industry/Approved or Certified HAZMAT Handlers/Municipal Corporation

		• Oil and bilge along with balasst water shall be treated in the Oily Water Separator (OWS) Facility • Solid and liquid HAZMATS will be visually inspected, and sampled for testing as a part of the IHM procedures by certified HAZMAT handlers • Proper management of all facility waste including kitchen waste, human waste, industrial waste shall be ensured. STP shall be used to treat grey and black water • All process of toxic and hazardous waste management shall be followed as per the project plan • Rainfall runoff carrying of waste materials to the river must be prevented by treatment of the water retain the water onsite for facility use • Proper drainage facility will be implemented to ensure the containment of waste water and easy discharge of fresh or treated water back to the river	
	Local improvement/ Involvement	• Some quota should be provisioned for employing local people	Industry
	Tree plantation	• Adequate number of trees must be planted and nurtured to balance for the cutting of trees	Industry

	Environmental Monitoring and Management	• Periodic environmental monitoring and taking necessary mitigation measures for any newfound environmental issue	Industry

EMP Implementation cost is allocated in the project of an amount of BDT 62.139 lakh for Pre-construction, Constriction, and initial duration of Operation phase.

1.7 Emergency Management/Response Plan

Emergency Management, Response Plan is essential to ensure timely repose and action during emergency situations.

Pre-construction, and Construction phases		
1.	Accidents	○ On-site medical facilities including first-aid ○ On call doctors ○ Routine health checkups ○ Ambulance facilities for emergencies ○ Nearby hospital contacts
2.	Fire and Electrical Hazards	○ On-site firefighting equipment ○ Electrical Safety
3.	Natural Disasters	○ Evacuation ○ Shelter ○ Drills
Operation Phase		
1.	Accidents	○ On-site medical facilities including first-aid ○ On call doctors ○ Routine health checkups ○ Ambulance facilities for emergencies ○ Nearby hospital contacts
2.	Fire, Explosion	○ On-site firefighting equipment ○ Fire Service and Civil Defence ○ Evacuation ○ Fire Drills
3.	Natural Disasters	○ Drills ○ Evacuation ○ Emergency shut-down/closing procedures
4.	Environmental Disasters	○ Emergency Mitigation Measures ○ Assessment and Management for long term recovery
5.	Emergency Procedure	○ Emergency Response Team ○ Emergency Communication Practice ○ Emergency Responsibilities ○ Emergency Actions

1.8 Organizational Structure

Initially the project will be implemented by BSEC through a Project Management Office (PMO).

During, operation phase a dedicated team of considerable workforce will be in place to run the industry.

1.9 Environmental Monitoring

Serial No.	Monitoring Parameter	Frequency	Responsibility
1	Air quality	Quarterly	BSEC/Industry authority
2	Noise level	Monthly	BSEC/Industry authority
3	Surface Water Quality	Quarterly	BSEC/Industry authority
4	Ground Water Quality	Bi-annually	BSEC/Industry authority
5	Soil and Sediment quality	Annually	BSEC/Industry authority
6	Health checkup	Bi-annually	BSEC/Industry authority
7	Disturbance to Forest area	Bi-annually	BSEC/Industry authority (in coordination with Forest Department)
8	Public liaison	As needed	Communication option for local community people shall kept open for them to be able to submit any complaints or concerns
Other	Other tests may be needed for specific reasons like complaints or accidents		

1.10 Conclusion

Impact of the project has been assessed on the baseline environment, by collecting necessary data, and analyzing the potential impacts with the impact magnitude. Mitigation measures have been identified for the negative impacts.

Overall, the project is not expected to have long term adverse impacts as the area is entirely built-up. Major impact during initial phase will be from Land acquisition and Resettlement. But, the industry will run a hazardous process and any accidents or lack of caution may cause environmental damage.

2. General Information

In order to improve the living standard of people from the southern region, the Government of Bangladesh (GoB) has taken numerous steps to create employment through industrialization. Bangladesh Steel & Engineering Corporation (BSEC) of the Government of Bangladesh (GoB) is planning to establish an environment-friendly ship recycling industry in the Barguna district within the southwestern part of the Coastal area of Bangladesh.

2.1. Background

Over two decades ship-recycling industry in Bangladesh has received considerable attention via providing raw materials to the steel industry, shipbuilding industry, and some other industries in Bangladesh and some other countries of South Asia. Bangladesh derives 80-90% of its steel from end-of-life ships. Ship-breaking industries generate a number of employment opportunities for Bangladesh either. Green ship recycling, which carries great responsibility for saving the environment, offers a better recycling standard. It will help to achieve sustainable development goals by reducing poverty to a great extent.

Ship recycling is a growing industrial sector in Bangladesh that has been ongoing for a few decades. There are several such industries in Bangladesh which are mostly situated in the south-eastern region (Sitakunda & Bhatiary, Chattogram) of coastal Bangladesh. This initiative can be fortuitous for people of the southwestern region, especially due to the area being economically unadvanced. However, this type of facility/industry is also of great environmental risk due to a considerable quantity of hazardous materials obtained from ships during dismantling, hence requiring proper assessment and planning beforehand to avoid any human-caused catastrophe. The Government of Bangladesh is very cautious, having policies and practices in place to manage adverse environmental impacts by ensuring proper assessment of any industrial or large-scale projects. It is obligatory by law to carry out required assessments and provide necessary mitigative commitments to obtain clearance to establish any such industry or facility.

The government has declared in a public meeting at Rangababali in Patuakhali district to establish an environment-friendly (green) ship re-cycling Industry near the Bay of Bengal of the southern region, and as a result, has allocated public funds for the cost of a feasibility study of environment-friendly ship re-cycling industry at Taltali upazila in Barguna district.

The proposed ship recycling industry will serve the rising demand for steel-melting scrap in Bangladesh. The area was selected as an ideal location for ship recycling due to the unique geographical features of the area including a low tidal range and wide intertidal area, which makes any size ships to be beached easily. The proposed slipway is a concrete slipway which is extending to the sea. The Tetulbaria; Taltali upazila area was designated as an industrial notified area of around 105.5 acre.

2.2. Importance of the project

The project is expected to benefit the county, the region, and the locality with a range of positive outcomes.

2.2.1. Boost to Local Economy

The Taltali upazila, Barguna district recycling industry has been connected with an enormous down-stream market in secondary products like furnishings, machinery, carpentry, electrical equipment, house decor, painting, equipment, etc. This promotes the notion that the

production of ship recycling yard products is environmental ecological or industrial symbiosis as contributors to small-scale sectors operating on the restoration of products that are finally sold on the secondary market.

All this is in addition to the steel re-rolling mills and steel melting mills which utilize ferrous scrap from end-of-life ships to produce steel goods such as bars, ingots, pipes, plates, etc. The entire localized industry developed due to ship recycling yards is a major boost to the local economy, as it assists in the flourishing of the trade of second-hand goods, ferrous scrap, and non-ferrous scrap. At the same time, a large number of jobs are also created.

2.2.2. Creation of Jobs

The environment-friendly recycling yards, rolling mills, steel mills, and second-hand stores create a localized business sector, employing tens of thousands of individuals in marginalized sectors of the population. Semi-skilled and unskilled workers in the dismantling and slicing of end-of-life vessels and other upstream sectors mentioned above. A considerable workforce will be employed through the initiative.

2.2.3. Recovery of Metal Scrap

The metal scrap obtained from end-of-life ships includes both ferrous scrap and non-ferrous scrap. Ferrous scrap is generally classified in two ways – re-rollable scrap and melting scrap. In South Asian ship recycling yards especially in India, Bangladesh, and Pakistan about 60 percent of the total weight of the ship's steel is obtained in the form of re-rollable scrap. This comprises plates, beams, girders, and angle bars.

2.2.4. Reduced Pollution

The recycling of steel scrap obtained from end-of-life ships also helps reduce air and water pollution. At the same time, it helps reduce water consumption. These reductions are because fewer resources are required to manufacture products from metal scrap as compared to metal ore. Scientifically published estimates suggest 86 percent less air pollution, 76 percent less water pollution, and a 40 percent reduction in water usage while making steel from scrap than from iron-ore.

The above aspects of the global ship recycling industry corroborate the fact that generally, the industry is beneficial for the environment and society. However, doubts have been raised by some on the manner in which ships are dismantled on some yards in the Indian sub-continent. The way ships are dismantled can have consequences on the environment and the health and safety of the workers. Therefore, the need to improve the substandard facilities cannot be refuted.

2.2.5. Reduced Greenhouse Gas (GHG) Emissions

The positive effect of using scrap metal to produce finished products instead of using metal ore is seen in terms of reduced GHG emissions. The emissions reduction is due to the reduced energy consumption by up to 70 percent in steel making using scrap steel as compared to using iron ore. Moreover, the need for metal mining is also diminished, which adds to the reduction of GHG emissions.

This is a major input to the sustainability of the ship recycling sector because, following the problems of global warming, degradation of the ozone layer, and climate change the earth has to discover methods to decarbonize the atmosphere.

2.3. Objectives of the EIA Study

The proposed industrial project is under preparation. Preliminary activities of the project under assessment have been underway for quite a long time with the Feasibility study already completed but the Environmental Impact Assessment (EIA) remaining. As such, BSEC has sought the service of "Innovate Engineering & Development" through a Consultancy service for the EIA of the proposed project with the Department of Environment's approved Terms of Reference (ToR). The Inception Report has been prepared in accordance with the ToR of this study.

The project had initially carried out an EIA during 2019 but approval from DoE was yet to be received. In 2023, the new Environmental Conservation Rules 2023 (ECR 2023) came into effect in Bangladesh. The new ECR 2023 outlines updated requirements for environmental clearance for projects. In addition, the old assessment was done 5 years ago, making the site-specific information to be considered backdated. As such updating the EIA has been essential to comply with new requirements. As such, it has been essential for BSEC to update the old EIA report, to comply with the regulations in order to obtain clearance for the project.

The project plans to establish the shipbreaking/recycling industry in an environmentally friendly way. The feasibility study team has analyzed different methods of such industries, keeping the cost-benefit in consideration. After, the necessary assessments, the method of the facility that has been selected is the Slipway Method.

The target capacity of the industry is 120,000 LDTs/year equivalent to ship recycling. It is estimated to generate around 3,000 job opportunities.

The selected site for the facility is in Nishabaria Union of Taltali upazila in Barguna district within the Barishal division of Bangladesh. The area is on the bank of the Payra River, approximately 2.5 km inland from the sea. The proximity to the Bay of Bengal makes it a very ideal location for such an industry as it will be very convenient to bring over the ships for breaking at the facility through the big river from the sea. The current land cover of the area includes agricultural lands, houses, trees, and protective embankments.

2.4. Applicable Rules, Regulations, Guidelines, Laws, and Conventions

Bangladesh has been at the forefront of environmental sustainability initiatives through regularly updating relevant policies, practices, and guidelines to ensure environmentally friendly industrial development. Following are some applicable Laws, Rules, and Regulations of the Government of Bangladesh that govern environmental assessment in Bangladesh:

2.4.1. National Environmental Policy 2018

The National Environment Policy envisaged environment conservation, pollution control, biodiversity conservation, and mitigation of the adverse effects of climate change to ensure sustainable development.

Link: National Environment Policy 2018 Document

2.4.2. Bangladesh Biodiversity Law 2017

The law aims to conserve biodiversity and its components in Bangladesh with sustainable and appropriate utilization, and related practices.

Link: Biodiversity Law

2.4.3. The National Water Policy 1999

The National Water Policy of 1999 was adopted to ensure efficient and equitable management of water resources, proper harnessing, and development of surface and groundwater, availability of water to all concerned, and institutional capacity building for water resources management. It has also addressed issues like river basin management, water rights and allocation, public and private investment, water supply and sanitation, and water needs for agriculture, industry, fisheries, wildlife, navigation, recreation, environment, preservation of wetlands, etc.

2.4.4. National Agriculture Policy 1999

This policy aims to make the nation self-sufficient in food through increasing production of all crops including cereals and ensure a dependable and secure food system for all. One of the objectives of this Act is to preserve and develop land productivity. The policy particularly stresses on research and development of improved varieties and technologies for cultivation in water-logged and salinity-affected areas. The policy also recognizes that adequate measures should be taken to reduce water-logging and salinity and provide irrigation facilities for crop production.

2.4.5. Environment Conservation Act 1995 (amended in 2000, 2002, & 2010)

The Bangladesh Environment Conservation Act is an Act to provide for the conservation of the environment, improvement of environmental standards, and control and mitigation of environmental pollution.

Link: Environmental Act 1995

2.4.6. Bangladesh Water Act 2013

Bangladesh Water Act, 2013 has been made for the improvement, management, collection, distribution, usage, protection, and preservation of the water. The act recognizes the significance of managing all forms of water resources in the context of the natural flow of surface water and the recharge of groundwater. The private landowners will be able to use the surface water inside their property for all purposes by the Act. No individuals or organizations will be allowed to extract, distribute, use, develop, protect, and conserve water resources, nor will they be allowed to build any structure that would impede the natural flow of rivers and creeks.

The conservation of wetlands as grazing ground and sanctuary for the migratory birds has been given much importance while the conservation of ponds as a source of pure drinking water in critical areas has been abandoned. But this is unfortunate that the Act recognizes the significance of managing all forms of water resources in the context of the natural flow of surface water and recharge of groundwater rather than making a commitment by the government to ensure the quality of water for various beneficial uses. The lack of clear

directives that will facilitate recovery of the flood flow zone by evicting land grabbers and encroachers remains a serious weakness of the Act.

The Act specifically mentions that rights over surface water on any private land shall remain with the owner of such land. However, the executive committee can issue a protection order to the owner of such private land without discrimination for protection and conservation specially to prevent the wastage and misuse of water.

2.4.7. The Forest Act 1927 (Amendment 2000)

The Forest Act, of 1927 is the first and omnibus law of the land on forestry. It provides for reserving forests over which the Government has an acquired property right. According to the act the government (Forest Department) can prohibit certain activities in the declared reserved forest area such as any intervention kindles, keeps or carries any fire; trespasses or pastures cattle, or permits cattle to trespass; causes any damage by negligence in felling any tree or cutting or dragging any timber; etc. Acts prohibited in such forests including any person who, in a reserved forest:

- Kindles, keeps, or carries any fire except at such seasons as the Forest Officer May notify on this behalf;
- Trespasses or pastures cattle, or permits cattle to trespass;
- causes any damage by negligence in felling any tree or cutting or dragging any timber;
- Quarries stone, burns lime or charcoal, or collects, subjects to any manufacturing process, or removes any forest produce other than timber; or who enters a reserved forest with firearms without prior permission from the divisional forest officer concerned, is punishable by law.

2.4.8. Environmental Conservation Rules 2023

Environmental Conservation Rules 2023 (ECR 2023) aims to ensure sustainable development and prevent environmental degradation in Bangladesh by regulating activities that may have adverse impacts on the environment and human health. It includes the procedure to obtain environmental clearance and location clearance certificates and the validity thereof. Criteria and guidelines for conducting EIA and preparing an environmental management plan are also included in this. Furthermore, environmental standards for water quality, liquid waste emission, etc. regarding construction, approval, and operation of liquid/sewage waste treatment plants of industrial establishments and projects are also within this. The updated regulation includes new categorization of projects and industries with improved guidelines for carrying out environmental assessments, and a more streamlined process to obtain environmental clearance. Fees to get clearance have also been updated.

Link: ECR 2023

2.4.9. Noise Pollution (Control) Rules 2006

Noise pollution control rules categorize areas with allowed noise levels:

- Silent areas: 50 decibels for daytime and 40 decibels for night. The usage of horns is strictly prohibited.
- Residential areas: 55 decibels for daytime and 45 decibels for night.
- Mixed areas: 60 decibels for daytime and 50 decibels for night.
- Commercial areas: 70 decibels for daytime and 60 decibels for night.

- Industrial areas: 75 decibels for daytime and 70 decibels for night.

Link: Noise Pollution Control Rules

2.4.10. Air Pollution (Control) Rules 2022

The Air Pollution Control Rules in Bangladesh create the National Air Quality Control Plan and the Air Pollution Prevention Plan, identify air pollution activities, and establish standards for emissions from industry, automobiles, and large projects like power generation, textiles, cement, and fertilizers. The main objectives of this rule are to prevent, control, and reduce air pollution.

Link: Air Pollution Control Rules

2.4.11. Solid Waste Management Regulations 2021

The Bangladesh Solid Waste Management Rules 2021 is formulated by the government of Bangladesh to ensure proper management of solid waste. The rules include specific sub-clauses for the management of solid waste and have included Extended Producer Responsibility (EPR) for the first time in Bangladesh. The government has also developed a system to handle medical waste properly and enacted Medical Waste Management Regulations.

Link: Solid Waste Regulations

2.4.12. EIA Guidelines for Industries

This is a comprehensive guideline from the Department of Environment (DoE) of the Government of Bangladesh on the preparation of EIA for industries in Bangladesh.

Link: DoE EIA Guidelines

2.4.13. Air Pollution Prevention Guidelines

Air pollution prevention guidelines include updated practices and legislative measures to reduce air pollution, including procedures for construction works and industries.

Link: Air Pollution Prevention Guideline

2.4.14. The Ship Breaking and Recycling Rules 2011

The Ship Breaking and Recycling Rules 2011 of Bangladesh applies to all ship recycling activities in Bangladesh with relevant regulations.

Link: SBSR Rules 2011

2.4.15. Bangladesh Ship Recycling Act 2018

The Bangladesh Ship Recycling Act 2018 establishes a Board to oversee the recycling of ships and ensure that the Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships, 2009 as well as other international conventions are being applied. They may issue guidelines on the implementation of these at the national level.

Link: Ship Recycling Act

2.4.16. Basel Convention

The “Basel Convention on the Transboundary Movements of Hazardous Wastes and their Disposal”, hereinafter called as Basel Convention, was adopted in 1989 and came into force in 1992. The “Ban Amendment”, prohibits the transportation of wastes from an OECD country to a non-OECD country. Although this amendment has not come into force, several countries including all the EU countries have ratified it.

As per the Basel Convention, ships sent for recycling will subjected to:

- To be classified as waste
- To be subject to transboundary movement
- Both the state of export and the state of import have to be parties to the Basel Convention

Two major hurdles to the effective application of the Basel Convention are the challenges in identifying in practice when a ship becomes waste, and in identifying which country is to be regarded as the “State of Export” under the Basel Convention. These difficulties led to the development of the Hong Kong Convention at the International Maritime Organization (IMO).

2.4.17. Hong Kong Convention

The Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships, commonly known as the Hong Kong Convention (HKC), was adopted at a diplomatic conference held in Hong Kong in May 2009 (IMO, 2009). However, it is not yet in force; as of the end of June 2019, the convention has been acceded by twelve countries – Norway, Congo, France, Belgium, Panama, Denmark, Turkey, Netherlands, Serbia, Japan, Estonia, and Malta. It will enter into force two years after "15 states, representing 40% of the world merchant shipping by gross tonnage, and on average 3% of recycling tonnage for the previous 10 years, have either signed it without reservation as to ratification, acceptance or approval or have deposited instruments of ratification, acceptance, approval or accession with the Secretary-General".

Table 1: Obligations of HKC to various stakeholders

Recycling State	Ship Recycling Facility	Ship Owner	Flag State
▪ Authorize the ship recycling facility by issuing a Document of Authorization for Ship Recycling (DASR) ▪ Approve the ship recycling Plan ▪ Send a copy of the Statement of Completion to the Flag State	▪ Prepare a Ship Recycling Plan (SRP) ▪ Develop a ship-specific Ship Recycling Plan ▪ Notify the Competent Authority (CA) of the planned start of recycling a ship ▪ Notify the CA of the completion of the ship recycling by issuing the Statement of Completion	▪ Always keep an Inventory of Hazardous Materials (IHM) on board the ship ▪ Finalize the ship’s IHM before sending it for recycling ▪ Provide ship-related information to the ship recycling facility	▪ Verify IHM, SRP and DASR

Even though the HKC has not been enforced yet, the world is steadily stepping forward to enact the HKC soon. After the entry into force of the Convention on 26th June 2025, ships shall only be recycled at ship recycling facilities authorized by the Convention. In preparation many ship recycling yards, especially in India (Gujarat), have upgraded their yards to achieve the statement of compliance (SoC) with the Hong Kong Convention.

These SoCs have been handed out by three (03) International Classification Third Party Inspection & Auditing Organizations, of which, the notable ones are the Japanese classification society - Class NK, French classification society Bureau Veritas (BV), and the Indian Register of Shipping (IRS). Besides, other classification societies are also prominent in the EU region – Italian RINA & UK's Lloyd's Register. The Japanese classification society Class NK is the first company to issue an SoC to an intertidal landing yard, and the first intertidal landing yards that received SoCs were Priya Blue, RL kalthia, Leela Group, and Shree Ram Yard, which are all located on the Indian beaches of Alang-Sosiya. From four yards in Alang-Sosiya receiving the SoC with the Hong Kong Convention in 2015, there are now reportedly 92 yards that have SoC in India. According to information from Class NK, until June 2019, they have issued SoC to 33 yards worldwide. Most of them are using the intertidal landing method and are located in Gujarat, India.

In 2017, the PHP Family shipbreaking yard became the first ship recycling facility in Bangladesh to receive SoC from the IRS, initially, and later they also received SoC from Class NK. Also, they have received SoC from RINA, which is the only yard now in Bangladesh to get RINA certification. Till 2024, there are now a total of 5 Ship Recycling Yards in Bangladesh that have received the SoC which includes: PHP, KSRF, SN Corporation, KR Ship Recycling Yard, and MAK Corporation. Of them, except MAK Corporation, the rest 4 yards have SoC issued by Class NK, apart from IRS and BV. Only, MAK Corporation has the certification from the IRS. Besides, about 12-15 more ship recycling facilities in the Chattogram (Sitakund-Bhatiary) regions of Bangladesh are in the pipeline of getting SoC by the end of 2025 or the first half of 2026.

2.4.18. EU Ship Recycling Regulation

The EU Regulation No. 1257/2013 on ship recycling, commonly known as EU Ship Recycling Regulation (EUSRR), was formally adopted by the European Parliament and the Council of the European Union on 20th Nov 2013. It entered into force on 30th Dec 2013 and became applicable on 31st Dec 2018. It is similar to the HKC in most aspects and does not contain any contradictory provisions that could impede the prospects of HKC entering into force. Table 2.2 shows the comparison between HKC and EUSSR.

According to EUSRR, EU-flagged ships are obliged to be recycled only in approved ship recycling facilities (both EU and non-EU) which are included in the "European List". To get approved, recycling facilities shall comply with the provisions of the HKC and also with the following three additional requirements:

- "Operate from build structure"
- Demonstrate "the control of any leakage, in particular in intertidal zones"
- Ensure "the handling of hazardous materials, and waste generated during the ship recycling process, only on impermeable floors with effective drainage systems".

According to a European list released in June 2019, there are a total of 34 approved ship recycling facilities. Most of them are inside the EU and using various methods of recycling such as dry-dock, alongside, and slipway. Only three landing yards in Turkey and one alongside yard in the US have been approved for the European List as non-EU recycling facilities.

Table 2: Comparision between HKC and EUSRR

Criteria		Requirement
Hong Kong Convention criteria	Authorization of ship recycling facilities	The ship recycling facility (SRF) should have a ship recycling permit issued by a national authority – the Ministry of Industries, GoB.
	Ship Recycling Facility Plan & Ship Recycling Plan (SRP)	The SRF should prepare an SRFP, that includes elements such as a policy ensuring workers' safety and the protection of human health and the environment, and a total facility operations plan. Besides, ship ship-specific recycling plan (SSRP) under SRP must be implemented and practiced in the SRFs
	Prevention of adverse effects on humans and the environment	The SRF should establish, maintain, and utilize procedures for safe-for-hot works and safe-for-entry conditions
	Safe and environmentally sound management of hazmat	The SRF should ensure safe and environmentally sound removal of any hazardous materials (hazmat) contained in a certified ship
	Emergency preparedness and response	The SRF authorized by a Party should establish and maintain an emergency preparedness and response plan.
	Worker safety and training	The SRF shall provide training programs, and provide and ensure the use of personal protective equipment.
	Reporting of incidents, accidents, occupational diseases, and chronic effects	The SRF should report any incident, accident, occupational disease, or chronic effects causing risks to workers' safety, human health, and the environment.
	Information exchange/communication	The SRF shall provide information requested by relevant bodies.
Additional criteria for EUSRR	Treatment of hazardous waste	The SRF should ensure the treatment and disposal of hazardous waste is carried out in an environmentally sound and safe way.
	Pollution prevention from spills	The SRF should employ means of preventing pollution from spills.
	Monitoring and publication of progress	The SRF should monitor performance related to the above indicators.
	External audit/third-party audit	An audit of performance should be carried out at the SRF by an external or third party.
	Environmental and/or occupational health and safety certification and management	The SRF should hold relevant environmental and occupational health and safety certifications.

2.5. Approach and Methodology

The main focus of the EIA study involves carrying out surveys, field visits, consultation with stakeholders, review of existing data and old EIA reports, assessment to identify adverse impacts, and preparation of EMP and post-project environmental monitoring program. Hydrological modeling tools were used to analyze the hydrological impact of proposed project activities. Physical assessments were made for entire corridors concerning terrestrial and aquatic aspects.

The EIA of the project will follow a systematic process of:

- ✓ Shipbreaking falls under the 'Red' category as per Environment Conservation Rules (ECR) 2023 and therefore, an EIA study is essential to obtain environmental clearance from the DoE.
- ✓ Consult environmental and social baseline conditions against which the assessment will be undertaken;
- ✓ Consult with stakeholder and integrate their views into the project design and mitigation;
- ✓ Systematically predict and evaluate the positive and negative changes in these baseline conditions;
- ✓ All impacts and benefits of the project should be documented and fully explained within the EIA report
- ✓ Identify the mitigation measures that ship recycling will take to avoid, reduce, remedy offset, or compensate for adverse impacts, and to provide or enhance benefits from the project.
- ✓ Develop an environmental management plan (EMP); and
- ✓ Present and disclose EIA findings.

3. Project Description

The project plans to establish the shipbreaking/recycling industry in an environmentally friendly way. The site is situated at the estuary of the Baleshwar, Bishkhali, and Burishwar rivers.

3.1. Project Location

The selected site for the facility is in Nishabaria Union of Taltali upazila in Barguna district within the Barishal division of Bangladesh. The area is on the bank of the Payra River, approximately 2.5 km inland from the sea. The proximity to the Bay of Bengal makes it a very ideal location for such an industry as it will be very convenient to bring over the ships for breaking at the facility through the big river from the sea. A GIS map of the proposed site is provided below:

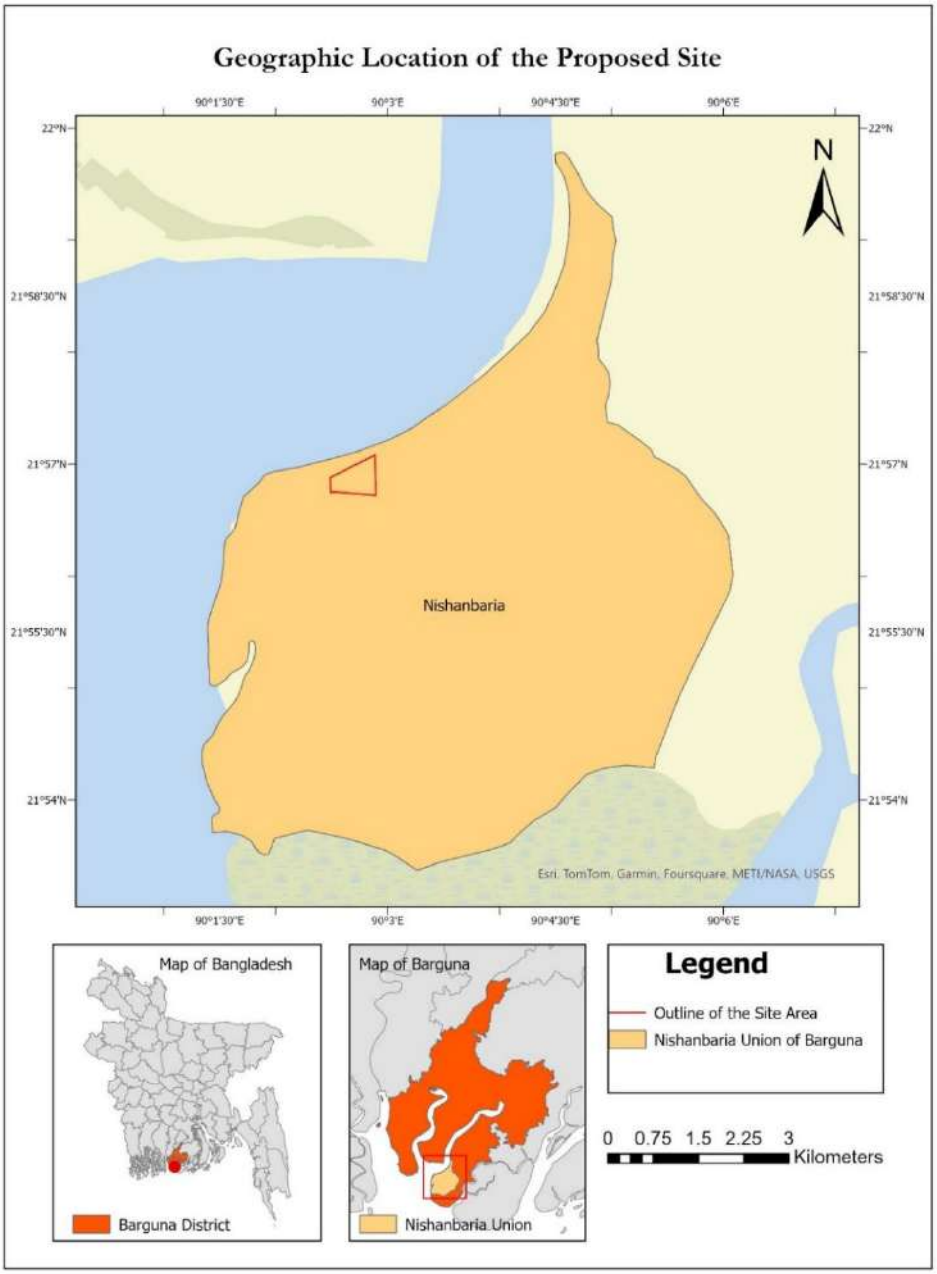


Figure 1: Site Location Map

Table 3: Some pictures of the site area




The topographic survey has been carried out in the field. Though the planned project site area was 105.5 acres, the total area of the site found during surveys is 93.677 acres (379,099.89 m^2). Some part of the area has been eroded. The adjacent river is regularly used for navigation. Ships carrying goods are making trips frequently, especially with coal for a power plant, that is situated a little further upstream from the site. The current land cover of the area includes agricultural lands, houses, trees, and protective embankments. There are around 200 households within the area. Number of trees sums up to around 808. A large portion of the area is utilized for agricultural purposes, cultivating paddy and other crops. There are also some business activities in the area, mostly related to fishing and some other small local businesses. Shore line length of the site is about 816m. The area is generally low lying with the embankment being the highest. The highest elevation is found to be 3.95m. The lowest elevation is below 0.0m as there are some water bodies like ponds inside the area. Relevant maps of the site surrounding area is provided below:

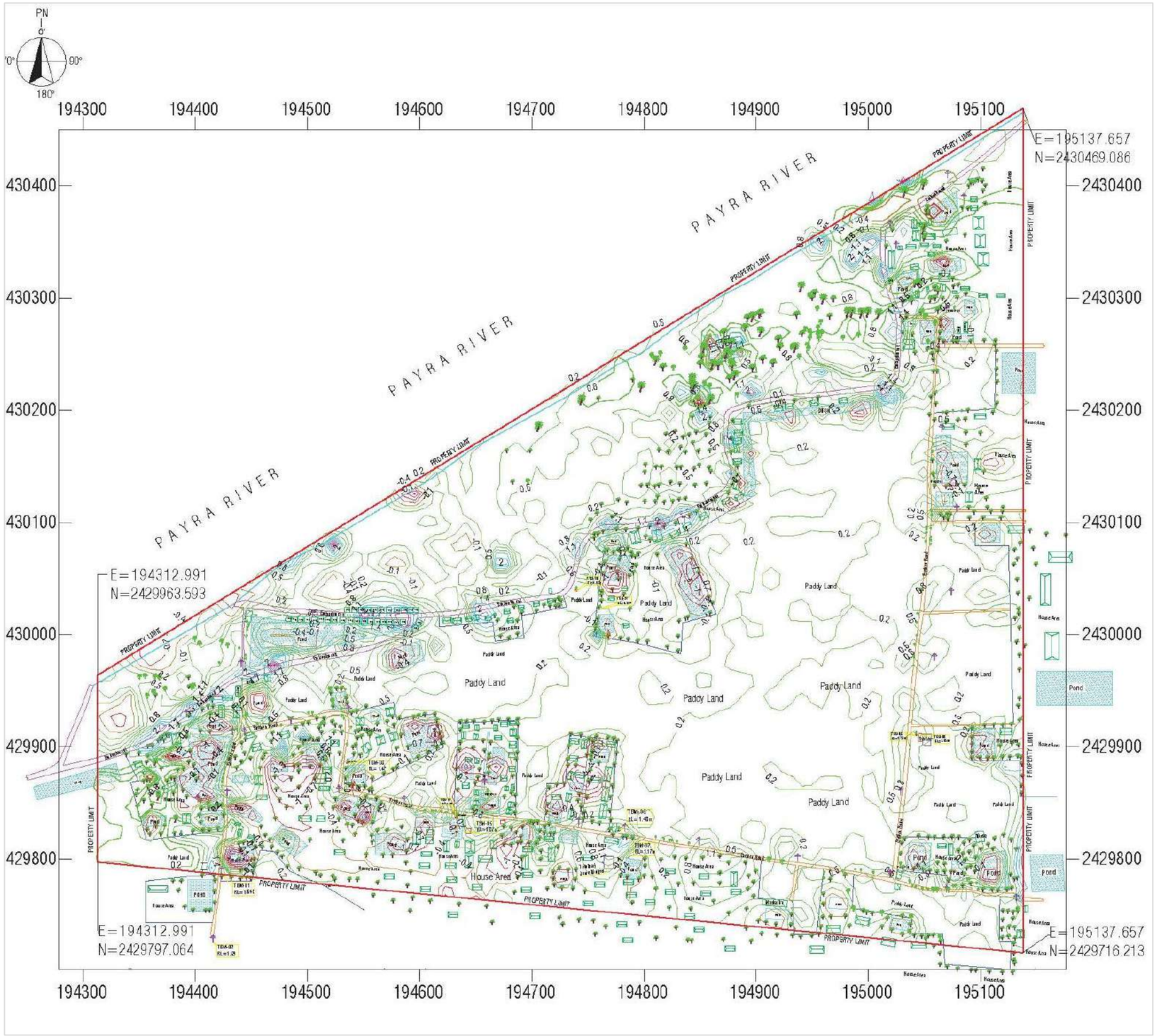


Figure 2: GPS location and orientation of the site

Figure 3: Land Use and Land Cover of the Site

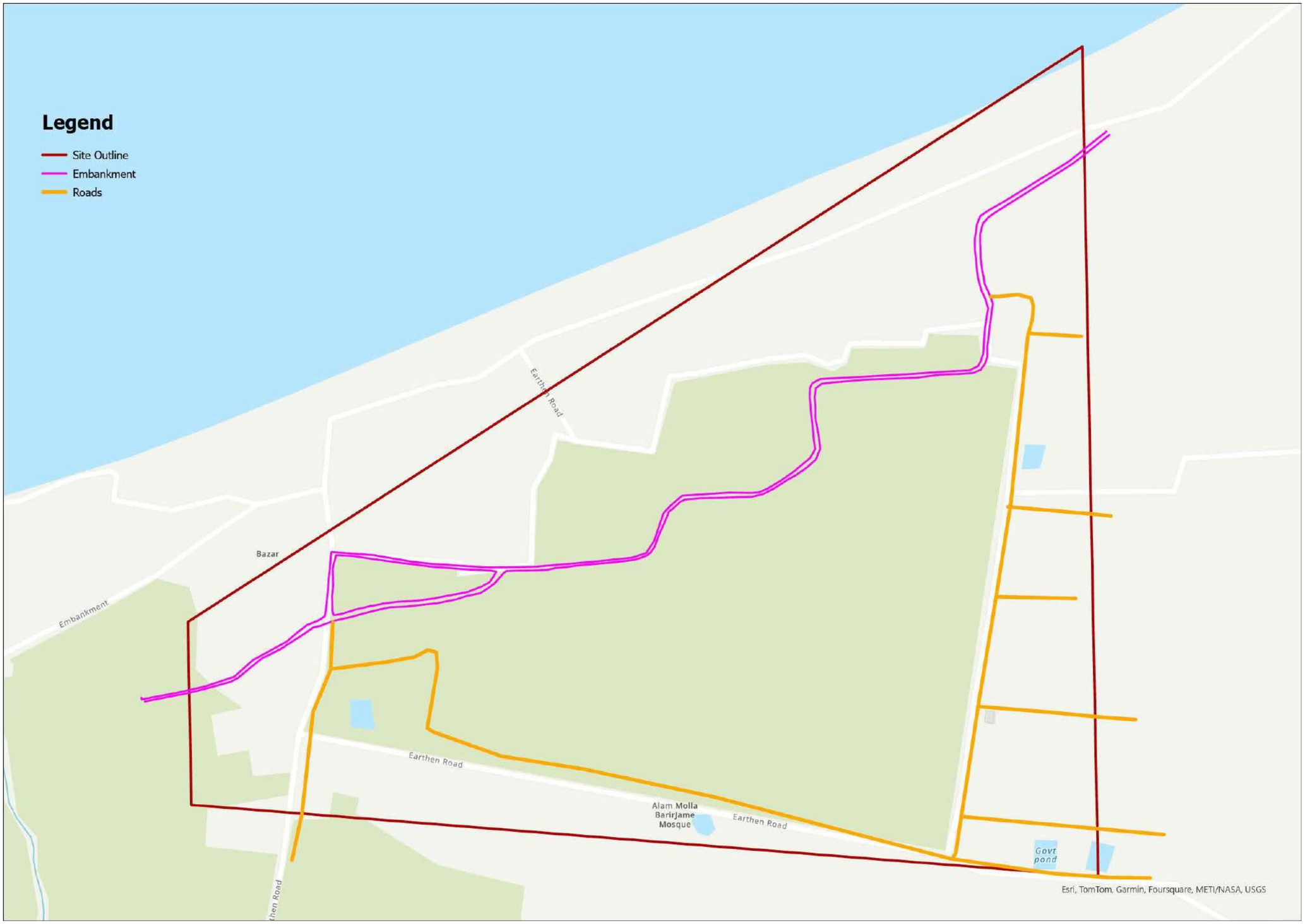


Figure 4: Connectivity to the site area

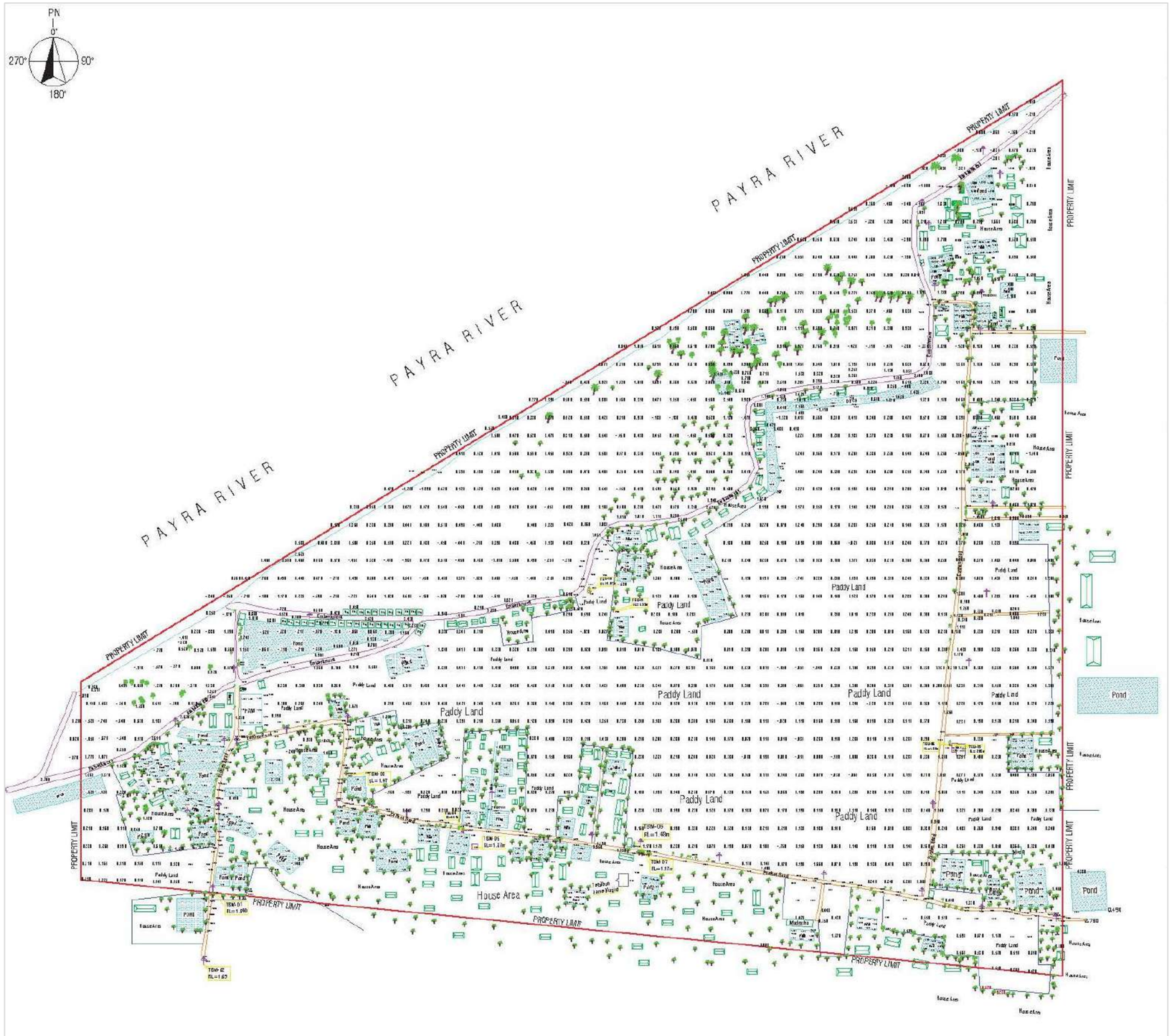


Figure 5: Elevation data

3.2. Project Design

The selected method of ship-breaking at the yard will be a Slipway, with consideration for the construction of three slipway facilities. Each slipway will have a dimension of 45m width and 220m length. The slipway platform will host a steel cradle on steel railways embedded in its concrete foundation and will be inclined at a 1:25 gradient extending from shoreline to sea. The proposed design of the slipway can accommodate ship sizes up to a maximum of 30,000 DWT. Other supporting equipment for hulling and cutting includes service barges, winches, heavy-lifting cranes, and cutting tools. There also will be storage facilities for scrap and waste materials and magnet or wheel cranes and excavators for handling scrapped materials. The slipway and associated system will be hosted in the impermeable concrete pavement with the proper drainage system.

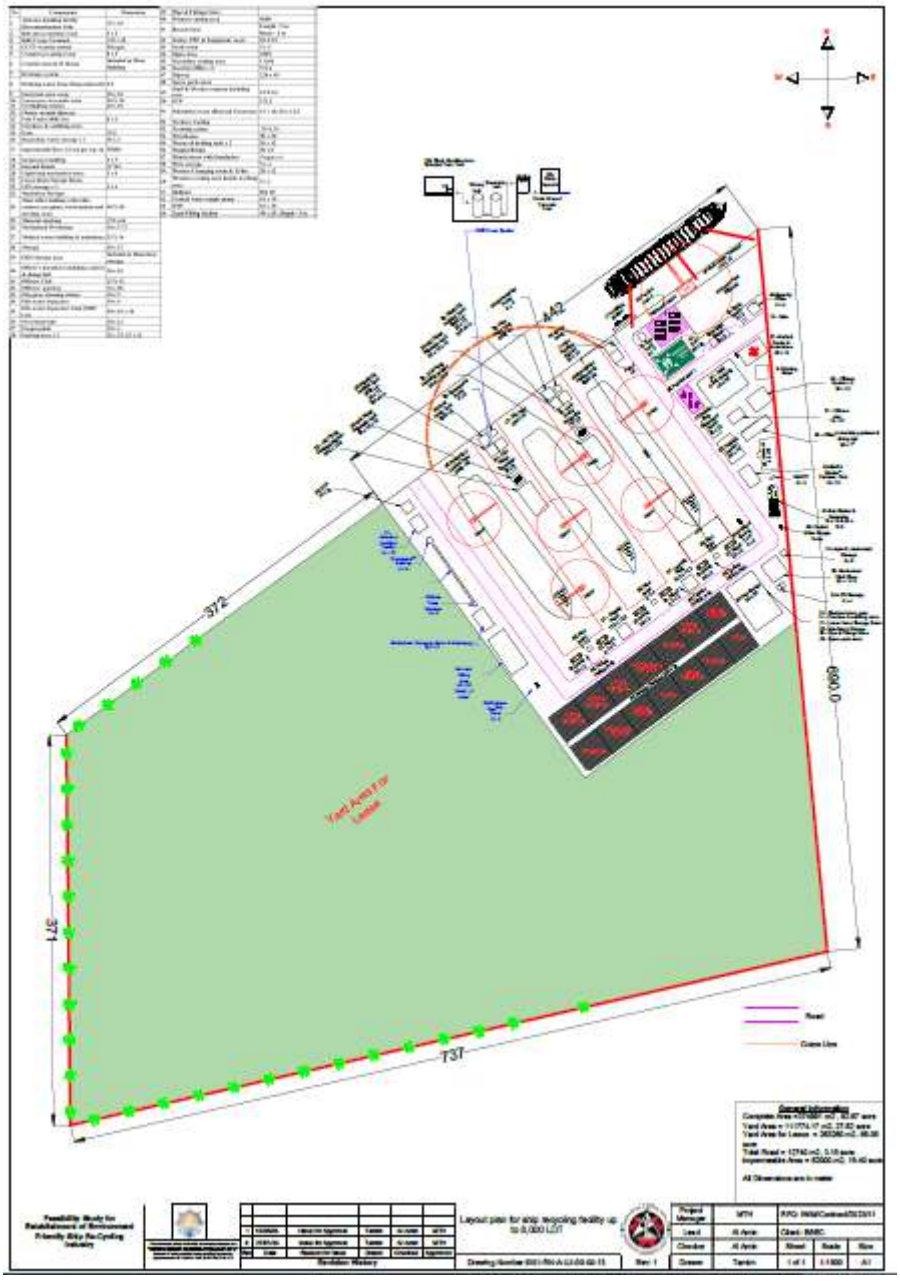


Figure 6: Layout plan for a ship recycling facility

There will be the following other supporting operational facilities within the yard:

- Administration office
- Vehicle & Heavy Equipment parking areas
- Medical Centre
- Workshop
- Training rooms
- Safety/PPE room
- Officer's dormitory
- Security post
- Electric distribution system
- Fresh water supply system
- Drinking water system
- Firefighting system
- Other auxiliary facilities: weighbridge for truck, Scale room, light masts, worker's change rooms, rest shelters, restrooms, canteen.

3.3. Navigability of Access Channel & Bathymetric Analysis

A multibeam bathymetric survey has been conducted along the deepest waterway to obtain precise depth measurements in the proposed navigational access channel.

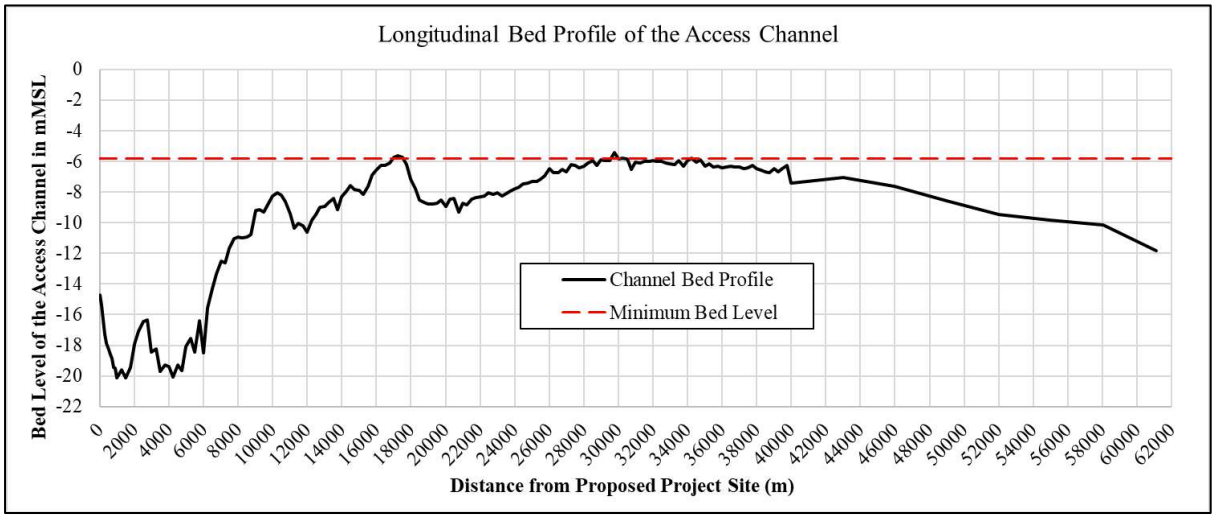


Figure 7: Longitudinal bed profile of the access channel

Survey data shows that the minimum available water depth along the proposed navigational route is at around (-) 6.0 mMSL. Analysis of time series of bathymetric data has been carried out to assess the scouring/ sedimentation as well as understand the morphological characteristics. Analysis shows that the estuary is dominantly sediment-prone with scouring in the deep channel at the outfall of the Burishwar river. Scouring in deep channel varies between 2.0 to 4.0m during 2021 to 2023 at outfall. The severity of scouring diminishes with moving towards the sea where the channel is siltation prone. The siltation at the offshore area varies from 0.5 to 1.0 m during 2021 to 2023. Overall, siltation is prominent in the shallow area of the estuary.

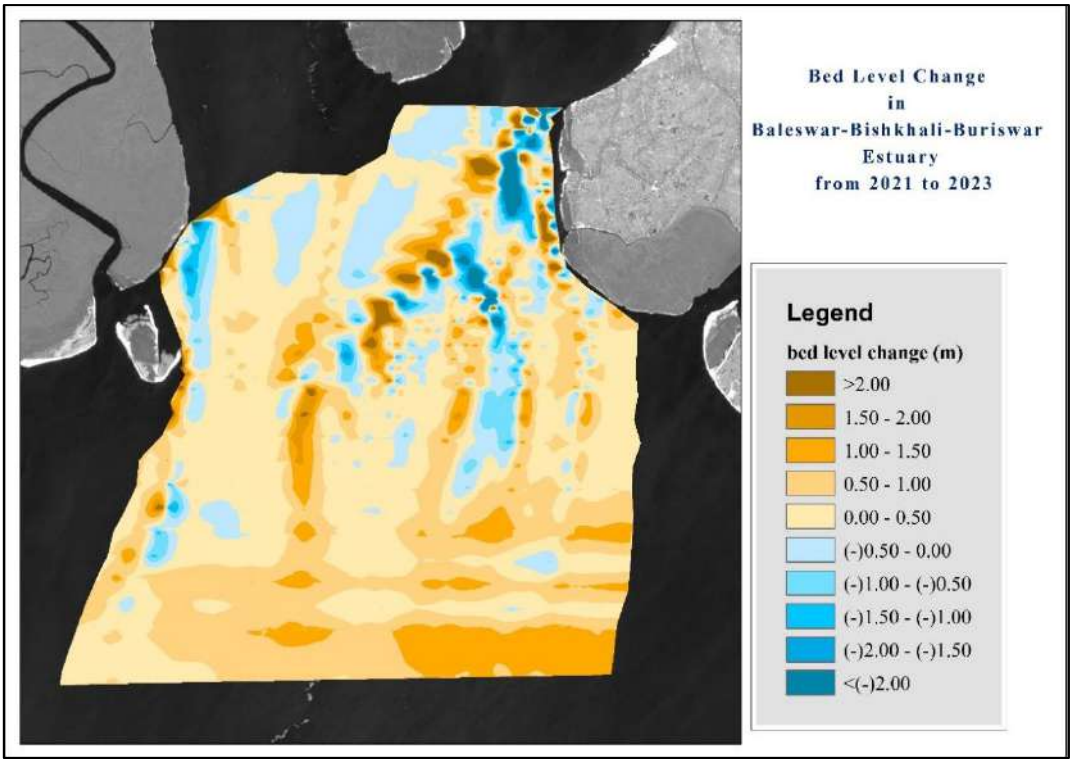


Figure 8: Scouring and sedimentation at the mouth of Baleshwar-Bishkhali-Burishwar River during 2021 to 2023

3.4. Demand Analysis

Bangladesh has emerged as a leading ship recycling country in the world over the past decade. The types of ships dismantled in Bangladesh diversified with the expanded capacity and experience of local shipbreaking yards as well as the global supply of a range of ship types. However, in terms of both number and weight, oil tankers have been the most recycled ship type in Bangladesh, followed by dry cargo and bulk carriers. According to the data released by the NGO Shipbreaking Platform, 185 ships were scrapped in Bangladesh yards in 2018. It resulted in a total scrapping volume of about 7.93 million GT (Gross Tonnages), which accounted for about 42% of the worldwide scrapping volume. Analysis (EU Clarkson Database Projections) shows that the tankers, bulk carriers, and containers will continue to take major portions of the ship scrapping volume; and the annual scrapping volume will continue to increase from 2024 to 2035 (almost double times of current recycling capacity) which corresponds with the increment of shipping volume from 1992-2012. Of them, medium-sized ships are the highest available in the current global fleet, which would resort to scrapping within the next 10 years' time.

The proposed ship recycling facility can re-cycle 15 nos. 8,000 LDTs per ship (as per the slipway design), up to about 30,000 DWT maximum per ship), annually with a total scrapping volume of 120,000 LDTs/year. For future expansion (if required), the ship size and number of scrapping plots shall be decided in consideration for maximizing the domestic market share.

3.5. Proposed Project Interventions

A preliminary design for the green ship recycling facility has been developed based on the outcomes of the study for green ship recycling regulations, processing method assessment, location assessment, and ship recycling market study. The ship recycling facility will be constructed on the acquired land at Taltali Upazila, Barguna district with a total available area of around 93.677 acres and a shoreline of about 816 m. It will be constructed to handle the recycling of ships up to 120,000 LDTs/annum and will have three slipway plots at the initial stage, with a cargo terminal of 170m in length, to facilitate the transport of scrap and other reusable materials.

3.5.1. Slipway

Three slipway facilities construction has been considered and a typical layout plan of the slipway has been prepared considering site survey recycling methods market study, and demand analysis. Each slipway will have a dimension of 45m width and 220m length. The slipway platform will host a steel cradle on steel railways embedded in its concrete foundation and will be inclined at a 1:25 gradient extending from shoreline to sea. The proposed design of the slipway can accommodate ship size up to a maximum of 30,000 DWT.

Other supporting equipment for pulling the ships and cutting includes service barges, winches, heavy-lifting cranes, and cutting tools. There also will be storage facilities for scrap and waste materials and magnet or wheel cranes and excavators for handling scrapped materials. The slipway and associated system will be hosted in impermeable concrete pavement with a proper drainage system and oily-water separator and filtration mechanisms.

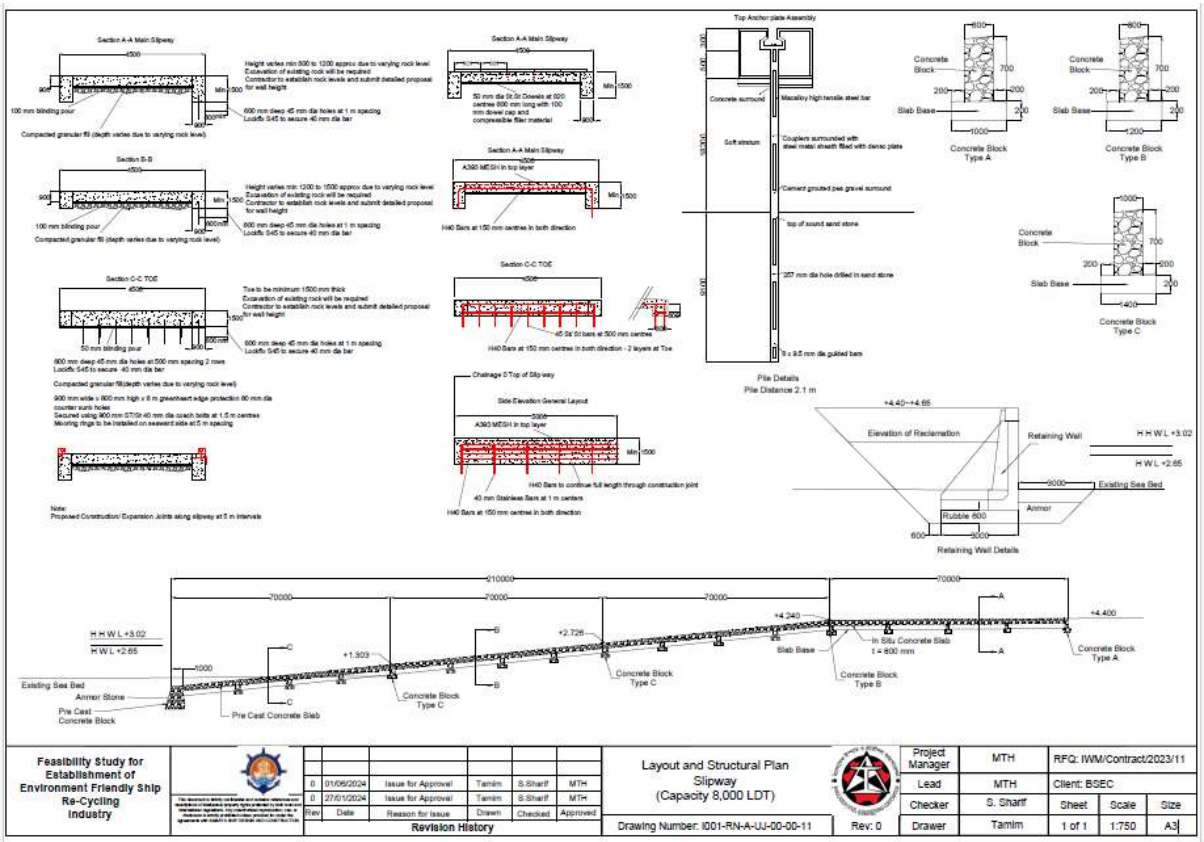


Figure 9: Slipway Layout with 8000 LDT capacity

3.5.2. Cargo Terminal

A 170-meter-long concrete quay will be built in the northeast corner of the ship recycling facility to serve as a multi-function terminal. It will handle loading scrapped materials onto transport vessels, unloading materials from service barges, and providing berthing for ships and tugboats up to 20,000 DWT, with additional access for loading and unloading vehicles.

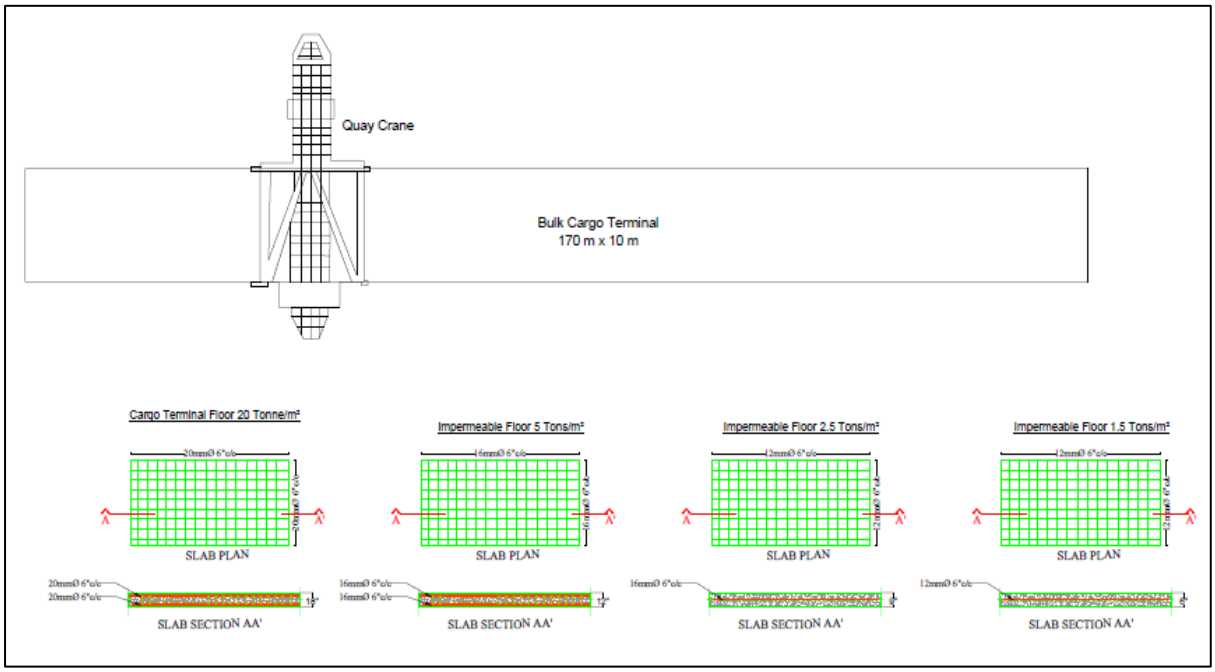


Figure 10: Cargo Terminal Layout

3.5.3. Environmental Sustainability, Climate Resilience and Disaster Risk Analysis

3.5.3.1. Climate Change and Disaster Risk Analysis

The project area is highly vulnerable to cyclonic storm surges and erosion. Climate change and sea level rise are likely to intensify the impact of storm surges and cyclonic waves. Storm surge level and wave height for different return periods under climate change conditions are provided in the following Table:

Table 4: Water level heights in different scenarios

Return Period	Storm Surge Level (MSL)		Significant Wave Height (m)	
	Present	Climate Change	Present	Climate Change
10-year	2.28	2.64	1.75	1.88
25-year	3.15	3.65	2.29	2.51
50-year	3.80	4.40	2.64	2.90
100-year	4.44	5.14	2.94	3.24

3.5.4. Facilities

3.5.4.1. Primary Cutting Area

The primary cutting area is the place where the recycling ship will be cut into large cutting blocks. These cutting blocks will be transferred by heavy-duty material handling equipment to

the secondary cutting areas to be cut up into smaller pieces. The primary cutting area shall be on the impermeable floor (the ship hull is also considered as an impermeable floor), so that hazardous materials, wastes, and any leakage can be contained, cleaned, and treated. The impermeable floor shall be provided with an effective drainage system as per requirements of convention and international regulations. As a part of the ship recycling plot, the primary cutting area should have the major facilities and equipment such as a slipway, impermeable floor, winch, heavy lift crane, barge with heavy lift crane, cutting tools, and firefighting equipment as a minimum. For the slipway recycling plots, the primary cutting activities will be performed onboard when ships are in the inter-tidal zone and on the slipway when ships are pulled on land. The primary cutting area is 8600 sq. meters.

3.5.4.2. Ship Recycling Plots

There are 3 slipways. Every slipway can scrap down a maximum of 5 ships annually, with a maximum capacity of 8000 LDTs per ship. These plots are equipped with slipway rails or carriages, and movable or portal jib cranes to facilitate the cutting process. Besides, the ships can be pulled onto the slipway by the use of winches having a certain drum-wire ratio to efficiently handle the pulling of ships onto the plots for ease of cutting down. The design details are illustrated in the layout provided in this report.

3.5.4.3. Impermeable Floor

The impermeable structure will be considered to protect soil and underground water from pollution and also to prevent any spill of hazardous materials from spreading to the inter-tidal zone in compliance with the requirements of the convention and international regulations. According to the requirements, impermeable floors shall be considered for primary and secondary cutting areas, hazardous material storage areas, and areas that handle oily or hazardous materials.

The impermeable floor is constructed as a concrete floor with a geo-membrane layer thickness of more than 1.5mm as an impermeable barrier.

As common practice in many Indian shipbreaking yards according to the technical guidelines of the Indian State Pollution Control Board (SPCB) for impermeable structure, the impermeable floor is specified in the figure below:

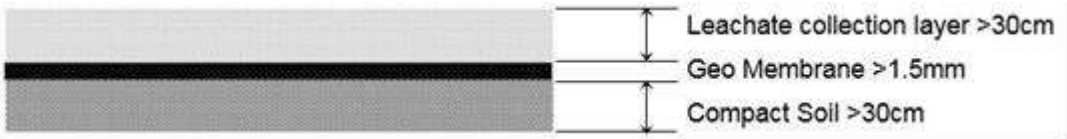


Figure 11: SPCB guide for impermeable floor

The drainage trench is provided at the edge of the floor to collect the wastewater to a drainage pit which then is routed to the common oily water collecting tank for treatment. The total impermeable floor area with an average of 2.5 tons/sq. Meters load capacity is around 55,860 m^2.

3.5.4.4. Material Handling Equipment

Each recycling plot (slipway) is provided with two one heavy lifting machines (portal jib cranes mounted on rails) for removing or lifting salvaged ship blocks safely onto the impermeable

floors and secondary cutting zones and also for cutting blocks from the ship to ground and for transferring them to the secondary cutting area. It is recommended to have 80-ton fixed jib crane and 200-ton mobile crawler cranes (03 nos.) for all slipways combined. Besides, to aid in ship cutting with efficiency and safety, a barge-mounted crane (01 nos. having capacity of 45 tons) has been proposed. Besides, the barge mounted crane can also be used a separate barge as needed for operational purposes. This barge will be able to collect oily water and sludge in barrels which is generated as waste oily water from the cleaning of residual sludge in the cargo oil tank of crude oil tanker and oily water and sludge in the slop tank.

Figure 12: Portal or Mobile Jib Crane

Figure 13: Barge Mounted crane on a floating platform

Figure 14: Boom/Crawler Crane

3.5.4.5. Material Handling Equipment

The winches for towing the ship onshore should be electro-hydraulic or electric-powered towing winch type with a capacity of 200 tons (06 nos. – 2 for each slipway, with a drum-to-wire ratio of 1:20) and should be provided with pulleys and towing wires. It should be installed on the concrete foundation and in a winch, house fitted with a roof to prevent the greased wires that may be washed by rain. Its mounting frame also should be anchored down to the concrete foundation. Besides, each winch should be surrounded by a fence of steel bars at its back and both sides to protect workers when the wire accidentally snaps and rebounds. Storage space for wires and accessories should be set up behind the fence at the rear of a winch. The space is also covered within the roof and is sunken or surrounded with coaming to prevent oily rainwater from flowing out.

Figure 15: Typical winch shelter

Design data for the winch is as follows:

- Type: Electro-hydraulic towing winch 200-ton
- Capacity: 1st layer 200 tons at 7.5m/s
- Brake holding load: 300 tons
- Wire capacity: 1000m of 64 mm diameter
- Drum to Wire Ratio – 1:20
- Material: Carbon steel
- Quantity: 06

3.5.4.6. Secondary Cutting Area

The secondary cutting area is the place where large cutting blocks will be cut into smaller pieces and sorted into material types. It should be arranged as close to the primary cutting areas as possible. Each secondary cutting area should have at least a laydown area, oily machinery storage area, oily cutting zone and cleaning area, non-oily cutting zone, tool and equipment storage area, and rest shelter.

The large cutting blocks and salvaged equipment are to be transferred from the primary cutting areas to the secondary cutting area by heavy lifting equipment like jib cranes or crawler cranes. They are first laid down at the designated laydown area. Then, they will be cleaned, and paint chips will be removed before cutting. The oily machinery storage area is used for temporarily storing oil-contaminated machines and equipment such as mooring winches, steering gears, engine generators, etc. before they are cleaned and moved to the machinery storage area. The areas for handling oily parts and cleaning shall be impermeable concrete floors with drainage systems.

Equipment and tools such as high-pressure water cleaning devices, paint chip removal equipment, cutting torches, LPG cylinders, Oxygen outlets, fire extinguishers, etc. should be provided at the cutting area. These equipment and tools should be kept in the tool and equipment storage area of each cutting plot for easy access. Besides, rest shelters with drinking water also should be arranged at each cutting plot.

Scrapped and sorted materials from secondary cutting areas will be transferred to designated storage areas by trucks or tractors with flat trailers. Some material handling equipment such as magnet cranes, wheel cranes, wheel scrap loaders, or excavators could be used for loading and unloading scrapped materials. The total size of the secondary cutting area is 11,160 sq. meters.

Figure 16: Typical magnet crane, scrap loader, and excavator

For efficient and safe material handling, the following list of equipment and machinery will be required:

Table 5: Cutting area equipment

Sl	Material Handling Equipment	Unit	Quantity
1	Magnet Crane (3 ton)	Nos.	6
2	Wheel Crane (Pick & Carry Bucket) (12 ton)	Nos.	3
3	Truck (10 ton)	Nos.	3
4	Excavator (5 tons) - WASTE Man.	Nos.	1
5	Weight Bridge (50 ton)	Nos.	1
6	Bell Press Machine	Nos.	1
7	Cutter Set (20) & Welding machine (5)	Nos.	25
8	Forklift 3/5 Tons	Nos.	6
9	Mechanical Workshop Machinery & Equipment	Set	1
10	Safety Equipment (Health and Work Place Safety Equipment)	Set	1

3.5.5. Waste Handling and Treatment

3.5.5.1. Estimation of Wastes

During the ship recycling process, a lot of wastes are generated. Although the amount of waste discharged from the ship is just about 0.1-0.3 % per LDT, most of them are hazardous wastes that should be collected, treated, and disposed of properly under national and international regulations to protect workers' health and the environment. As wastes are discharged in the process of recycling of the ships, there is fuel oil remaining in the ship itself, oily water such as bilge, insulation materials such as asbestos, glass wools, and other solid wastes as shown in the below Table:

Wastes generated through the ship recycling process:

Table 6: Wastes from the facility

No.	Waste	Characteristics		Treat
1	Waste oil	Residual oil in the FO tank	Good waste oil is corrected and sold	None
2	Slop oil	Slop oils reside in the slop oil tank of the tanker. The oil content is about 15%. With a 30,000 DWT tanker, about 0.75% of DWT will be generated.	The supernatant (quality oil) of the slop oil tank after tank cleaning will be collected and sold. Waste oil in the lower part (high-density oily water) remains and is collected for	ETP/Oily Water Separator

No.	Waste	Characteristics		Treat
3	Oily sludge	Silted oily sludge on the tank bottom contains rust and other impurities. About 0.1% of DWT depends on the type of tanker and cargo.	Oily sludge containing crude oil may cause fire and explosion. It will be collected and incinerated.	Oily Water Separator
4	Bilge water	Wastewater contains L.O. and F.O. in the bottom of the engine room. The oil content of bilge water is about 1~2%. With 1,000 GT ships, about 100 tons of bilge will be	It may be emulsified with detergent. It is generated while on the voyage and at the port.	ETP/Oily Water Separator
5	Ballast water	Sea water (mud and it may contain marine growth)	Ballast water is obliged to exchange at high sea.	None
6	Tank cleaning water	Cleaning water of cargo oil tank of tanker and bunker oil (FO). Oil content is about 2.4%. With 30,000 DWT tankers, about 6% of DWT will be generated.	The cargo oil tank will be cleaned offshore and the bulker oil tank will be cleaned after landing by a high-pressure water cleaning unit and collected.	ETP
7	Cleaning water for the bottom and machine	Wastewater with red rust accumulated on the bottom	It will be cleaned and collected.	ETP
8	Rainwater	Rainwater in the recycling yard may contaminated by oil, etc.	Rainwater will be collected by drain and separated at ETP and water will be discharged to sea. Separated oil will be	ETP
9	Oily wastes (Solid/semi-solid form)	Oily wastes in the engine room and used for recycling work.	They will be collected and incinerated	INCI/Oily Water Separator
10	Other oily wastes & Chemicals	Wastes such as painting, grease, LO, and other residuals on board ship	Recyclable wastes will be collected. Others will be collected and transferred to a treatment facility.	ETP/Oily Water Separator
11	Asbestos, glass wool	Used as heat insulation, gasket, etc.	To be removed.	Temporary Storage as per
12	Garbage and general wastes	Wastes generated until the last voyage	To be collected and solid wastes will be incinerated. Sewage will be treated.	INCI

On a general basis, the type and amount of waste vary on the vessel type and size. The below Table shows the results of the investigation for the type and amount of waste generated during the ship recycling process of two vessels: a bulk carrier and a container ship. As a result, one vessel confirmed the usage of asbestos, but PCB, TBT paint, etc., were not detected. PCB was not detected even in inventory and sample analysis, but it may be contained in the insulation of electric wire. Similarly, TBT paints have not been applied for two vessels, but harmful paints other than TBT (such as lead) have not been removed in advance.

Table 7: Type and volume of wastes generated through the recycling process (Sample Ship)

No.	Waste Description	Type of Waste	Approx. Quantity		Unit	Disposal Mode
			B.C.Panamax	Container		
1	Asbestos	HW	538	-	kg	Negative Pressure Unit (NPU/ADU) and TSDF in 2030
2	Glasswool/Mineral wool	HW	8,280	10,650	kg	Intact glasswool to be sold
3	Food Waste & general waste	NHW	100	250	kg	Municipal Corporation/Incinerator
4	PUF/Polystyrene	HW	220	-	kg	Incinerator
5	Waste oil	HW	21,000	400	L	Sold in local linkage market
6	Oily sludge	HW	650	32,000	L	Oily Water Separator
7	Plastics	HW	70	200	kg	Incinerator
8	Paint Chips	HW	2,972	4,480	kg	Incinerator
9	Oily -Chemical-contaminated rags (Solid/Semi-solid)	HW	50	150	kg	Incinerator
10	Bilge Water	HW	5,500	50 (tons)	L	Effluent Treatment Plant
11	Used oil	HW	-	30,000	L	Sold in local linkage market
12	Iron scale	NHW	-	-	kg	Sold in local linkage market
13	Fiber glass/Rexene	NHW	-	-	kg	Sold in local linkage market
14	Cardboards & Packages	NHW	-	-	kg	Sold in local linkage market
15	Glass	NHW	-	-	kg	Sold in local linkage market
16	Rubber	NHW	200	-	kg	Sold in local linkage market
17	Lubricating oil	HW	1,008	92,000	L	Sold in local linkage market

No.	Waste Description	Type of Waste	Approx. Quantity		Unit	Disposal Mode
			B.C.Panamax	Container		
18	Grease	HW	345	300 (kg)	L	Sold in local linkage market
19	Paints	HW	200	160	L	Sold in local linkage market
20	H.F.O	HW	2,000	407 (tons)	L	Sold in local linkage market
21	Engine Oil	HW	110	5,000	L	Sold in local linkage market
22	Slop Oil	HW	4	200	L	Sold in local linkage market
23	Hydraulic Oil	HW	400	11,300	L	Sold in local linkage market
24	Cylinder Oil	HW	1,600	60	L	Sold in local linkage market

The above typical type and amount of waste generated during the recycling of the Panamax bulk carrier and container ship had been used as the basis to estimate the annual volumes of wastes from the ship recycling facility to be disposed of.

3.5.5.2. Waste Handling

According to the ship recycling process, the recycling ship should have the oil tanks washed and gas-freed before coming to the ship recycling facility. However, there is still oil sludge at the bottom of the tank, fuel oil for engines, and lubrication oils in engines and equipment. After landing at the shipyard, the vessel should be processed for consumables and oils recovery, decontamination, and removing the hazardous materials before cutting permission is granted.

Oil Recovering and Tank Cleaning: At first, all oil tanks and equipment on board will be checked and recovered for remaining oils such as fuel oil, engine oil, lubrication oil, etc. Residual oils are stripped by using pumps. The remaining sludge inside the tank is absorbed and cleaned with sawdust or sand and collected. It is also possible to use portable high-pressure water cleaning equipment to clean the tank and remove the oil sludge. All oil tanks will be washed and removed from oily sludge. Then, the bilge water will be collected, and the bilge tank will also washed. Recovered oils, oily water, and bilge water shall be collected in suitable tanks or drums and transferred onshore by service barge.

An emergency kit in case of an oil spill shall be available during the recovery process. It shall include the oil booms, oil skimmers, and oil dispersant as a minimum.

Figure 17: Portable high-pressure water cleaning unit

Recovered oils will be sold to an authorized recycler for recycling. The collected oil sludge, oil sand, or sawdust will be treated by the incinerator, and the collected oily water including bilge water will be stored and treated at the Effluent Treatment Plant (ETP) of the ship recycling facility.

Table 8: Equipment for Oil & Chemical Recovery and Cleaning of Oil Tanks

SI	For Oil & Chemical Recovery	Unit	Quantity
1	Pumping and draining equipment	Nos.	2
2	200 storage drums for oil & chemical	Nos.	200
3	Oil dispersant drum	Nos.	4
4	Oil skimmers	Nos.	2
5	Cleaning solvent drum	Nos.	10
	For Cleaning Tanks		
7	High-pressure water cleaning equipment	Nos.	3
8	Pumping equipment for sewage, bilge, and ballast water	Nos.	2
9	10,000 L transportable storage tanks for oily water & bilge water	Nos.	10
10	Waste/ Oily water collection system	Nos.	1
11	Waste Oil Holding Tank (5000 L)	Nos.	110
12	Oily Water Separator Facility (50 m3/Day)	Nos.	2

Hazardous Material Decontamination: After recovering oils and cleaning oil tanks, the consumables, and un-used materials remaining on board such as foods, oil, chemicals, paints, etc., will be collected, and then the ship can be processed for removing the hazardous materials. Inspection for actual inventory of hazardous material on board shall be carried out to verify the IHM record before conducting decontamination. The decontamination works can be processed on board with a mobile decontamination unit or at the decontamination area on the shipyard depending on the actual site conditions.

The mobile decontamination unit or asbestos containment unit is a negative-pressure mobile container equipped with a HEPA filter and mobile vacuum cleaner. It can be brought on board to treat hazardous materials such as asbestos on site.

Figure 18: NPU or Asbestos Decontamination Unit

The decontamination area is the negative pressure building fitted with an exhaust ventilator and HEPA filter for preventing asbestos from scattering into open air while removing asbestos (such as from pipe insulation).

Figure *19*: Hazardous Waste Decontamination Area

The following tables outlines the equipment shall be provided for hazardous material decontamination works:

Table 9: Decontamination of hazardous materials

SI	For Asbestos	Unit	Quantity
1	Mobile decontamination unit (negative pressure with HEPA filter)	Nos.	1
2	Decontamination area (building) with exhaust fan and HEPA filter	m^2	200
3	Air monitoring equipment	Nos.	2
4	Vacuum cleaners	Nos.	2
5	Bags for asbestos (100 pcs/box)	box	50
	PCB		
6	Airtight drums for PCB materials	Nos.	10

SI	For Asbestos	Unit	Quantity
	Paints		
7	Abrasive blasting equipment	lot	3
8	Chemical (solvent) for stripping paint	drum	3
9	Power tools for mechanical removal of paint (angle grinder)	Nos.	8
	ODS-containing materials		
10	Airtight containers	drum	10

Wastewater from the Ship Recycling Yard: To prevent pollution at the recycling yard, the green ship cycling yard shall have a concrete floor (impermeable floor) with a drainage system for its cutting areas to avoid spillage of oil and other hazardous substances. The pit shall be installed at the edge of the concrete yard to collect rainwater or washing water containing leaked oil and other hazardous materials that may run down from the concrete yard. Also oil contaminated parts are stored on the concrete floor in designated area to avoid direct contact with soil. All the drainage pits shall collect the oily water into the dirty oily water tanks and rainwater into rainwater tanks.

Rainwater in the rainwater tank will be checked for contamination before discharging to the sea. If the rainwater is treated, it will be diverted to an oily water tank.

An oily water separator will be used to treat the wastewater in oily water tanks with a 10-ppm oil monitor for the treated water discharged to sea to meet the Bangladesh government regulations. The collected oil from the separator and the remaining sludge in the oily water tank will be sent to ETP for further treatment.

Figure 20: A Typical Oily Water Separator System

Table 10: Equipment for Wastewater from Recycling Shipyard

Equipment for Wastewater in Recycling Shipyard		Unit	Quantity
1	Underground storage tank for oily water 10,000L	Nos.	1
3	Pumping equipment	Nos.	1
4	Oil-water separation equipment, 10ppm oil monitor	Nos.	1

3.5.5.3. HAZMAT Handling and Transportation

The following types and number of wastes (hazardous materials) have to be treated or transferred to the proposed TSDF (Treatment, Storage and Disposal Facility) in Chattogram:

Table 11: Estimated Hazmats

Part 1	13
Part 2	16
Part 3	42
Total	71

As the Taltali ship recycling yard will have an OWS (Oily Water Separator) facility, hence there are no requirements for transferring the bilge, oily water, waste oil, etc.

Table 12: Inventory of Hazardous Materials Part-1

Code No.	Material	Remarks
A-1	ACM (Asbestos Containing Materials)	The 13 different types of hazmat listed as per IHM Part-1 are needed to be transferred to TSDF. Considering the quantity, these can be transferred once every 03 months as the yard has adequate space to store these for a certain period of time. These HAZMAT could be transferred by sealed container.
A-2	Polychlorinated Biphenyls (PCBs)	
A-3	Ozone Depleting Substances (ODS)	
A-4	Anti-fouling systems containing organotin compounds as a biocide (TBT - Tributyltins)	
B-1	Cadmium and cadmium compounds	
B-2	Hexavalent chromium and hexavalent chromium compounds	
B-3	Mercury and Compounds	
B-4	Lead and lead compounds	
B-5	PBB – Polybrominated Biphenyls	
B-6	PBDE – Polybrominated Diphenyl Ethers	
B-7	Polychlorinated naphthalenes (more than 3 chlorine atoms)	
B-8	Radioactive Substances	
B-9	Certain short-chain chlorinated paraffin (Alkanes, C10-C13, chloro)	

Table 13: Inventory of Hazardous Materials Part-2

Code No.	Goods	Remarks
C-31	Waste oil (sludge)	OWS treatment
C-32	Bilge and/or wastewater generated by the after-treatment systems fitted on machinery	OWS treatment
C-33	Oily liquid cargo tank residues	Sold to approved vendor
C-34	Ballast water	De-ballasting prior arrival to yard
C-35	Raw sewage	Sewage treatment plant
C-36	Treated sewage	Landfilling in TSDF
C-37	Non-oily liquid cargo residues	Landfilling in TSDF
C-39	Dry cargo residues	Landfilling in TSDF
C-40	Medical waste/infectious waste	Local medical waste treatment facility or TSDF by using sealed containers. Possible to handle by using a pit system
C-41	Incinerator ash	Landfilling in TSDF
C-42	Garbage	Landfilling in TSDF
C-43	Fuel tank residues	Incinerator
C-44	Oily solid cargo tank residues	Incinerator
C-45	Oily or chemical-contaminated rags	Incinerator
C-53	Dry tank residues	Landfilling in TSDF
C-54	Cargo residues	Landfilling in TSDF

Table 14: Inventory of Hazardous Materials Part-3

Code No.	Material
C-1	Kerosene
C-2	White spirit
C-3	Lubricating oil
C-4	Hydraulic oil

C-5	Anti-seize compounds
C-6	Fuel additive
C-7	Engine coolant additives
C-8	Antifreeze fluids
C-9	Boiler and feed water treatment and test reagents
C-10	Deionizer-regenerating chemicals
C-11	Evaporator dosing and descaling acids
C-12	Paint stabilizers/rust stabilizers
C-13	Solvents/thinners
C-14	Paints
C-15	Chemical refrigerants
C-16	Battery electrolyte
C-17	Alcohol/methylated spirits
C-18	Acetylene
C-19	Propane
C-20	Butane
C-21	Oxygen
C-22	Carbon dioxide
C-23	Perfluorocarbons (PFCs)
C-24	Methane
C-25	Hydrofluorocarbons (HFCs)
C-27	Nitrous oxide (N2O)
C-28	Sulfur hexafluoride (SF6)
C-29	Bunkers, e.g., fuel oil
C-30	Grease
C-38	Fuel gas
C-46	Batteries (including lead-acid batteries)
C-47	Pesticides/insecticide sprays
C-48	Extinguishers

C-49	Chemical cleaner (including electrical equipment cleaner, and carbon remover)
C-50	Detergent/bleacher (potentially a liquid)
C-51	Miscellaneous medicines
C-52	Fire-fighting clothing and personal protective equipment
C-55	Spare parts containing Hazardous Materials
D-1	Electrical and electronic equipment
D-2	Lighting equipment
D-3	Non-ship-specific furniture, interior, and similar equipment
EU-1	PFOS
EU-2	HBCDD
These items can be reused or sold to vendors	

If only a few items, particularly those classified as Part-I hazardous materials, need to be transferred to the Treatment, Storage, and Disposal Facility (TSDF), the process can be managed efficiently.

- Segregation and Storage: The hazardous materials designated for transfer to the TSDF, particularly Part-I items, should be carefully segregated from other materials in the yard. This segregation ensures that incompatible substances are not stored together, reducing the risk of chemical reactions or accidents.
- Sealed Container Storage: The segregated hazardous materials should be stored in sealed containers to prevent leaks, spills, or contamination. These containers should be selected based on compatibility with the specific chemicals being stored, ensuring they are suitable for long-term storage.
- Consideration of Compatibility: Compatibility between the hazardous materials and the containers used for storage is crucial to prevent chemical reactions or degradation of the containers. Compatibility charts or databases should be consulted to ensure that the selected containers are appropriate for the substances being stored.
- Transfer Interval: Given that only a limited quantity of hazardous materials needs to be transferred to the TSDF, a transfer interval of every 3 to 6 months is reasonable. This interval allows for sufficient time to accumulate a significant quantity of materials for transfer while also ensuring that the storage containers do not reach capacity or exceed their recommended storage duration.
- Road Transport: Transfer of hazardous materials to the TSDF should be conducted via road transport. This method offers flexibility and accessibility, especially for transporting smaller quantities of materials over shorter distances. Specialized vehicles equipped with containment features may be used to ensure the safe transport of hazardous materials.

Compliance and Safety Measures: Throughout the entire process, strict compliance with regulatory requirements and safety measures is essential. This includes adherence to transportation regulations, proper labeling and documentation of the materials being transferred and implementation of emergency response procedures in case of accidents or spills.

3.5.5.4. Waste Storage and Treatment Facility

To protect the environment and workers" health, all wastes generated during the ship recycling process shall be properly stored and treated before disposing to the environment. The ship recycling yard will have on-site a waste storage and treatment plant with two major facilities to handle the wastes from the ship recycling facility which include Incinerator for solid wastes, and Effluent Treatment Plant (ETP) for oily water.

Solid wastes that cannot be processed by incinerators such as, ash from incinerators, sludge sun dry from ETP, etc., shall be properly contained and delivered to the authorized Waste Treatment Storage Disposal Facility (TSDF), proposed to be constructed and operated in 2030 by the Minsitry of Industries (MoI). Because there is no scope to create any landfill as per ECR 2023, and also as per the MoI gazette for ship recycling facilities to temporarily lock and store in a secured concrete space, the solid wastes such as PCBs, ODS, TBTs, radioactive chemicals, and mineral wool or similar such hazardous materials (HAZMATs), it cannot be arranged inside the ship recycling facility. Only a TSDF can carry out the process for proper treatment, disposal, storage or landfilling of HAZMATs in a large area with consideration for the surrounding environment.

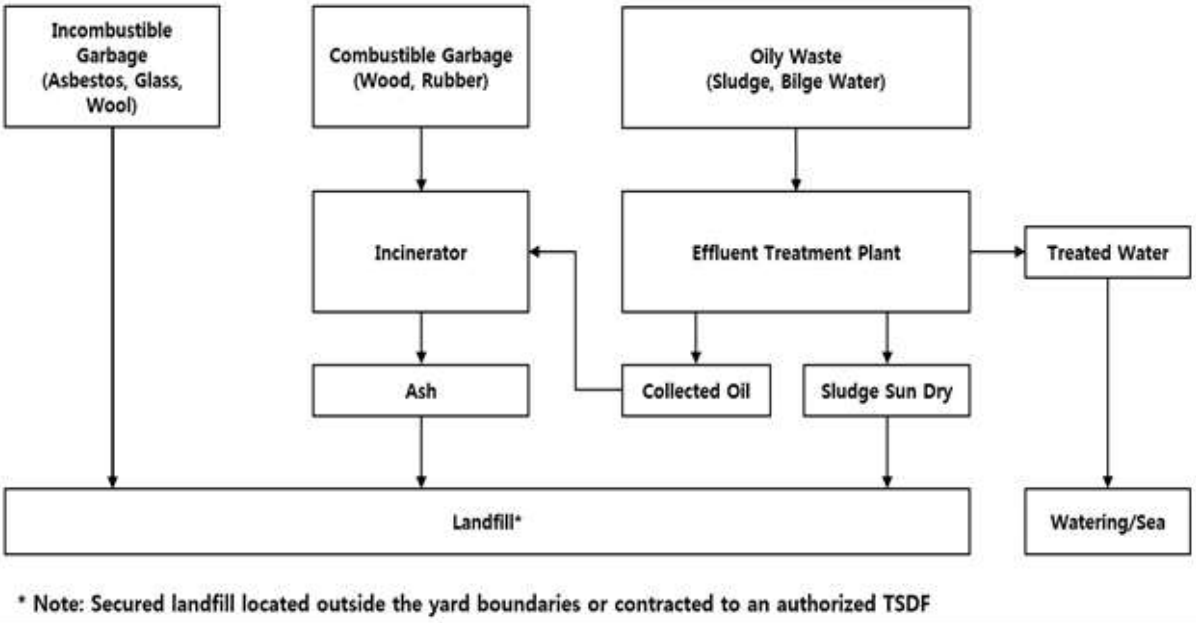


Figure 21: Waste Treatment Flow (Proposed TSDF in Chattogram)

i). Incinerator

The incinerator facility can handle solid, semi-solid, and liquid harmless/hazardous waste with enough incineration capacity to handle the total generated combustible wastes from recycling ships and ship recycling yards. The generated hazardous wastes that shall be incinerated

include oil sludge, oil-contaminated cloth and/or sand, paint/coating materials, rubber gasket, polyurethane foam, polystyrene foam, waste plastic, etc.

The incinerator consists of a primary kiln and a secondary kiln and is designed to incinerate wastes of more than 850 deg. C and 1100 deg. C respectively. Exhaust gas from the incinerator is released into the atmosphere after being treated with a wet scrubber. Wasted water from the wet scrubber will be treated at the ETP facility and ash from the incinerator will be packed for the TSDF. The overall process of incineration is shown in the figure below:

Figure 22: A Typical Incinerator

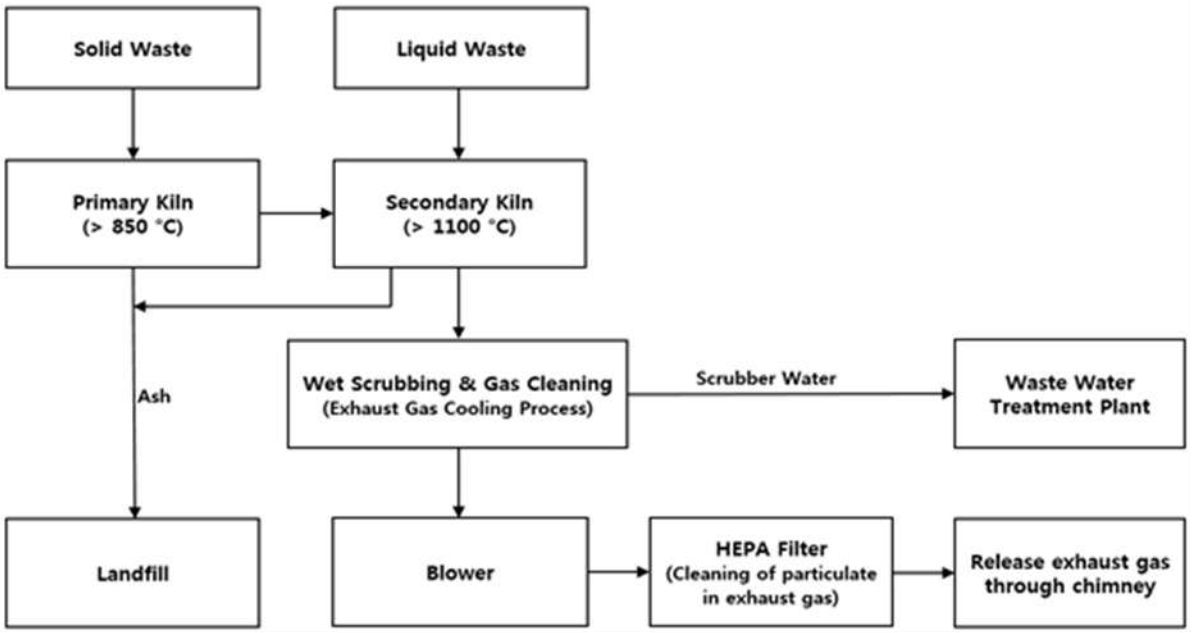


Figure 23: Incineration Process (Ideal with consideration for future TSDF)

The estimated amount of waste from recycling ships and ship recycling facility to be incinerated as follow:

- Solid waste amount: 338 kg/month
- Semi-Solid waste amount: 205 L/month

ii). Effluent Treatment Plant (ETP)

Effluent treatment plant is used for treating the oily water, bilge water and scrubber water from incinerator. Wastewater is treated by coagulating sedimentation and biodegradation method, and the treated water is partially stored and utilized for greenery in the ship recycling facility. Sludge is packed and sent to landfill site under the TSDF after it is dried up at a drying bed. Recovered oil is transferred to the authorized recycler or incinerated. The oily water separator normally can process wastewater containing low concentration of oil. It might not deal with wastewater containing high concentration of oil such as oil sludge. Therefore, it is necessary to have a processing device capable of treating high oil content drainage and sludge before sending to oily water separator.

The estimated amount of oily wastewater from ship recycling facility as follow:

- Oily wastewater amount: 1,500 L/day

The effluent treatment process flow diagram is shown in the figure below:

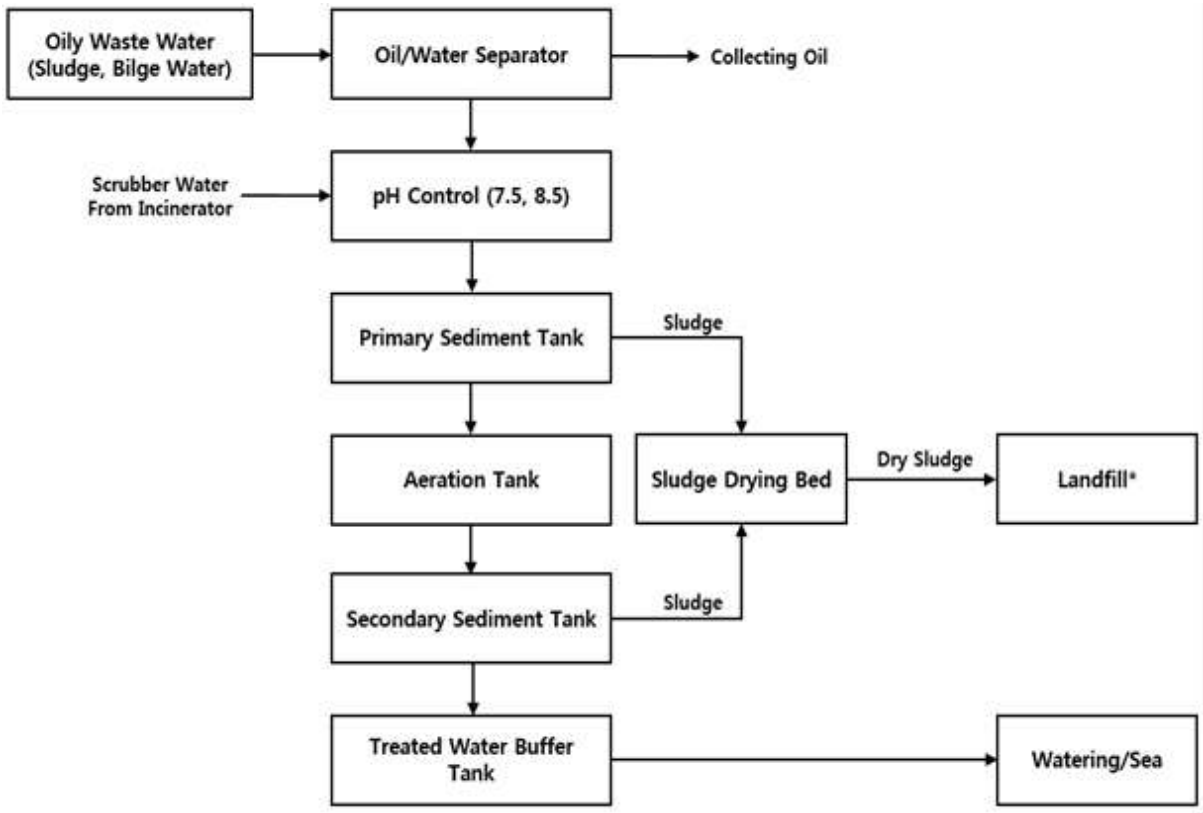


Figure 24: Effluent Treatment Plant Process Flow

Figure 25: A Typical Effluent Treatment Plant

iii). Landfill Disposal Facility

Solid wastes from the ship recycling facility including ash from incinerator and dry sludge from ETP shall be sent to the landfill disposal facility situated elsewhere outside the ship recycling area or sub-contracted to the authorized TSDF with proper landfill site. The solid wastes for landfill from the ship recycling facility will include asbestos, glass wool, mineral wool, food waste and general wastes in the designated TSDF. Among them, glass wool occurs in large quantities in waste from the ship. In order to reduce the volume of waste to be land filled, a compressed packing machine (baler) might be considered.

The estimated amount of waste from the ship recycling facility is as follows:

- Annual hazardous waste amount: 1320Tons/ year
- Annual general waste amount: 2400 tons/ year

Since the type and quantity of wastes generated during ship recycling process will differ for different ship size and type, it is important to reserve the area for future disposal and it is recommended to use the TSDF to reduce the volume of waste.

3.5.6. Storage Area

A storage area has a description as an area within a plant where containment is physically placed. In the ship recycling yard, storage area is arranged depending on the size of the yard and the type of stored materials. There can be more than one plant storage area within a yard. The ship recycling facility should have the following storage areas:

- Outdoor storage areas for scrapped metal sections and metal plates
- Storage area for scrapped machinery
- Indoor storage area for scrapped electrical and electronics items
- Storage area for LPG cylinders and Oxygen cylinders/tank
- Storage area for Diesel Oil
- Storage area for waste materials including general waste, hazmat, wasted oils, oily water, sludge oil, bilge water, etc.

- ❖ Storage area for miscellaneous items

As regulations, all storage areas of the ship recycling facility shall be located on concrete floor. Outdoor storage areas shall have curb and drainage system to collect rainwater, and other storage areas should have at least roof for protection from rain.

Outdoor storage areas for scrapped metal sections and metal plates are segregated by metal types such as ferrous area, non-ferrous area, metal plates, metal sections, pipes, valves, etc.

Storage areas for flammable materials such as Diesel Oil, LPG cylinders, waste oils, oily waters, etc. shall be arranged away from hot work areas and shall be provided with firefighting equipment.

Storage areas for hazardous materials shall be enclosed areas which also required for impermeable floors with effective drainage systems. The storage areas of hazardous materials shall be arranged together with or as close as possible to the hazardous decontamination building. The storage areas have several separated rooms which are designated for storing different materials such as asbestos, glass wool, plastic, chemical, broken lamp, lead acid battery, paint, radiation materials (smoke detector), PCB, ODS, oily rags, hazardous liquids, etc.

Table 15: Storage Area Descriptions

Sl	Storage Area Descriptions	Unit	Quantity
1	(Open area within the yard)	m2	3528
2	Storage Area for Non-Ferrous Metal, Steel Metal and Scrap	m2	12,600
4	Warehouse	m2	1500
5	Storage Area for LPG Cylinders	m2	20
6	Storage Shelter for Oxygen Tank	m2	40
7	Storage Area for Diesel Oil Tank	m2	240
8	Storage Rooms for Hazmat Materials (Asbestos, PCB, ODS, Paint Chips, Lead Acid, etc.)	m2	195
9	Storage Shelter for Wasted Oil Drum	m2	50
10	Storage Area for Oily Water Tanks (Sludge Oil, Bilge Water, Oily Water, Etc.)	m2	500
11	Storage Room for Safety and PPE items, Equipment, Tools and Miscellaneous Parts	m2	200
12	Liquid and Mechanical Store	m2	30
13	Wire Storage Area	m2	20

3.5.7. Utility Supply and Distribution

3.5.7.1. Power

Primary electric power required during the construction and operational phases of the facility shall be supplied from local power grid. The HV power lines from local grid will be connected to power transformer at electric room, then the converted LV electric power will be distributed

to all electrical loads on yard such as lighting, air conditioners, pumps, etc. The initially estimated maximum electric power consumption is about 2.5 MW.

Besides, emergency diesel generator(s) (EDGs) shall be provided as standby to supply backup power in case loss of primary supply power from grid.

3.5.7.2. Fresh Water and Drinking Water

About 300 m3/day of fresh water will be required for cutting block washing, green belt irrigation and domestic purposes. Fresh water will be supplied from local water plant or desalination plant to the facility by lorry truck. Facility should have freshwater storage tanks that can supply fresh water for at least 3 days.

Drinking water will be supplied to the facility in cans or tanks. Drinking water should be arranged at each rest shelters. There will be central tank with 300 m3 freshwater storage capacity and also drinking water supply with deep tube well installation.

3.5.7.3. Diesel Fuel Oil

Diesel fuel oil is required for diesel engine operated equipment such diesel generator, winches, cranes, vehicles, etc. A storage area with capacity about 10,000 liters should arranged in the facility. The designated storage area shall be away from the hot work area and shall be provided with proper firefighting equipment.

3.5.7.4. LPG and Oxygen

LPG and Oxygen Cylinders will be used for gas cutting torches. For cutting onboard of ship, LPG cylinder bottles (12kg) should be used. Oxygen gas will be supplied in cylinder bottles (47L 150bar type gas cylinder).

Storage areas for about 300 gas cylinders shall be arranged onsite, away from cutting areas and shall be provided with rain roof. There will two oxygen plants- industrial oxygen plant with capacity 100 Nm3/Hr and medical oxygen grade cylinders will be supplied with capacity 6 Nm3/Hr.

3.5.8. Administrative Office

The administrative office building will be constructed with enough space to accommodate the planned staff. It is planned to be 3 stories building (40m x 25m) with the following functions: office, meeting rooms, mosque, staff's canteen, etc. The administrative office building will be arranged at the location that it is possible to overview the whole facility from the top floor.

3.5.9. Parking Facility

There will be 03 parking areas to be arranged in the facility, one for office vehicle parking area and two for plant vehicle & equipment parking area. The parking areas should be paved. Vehicle repair workshop and fueling station should be arranged close to the parking area as possible.

3.5.10. Medical Centre

There will be a medical Centre at the ship recycling facility to render immediate aid to casualties especially burn cases, cases involving blunt trauma and cases involving smoke/gas

inhalation or other severe injuries. Medical Centre will have ambulance to move serious cases to the designated specialty hospital.

3.5.11. Workshop and Training Rooms

Workshop and training rooms will be required in the facility for equipment maintenance and for training the staff and workers. They should be provided with necessary equipment for maintenance and training.

3.5.12. Safety Room

Safe room will be required for the daily work permit issuance. It should have meeting room for safety meeting. It also will include the storage area for PPE.

3.5.13. Officer Dormitory

The dormitory will be constructed in the facility to provide the accommodation for officers. It can accommodate around 250 people along with their families. It should be segregated with the ship recycling facility, so that it is possible to control and monitor the number of workers who are working on site.

3.5.14. Fire Fighting System

Workers in the ship recycling facility can face risk from fire, explosions, exposure to toxic gases and fumes that can results in burns, death, and asphyxia. Workers are also at special risk when fighting fires in ship recycling facility. Therefore, cutting areas shall be provided with sufficient numbers of portable fire extinguishers and balls. Suitable firefighting equipment shall be provided at the storage areas of flammable materials. The facility will also require a water firefighting system to supply fire water to each cutting plot, administration office building and labor dormitory. The fire water system will include an underground water storage tank, fire water pumps and distribution pipes.

3.5.15. Safety & Security and other Amenities

All employee working on the recycling yard shall ware PPE. In the recycling operation all the normal safety provisions will be observed. All works should be granted the permit to work and should be supervised. Safety officers will frequently check the works for safety again the approved work permit.

Entrance gates, security posts and security officers will be required for checking for people and material in and out of the facility and ensure the safety of the facility.

Surveillance CCTV cameras will be required for monitoring the normal operation, safety of the facility and supporting the investigations.

The ship recycling yard also will be provided with other supporting facilities for its normal operation such as weigh bridge for loading truck, light masts for lighting of shipyard, worker's changing rooms, rest shelters, restrooms, canteen, etc.

3.5.16. Equipment and Tools for Daily Operations

Equipment and tools are required for daily operation and maintenance works as follows:

Table 16: Essential Operational Tools

SI	Equipment and Tools	Unit	Quantity
1	Flame cutter using oxygen and LPG	Sets	20
2	Welding equipment	Sets	5
3	Magnet device for checking & sorting ferrous or non-ferrous metal	Nos.	5
4	Cold work devices/Tools	Nos.	30
5	Hand tools	Nos.	20

Table 17: Safety kits for daily operation and maintenance works

Serial No.	Name of the Machinery Item	Unit	No. of units
1	Multi Gas Detector	Nos.	10
2	Decibel meter	Nos.	10
3	Lux meter	Nos.	10
4	Oil Spill Kit	Nos.	10
5	Fire man outfit	Nos.	10
6	Self-containing Breathing apparatus (SCBA) Full set	Nos.	10
7	Life Jacket	Nos.	50
8	Gloves	Nos.	200
9	Earmuff (defender)	Nos.	200
10	Fall arrestor for height work	Nos.	25
11	Disposable suite	Nos.	100
12	Masks (surgical)	Nos.	1000
13	Florescence jacket	Nos.	25
14	Boiler suit	Nos.	50
15	Safety helmet	Nos.	500
16	Safety Shoes	Nos.	500
17	Safety Goggles	Nos.	500
18	Gum Boots	Nos.	300
19	Ear plugs, Small	Nos.	500
20	Ear Defender	Nos.	500
21	Gas Mask (P2, P3 Type)	Nos.	200
22	Cutting Apron (Water Resistant & Nylon material)	Nos.	100
23	Leather Hand Gloves (Welding/Cutting)	Nos.	200
24	Rubber Hand Gloves (Electrical Works)	Nos.	200
25	Rubber Hand Gloves (Chemical)	Nos.	200
26	Nylon Hand Gloves (Normal)	Nos.	200
27	Safety Belt	Nos.	50
28	Safety Harness	Nos.	50
29	Lifeline	Nos.	50
30	Fireman Suit	Nos.	50

Serial No.	Name of the Machinery Item	Unit	No. of units
31	Fire Blanket	Nos.	50
32	Oil Removal Suit	Nos.	10
33	Oil Removal Boot	Nos.	10

3.5.17. Bathymetric Analysis and Survey for the Project Site

A comprehensive data collection program has been carried out in connection with this project to collect bathymetry, water level, current speed, suspended sediment concentration, riverbed sample and wave measurement in the Baleswar-Bishkhali-Buriswar estuary. Also, historical hydro-morphological data, past study reports & relevant maps, and satellite images for the concerned study area has been collected from available secondary sources. All the collected data has been analyzed to establish historical change and present hydro-morphological conditions of project area, development, and calibration of hydrodynamic, storm surge, wave, and morphological models, design parameters for any proposed infrastructure facilities etc.

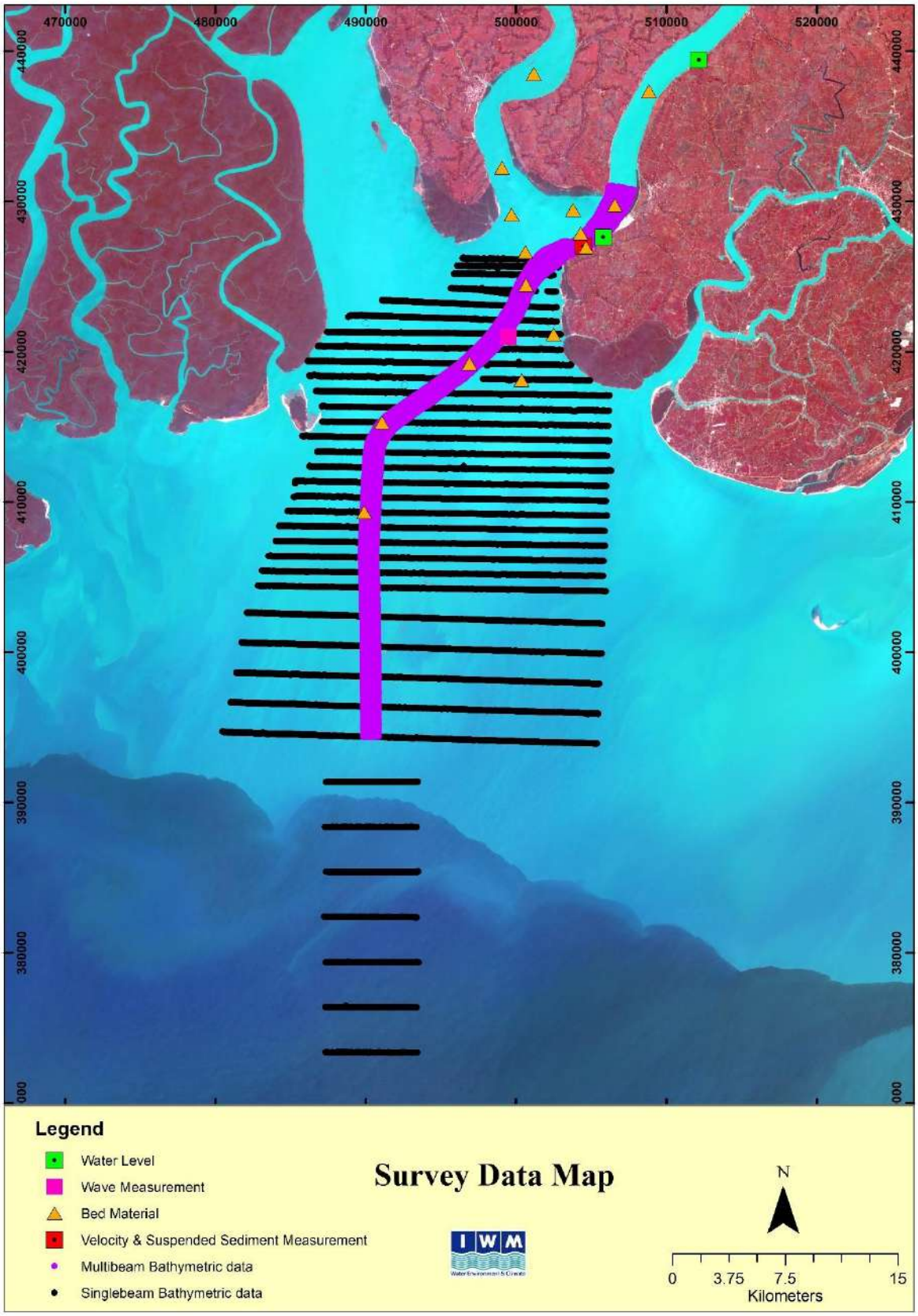


Figure 26: Survey Data Map

Table 18: Survey Data Inventory

Sl. No.	Item	Item Description	Unit	Quantity
1	Bathymetric Survey (multi-beam)	Bathymetric Survey along the Burishwar-Bishkhali-Pyra river and the estuary with multibeam Echo-sounder	sq.km	47
2	Bathymetric Survey (single beam)	Bathymetric Survey along the Burishwar-Bishkhali-Pyra river and the estuary with singlebeam Echo-sounder @1 to 2km interval	km	581
3	Current Speed	24 Hr. Velocity measurement during Spring Tide in monsoon season for 7 days at project site	day	7
4	Water Level	Water level measurement at 2 locations for 3 months during dry monsoon by pressure sensor	Month	2 stations X 3 months
5	Bed Materials	Bed materials collection and analysis during bathymetry survey	Nos.	15
6	Suspended Sediment Concentration (SSC)	Sediment sampling [1 location x (7 days with current speed measurement) x 13hrs x 3 depth] and lab analysis	Nos.	273
7	Wave	Wave measurement	Month	1

Bathymetric survey was conducted using both single beam and multi beam echo sounder. Single beam survey was conducted covering full width of the river and extended up to the sea until sufficient water depth is found. A total of 581 km transect length is covered through single beam survey. Single beam survey data is used to identify the deep channel and prepare a plan for multibeam survey. Multi beam survey was conducted along the deep channel about 47 sq km area. Bathymetric survey using Multi beam echo sounder has been shown in the figure below. Both single beam and Multi beam data is used to develop the model bathymetry and assess the navigability of the channel. In addition, surveyed bathymetric data is used to estimate dredging volume required along the approach channel for different specified vessel drafts that are considered in this study.

3.5.18. Morphological Change

Analysis of timeseries of bathymetric data is important to assess the scouring/ sedimentation as well as understand the morphological characteristics. Figure 27 shows the location of bathymetric data collected under the present study in 2023. IWM conducted bathymetric survey at the mouth of Baleshwar-Bishkhali-Burishwar river in 2021 in connection with some other project. Bathymetric data in 2021 and 2023 is shown in Figure 27. Two surfaces have been prepared by interpolating the bathymetric data of 2021 and 2023. Interpolated surface of 2021 is subtracted from 2023 to prepare the scouring and sedimentation map. Figure 28 shows the scouring and sedimentation at the mouth of Baleshwar-Bishkhali-Burishwar river during the period of 2021 to 2023.

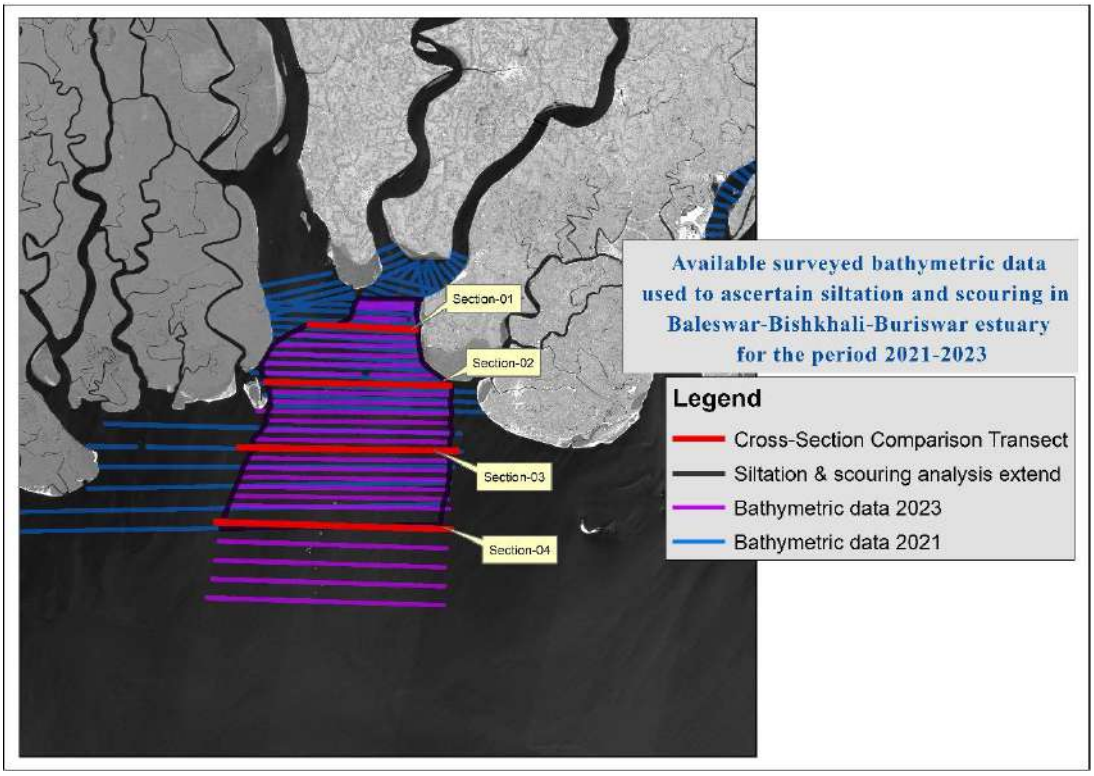


Figure 27: Bathymetric data in 2021 and 2023

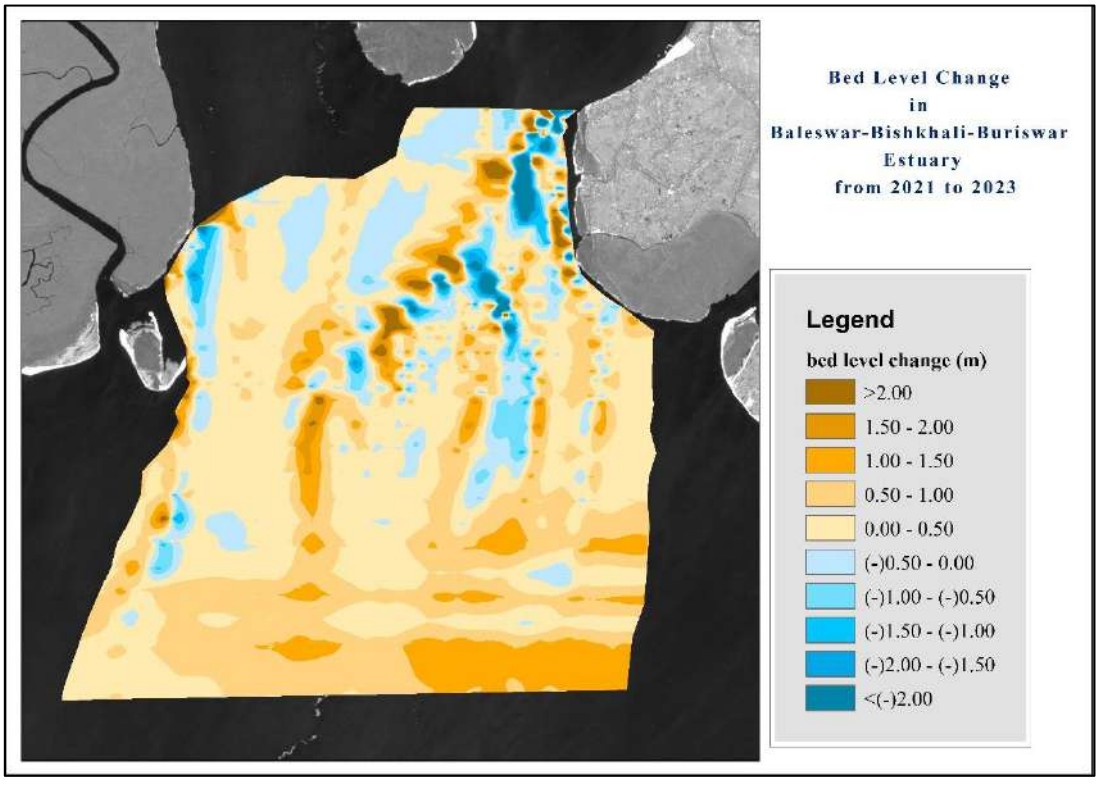


Figure 28: Scouring and sedimentation at the mouth of Baleshwar-Bishkhali-Burishwar river during 2021 to 2023

Above figure shows that sedimentation is predominant in this area. However, some locations are experiencing scouring.

3.5.19. Relevance of the Project Idea

This project is proposed for construction of environment friendly ship recycling industry in Taltoli upazila of Barguna district. Proposed project will also require dredging in the access channel for navigability improvement.

The Perspective Plan 2021-2041 is a development strategy formulated in order to convert Vision 2041 into a reality. Specifically, Vision 2041 seeks to eliminate extreme poverty and reach Upper Middle-Income Country status by 2031, and High-Income Country status by 2041 with poverty approaching extinction. The proposed project is in line with the Perspective Plan 2021-2041 for sustainable growth.

Over the past decade, the policy, strategy, plans, objectives, goals and conditions in different sectors have changed significantly. The Seventh Five Year Plan has expired. Therefore, the purpose of this project is logically consistent with the Eighth Five Year Plan. The objectives and goals of the Eighth Five Year Plan are related to implementation of Vision 2021.

The project is also important in view of achieving the Sustainable Development Goals (SDGs). The no. 1 goal of SDG is 'No Poverty' which can be ensured by constructing environment friendly ship recycling industry. The project will require many workers during construction and operation of the industry which will create job opportunities for the local communities. As a result, poverty alleviation will be accelerated. The no. 9 goal of SDG is 'Industry, innovation and infrastructure'. The proposed project will construct environment friendly ship recycling industry.

The proposed project area is located in the "River and Estuary" area out of the six hotspots mentioned in Bangladesh Delta Plan-2100 (BDP 2100). The project objective is very much aligned with the strategy, sub-strategy and measures of blue economy: enhance environmental ship recycling. Again, Proposed project required dredging in the access channel to improve the navigability which is aligned to the River System and Estuaries strategies of BDP-2100.

3.5.20. Soil Improvement Methods

3.5.20.1. General Types of Soil Improvement Method

Improvement method of soft soil is below Table. Improvement method is selected considering of cost, construction period, discharge load, supply of material, soil condition, site condition, environmental condition, etc.

Table 19: Improvement Method of Soft Soil

Principle	Method	Soil Type		Purpose		Note
		Sand Layer	Clay Layer	Settlement promotion	Settlement reduction	
Drain	Plastic Board		O	O		
	Rubble / Sand	O	O	O		
Replacement	By Dredging	O	O		O	
	By self-weight		O			
Drain & Compaction	Sand pile	O	O	O	O	
	Rubble pile	O	O	O	O	
Compaction	Vibro-flotation	O			O	
	Rod-Compaction	O			O	
	Vibro-Compaction	O			O	
Mixing	Shallow	O	O		O	
	Deep	O	O		O	
Injection Solidification	Jet Grouting	O	O		O	
	Compaction Grouting	O	O		O	
	Chemical Grouting	O	O			Slipway
Loading	Pre-loading	O	O	O		Yard

For improving the soft soil, slipway with large load is applied a compaction grouting method and yard area with not heavy load is applied a preloading method.

3.5.20.2. CGS For Slipway

Slipway uses Compaction Grouting System (CGS) among grouting methods. CGS is used in various fields of application which frequently can be combined in a single project: Soil improvement, Stabilization and rehabilitation of foundations, Cavity Grouting.

CGS process: When applying the compaction grouting process usually a stiff to plastic grout is injected into the soil under pressure. It expands in the soil as a relatively homogeneous mass and at the same time is forming almost ball-shaped grout bulbs. The soil surrounding the grouted area is displaced and at the same time compacted.

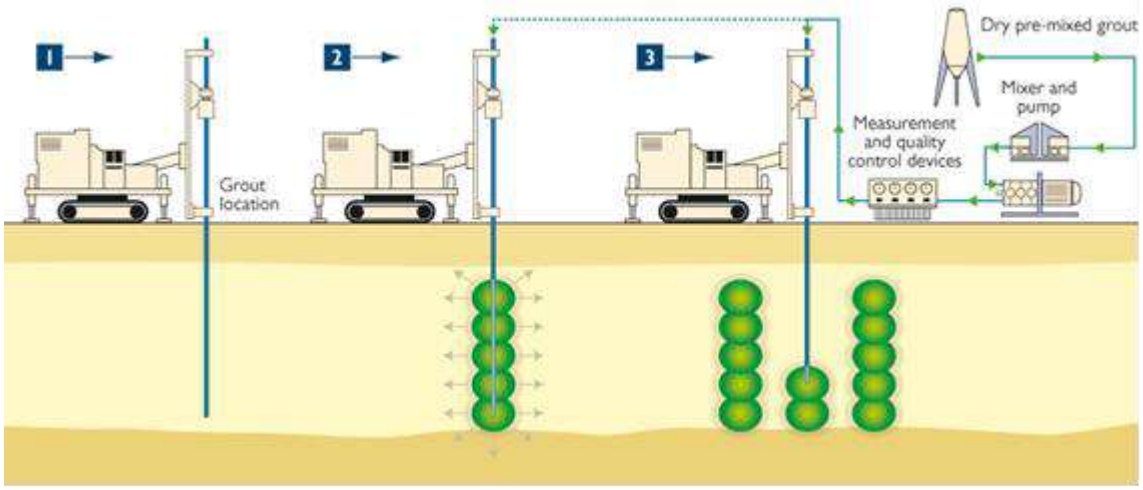


Figure 29: CGS process

3.5.20.3. Preloading of Yard

Preloading is a process to apply surcharge load on to the ground prior to the placement of structure to consolidate the soil. Primary settlement will occur so as to increase the bearing capacity and reduce the compressibility of weak ground as water is flushed out. The temporary surcharge applied on the ground is generally more than the expected bearing capacity. It is more effective for soft cohesive ground and is removed after completion of process.

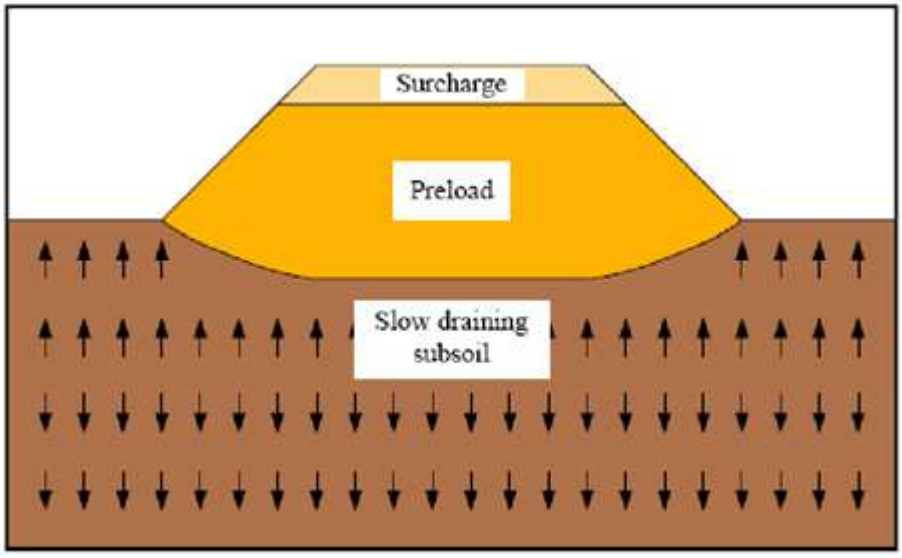


Figure 30: Preloading Process

3.5.21. Stakeholders

Stakeholders are individuals or groups who are both affected by or has an impact on a system's policies, decisions, or actions. Groups of people, organizations, institutions, and possibly even single persons can be stakeholders. Stakeholders can be divided into primary and secondary stakeholder categories.

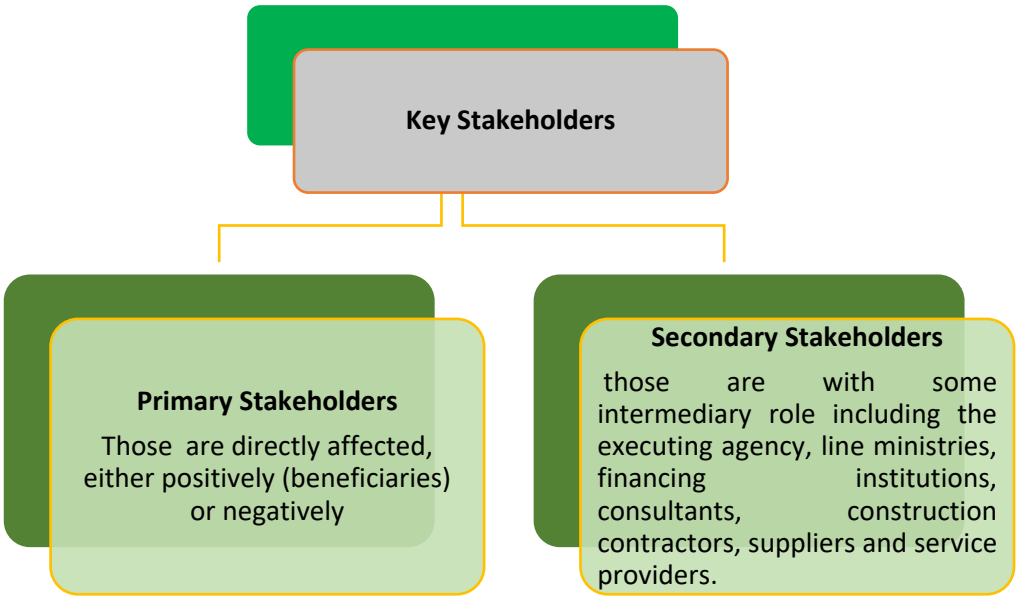


Figure 31: Key Stakeholders

Primary Stakeholders: People who would be directly benefited or affected by this project intervention. In this project, Bangladesh Steel and Engineering corporation is the major stakeholder. Other primary stakeholder includes farmers, fishermen, small business communities as well as the households that may be displaced due to project interventions, women groups, and wage laborers. However, local leaders, community members and other local representatives were also consulted during these consultations.

Secondary Stakeholders: This category of stakeholders pertains to those who may not be directly affected but have interests that could contribute to the study, play a role in implementation at some stage, or affect decision-making on Project aspects. Secondary stakeholders for the Project include different steel re-rolling mills, local government institutions (LGI), other government agencies, NGOs and general public at large.

All the major stakeholders will be consulted for carrying out the project by the technical and social team. Details of the stakeholder consultations and findings will be presented in the final EIA Report.

3.5.22. Technical Design

3.5.22.1. Green/Compliant Ship Recycling Process and Overview

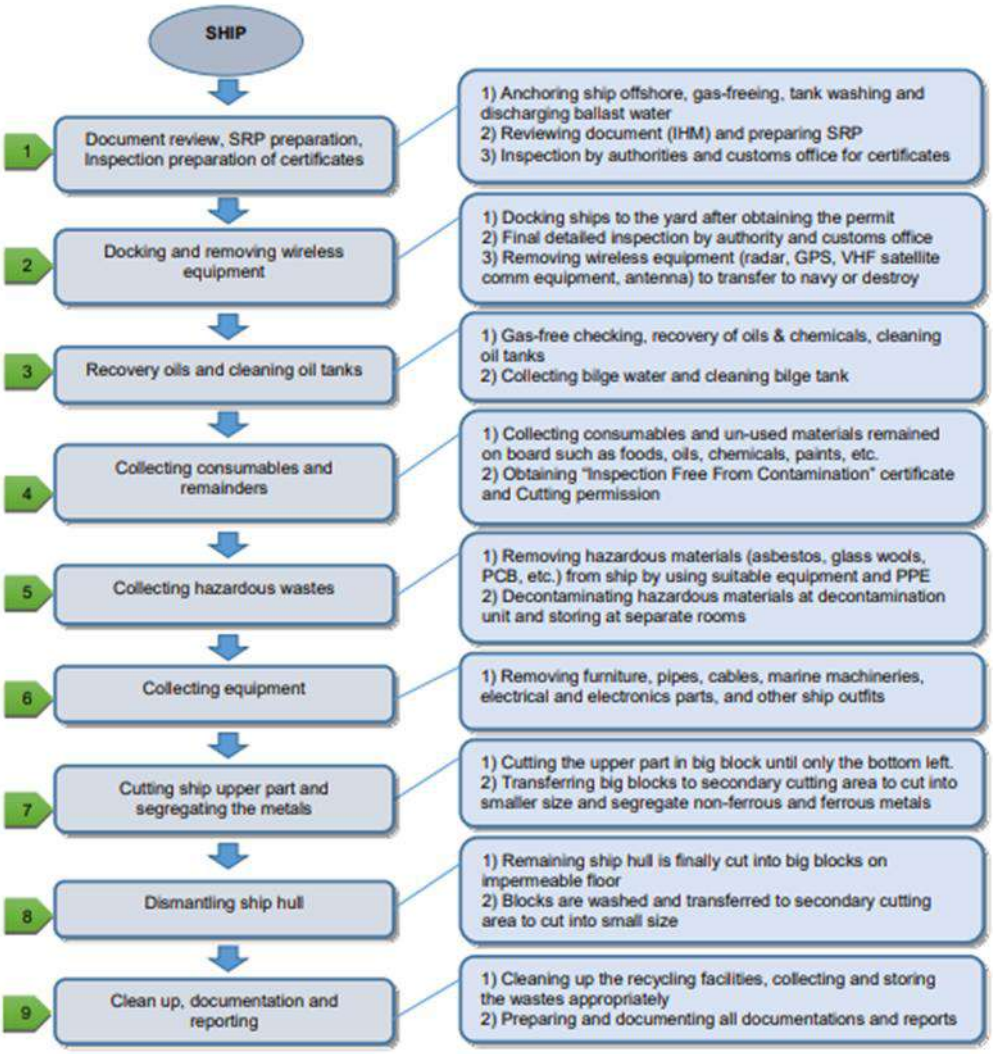


Figure 32: Compliant Ship Recycling Process

In general, a ship recycling yard is assessed and certified as green ship recycling facility based on the governing national and international regulations for ship recycling. The major difference between various applicable recycling processes is mainly in the applied docking methods which lead to the primary cutting area will be performed either on inter-tidal zone or completely on onshore dry dock, and the level of mechanization used to carry out the recycling process. The various applied process methods depend greatly on the location of the yard and the prevalent practices in the region. Four general methods to dock ships for dismantling are beaching, slipway, alongside and dry-dock. However, the beaching method which has been widely applied in Asia for dismantling ships at the intertidal zone of a beach, has faced harsh criticism globally for un-safe and environmental harmful practices. In this study, the four (04) safe and environmentally friendly ship recycling methods are brought in consideration including landing with slipway, slipway, alongside with slipway and dry-dock.

3.5.22.2. Features of Green/Compliant Ship Recycling Facilities

Based on the criteria spelled out by HKC and EUSRR, the key criteria for assessing green ship recycling facilities are fleshed out and listed as follows:

- Practice environmentally and occupationally sound operations and management.
- Comply with national and international waste trade laws.
- Have all licenses/permits including hazardous waste management licenses.
- Operate in countries with downstream environ-friendly disposal facilities for wastes/materials.
- Ships recycled at the facilities have passed all evaluation of hazardous materials, wastes onboard and IHM evaluation, and have obtained gas-free certificates. All wastes, oil and fuel must also be removed from ships prior to recycling.
- Pass health and environmental monitoring of workers and workplace.
- Obtain broad-based community support.
- Have environmental management system.
- Have firefighting and personnel protective equipment and onsite /offsite medical and emergency facilities.
- Comply with labor rights and protection rules/laws.
- Responsible for occupational safety and health.
- Have equipment to minimize heavy lifting and dangerous manual labor.
- Have docking (wet and/or dry) facilities for dismantling of ships in a clean, non-polluting and safe manner.
- Handle of hazardous materials, and of waste generated during the ship recycling process only on impermeable floors with effective drainage systems.
- Have ship pre-cleaning equipment and facilities to undertake pre-cleaning in environmentally friendly way and in accordance with ISO/PAS 30000:2008. With these equipment and facilities, all materials / objects not belonging to the vessels' construction including wastes are removed before the ships are dismantled.

3.5.22.3. Typical Green Ship Recycling Facility

A green ship recycling facility should be utilized with sufficient facilities and equipment in order to recycle ships in consistent with the national regulations as well as international conventions. The major facilities and equipment that should be available in the green recycling yard including the following, but not limited to:

- Access channel and navigation assistant
- Docking and mooring facility
- Primary cutting area such as quays, berth, slipway, etc.
- Secondary cutting area with impermeable floor and effective drainage system
- Workshop and indoor hazardous decontamination facility
- Storage areas with proper storage equipment for structural parts; machinery and outfits; electric and electronics parts; hazardous materials such as asbestos and PCB; flammable liquid (fuel oil, lubrication oil and oily water) and flammable gas
- Scrapping work equipment and tools such as flame cutting tools and equipment, scaffoldings, hoists and tackles, etc.
- Lifting and transportation equipment such as crane, forklift truck, truck, etc.

- ❖ Office and other supporting facilities such as office building, canteen, clinic, mosque, security post, rest room, power generator, freshwater tank, parking ground, etc.
- ❖ Safety appliances and facilities such as firefighting system, oil spill prevention and recovering equipment, PPE, etc.
- ❖ Access road

A typical layout for a model facility from the BC Technical Guidelines is shown in the figure below:

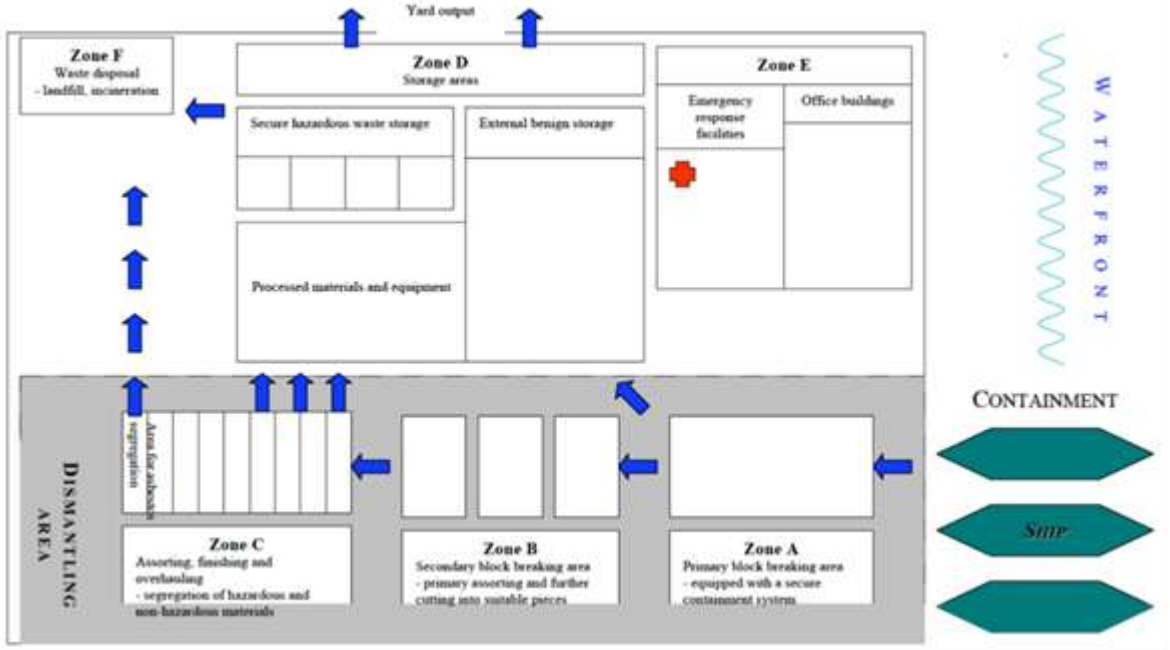


Figure 33: Typical layout for a model facility in BC Technical Guidelines

General layouts of some actual green ship recycling yards worldwide are shown in the below figure.

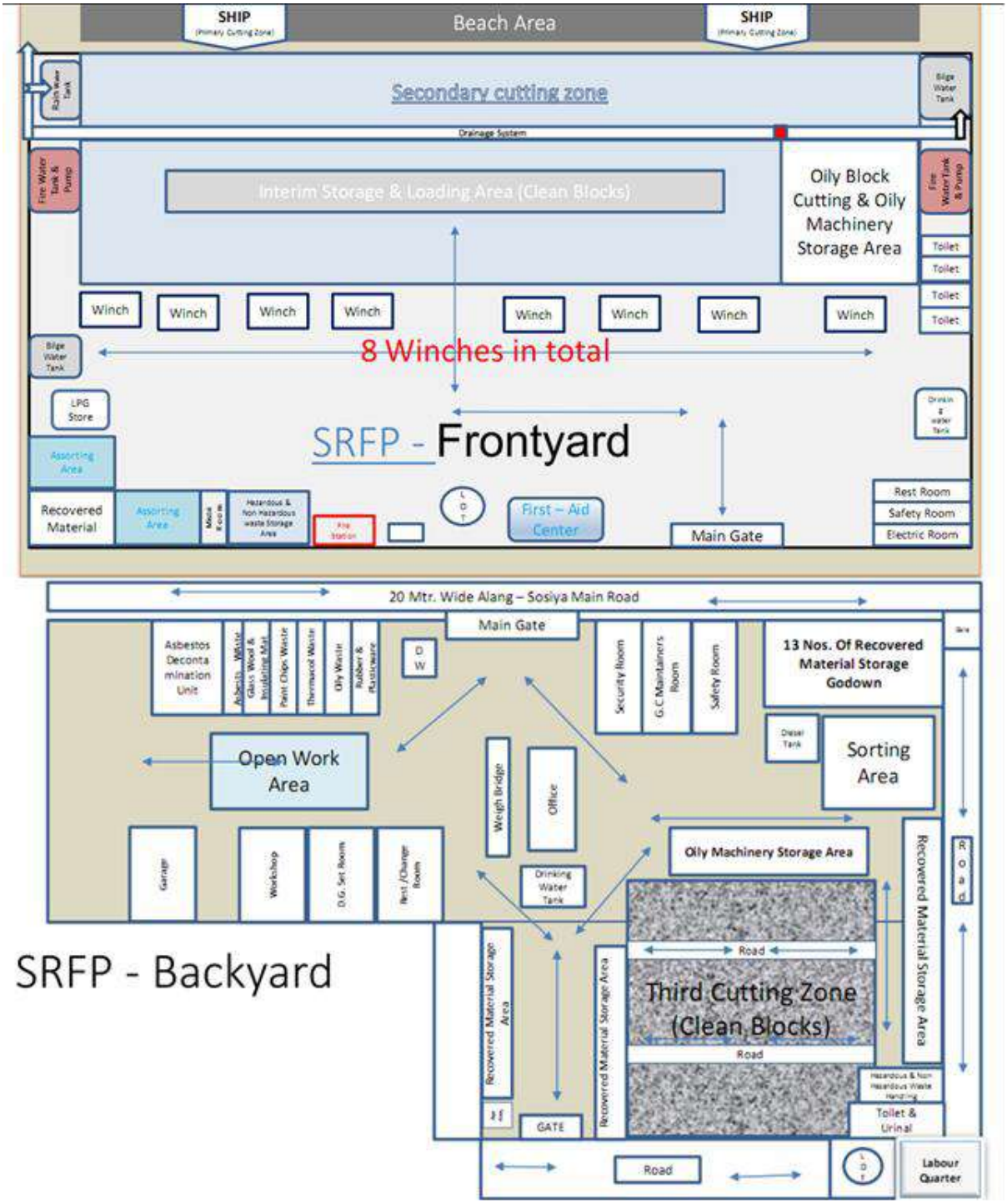


Figure 34: Layout of Green Ship Recycling Yard Priya Blue (India) (ClassNK certified to HKC) Source: Priya Blue Industries website

Figure 35: PHP Layout, Bangladesh Class NK Certified Yard, picture during site-visit

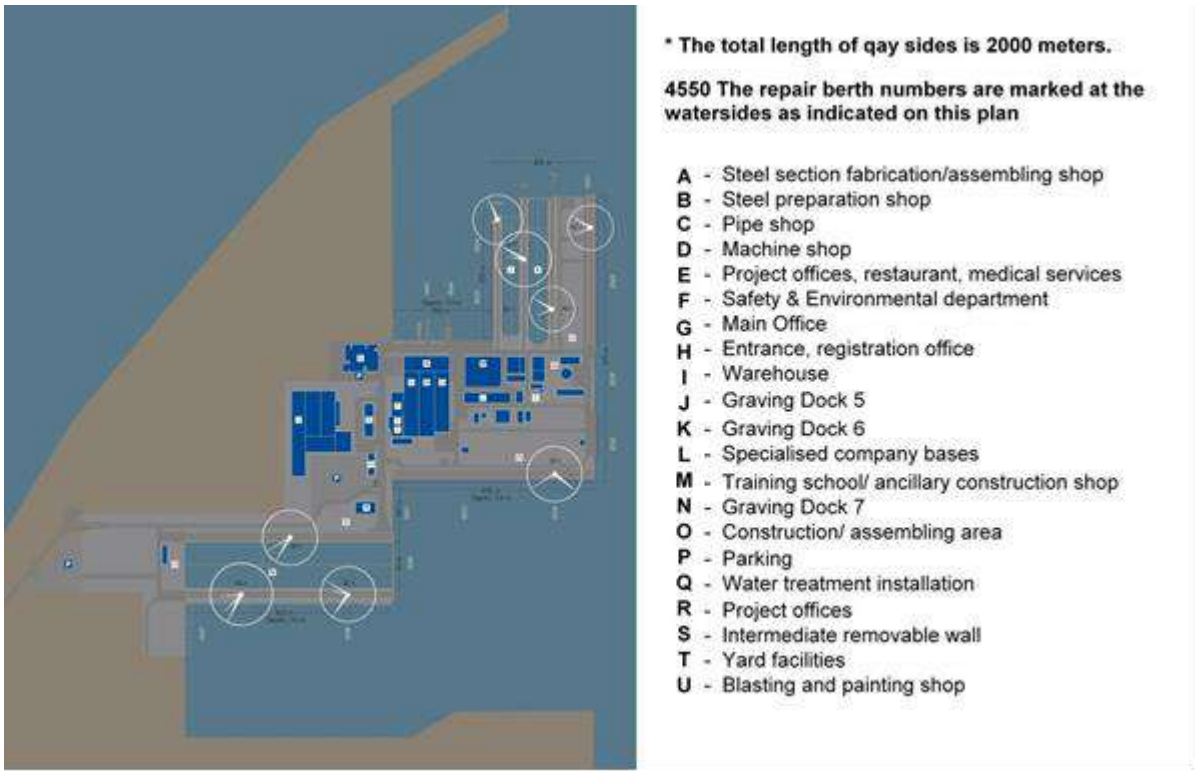


Figure 36: Layout of Green Shipyard Damen (Kepple)-Verolme (Netherlands) (EUSSR List) Source: Damen-Verolme Website

3.5.23. Green Ship Recycling Method Evaluation

Many processing methods are being applied for ship recycling industry such as beaching, landing, slipway, dry-dock, alongside, etc. However, beaching method is a traditional method and is commonly practiced in many recycling shipyards in Chittagong beach. It is applied where there is high tidal difference and doesn't need many equipment and facilities. However, it is catching a lot of national and international attention for it un-safe working conditions and environment pollutions. The cutting is performed in the intertidal zone, so that the cutting blocks drop in the intertidal mud and the waste materials including leaked oils, sewage are washed to the sea causing serious environment pollution. Beaching method is not approved by Hong Kong Convention and EUSSR, therefore in this study, only four (04) possible green recycling methods including landing, slipway, alongside and dry-dock are brought into evaluation as below.

3.5.24. Landing Method

Figure 36 shows the landing method for ship recycling. In this method, the ship is sailed against a short concrete slipway extending into the sea by its own power. The ship is then pulled up higher to onshore concrete cutting plot by winch. The recycling process is "top to bottom" and "head to tail". The process starts from the bow part after landing, and after collision fore bulkhead is removed. An opening square hole with size suitable for a mobile crane is made by cutting the lowest part of each of bulkhead plates and a temporary bridge is set up at the front cutting edge to create a passage for the crane getting on board.

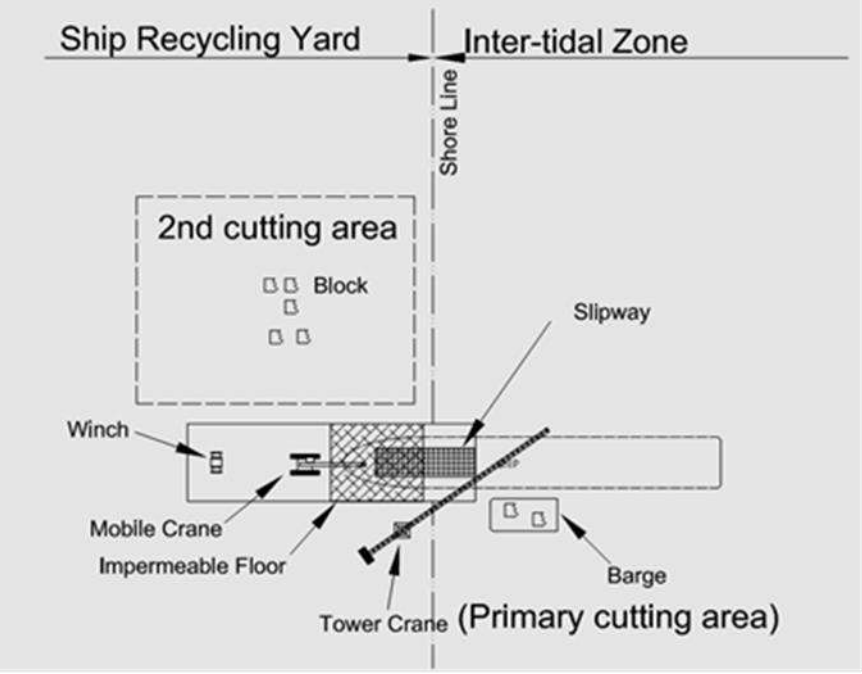


Figure 37: Landing method

Figure 38: PHP Family recycling yard – first HKC certified yard in Bangladesh Source: PHP

Figure 39: Example of mobile cranes operating on board.

It is also possible to use fixed tower crane, mobile overhead cranes and/or barge to dismantle the ship upper parts into big blocks. Blocks is then transferred by cranes, trucks or barges to second cutting area to cut further into smaller pieces and to segregate the metals. When the ship body becomes lighter, it is gradually pulled upper to onshore and cut on the impermeable floor with effective drainage systems. This method is widely applied in many certified green ship recycling yards in Turkey, India and Bangladesh. Figure 37 and Figure 38 illustrate the examples of certified yards with landing practice.

3.5.25. Slipway Method

Figure 39 shows the slipway method for ship recycling. In this method, ship is also sailed by its own power toward a concrete slipway extending into the sea.

Figure 40: Example of slipway shipyard in Turkey

The processing method is also top down. By using barges with cranes on board and/or fixed cranes, the ship upper part is cut into big blocks and transferred to the second cutting area onshore. Finally, by using winch and slipway, the whole light ship hull will be totally pulled up to onshore to be cut on the impermeable floor with the effective drainage system. This method is commonly practiced in many certified green ship recycling yards in Turkey, EU, US and China. Figure 39 illustrates the example of yard with slipway practice.

3.5.26. Alongside Method

Figure 40 shows the alongside method for ship recycling. The alongside method, also referred to as quayside, pier side or floating method, is a method to dismantle ships that are afloat and moored along wharfs, jetties or quays and/or moored offshore. The breaking process is “top down” i.e., the superstructure and upper pieces are removed first, then the work continues along the ship into the engine room until only the double bottom is left. Finally, the whole light ship hull will be brought to onshore by using crane or winch and slipway. It will be cut on the impermeable floor with the effective drainage system.

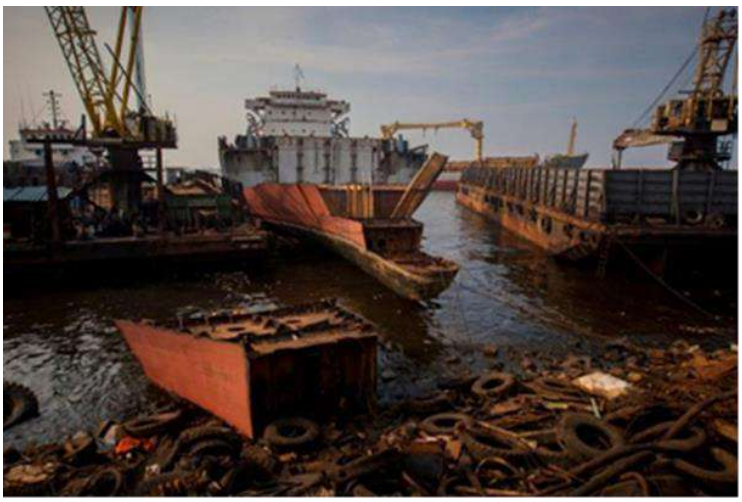


Figure 41: Alongside method

This method is commonly practiced in many certified green ship recycling yards in China, US and EU.

3.5.27. Dry-dock Method

Figure 41 shows the dry-dock method for ship recycling. In this method, ship is docked on the concrete dry-dock with gate. Ship is dismantled with support of material handling equipment such as overhead cranes, mobile cranes, forklifts and trucks. The dry-dock floor where is subjected to primary cutting and spills, shall be impermeable and provided with drainage systems.

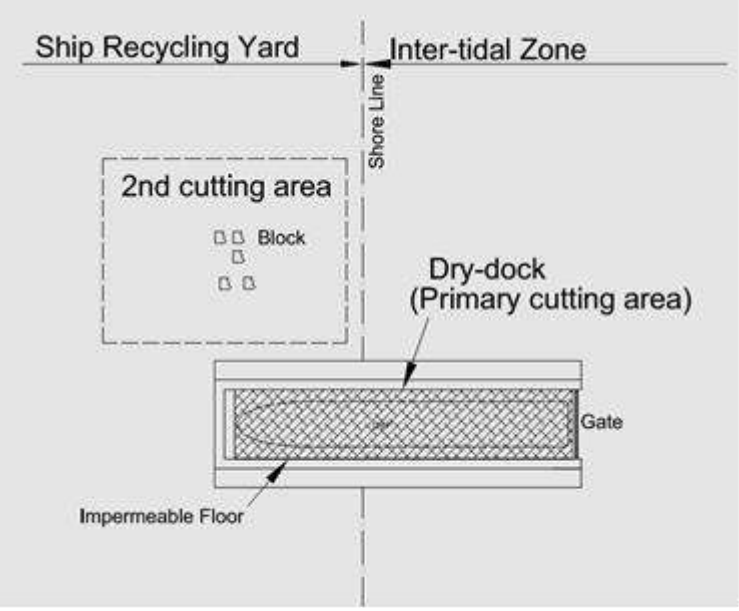


Figure 42: Dry-dock method

Figure 43: Example of dry-dock recycling yards

This method is commonly practiced in many certified green ship recycling yards in US, EU and China. Figure 42 illustrates an example of yard with dry-dock practice. The following table shows the evaluation method for green or compliant ship recycling in terms of comparison.

Table 20: Comparison of different methods

Criteria	Landing method		Slipway method		Alongside method		Dry-dock method	
Required facilities	➢ Primary cutting area: smaller concrete floor & impermeable floor, small slipway & concrete extended into the sea. ➢ Require winch, mobile crane and small barge.	+++	➢ Primary cutting area: concrete floor, impermeable floor and slipway extended into the sea. ➢ Require winch, large barge with crane	++	➢ Primary cutting area: Jetty/Quay, slipway, concrete floor, impermeable floor. ➢ Require winch, badge with crane or large jib crane on Jetty/Quay	+	➢ Primary cutting area: Dry-dock, impermeable floor. ➢ Require overhead crane and other material handling equipment.	+
Construction Cost	➢ Lowest construction cost for smaller concrete floor and smaller impermeable floor	+++	➢ Construction cost higher than landing method for bigger concrete floor and impermeable floor	++	➢ Construction cost higher than landing method for bigger concrete floor, impermeable floor and jetty/quay	+	➢ Highest construction cost for heavy dry-dock, bigger concrete floor and impermeable floor. ➢ Difficult and high cost to construct heavy dry-dock on soft soil	+
Operation Cost	➢ Lowest operation and maintenance cost for mobile crane and small barge	+++	➢ Higher than landing method for maintenance costs of slipway.	++	➢ Highest operation and maintenance costs for slipway, winch, jetty/quay and material handling equipment.	++	➢ Highest operation and maintenance costs for dry-dock, gate, pumping system and equipment	+
Influence if Tidal	➢ Need high tide to pull ship to land ➢ Easy to pull ships in case of large tidal range.	+	➢ Only need high tide to pull ship to land on slipway. ➢ Increase slipway length in case of large tidal range	++	➢ Only need high tide to pull ship to land on slipway. ➢ Increase jetty / quay level by high tide	++	➢ Not affected by tide	+++
Scrapping Time	➢ Average scrapping time	++	➢ Same as landing method	++	➢ Faster than landing method	+++	➢ Fastest scrapping time	+++
Main pollution risks	➢ There is risk of pollution from ship paints as pre-removal is not possible and cutting blocks drop to inter-	+	➢ There is risk of pollution from ship paints as pre-removal is not possible and cutting blocks drop to	++	➢ There is risk of pollution from ship paints as pre-removal is not possible and cutting blocks drop to inter-	++	➢ There is no risk of pollution from ship ➢ Water pollution associated with dredging	+++

Criteria	Landing method		Slipway method		Alongside method		Dry-dock method	
	tidal area when being transferred from ship to barge. ➢ Water pollution associated with dredging. ➢ Unexpected high tide when sea level rise in future that can flood the impermeable floor.		inter-tidal area when being transferred from ship to barge. ➢ Water pollution associated with dredging. ➢ Less risk for unexpected high tide when sea level rise in future that can flood the impermeable floor.		tidal area when being transferred from ship to barge. ➢ Water pollution associated with dredging. ➢ Less risk for unexpected high tide when sea level rise in future that can flood the impermeable floor.		➢ There is no risk for unexpected high tide when sea level rise in future.	
Main impacts on natural environment	➢ Possible impacts on marine organisms through pollution of inter-tidal area ➢ Loss of habitat due to construction of extended concrete and slipway ➢ Water pollution from dredging activities may impact marine organisms	++	➢ Possible impacts on marine organisms through pollution of inter-tidal area ➢ Loss of habitat due to construction of extended concrete and slipway ➢ Water pollution from dredging activities may impact marine organisms	++	➢ Possible impacts on marine organisms through pollution of inter-tidal area ➢ Loss of habitat due to construction of extended concrete and slipway ➢ Water pollution from dredging activities may impact marine organisms	++	➢ There is no pollution to inter- tidal area ➢ Loss of habitat due to construction of dry-dock ➢ Water pollution from dredging activities may impact marine organisms	+++
Risk of accidents	➢ Same level of risk as other industrial plants. Mainly involving in material handling.	++	➢ Same level of risk as other industrial plants. Mainly involving in material handling.	++	➢ Same level of risk as other industrial plants. Mainly involving in material handling.	++	➢ Same level of risk as other industrial plants. Mainly involving in material handling.	++
Main health risk to workers	➢ There are health risks associated with expose to gas-cutting fumes and dusts	++	➢ Same level of risk as landing method	++	➢ Same level of risk as landing method	++	➢ Same level of risk as landing method	++
	Recommended		Recommended		Recommended		Less likely to be recommended due to construction difficulty	

+++: High rating ++: Average rating +: Low rating

Even though the landing method is widely used in many certified green ship recycling yards, this method possesses some risks to environment pollution due to the cutting activities of ship hull at nearby the shoreline and the possibility of dropping the cutting blocks into the intertidal mudflat.

In consideration for both regulations, operation & construction costs, environment and scrapping time, the Slipway method is preferred for this ship recycling facility. When recycling the small ship, it is possible to pull the whole ship onshore on the slipway for breaking. However, in the case of recycling the heavy ship, its superstructure can be cut and removed safely, environmentally friendly and fast by use of the crane operated on shoreline and/or on barge (a stable built structure) to reduce the ship weight. Then, the light ship hull can be pulled up to the slipway for cutting. The process will improve the cutting time and eliminate the possibility of dropping the cutting blocks into the intertidal mudflat. Besides, since the superstructure is including equipment, machinery and furniture in accommodation and engine rooms, which are valuable and resalable goods, they can be removed carefully and smoothly in early stage by use of crane without damages, the working efficiency may be increased.

The dry-dock method can also be preferred in the case of recycling the heavy ship that it is too difficult to pull it on the slipway. Even though it will be costly for construction of structures, the dry-dock is the most environmentally friendly method for ship recycling with fastest scrapping time.

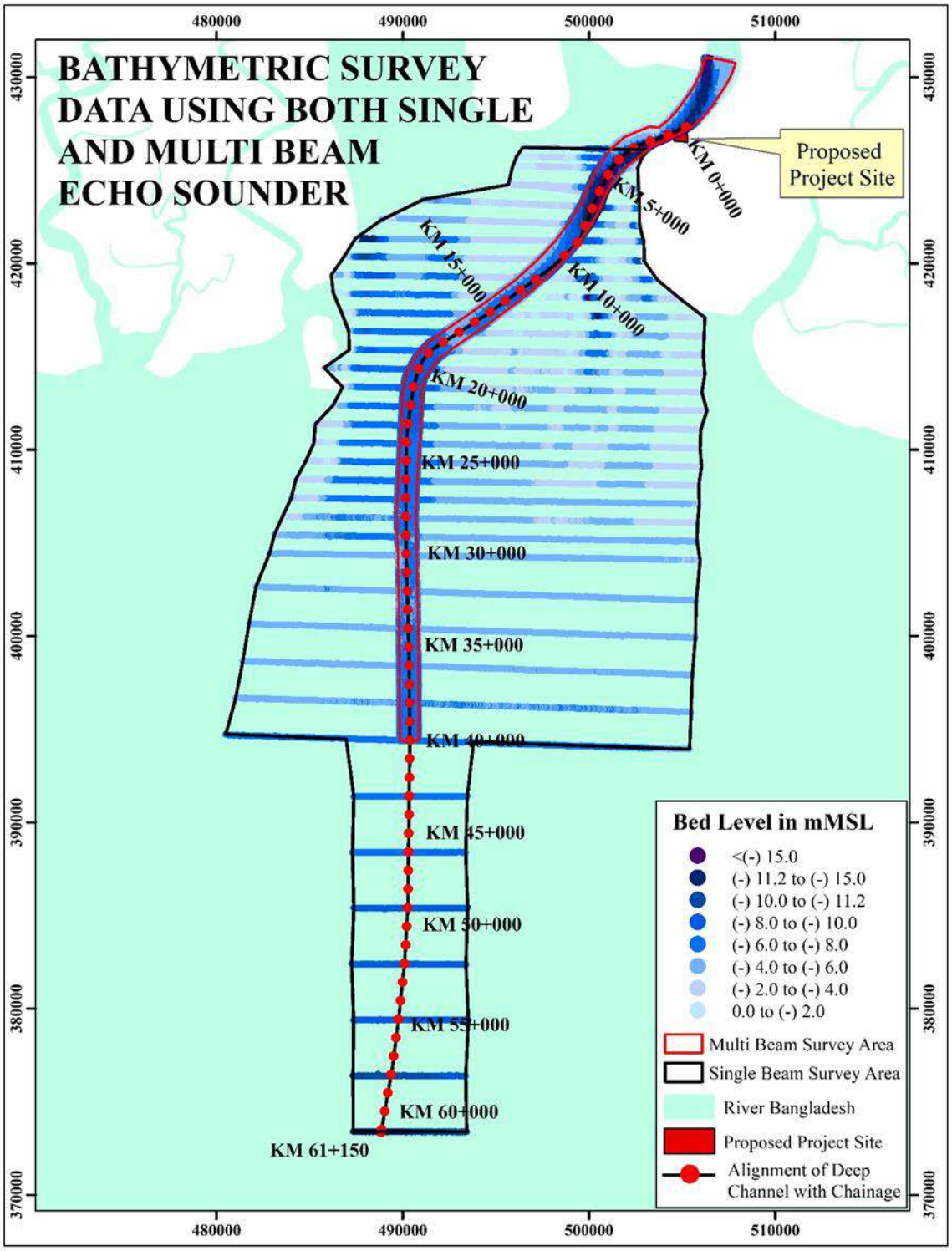


Figure 44: Bathymetry of the access channel surveyed using single beam and multi beam echosounder

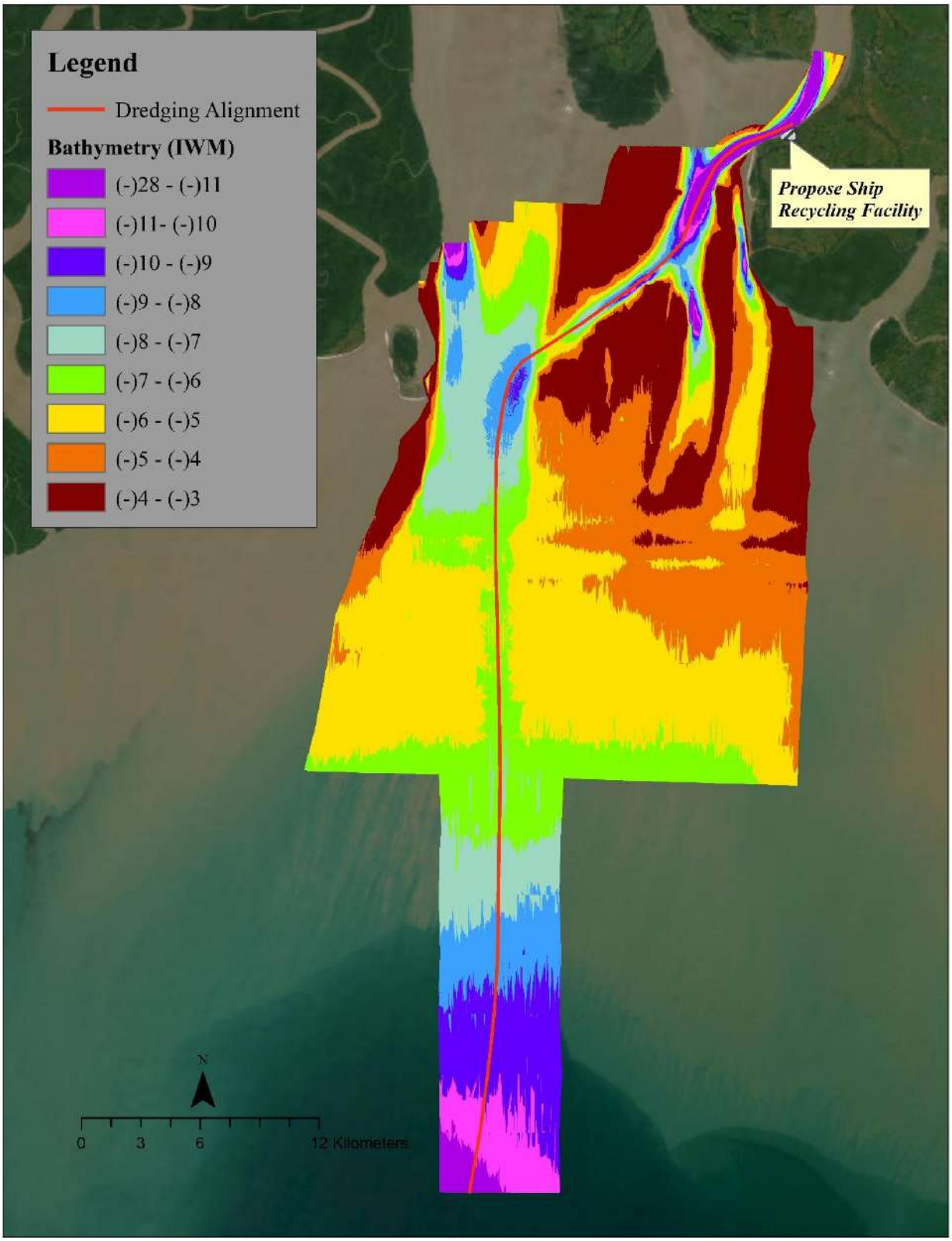


Figure 45: Digital Elevation Map of Bathymetric Survey

3.6. Project Investment

A tentative cost estimate of the project investments is provided below:

Table 21: Project Cost

SL	Item	Unit	Quantty	Taka in BDT
1	Land Acquisition			213,100,083
2	Development of land			882,716,000
3	Boundary wall with gate			201,861,660
4	Internal Road, Drainage & Vehicle Parking			249,200,000
5	Yard			2,156,828,096
6	Slipway			1,956,933,096
7	Cargo Terminal			207,106,048
8	Yard Facility			248,400,000
9	Building			564,628,378
10	Electrical & Communication			315,000,000
11	Machinery and equipment			2,326,105,000
12	Consultancy			599,417,000
13	Individual Consultancy			33,600,000
14	RAP			467,227,793
15	INGO			16,479,375
16	Decommissioned Ship Purchase			1,001,520,000
17	Vehicle, Equipment & Furniture			68,212,000
18	Running Capital - included in Detailed Financial Analysis under Operational Expenses			250,000,000
19	General			582,181,471
			Total cost =	**12,340,516,000**
			Physical contingency (1%) =	123,405,160
			Price contingency (3%) =	370,215,480
Total Project (Yard Development) Investment Capital Cost (in BDT), For 3 Slipways and Associated Items				**12,834,136,640**

3.7. Analysis of Alternatives

Three alternative options have been developed for ship recycling industry considering the market analysis of ships, field survey data, analyzing the results of mathematical models and consultation with the relevant stakeholders and experts of ship recycling industry. Two slipways and one dry-dock to be constructed was initially planned in all the options. However, in each option ship sizes are different. Ship sizes are upto 30,000 DWT (maximum up to 8000 LDTs) for option 1 and upto 40,000 DWT (around 10,000 LDTs) for option-2, and option-3 considered up to 60,000 DWT (around 15,500 LDTs) ship for slipway and up to 100,000 DWT

(around up to 35,000 LDTs) ship for dry dock. The navigational requirement for different options is as follows:

Table 22: Detail of Devised Options for Technical and Economic Analysis

Option	Ship size (DWT)	Weight (LDT)	Beam (m)	Full load draft (m)	Ballast load draft (m)	Channel width (m)	Channel depth (m)
Option 1	Upto 30000	8000	28	9.8	4.90	90	6.21
Option 2	Upto 40000	10,000	31	11.5	5.75	93	6.61
Option 3	Upto 60,000	15,500	33.5	13.2	6.6	127	7.59
	Upto 100,000	35,000	41.3	15.4	7.7	129	9.64

Bathymetric survey data shows that there is approximately 6.0m channel depth available from the mean sea level in designated navigation route at present. Option-1 requires 6.21m channel depth and required dredging volume is negligible, with scrap ship draft of 4.90 meters. Option-2 requires 6.61m channel depth which indicates that 61.0cm dredging is required in navigational channel to sail desired ship size round the year, however since the ballast draft is 5.75m, it may be suitable to take ships for dismantling without consequent dredging. Option-3 requires 9.64m channel depth to navigate 100,000 DWT ship. But, in that case, the ballast load draft will be around 7.7 meters, which is much higher than available channel depth at the moment.

It is necessary to mention that in case of option-2, 40,000 DWT ship can be navigated throughout the year (12 months * 30 days * 12 hours). Option-3 comprises two ship sizes. 60,000 DWT ship requires 7.59m channel depth. Channel depth considering high tide (90cm) and dredging depth suggested in option-2 (61.0cm) becomes 7.51m. Thus, 60,000 DWT ship can be navigated thorough the channel during spring tidal condition (12 months * 6 days * 6 hours). Again, 100,000 DWT ship requires 9.64m channel depth. Channel depth considering high tide level (90cm), seasonal variation (90cm) and dredging suggested in option-2 (61.0cm) is 8.4m. Thus, 100,000 DWT ship can be navigated thorough the channel during monsoon spring tidal condition (4 months * 6 days * 6 hours). Hence, the dredging bed level for option-2 and option-3 is equal. However, duration of navigability in access channel varies with ship size considered in option-2 and option-3. Considering duration of navigability in access channel, number of ships to be dismantled at ship breaking yard is estimated.

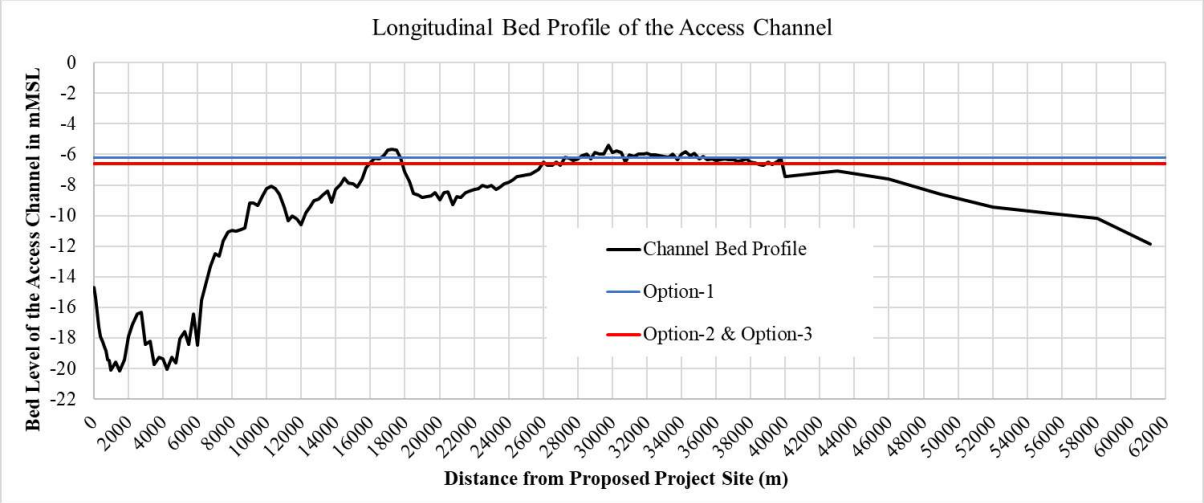


Figure 46: Longitudinal bed profile and design bed level of access channel

The above figure illustrates the existing bed profile of proposed access route and design bed level of three options. Profile plot shows that available depth in intended navigational channel can accommodate up to 30,000 DWT (around 8000 LDTs) ship however dredging is required in access channel to allow navigation for up to 40,000 DWT, upto 60,000 DWT and upto 100,000 DWT ship.

The capital dredging volume for different ship size is given in the following Table.

Table 23: Capital dredging volume for different ship size

Option	Design Width (m)	Design Level (mMSL)	Dredging Length (km)	Dredging Volume (m^3)
Option-1	90	(-) 6.21	-	-
Option-2	93	(-) 6.61	24	628685
Option-3	129	(-) 6.61	24	839295

Option-1: Up to 30,000 DWT (8000 LDT) ship requires no dredging work in channel as navigational depth in designated waterways is adequate for sailing of ship in mean sea level (MSL) tidal window. The estimated EIRR is 14.84% and FIRR is 12.52% in cost benefit analysis. Again, morphological assessment in estuary reveals that navigational channel is sediment prone and siltation is occurring in channel as evidence by bed level change analysis between defined periods. In light of this analysis, it is perceived that dredging work may be needed to carry out in navigational waterways in future for safe passage of recycling ship to breaking yard.

Option-2: Estimated 628,685 m^3 capital dredging volume is needed for upto 40,000 DWT (10,000 LDTs) draft vessels to navigate proposed route within MSL tidal window. However, upto 40,000 DWT ships can navigate without dredging during monsoon season when additional 60 cm depth is obtained due to seasonal variation. The estimated EIRR and FIRR

for Option-2 are 12.04% and 7.55% respectively. Therefore, Option 2 is only economically viable.

Option-3: Required navigational depth is highest among three options and dredging is required in all conditions for navigation in proposed access channel, with estimated capital dredging volume 839,295 m^3. Again, the cost-benefit analysis reveals that the Internal Rate of Return for Economic and Financial aspects are 15.48% and 10.42% respectively.

Both Option-2 and Option-3 come out economically and financially not viable in cost-benefit analysis.

Also, dry dock construction is expensive and not mandatory for the green ship recycling process as per HKC guidelines. According to the decision of the validation workshop on the draft final report, dry dock construction is discarded from Option 3, and another slipway is considered (total 3 slipways). Eventually, dredging is also discarded from the investment cost. Based on this consideration, only option 1 has been developed as the ideal option and economic analysis that has been carried out has reaped viable outcomes.

Under option-1, the construction of three slipways is considered and the design ship size for dismantling is up to around 8,000 LDTs (30,000 DWT). By taking advantage of seasonal variation and high tide conditions, up to a maximum of 35,000 DWT ships can navigate in access channels without dredging, provided that the slipways can tow and accommodate these ships for scrapping. In the cost benefit analysis, the estimated EIRR and FIRR for option-1 are 14.84% and 12.52% respectively. Therefore, Option-1 is both economically and financially viable and is considered best suitable option.

3.8. Downstream supply chain management of material from the yard

The geographical location of the yard in Barguna poses challenges for selling scrap materials, particularly due to the absence of local steel mills in the vicinity. Transporting scrap materials from Barguna to Chattogram & Dhaka incurs high transportation costs, making it difficult to remain competitive in the market. However, a viable solution lies in selling the scrap to the government-owned steel mill in Bagura, presenting a win-win scenario for both parties involved.

Moreover, alternative transportation routes such as utilizing river transport to transfer scraps to the rolling mills in the Dhaka region offer promising opportunities. Leveraging the existing cargo loading area as infrastructure facilitates this mode of transport, potentially mitigating transportation costs and improving market competitiveness. Notably, the demand for scrap metal is higher in Dhaka compared to Chattogram, indicating a lucrative market for scrap materials in the capital city.

Additionally, apart from scrap materials, the yard also yields prime-quality plates from dismantled vessels, which can be sold to shipyards in the greater Barisal region for local shipbuilding and repair work. These plates hold significant demand in Dhaka for the production of structural items like H-beams, I-beams, and flat bars, further enhancing market opportunities.

Furthermore, major non-ferrous parts such as propellers, aluminum, and stainless steel can be directly collected by buyers from the yard, aligning with their specific interests and requirements.

As for furniture and other household items, establishing a local market within a short timeframe presents a feasible solution, considering the high demand for such products across Bangladesh. This localized approach enables efficient distribution and meets consumer demands effectively, contributing to the overall economic viability of the yard's operations.

3.9. Project Benefits

The project will generally benefit the country and the nation, directly or indirectly. Working communities will be the most directly benefited groups.

The Economic benefits of the project have been identified and quantified as far as possible for economic analysis for the objective of establishing the project.

For economic analysis, the financial values are converted into economic values using Standard Conversion Factors (SCF). Economic benefits and costs are defined as follows:

- Economic benefit = economic value of financial benefit + Indirect benefits and positive externality (beneficial spillover effects of the project)
- Economic cost = economic value of the financial cost + negative externality (harmful spillover effects of the project).

For valuation of economic costs and benefits we have identified ship breaking revenue. The expected monetary value of the benefits and costs concerned has been estimated over the lifetime of the project i.e., 40 years. The valuation has been made at current prices.

3.10. Potential Hazards from the Industry

Hazard is the characteristic of any system or process which has the potential for accident. Identification of hazards during ship breaking process is of primary significance in the analysis, quantification and cost-effective control of accidents involving chemicals and process. Hence, all the components of a system need to be thoroughly examined to assess their potential for initiating or propagating an unplanned event/sequence of events, which can be termed as an accident. Hazardous substances may be classified into three main classes namely Flammable substances, unstable substances and Toxic substances. Flammable substances require interaction with air for their hazard to be realized. Under certain circumstances the vapors arising from flammable substances when mixed with air may be explosive, especially in confined spaces. However, if present in sufficient quantity such clouds may explode in open air also. Unstable substances are liquids or solids, which may decompose with such violence so as to give rise to blast waves. Besides, toxic substances are dangerous and cause substantial damage to life when released into the atmosphere. The ratings for a large number of chemicals based on flammability, reactivity and toxicity have been given in NFPA Codes 49 and 345 M.

Hazard assessment and evaluation: During operationalizing, a preliminary hazard analysis shall be carried out to identify the major hazards associated with storages in the facility. This is followed by consequence analysis to quantify these hazards. Finally, the vulnerable zones are plotted for which risk reducing measures are deduced and implemented.

Frequent causes of accidents:

- Fire and explosion: explosives, flammable materials

- Being struck by falling objects
- Caught in or compressed
- Snapping of cables, ropes, chains, slings
- Handling heavy objects
- Access in progressively dismantled vessels floors, stairs, passageways)
- Electricity (electrocution)
- Poor illumination
- Falls from height inside ship structures or on the ground
- Struck by moving objects
- Slipping on wet surfaces
- Sharp objects
- Oxygen deficiency in confined spaces
- Lack of PPEs, housekeeping practices, safety signs
- Shackles, hooks, chains
- Cranes, winches, hoisting and hauling equipment.

Hazardous substances and wastes:

- Asbestos fibres, dusts
- Heavy and toxic metals (lead, mercury, cadmium, copper, zinc, etc.)
- Organometallic substances (tributyltin, etc.)
- Lack of hazard communication (storage, labelling, material safety data sheets)
- Batteries, fire-fighting liquids • PCBs and PVC (combustion products)
- Welding fumes
- Volatile organic compounds (solvents)
- Inhalation in confined and enclosed spaces
- Physical hazards
- Noise
- Extreme temperatures
- Vibration
- Radiation (UV, radioactive materials)

Physical hazards:

- Noise
- Extreme temperatures
- Vibration
- Radiation (UV, radioactive materials)

Mechanical hazards:

- Trucks and transport vehicles
- Scaffolding, fixed and portable ladders
- Impact by tools, sharp-edged tools
- Power-driven hand tools, saws, grinders and abrasive cutting wheels
- Failure of machinery and equipment
- Poor maintenance of machinery and equipment
- Lack of safety guards in machines

- Structural failure in the ship

Biological hazards:

- Toxic marine organisms
- Risk of communicable diseases transmitted by pests, vermin, rodents, insects and other animals that may infest the ship
- Animal bites
- Vectors of infectious diseases (TB, malaria, dengue fever, hepatitis, respiratory infections, others)

Ergonomic and psychosocial hazards:

- Repetitive strain injuries, awkward postures, repetitive and monotonous work, excessive workload
- Long working hours, shift work, night work, temporary employment
- Mental stress, human relations (aggressive behavior, alcohol and drug abuse, violence)
- Poverty, low wages, minimum age, lack of education and social environment

Other Risks:

- Lack of health and safety training
- Poor working environment
- Inadequate housing and sanitation
- Inadequate accident prevention and inspection
- Inadequate emergency, first-aid and rescue facilities
- Lack of medical facilities and social protection

Implementation of Environmental Management Plan (EMP) and Emergency Response Plan (ERP) must be ensured to maintain safe, and sustainable operation of the industry.

4. Baseline Environmental Condition

Baseline environmental condition of the site area has been studied to understand possible impacts from the project.

4.1. Study Area

Surrounding area of the project sites within 5-km radius is being considered for the study:

Figure 47: Tentative Project Influence Area

4.2. Geology and Geography

4.1.1. Geology

The site area in within Barguna district, located in south-western Bangladesh, within the coastal region. The land mass type is mostly consisting of tidal deltaic deposit.

4.1.2. Geography

Barguna district is situated in the south-western part of Bangladesh. Area of the district is 1,939.39 km^2. Area of Taltali upazila is 258.94 km^2 (*14.14% of the district*). Within the upazila, there are 7 unions and 18 mouzas. There are no municipality in Taltali.

This is a flat low-lying land with lots of rivers and estuarine creeks, having regular low and high tides. The Bay of Bengal is just down south of this district.

Similar to other districts in the region, Barguna also has lots of agricultural production. The cropping pattern is largely inclusive of Rice, beans, dal, mustard, chilies, sweet potato, potato, tobacco, and vegetables.

4.3. Physical Environment

4.3.1. Environmental Sensitive Areas

The site area is very close to environmentally sensitive and protected areas. It is only about 18 km distant from the Sundarbans:

Figure 48: Proximity to Sundarbans

Moreover, the Tengragiri area, which is also a protected forest area is only 5.5 km away:

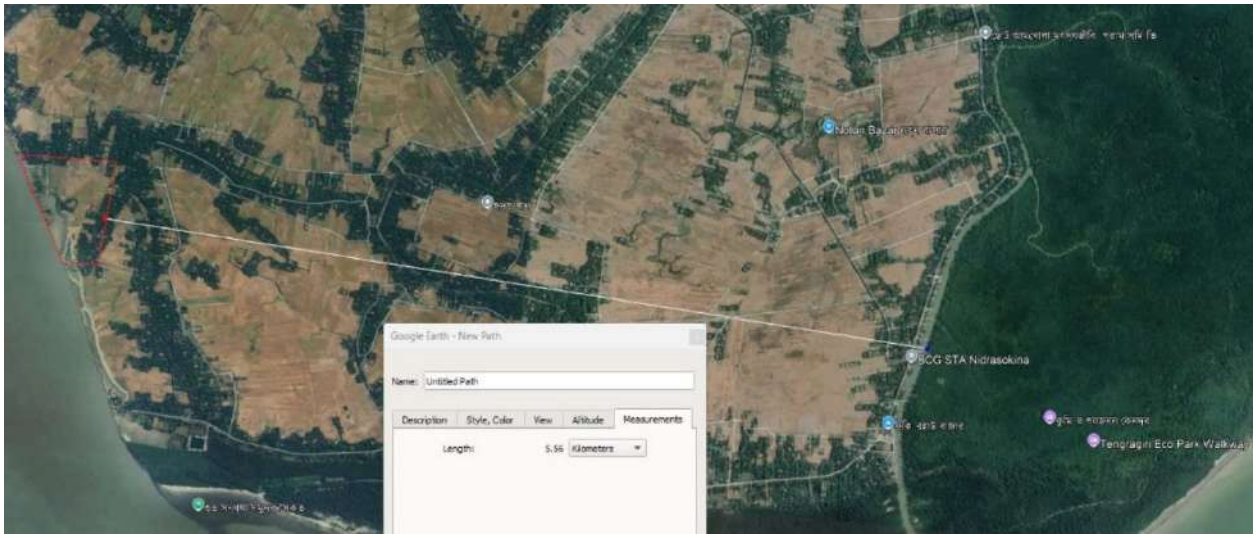


Figure 49: Proximity to Protected Forest Area

Close proximity to the river and the Bay of Bengal also makes this site critical to local and national ecology and biodiversity.

4.3.2. Air Quality

Due to being in the coastal area, without much industrial activity but with lots of natural greenery, existing air quality is good, without presence of any excess pollutants. Following is test results of air quality monitoring at 6 locations in the field:

Table 24: Air quality test results

Location No.	Location Information	SPM	PM_{10}	$PM_{2.5}$	NO_x	SO_2	CO	NH_3	O_3	Pb
		Units in $\mu g/m^3$								
1.	Choto Nishanbaria Union Parishad	82	53	25	14	9	156	15	12	<0.01
2.	Nolbonia Gorapara Primary School	72	47	23	11	7	137	12	10	<0.01
3.	Upstream of the site, near settlements	62	42	21	8	7	142	13	16	<0.01
4.	Agapara Madrasah	72	51	23	11	7	149	12	12	<0.01
5.	Within site area in North Eastern side	70	48	24	10	8	155	16	12	<0.01
6.	Within site are in South Western side	69	43	21	9	7	138	10	14	<0.01
Bangladesh Standards[2]		-	150	65	80	80	5000	400	100	0.5
All parameters are within the standard limits										

[2] Air Pollution Control Rules 2022

Figure *50: Air quality test locations*

4.3.3. Noise level

Current noise levels at the site are within standard limits. Following are noise level monitoring test results at 6 locations in the field:

Table 25: Noise level test results

Location No.	Location Information	Minimum	Maximum	Average
1	Within site area in North Eastern side	44.9	58.1	44.9
2	Tetolbaria	51.1	61.1	57.1
3	Choto Nishanbaria Union Parishad	47.2	61.1	52.2
4	Nolbonia Gorapara Primary School	52.1	63.2	57.1
5	Settlement Area 500m North of Site Boundary	42.2	54.3	47.2
6	Agapara Madrasah	55.3	67.6	62.4
Bangladesh Standard				
Type of Area		Noise Level Limit		
Industrial Area		75		

Commercial Area	70
Mixed Area	60
Residential Area	55

4.3.4. Sun Shine hours

The monthly average sun-shine hour in Taltali, Barguna varies from 4 to 9 hour/day in a year. Highest sunshine hours are recorded in month of April, May and June. In general, maximum average sun-shine hour of 12 hour in a day is found in April, May & June.

4.3.5. Hydrology

The site area is in a water bound region, situated beside the river, very close the sea. In addition, there are other water bodies like canals, and ponds in the area. As such, hydrology of the area is very active.

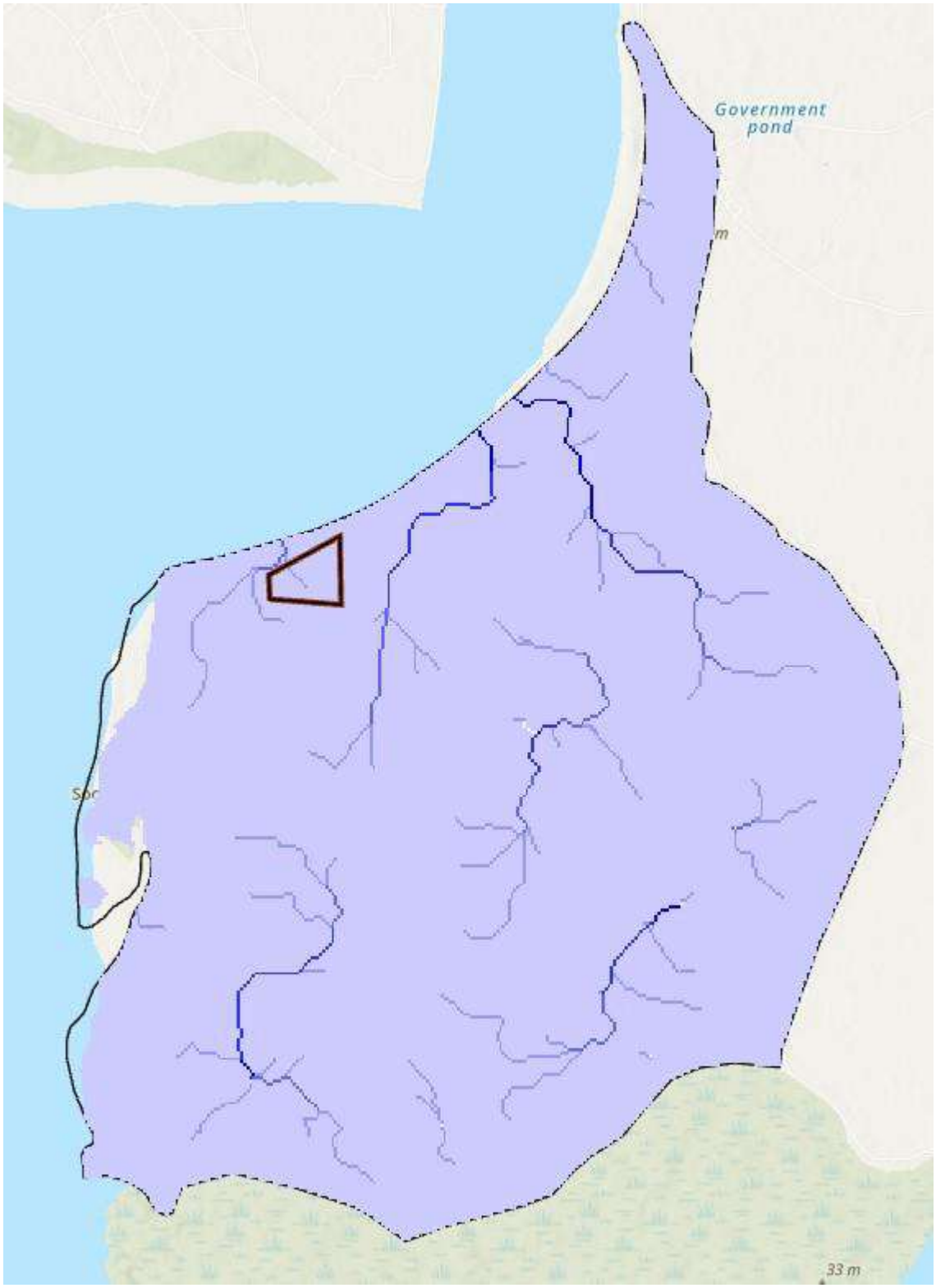


Figure 51: Water Channels of the Union

The relevant Watershed area is determined to be 2.6 km^2. A watershed map is provided below:

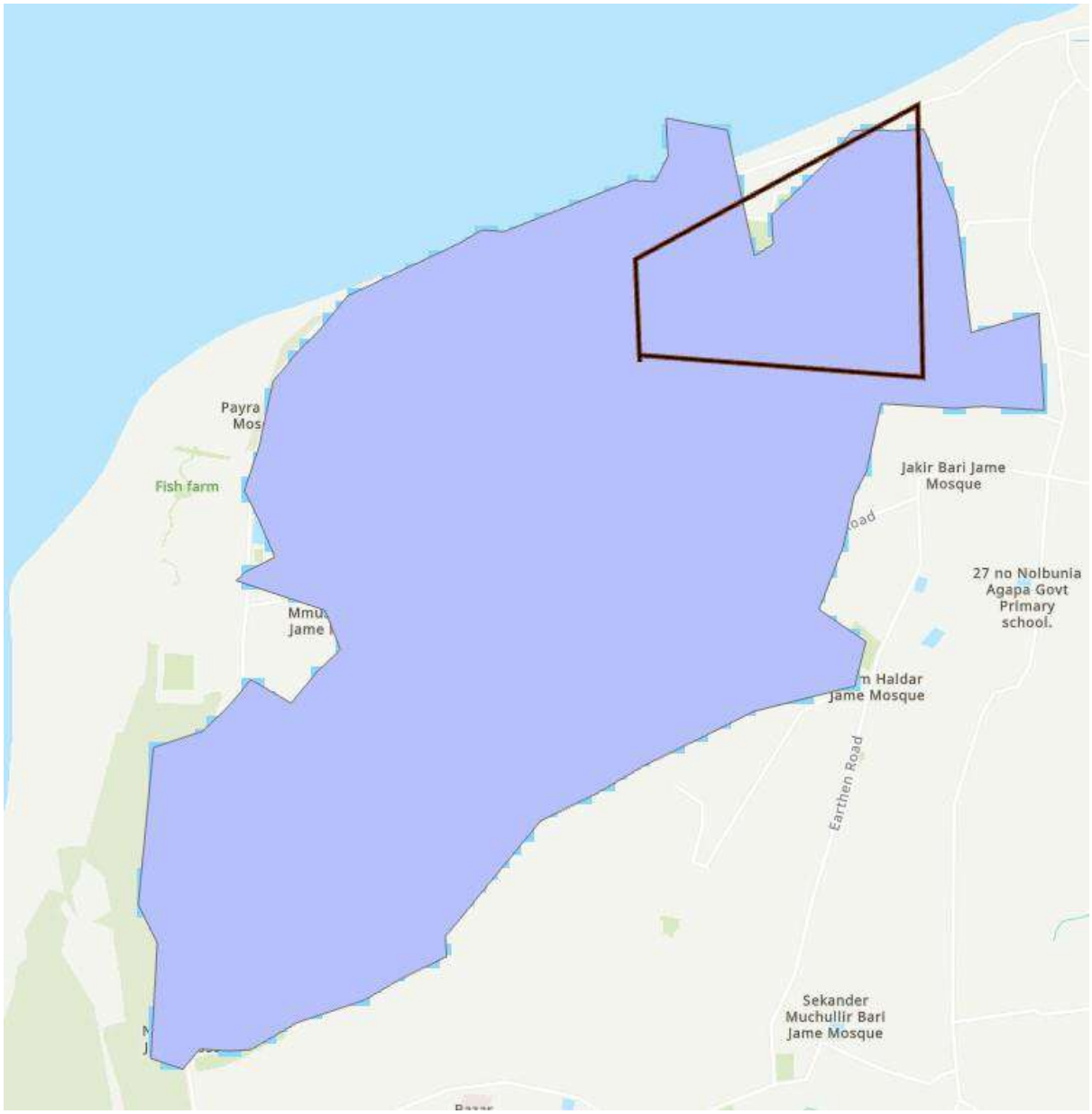


Figure 52: Water flow basin area

4.3.6. Water Quality

There is abundance of Water in the region but sometimes with issues like salinity, arsenic. For the study, tests have been conducted for both surface water and groundwater.

4.3.6.1. Surface Water

Surface Water was collected from the river that flows beside the site are and will be the navigation route for the facility. Results of laboratory tests are as follows:

Table 26: Surface water test results

Serial No.	Testing Parameter	Results	Standard

1.	pH	7.8	6.5-8.5
2.	Colour	6.2	15
3.	Turbidity	547	10
4.	Salinity	0.13	-
5.	Alkalinity	90	-
6.	Total Hardness	125	200-500
7.	Total Dissolved Solids (TDS)	132	1000
8.	Total Suspended Solids (TSS)	18	10
9.	Dissolved Oxygen (DO)	5.4	6
10.	Chemical Oxygen Demand (COD)	16	4
11.	Biochemical Oxygen Demand (BOD)	5.2	Inland: 30, Coastal: 100
12.	Iron (Fe)	5.65	0.3-1
13.	Manganese (Mn)	0.14	0.1
14.	Fecal Coliform (FC)	15	-
15.	Total Coliform (TC)	3	-
16.	Oil and Grease	2.7	Inland: 10, Coastal: 20

As reveled by the laboratory testing's, some parameters are beyond allowable limits.

4.3.6.2. Ground Water

During the sub-soil investigations, water table was found to be between range of 8-17m depth during the months of August.

Ground Water was collected from tube well in the locality. Results of laboratory tests are as follows:

Table 27: Ground water test results

Serial No.	Testing Parameter	Results	Standard
1.	pH	7.7	6.5-8.5
2.	Colour	2	15
3.	Turbidity	1.3	10
4.	Salinity	0.97	-
5.	Alkalinity	140	-
6.	Total Hardness	355	200-500
7.	Total Dissolved Solids (TDS)	970	1000
8.	Total Suspended Solids (TSS)	1	10

9.	Arsenic (As)	0.001	0.05
10.	Chemical Oxygen Demand (COD)	4	4
11.	Biochemical Oxygen Demand (BOD)	0.03	-
12.	Iron (Fe)	0.23	0.3-1
13.	Manganese (Mn)	0.03	0.1
14.	Fecal Coliform (FC)	0	0
15.	Total Coliform (TC)	0	0

The ground water mostly within allowable limits. There is presence of some salinity.

4.3.7. Soil

Physical Properties of the subsoil formation of the project area have been evaluated by the execution of 4(Four) number borings up to 100.0ft or 30.0m deep (firm strata). The top soil is grey loose to medium sandy fine SILT and up to the depth of investigation; the soil is grey medium dense fine to medium SAND, some/little silt.

Up to the depth of EGL to 21.0m, consistency of the top soil usually varies from loose to medium consistency of soil, however, gradually increase the consistency. The subsequent deep layers medium dense soil state.

Chemical properties of the soil are provided below:

Table 28: Chemical test results of soil

Sl. No.	Test parameters	Unit	Test results	Dutch Standards for Soil[3]
01	Lead (Pb)	mg/kg	9.25	NYS
02	Cadmium (Cd)	mg/kg	BDL	100
03	Chromium (Cr)	mg/kg	34.20	140
04	Nickel (Ni)	mg/kg	13.15	NYS
05	Zinc (Zn)	mg/kg	62.58	140
06	Iron (Fe)	(%)	2.52	NYS
07	pH	-	8.20	8.5

[3] There is no Bangladesh regulation/standard for soil. In the absence of local standards, Dutch standard is being referred to.

4.4. Biological Environment

4.4.1. Flora

The list of Common Flora in the Project Area is outlines in the following table:

Table 29: List of flora

Serial No.	Name	Scientific Name
1.	Ata	*Annona squamosa*
2.	Akashmoni	*Acacia aurculiformios*
3.	Ashok	*Saraca indica*
4.	Aurjun	*Terminalia arjuna*
5.	Amra	*Spondias pinnata*
6.	Banana	*Musa acuminata*
7.	Babla	*Acacia nilotica*
8.	Bel	*Aegle marmelos*
9.	Bot	*Ficus benghalansis*
10.	Dalim	*Panica granatum*
11.	Tal/Plum	*Boassus flabellifer*
12.	Mango	*Mangifera indica*
13.	Coconut	*Cocos nucifera*
14.	Suparee	*Areca catechu*
15.	Jack Fruit	*Artocarpus heterophyllus*
16.	Peyara	*Psitium guajava*
17.	Mehagoni	*Sweitenia mahogoni*
18.	Shishu	*Dalbergia sissoo*
19.	Raintree	*Albizia saman*
20.	Cotton	*Bombax ceiba*
21.	Joba	*Hibiscus Rosa-sinenesis*
22.	Paan/Betel leaf	*Piper betle*
23.	Bamboo	*Bambusa vulgaris*
24.	Chechra	*Schenoplectus articulatus*
25.	Kolmi	*Ipomoea aquatica*
26.	Dhol Kolmi	*Ipomoea carnea*

27.	Lebu	*Citrus aurantifolia*
28.	Papaya	*Carica papaya*
29.	Kochuripana	*Eichhornia crassipes*

Common flora pictures

4.4.2. Fauna

The diversified habitat and ecosystem in the project area support various types of animals as given in Table 4.7. The primary and secondary mode was adopted for the identification of fauna. Most of the birds are identified through direct observation rather than from people. Most of the Amphibians, Reptiles, and Mammals were identified by using books and descriptions of the local people during the field survey. Common Fauna in the Project Area are as following table:

Table 30: List of fauna

Serial No.	Name	Scientific Name
1.	Cow	*Bos taurus*
2.	Buffalo	*Bubalus bubalis*
3.	Monkey	*Rhesus Macaque*
4.	Sheep	*Ovis aries*
5.	Goat	*Capra hircus*
6.	Bengal Fox	*Vulpes bengalensis*
7.	Common Mongoose	*Herpestes edwardsii*
8.	Field Mouse	*Apodemus sylvaticus*
9.	House mouse	*Mus musculus*
10.	Mole Rat	*Heterocephalus glaber*
11.	Small Indian Civet	*Viverricula indica*

12.	Jungle Cat	*Felis chaus*
13.	Kuno bang	*Duttaphrynus melanostictus*
14.	Common toad	*Bufo melanostictus*
15.	Shona bang	*Hoplobatrachus tigerinus*
16.	Cricket Frog	*Rana cyanophlyctis*
17.	Bull Frog	*Hoplobactruchus crassus*
18.	Green Frog	*Rana clamitans*
19.	Monitor lizards	*Varanus bengalensis*
20.	Tortoise	*Indotestudo elongata*
21.	Common Garden lizard	*Calotes versicolor*
22.	Brahminy Skink	*Eutropis carinata*
23.	Brahminy Turtle	*Hardella thurjii*
24.	Monocellate Cobra	*Naja kaouthia*
25.	Binocellate Cobra	*Naja naja*
26.	Rat Snake	*Ptyas mucosa*
27.	Common Vine Snake	*Ahaetulla nasuta*
28.	Common Roof Turtle	*Pangshura tecta*
29.	Smooth water snake	*Enhydris enhydris*
30.	Chicken	*Gallus gallus domesticus*
31.	Duck	*Anas poecilorhyncha*
32.	Crow	*Corvus splendens*
33.	Black Drongo	Dicrurus macrocercus
34.	Asian Koel	*Eudynamys scolopaceus*
35.	Common Myna	Acridotheres tristis
36.	Asian Pied Starling	*Gracupica contra*
37.	Bank Myna	*Acridotheres ginginianus*
38.	Red-vented Bulbul	*Pycnonotus cafer*
39.	Oriental Magpie Robin	*Copsychus saularis*
40.	Common Tailorbird	*Orthotomus sutorius*
41.	Blue Rock Pigeon	*Spilopelia chinensis*
42.	House Sparrow	*Passer domesticus*

43.	Vulture	*Gyps indicus*
44.	Common Kingfisher	*Alcedo atthis*
45.	Grey Heron	*Ardea cinerea*
46.	Prawns	*Macrobrachium rosenbergii*
47.	Mussels	*Lamellidens marginalis*
48.	Pankourri	*Phalacrocorax carbo*
49.	Kanibok	*Ardeola grayii*
50.	Sadabok	*Egretta garzetta*
51.	Machranga	*Halcyon pileata*

Fish is the major and most important aquatic fauna of the project area. In addition to capturing fisheries in rivers, the ponds and burrow pits within the area are also utilized for fish culture.

4.4.3. Wildlife

The presence of any wildlife has not been known to be existing in the proposed project site area. There are some wildlife sanctuaries and eco park that are housing some animals in captivity for specific purposes like breeding. One such facility is the Tengragry which has crocodile breeding. There are also some deers.

Crocodiles at Tengragiri

Deer at Tengragiri

Wild Boar at Tengragiri

4.4.4. Ecosystem

The project area consists of land used for Fishing, Agricultural and other purposes. No primeval forests or tropical rain forests area. A sandy beach is located near the proposed project site, however there are mangrove forests or tidal flats. The area is the presumed habitat of birds, dolphins, and sea turtles on the IUCN Red list (endangered species, etc.), and construction work may have a possible impact on the rare species and ecosystem.

Within the project area, there is no habitat of precious species of flora designated by IUCN. Three species (Calamus guruba Buch-Ham, Trihosanthes cordata Roxb, Lepisanthes rubiginosa) which are considered by Bangladesh biologist as threatened species were observed in the project area, but they are commonly seen over broad areas and the impact of the project on these species will be insignificant.

As for precious species of animals designated by IUCN, the Spoon-billed Sandpiper (Eurynorhynchus pygmeus) and Hawksbill turtle (Eretmochelys imbricate) classified as CR (Critically Endangered), three turtles' species (Geoclemys hamiltonii, Chelonia mydas, Caretta caretta) classified as EN (Endangered) and one turtle species (Lepidochelys olivacea) classified as VU (Vulnerable) were observed within the project site and the front beach. There were no other precious species of insects, amphibians, reptiles, mammals or birds that were designated by IUCN.

Previous survey results point out that taltali; Barguna is a main migratory habitat for migratory birds, especially the Spoon billed Sandpiper in Bangladesh; this is also supported by other experts and reports. However, for the purpose of protecting the species, construction workers will be instructed to strictly comply with hunting and capturing restrictions prescribed by law.

Five species of reptiles (Calotes versicolor, Mabuya mabuya, Gekko gecko, Panghura tentoria, Naja naja) which are considered by Bangladesh researchers as threatened species, and 2 species of birds (Arachnothera magna, Ketupa zeylonensis) considered as threatened species were observed at the project site, however they are commonly seen over broad areas and the impact of the project on these species is expected to be insignificant.

Spawning takes place at nighttime when human activity is low, however the light and noise of any nighttime construction may have adverse effects on these species. Consequently, night construction activity in the spawning season should be avoided as much as possible, and

should be conducted under minimum light. Lighting colors that do not affect the spawning (e.g., red or yellow) should be selected. The careful monitoring of spawning status is necessary.

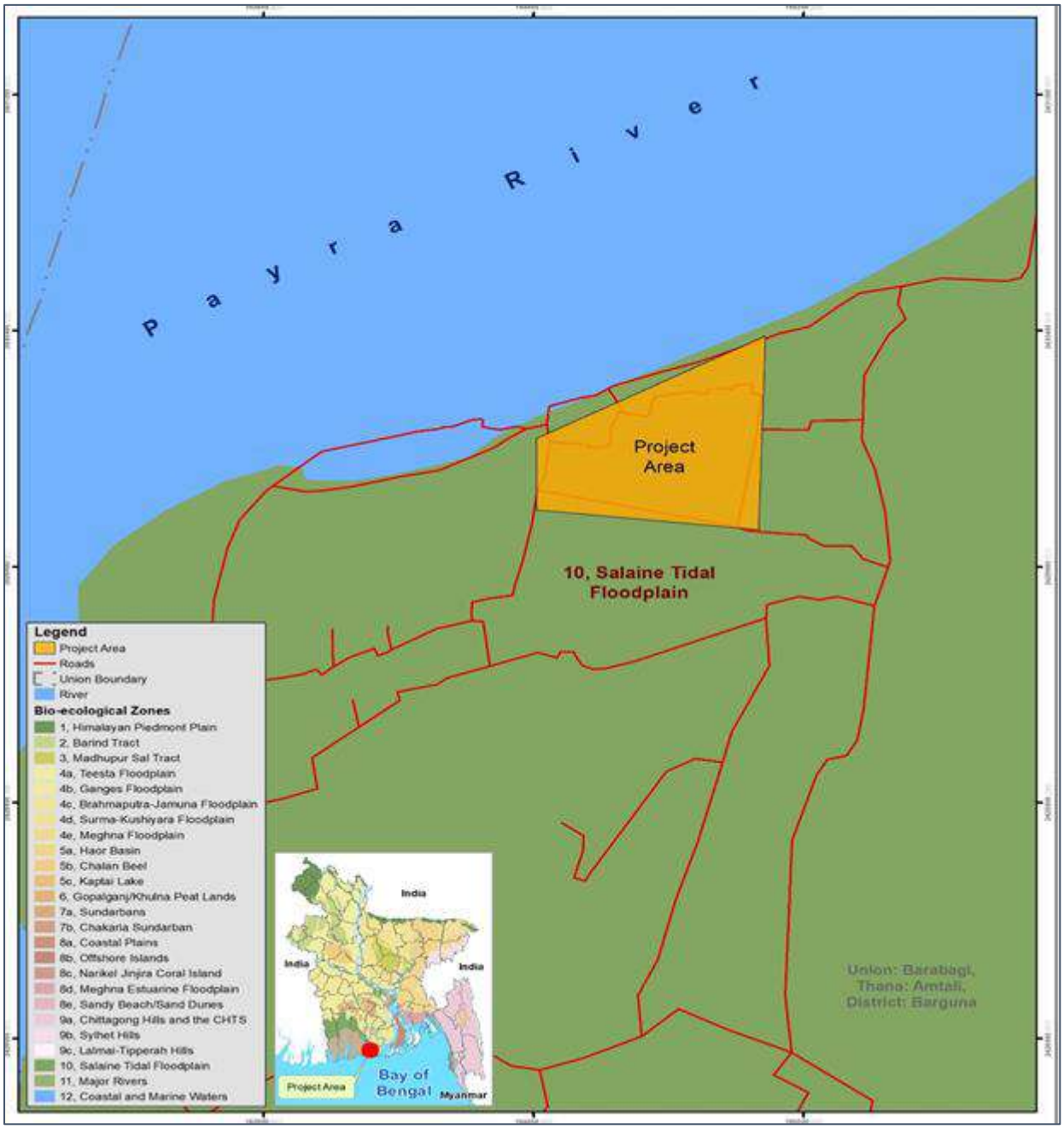


Figure *53: Bio-ecological zones of Bangladesh*

The study area and its surrounding comprise different landforms having varied vegetation patterns which create different habitats. The project area is located very near to the Bay of Bengal. Regular tidal flow, salinity intrusion through the canals and tidal surge is changing the land use pattern. The study area has been occupied by sea, canal, forest, stream, shrimp farm, mudflat, pond, homestead, agriculture land etc. The area has been demarcated under certain bio-ecological zone from physiographic and biodiversity points of view.

4.4.4.1. Terrestrial ecosystems

Terrestrial ecosystems comprise a community of organisms and their environment that occurs on the land masses of continents and islands (Sci-tech dictionary, 2009). As a result of past and continued land use within the Project area, there are four main terrestrial ecological communities within the Project area. They are:

- Agricultural Land;
- Village Forest and Homestead Plantation;
- Embankment and Roadside
- Mangrove and Charland.

4.4.4.2. Aquatic Ecosystems

Two aquatic ecosystems occur within the Project areas. These are freshwater and estuarine. Freshwater ecosystems mainly occur during and following the monsoon period, while estuarine ecosystems extend up the river systems past the Project site. Overviews of the occurrence of each of these ecosystems within the Project area are provided in the section below.

4.4.4.3. Freshwater Ecosystems

The river systems around the Project area are used as local transport routes, and are important for fishing and fish farming as well as providing an important nursery ground for native fish. In addition, a number of fishponds and freshwater wetlands occur within the Project area, particularly following the monsoon season. These areas provide diverse habitats for many aquatic flora and fauna

Wetlands within the impact area are mostly permanent and include fresh water river and fresh water fishponds. However, there are small areas of seasonal fresh water marshes and borrow pits within the Project area also. Few freshwater ecosystems will occur within the Project area in the dry season.

4.4.4.4. Aquatic Invertebrates

The coastal waters of the Bay of Bengal support a wide variety of invertebrates, including shrimps, crabs, mollusks, echinoderms and coelenterates. About 36 marine shrimp species are known to be present in the marine ecosystems of Bangladesh (Paul, 1995). Shrimps, both Galda (Macrobrachium rosenbergii) and Bagda (Penaeus monodon), are known in Bangladesh for their export value. Bangladesh earns a substantial part of foreign currency by exporting shrimp. Although Galda is now cultured almost all over Bangladesh, Bagda culture is limited to coastal areas, including the Project area, as these areas contain high water salinity, which is required for this species growth and propagation. The Char Chalitabunia area contains 8 species of shrimp with some major species of commercial importance. Crabs are common to all estuarine areas of Bangladesh with a total of 16 crab species occurring; of which 11 species (two freshwater) occur in Char Chalttabunia and Dhankhali. Mud crabs are harvested on a small scale for commercial purposes in some areas of the char chalttabunia.

4.4.4.5. Fish

Fish habitats within the Project area can be segregated into brackish and fresh water habitats. Brackish water habitats are dynamic in nature and influenced by daily tidal fluctuation. The number of brackish fish species is highly variable based on tidal flows, with the Rabnabad Channel and Tentulia River becoming almost dry during low tide. Fresh water habitats are mainly restricted by embankments and are an important nursery ground for native fish species.

The riverine fish species migrate for spawning and feeding through open and regulated khals are used as feeding and shelter ground of most of the open water fishes. Fish biodiversity has been high but declining over the years. Obstruction in fish migration routes, morphological changes of internal khals, siltation of fish habitats, squeezing of spawning and feeding grounds and further expansion of both culture fishery are some of the causes of gradual declining of fish abundance and biodiversity.

4.4.4.6. Amphibians

Frogs and toads were found to be numerous within the Project area during the field survey. They are the major biological pest controller in the agricultural areas of Bangladesh. A total of ten amphibian species within five families were recorded around the Project area. The common Toad (Duttaphrynus melanostictus) was the only toad found within the site. The most numerous tree frog recorded was the asian brown tree frog (Polypedates leucomystax). It usually found homestead forests, roadsides, around human habitation.

4.4.4.7. Turtles

Chalttabunia contains a number of turtle species including the Indian Roofed Turtle (Pangshura tectum), Spotted flap shell turtle (Lissemys punctata), Narrow-headed Soft-shell Turtle (Chitra indica), Peacock-marked Soft-shell Turtle (Aspederitis hurum).

4.4.4.8. Birds

Coastal wetlands of Bangladesh are very dynamic in terms of accretion and erosion which contributes to the formation of extensive wetlands. These wetlands are fertile and nutrient rich. Life forms of planktons are in good abundance, which attracts a large number of waterfowl each and every year.

4.4.4.9. Mammals

A number of dolphin species are known to occur within the Project area and its surrounds. At least four species of dolphins occur within marine waters close to the Project area. These are the Irrawaddy dolphin (Orcaella brevirostris), Finless porpoise (Neophocaena phocaenoides) Ganges River dolphin (Platinista gangetica) and the Spinner dolphin (Stenella longirostris). Of the recorded species, the Irrawaddy dolphin is very common within the area, followed by the ganges dolphin, particularly throughout the larger rivers of the area. The abundance of dolphins around the Project areas is seasonally dependent, peaking in winter. Dolphin populations become concentrated at the confluence of the larger rivers during winter. Areas of greatest dolphin activity (mainly Ganges River dolphin) have been mapped for the Project area. The spatial distribution of dolphins within the area is shown in Figure 6-39. The ganges river dolphin calving period is concentrated between December to January and March to May. This species is mainly limited to the freshwater ecosystems and observed in the Project area.

Other mammals common to the village and agricultural areas are often found utilizing the river and canal areas as foraging habitat.

4.5. Weather and Climate

Secondary meteorology data have been collected from Bangladesh Meteorological Department (BMD). The data are provided below:

4.5.1. Temperature

Monthly average temperature of the region:

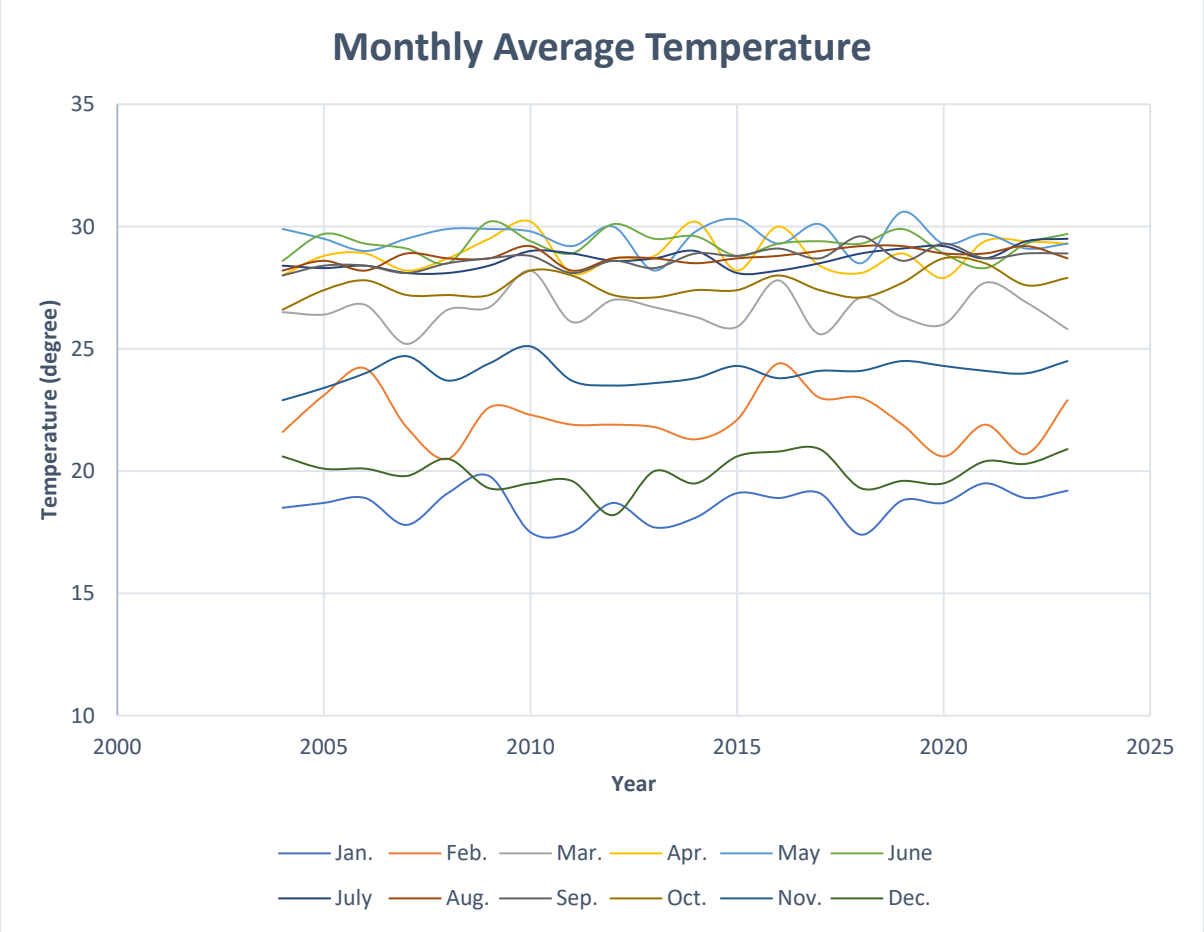


Figure 54: Monthly Average Temperature

Table 31: Temperature data

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sep.	Oct.	Nov.	Dec.
2004	18.5	21.6	26.5	28	29.9	28.6	28.4	28.2	28	26.6	22.9	20.6
2005	18.7	23.1	26.4	28.8	29.5	29.7	28.3	28.6	28.4	27.4	23.4	20.1
2006	18.9	24.2	26.8	28.9	29	29.3	28.4	28.2	28.4	27.8	24	20.1
2007	17.8	21.8	25.2	28.2	29.5	29.1	28.1	28.9	28.1	27.2	24.7	19.8
2008	19.1	20.5	26.6	28.7	29.9	28.5	28.1	28.7	28.5	27.2	23.7	20.5
2009	19.8	22.6	26.7	29.5	29.9	30.2	28.4	28.7	28.7	27.2	24.4	19.3
2010	17.5	22.3	28.2	30.2	29.8	29.4	29	29.2	28.8	28.2	25.1	19.5
2011	17.5	21.9	26.1	28.1	29.2	28.9	28.9	28.2	28.1	28	23.7	19.6
2012	18.7	21.9	27	28.7	30	30.1	28.6	28.7	28.6	27.2	23.5	18.2

2013	17.7	21.8	26.7	28.8	28.2	29.5	28.7	28.7	28.3	27.1	23.6	20
2014	18.1	21.3	26.3	30.2	29.8	29.6	29	28.5	28.9	27.4	23.8	19.5
2015	19.1	22.1	25.9	28.2	30.3	28.8	28.1	28.7	28.8	27.4	24.3	20.6
2016	18.9	24.4	27.8	30	29.3	29.3	28.2	28.8	29.1	28	23.8	20.8
2017	19.1	23	25.6	28.4	30.1	29.4	28.5	29	28.7	27.4	24.1	20.9
2018	17.4	23	27.1	28.1	28.5	29.3	28.9	29.2	29.6	27.1	24.1	19.3
2019	18.8	21.9	26.3	28.9	30.6	29.9	29.1	29.2	28.6	27.7	24.5	19.6
2020	18.7	20.6	26	27.9	29.3	28.9	29.2	28.9	29.3	28.7	24.3	19.5
2021	19.5	21.9	27.7	29.4	29.7	28.3	28.7	28.9	28.7	28.5	24.1	20.4
2022	18.9	20.7	26.9	29.4	29.1	29.3	29.4	29.2	28.9	27.6	24	20.3
2023	19.2	22.9	25.8	29.3	29.3	29.7	29.5	28.7	28.9	27.9	24.5	20.9

Data of 20 years have been collected and analyzed. Average Temperature peaked between 17.4° to 30.6° Celsius. Highest temperature is during the month of May while, lowest temperature is during the month of January. Overall, temperature is higher during the months of March-October, and low during the months of October-February.

4.5.2. Humidity

Monthly average humidity:

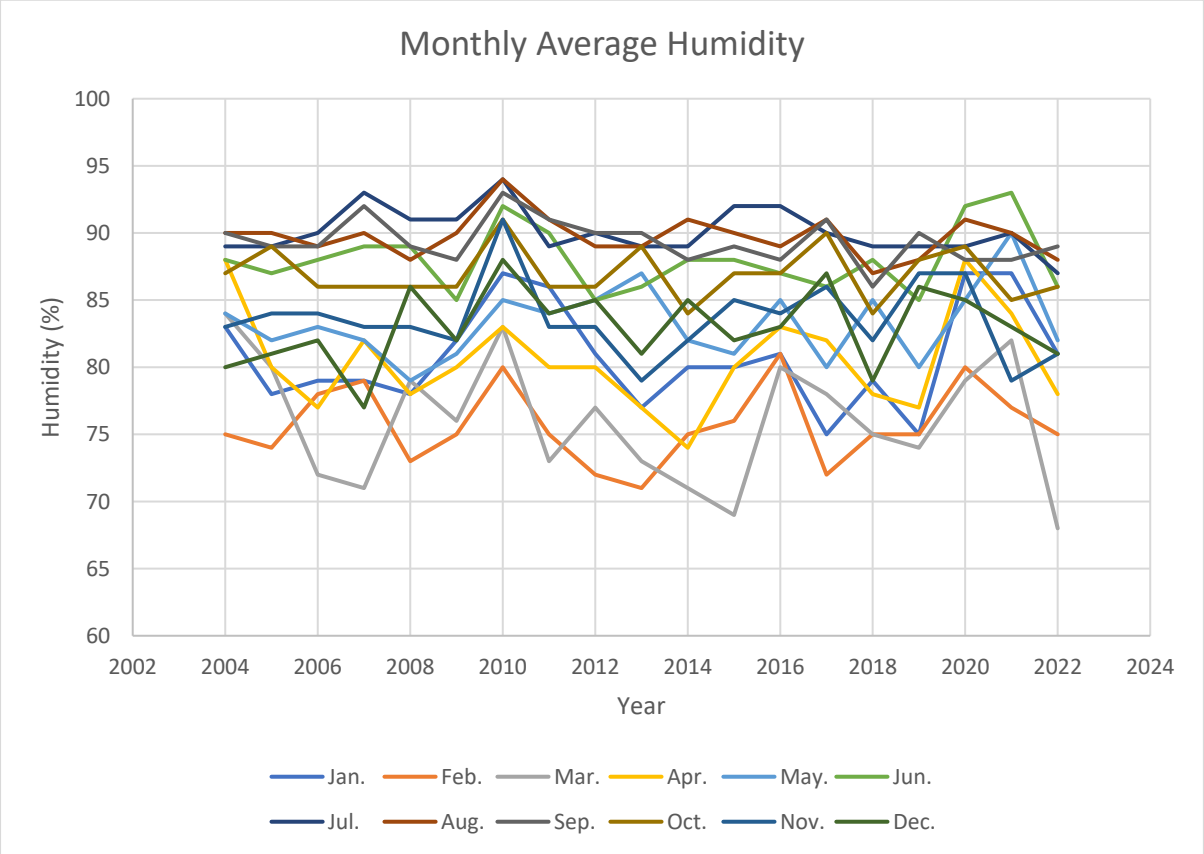


Figure 55: Monthly Average Humidity

Average humidity peaked between 68% and 94%. Humidity is relativity higher during the months of June to September, due to monsoon season.

Table 32: Humidity data

Year	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual
2004	83	75	84	88	84	88	89	90	90	87	83	80	85
2005	78	74	80	80	82	87	89	90	89	89	84	81	83
2006	79	78	72	77	83	88	90	89	89	86	84	82	83
2007	79	79	71	82	82	89	93	90	92	86	83	77	83
2008	78	73	79	78	79	89	91	88	89	86	83	86	83
2009	82	75	76	80	81	85	91	90	88	86	82	82	83
2010	87	80	83	83	85	92	94	94	93	91	91	88	88
2011	86	75	73	80	84	90	89	91	91	86	83	84	84
2012	81	72	77	80	85	85	90	89	90	86	83	85	83
2013	77	71	73	77	87	86	89	89	90	89	79	81	82
2014	80	75	71	74	82	88	89	91	88	84	82	85	82
2015	80	76	69	80	81	88	92	90	89	87	85	82	83
2016	81	81	80	83	85	87	92	89	88	87	84	83	85
2017	75	72	78	82	80	86	90	91	91	90	86	87	84
2018	79	75	75	78	85	88	89	87	86	84	82	79	82
2019	75	75	74	77	80	85	89	88	90	88	87	86	82
2020	87	80	79	88	85	92	89	91	88	89	87	85	86
2021	87	77	82	84	90	93	90	90	88	85	79	83	85
2022	81	75	68	78	82	86	87	88	89	86	81	81	81
2023	81	75	77	77	80	87	88	90	89	86	84	84	83

4.5.3. Rainfall

Monthly Variation of Rainfall:

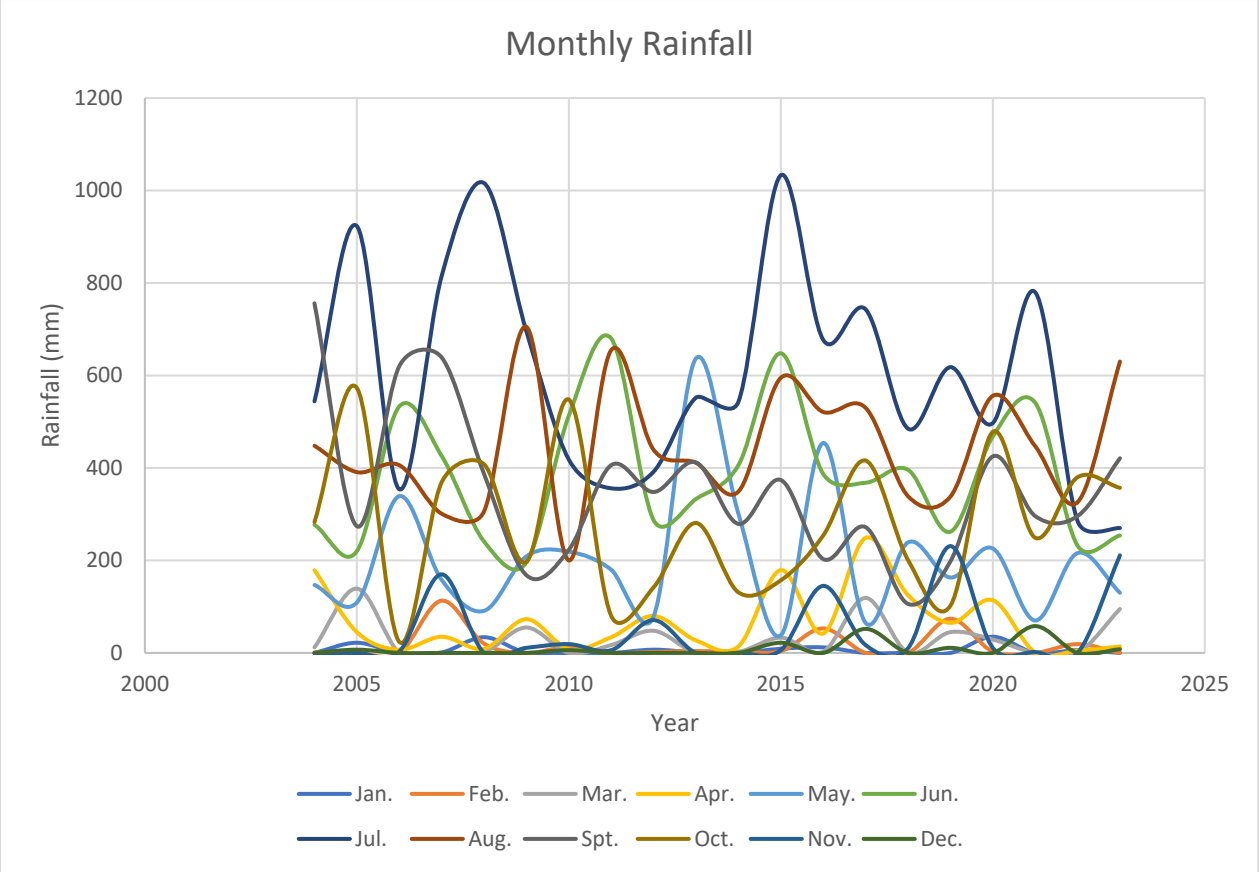


Figure 56: Monthly Average Humidity

Highest rainfall recorded was 1033mm during July 2015. Major Rainfall starts from May and ends in October.

Table 33: Monthly & Yearly Total Rainfall (mm)

Year	Jan.	Feb.	Mar.	Apr.	May.	Jun.	Jul.	Aug.	Spt.	Oct.	Nov.	Dec.	Annual
2004	0	1	12	179	147	277	544	448	756	283	0	0	2647
2005	22	0	139	45	109	220	923	391	274	573	0	7	2703
2006	0	0	1	7	339	533	354	406	620	24	3	0	2287
2007	1	113	0	35	158	426	815	301	639	369	170	0	3027
2008	34	20	2	9	91	241	1016	306	387	408	0	0	2514
2009	0	0	55	73	209	196	695	705	168	197	11	0	2309
2010	0	13	0	8	219	513	418	200	223	548	19	6	2167
2011	0	0	17	34	180	680	356	655	406	80	6	0	2414
2012	7	2	48	80	79	287	392	439	348	142	71	0	1895
2013	1	4	0	27	637	333	552	411	412	281	0	0	2658
2014	0	3	2	14	301	406	543	349	279	131	0	0	2028

2015	9	4	33	179	38	648	1033	595	374	157	6	22	3098
2016	12	53	3	42	454	387	677	521	203	254	145	0	2751
2017	0	0	119	249	65	368	743	530	272	416	17	52	2831
2018	0	0	1	125	239	396	485	339	106	201	10	0	1902
2019	0	74	45	65	163	262	618	338	198	102	231	11	2107
2020	35	3	29	114	226	468	497	556	425	478	11	0	2842
2021	0	0	0	1	70	541	780	447	296	249	2	58	2444
2022	6	19	0	5	216	232	285	326	296	380	0	0	1765
2023	0	0	95	14	130	254	270	630	421	357	211	8	2390

4.5.4. Wind

Table 34: Monthly prevailing wind speed (knots)

Year	January		February		March		April		May		June		July		August		September		October		November		December	
	Spd	Dir	Spd	Dir	Spd	Dir	Spd	Dir	Spd	Dir	Spd	Dir	Spd	Dir	Spd	Dir	Spd	Dir	Spd	Dir	Spd	Dir	Spd	Dir
2004	2.5	N	2.9	N	3.7	S	6	S	3.3	S	3	S	2.9	S	2.5	S	3.7	S	2.6	N	2.4	N	2.3	N
2005	2.5	N	2.4	S	3.2	S	3.2	S	2.7	S	2.8	S	2.9	S	2.4	S	4.2	SE	2.6	NE	3.5	N	3.3	N
2006	3.1	N	3.2	S	3.2	NW	4.2	S	3.2	S	4	S	3.1	S	4.4	SE	3.4	S	2	NE	2.1	NW	2.1	NNW
2007	2.5	NW	2.6	S	3.4	NW	4.1	S	3.3	S	3.4	S	3.4	S	4	S	5.4	SE	2.3	N	2.3	NNW	2.5	N
2008	2.9	N	2.9	N	2.6	S	3.6	S	2.6	S	3.3	S	2.1	S	2.5	S	2.1	S	2.1	N	2.1	N	1.8	N
2009	1.8	N	2.4	N	2.2	S	3	S	2.8	S	1.8	S	1.9	S	1.9	S	2.7	SSE	1.8	N	1.8	N	1.6	N
2010	1.7	NNW	1.8	N	2.9	S	3.5	S	2.3	S	2.1	S	1.7	SSE	1.6	S	1.7	S	1.9	N	1.8	N	2.1	N
2011	2.1	N	2	N	3.3	S	1.7	S	2.5	S	1.9	S	1.8	S	1.8	S	1.9	SSE	1.8	N	1.8	N	1.9	N
2012	2.1	N	2.1	NNW	1.9	S	2.2	S	1.8	S	2	S	1.7	S	1.8	S			1.9	NNW	2.1	NNW	2.5	NNW
2013	2.6	NNW	3	NNW	1.9	S	2.2	S	3.3	S	2.2	S	2.3	S	2.1	S	1.8	S	2	S	2.2	N	1.8	N
2014	2	N	2.3	NNW	1.9	S	2.1	S	2.4	S	1.8	S	2.1	S	2	S	2.1	S	2	N	2	N	1.9	N
2015	2.6	NNW	1.8	S	3.6	NNW	2.5	S	2.5	S	2.4	S	2.1	S	2.4	S	2.2	S	2.1	N	2.2	N	2.6	N
2016	2.3	N	1.9	S	1.9	S	3.3	S	2.5	S	2	S	2	S	2.3	S	2	S	2	N	3.3	N	2.2	N
2017	2.6	N	2.9	S	2.8	S	3	S	1.9	S	2.8	S	1.8	S	1.9	S	1.7	S	1.8	S	1.4	N	1.3	NW
2018	1.5	NW	1.4	NW	1.5	S	2	S	2.2	S	1.7	S	1.7	S	1.9	S	1.3	S	1.3	N	2.3	N	2.8	N

2019	1.7	N	1.9	N	1.6	S	1.9	S	2.5	S	1.9	S	1.9	S	2.2	S	1.5	S	2	N	1.9	N	2	N
2020	1.7	N	2.1	NW	2	NW	1.9	S	2.4	S	1.6	S	2	S	2	S	1.6	S	2.2	SE	1.7	N	1.9	N
2021	1.6	N	2.3	N	2.9	S	2	S	2.5	S	2.2	S	2.5	S	1.9	S	2.7	SE	1.5	S	1.5	N	2.6	N
2022	2.5	N	3.7	N	3.8	S	3.3	S	3.3	S	2.4	S	2.2	S	3.2	SSE	1.3	S	2.1	S	2.5	NNW	3	N
2023	2.4	N	2.5	S	2.1	S	2.4	S	2.8	S	2.7	S	2.2	S	2.3	S	1.9	S	3	S	1.9	NNW	2.4	N

A graphical distribution of the variation in wind speed is provided below:

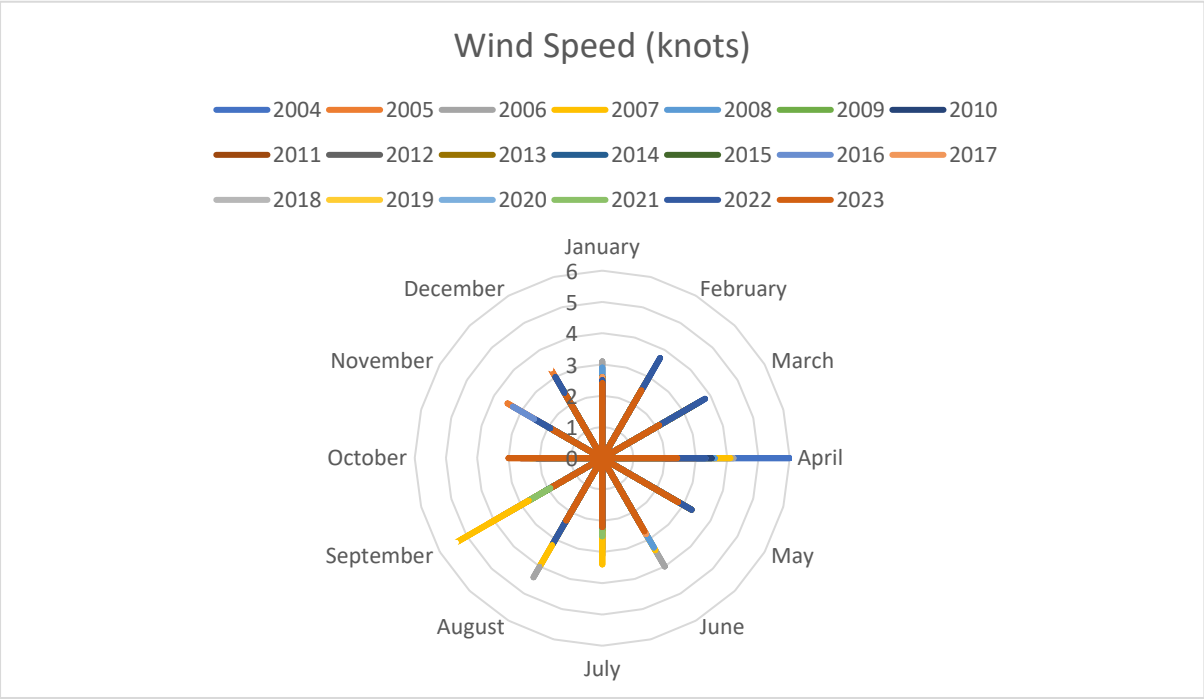


Figure 57: Wind Speed

Wind flow direction is mostly from South, and from North sides. Following is a visual representation of wind direction:

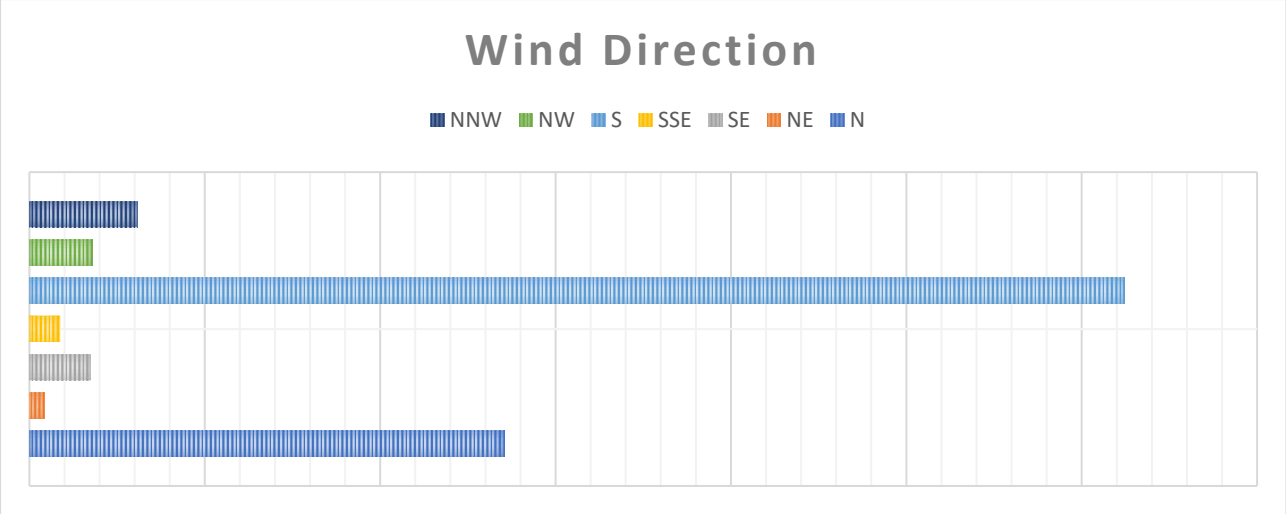


Figure 58: Wind Direction

4.6. Natural Disasters

The site area is vulnerable to natural disasters, especially cyclone, and erosion.

4.6.1. Cyclones

Cyclone risk for the area is very high. Cyclone tracks of major cyclones in Bangladesh over the last 60 years is provide below:

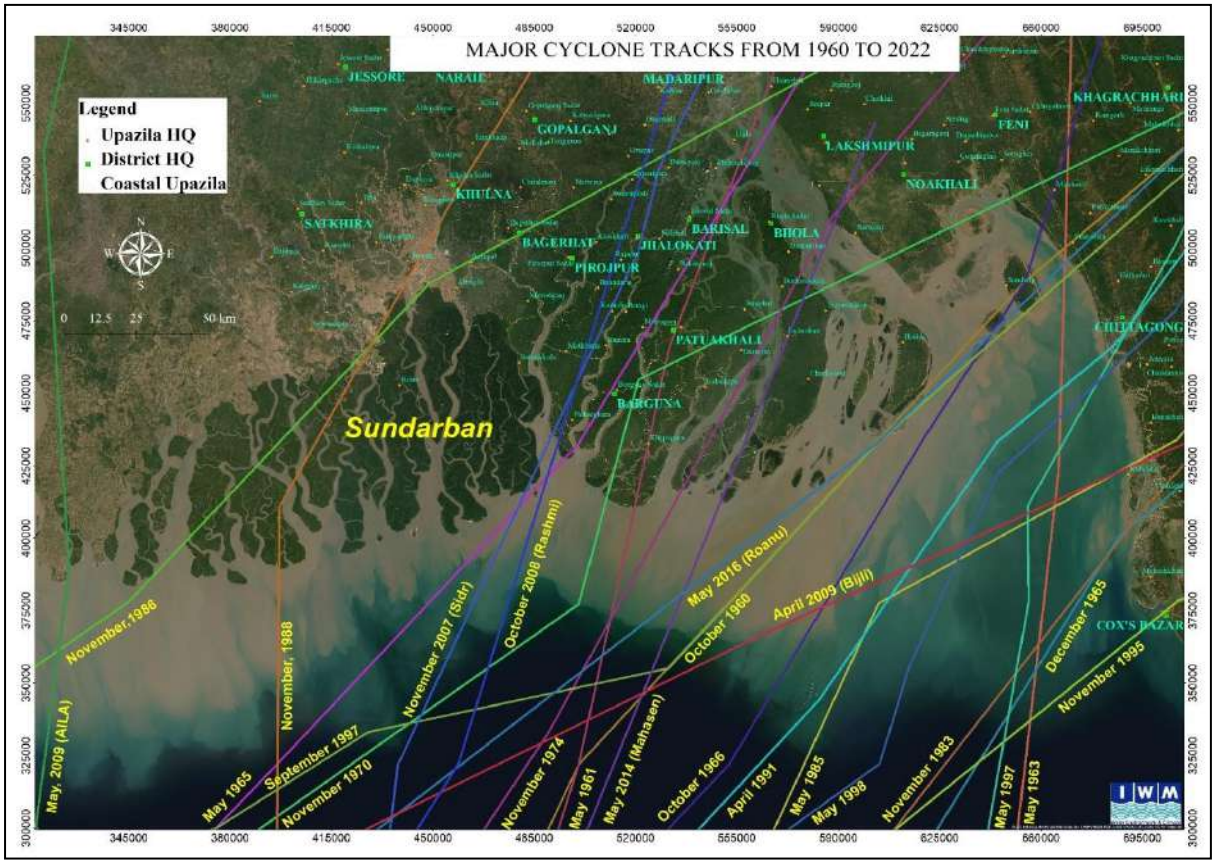
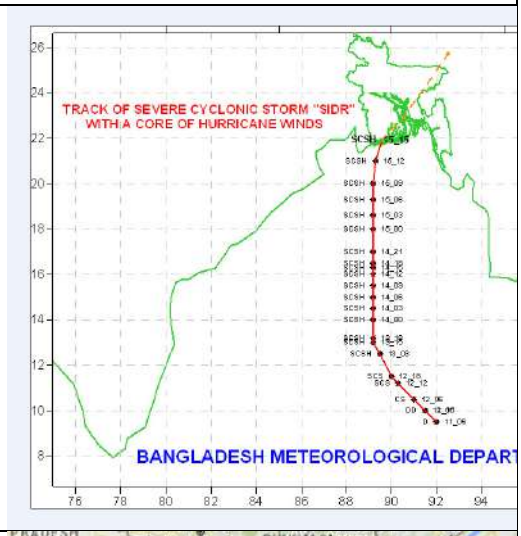
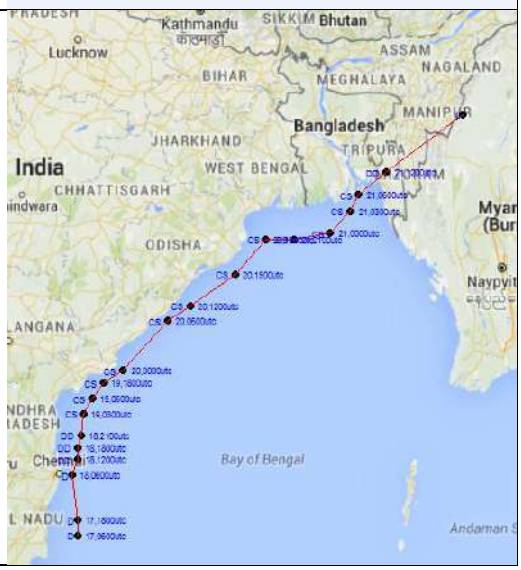


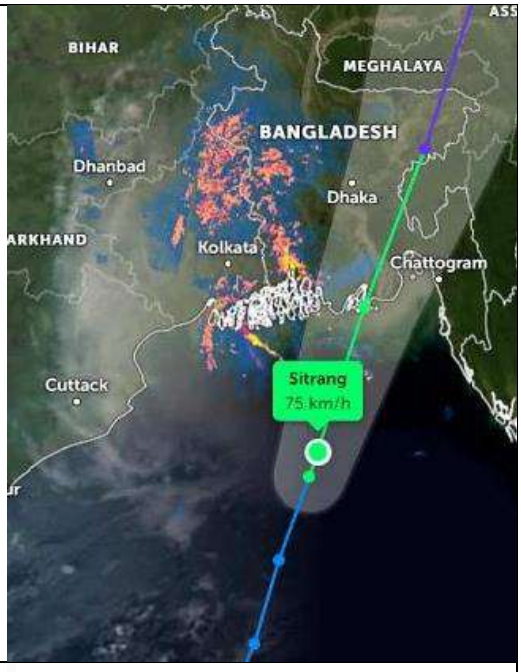
Figure 59: Historical cyclone tracks

More detailed information of some of the major Cyclones that affected the region are provided below:

Table 35: Historical cyclone events that affected the area

Year	Nature of Phenomenon	Landfall Area	Maximum Wind Speed in km/hr.	Direction of the Max. Wind Speed	Tidal Surge Height in ft.	Track Picture
2000	Cyclonic Storm	Sundarban Coast near Mongla	83	South-South-West	-	-

2002	Cyclonic Storm	Sundarban Coast near Raimangal River	65-85	South-South-West	5-7	-
2004	Cyclonic Storm	Teknaf-Akyab Coast	65-90	South-East	2-4	-
2007	Severe Cyclonic Storm with core of hurricane winds **(SIDR)**	Khulna-Barisal Coast near Baleshwar river	223	South-West	15-20	
2016	Cyclonic Storm **(ROANU)**	Barisal-Chittagong Coast near Patenga	128	West-South-West	4-5	

2022	Cyclonic Storm (**SITRANG**)	Barishal-Chattogram Coast near Bhola	88	NE-Bay and adjoining NW-Bay	-	
2023	**Midhili** (Tropical storm)	Khulna Barisal Chittagong	72 km/h	South-South-West and South-East	-	-

4.6.2. Storm Surge

Storm surge occur during storms like cyclones. Storm surge levels at different return period are provided below:

Table 36: Storm surge levels at different return periods

Return Period	Storm Surge Level (m)
10-year	2.28
25-year	3.15
50-year	3.80
100-year	4.44

Existing embankment height is about 3.5m. Usually 25-year return period is considered during designs.

4.6.3. Erosion

Erosion is frequent in the site area. The adjacent river is big with strong currents, and waves which results in significant damage to the surrounding region. To study on this, Landsat images were utilized to monitor the shoreline and Bankline dynamics along the coast of Baleswar-Bishkhali-Burishwar estuary. Landsat imagery from the Earth Explorer for the study, was from the time period of 1990 to 2022. The images were mainly collected during the dry season from

November to February, as clear images were not available during monsoon season due to clouds.

The change in the planform of the Baleswar-Bishkhali-Buriswar river estuary are depicted in following figures, covering the periods 1990-2022 and 2015-2022, respectively. Figure illustrates the long-term shifting of the bankline within the estuary from 1990 to 2022:

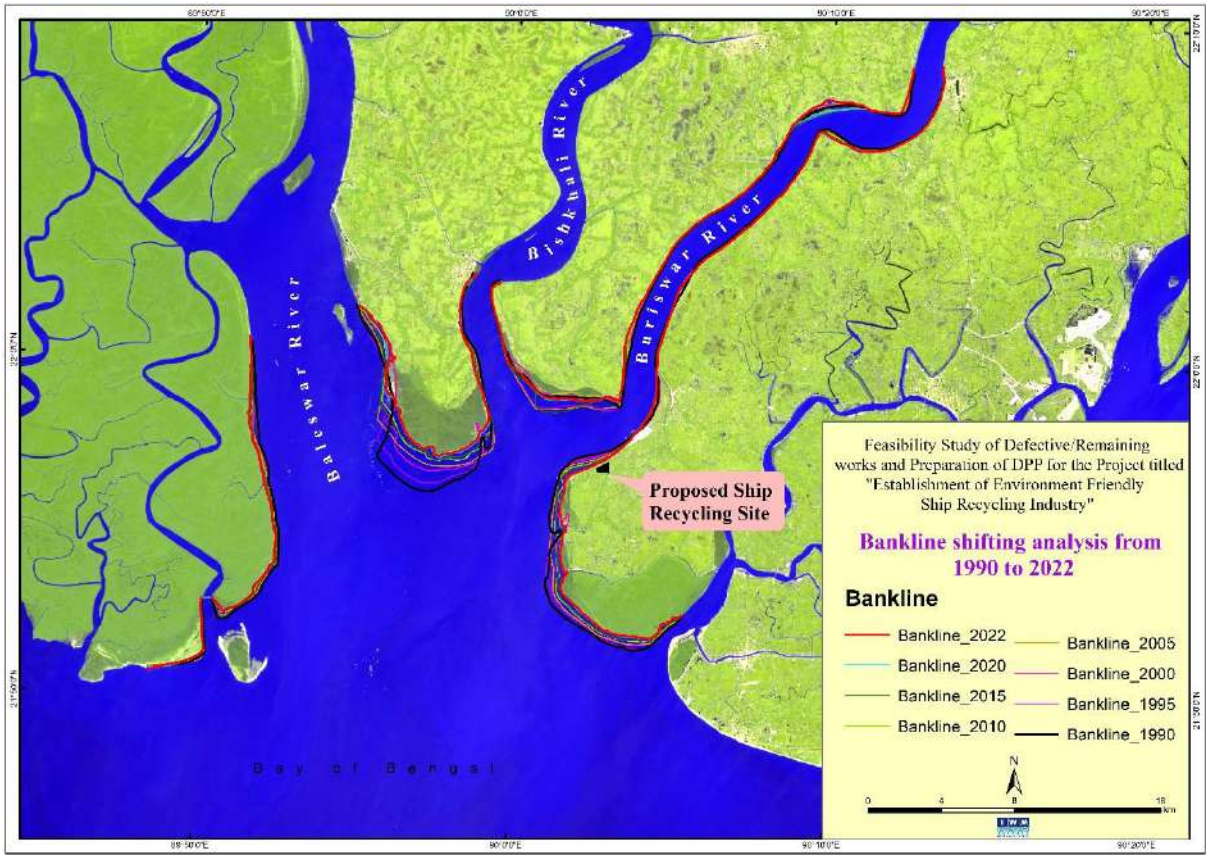


Figure *60*: Planform changes in the estuary of Baleswar-Bishkhali-Buriswar river system during 1990 to 2022

Notably, the changes in the bankline primarily signify erosion, with the most significant erosion occurring along the shoreline between Baleswar and Bishkhali. Moreover, erosion on both banks of the Buriswar river is relatively minimal, although the right bank of the Buriswar river, where the project area is situated, has experienced a notably higher degree of erosion.

In contrast, there has been a progressive buildup of land along the shoreline between Bishkhali and Buriswar river since 1990, although much of this accretion has been eroded in recent years. Furthermore, bankline changes on the right bank of the Baleswar river have been relatively minimal over the given period.

Conversely, the rate of bankline shifting has considerably decreased in the last eight years, spanning from 2015 to 2022, as demonstrated in Figure :

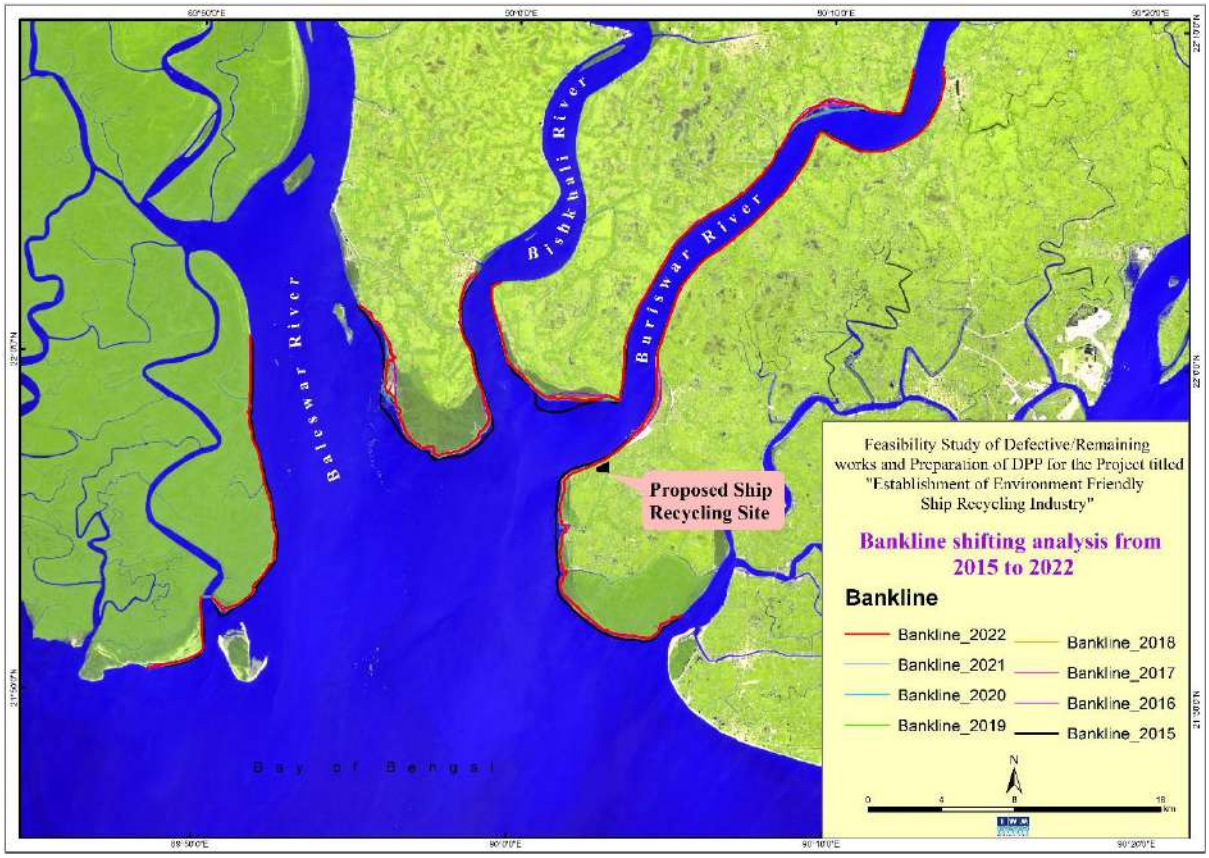


Figure *61*: Planform changes in the estuary of Baleswar-Bishkhali-Buriswar river system during 2015 to 2022

This suggests a relatively lower incidence of erosion in the estuary in recent times. Through image analysis, it has been determined that there was a total erosion of 493 meters at the proposed project site from 1990 to 2022. In the more recent period from 2015 to 2022, there was a recorded erosion of 95 meters at the project site.

Figure and Figure illustrate the erosion and accretion patterns within the estuary for the periods 1990-2022 and 2015-2022, respectively.

Between 1990 and 2022, there has been a total land area erosion of approximately 3722 hectares, averaging around 116 hectares per year. In contrast, land accretion has been minimal, accumulating to only about 150 hectares. The most significant erosion has taken place between the Baleswar and Bishkhali rivers, as well as along the left bank of the Buriswar river. Conversely, accretion has occurred between the Bishkhali and Buriswar rivers.

From 2015 to 2022, the estuary experienced shoreline erosion, resulting in a total land area loss of approximately 1748 hectares.

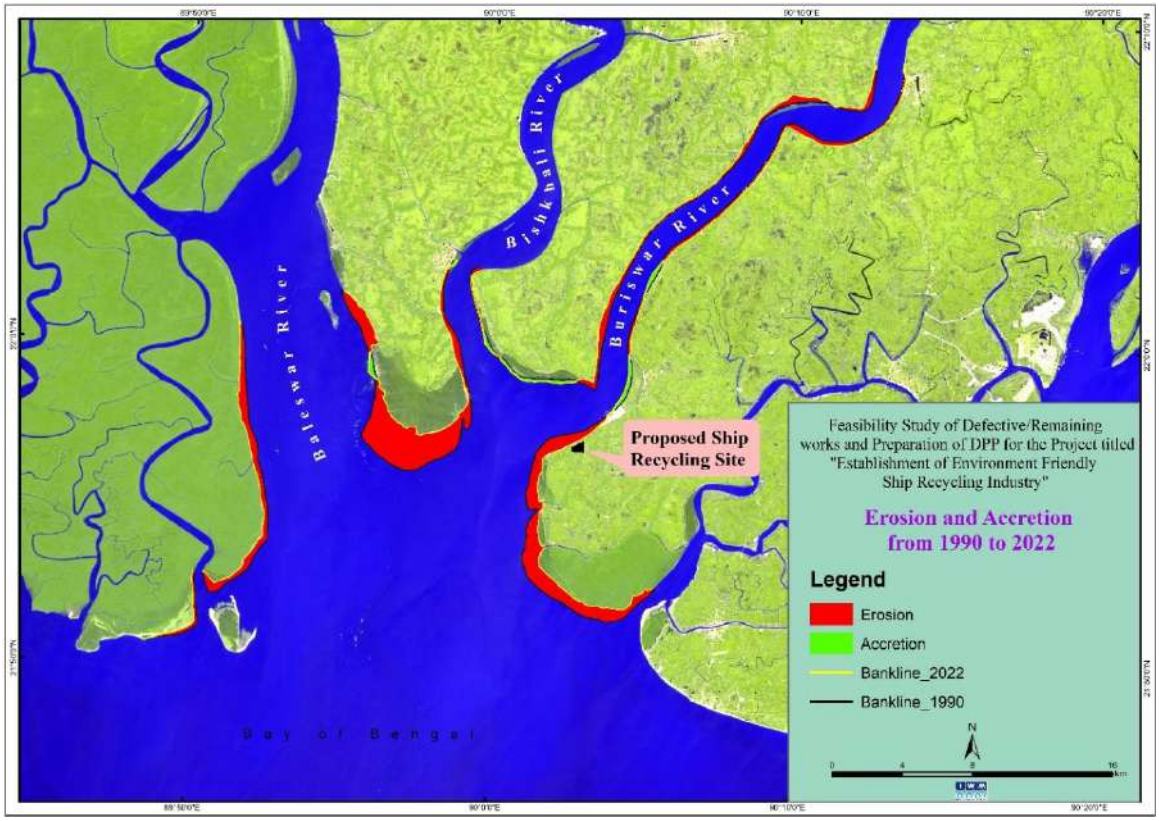


Figure *62*: Erosion Accretion map of estuary of Baleswar-Bishkhali-Buriswar river system during 1990 to 2022

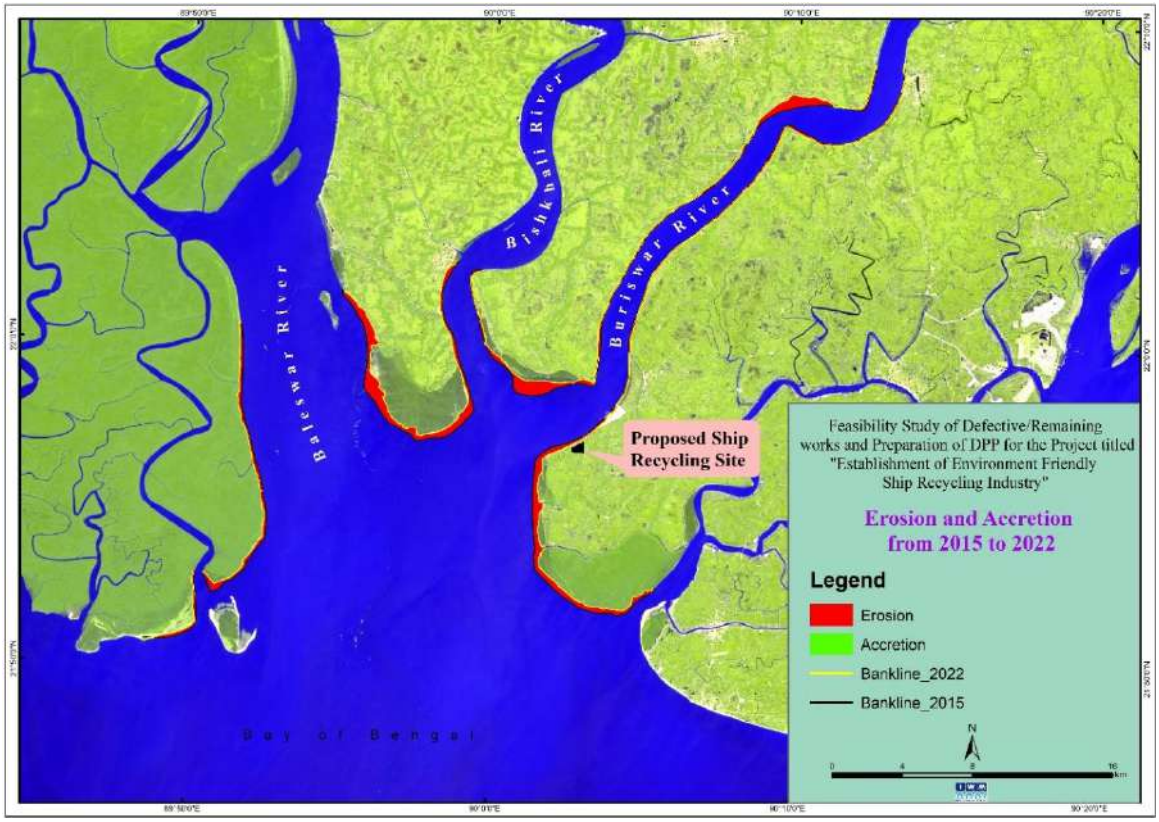


Figure *63*: Erosion Accretion map of estuary of Baleswar-Bishkhali-Buriswar river system during 2015 to 2022

4.6.4. Flood

The area is prone to some flooding and waterlogging, especially during monsoon season.

4.6.5. Earthquake

Risk of earthquake in the area is low.

4.7. Existing Socio-Economic Condition

4.7.1. Demography

The total population of Barguna district as of census 2022 is 1,010,531 (male: 494,738, female; 515,723). The distribution of population varies considerably among the 6 upazilas:

Table 37: Population data of Barguna by upazilas

Upazila	Amtali	Bamna	Barguna Sadar	Betagi	Patharghata	Taltali
Population	214,436	78,942	294,350	125,464	177,875	119,394

It is evident from the numbers that Taltali is the second least populous upazila of Barguna. However, on a scale of urban over rural population, Taltali has the second most urban population percentage.

Local demographic information of Taltali upazila is as follows[4]:

Table 38: Detailed population data of Taltali upazila

Population	Male	Female	Total
	61,144	58,250	**119,394**
Number of Households		**29,005**	
Household Size		4.03	

4.7.2. Education

Basic education status is as follows:

Table 39: Literacy situation data

Literacy Rate	Male	Female	Total Average
	82.40%	79.06%	**80.77%**

There is educational places like madrasa within the selected site area.

[4] Source: Bangladesh Bureau of Statistics census 2022

4.7.3. Economy

The economy of Barguna is primarily based on agriculture[5] and fisheries. Pisciculture and rearing of livestock and poultry are also practiced by some households. Though the prime economic activity is agriculture, some alternative economic activities have expanded to some extent in the Barguna district. In addition, some valuable timber and forest trees are available in this district.

4.7.4. Agriculture

A wide range of cultivation are practiced in Taltali. Cropping intensity is 136%.

Table 40: Agricultural production data

Agriculture by land area in Taltali (acres)									
Aus	Aman	Boro	Wheat	Maize	Jute	Pulse	Oil Seed	Sugarcane	Potato
6724	23494	731	10	83	3	1927	380	4	375

(source: BBS[6])

Cultivation pictures from the area

The crop production is restricted due to salinity in some areas during dry season. In the other areas it is affected by daily tide and monsoon tide. Crops get damaged by different climatic threats like food, drought, heavy rainfall, untimely rainfall, tornado, cyclone, river bank erosion etc. Within the threats, flood and cyclone are main objects that can damage the crops seriously.

In addition, there are practice of cultivating fruits like mango, banana, jackfruit, guava, coconut. Various vegetables are also cultivated including but not limited to bitter gourd (karala), pumpkin (misti kumra), brinjal.

4.7.5. Livestock

Livestock owners face challenges regarding availability of feeds during March to December due to shortage of grazing lands. In the kharif-I and kharif-II seasons, the lands are generally covered with rice crop in the area. Rice straw is the main fodder for cattle. Bran of wheat and

5 https://bbs.portal.gov.bd/sites/default/files/files/bbs.portal.gov.bd/page/c645bd51_3cb5_4f53_86f9_7d29244caa4e/2023-02-01-07-38-dfbf643496e1b51c98f0d3ac7e8348f3.pdf (page-3/pdf-34)

6 https://bbs.portal.gov.bd/sites/default/files/files/bbs.portal.gov.bd/page/c645bd51_3cb5_4f53_86f9_7d29244caa4e/2023-02-01-07-38-dfbf643496e1b51c98f0d3ac7e8348f3.pdf (page-44/pdf-75)

rice, oil cakes, and powder of cereal crops are the other common fodders, but the availability of these feeds in the Project area is limited. Shortage of grazing land throughout the year aggravates the feed problem for the livestock. The project location is susceptible to tidal surges and flooding with a variable degree considering the distance from the ocean and the elevation.

Livestock information is as follows:

Table 41: Livestock data

Type of livestock	Cow	Goat	Chicken
Amount (nos.)	33986	17543	165435

Common livestock pictures

4.7.6. Fisheries

Fisheries is a major part of Barguna district. Both capture fisheries and culture fisheries are practiced.

Fish of different species are available in the district. Large quantity of fish is captured from rivers, tributary channels, and other natural waterbodies.

Pictures of capture fisheries practices

Fish biodiversity is a decreasing trend because of morphological changes, obstruction to spawning migration, natural and anthropogenic drying up of wild fish habitats, indiscriminate fishing, and loss of river-khal connectivity and water regulatory structures on khals. Aquatic environmental quality is satisfactory though some pollutants are released from cultivation fields affecting fish production.

Fish is also cultured in ponds and other small waterbodies, even paddy fields are sometimes used for fish culture during rainy season. Lack of quality fish seed and feed makes it challenging for improved aquaculture practices. In addition, increasing salinity also adversely affects pond fish culture.

Fish production trend from capture/open water fisheries is declining in the project area, mostly due to obstacles to fish migration and shrinkage of fish habitat. Aquaculture is expanding gradually in the area by converting the cultivated land, as well as the medium low lands of the area.

4.7.7. Livelihood

Fishing is the most common livelihood among the local population. In addition, there are agricultural activities, and small businesses.

In Taltali, 6937 households are involved in agriculture, 4333 households are involved in fisheries.

4.7.8. Poverty

In Barguna district, poverty status ranges between 19.3~32.1%. Poverty level is considered moderate for Taltali upazilas. (source: BBS HIES[7]).

Table 42: Household structure materials data

Total Households in Barguna district	Cement/ Concrete	Metal Sheet/ Corrugated Iron Sheet	Wood/ Bamboo/ Mat/ Straw/ Chhan/ Bichali/ Golpata/ Palm Leaf/ Polythene	Hand Made Tiles	Other Materials	No roof
253,388	21,310	228,275	3,485	67	101	150
Ratio (%)	8.41	90.09	1.38	0.03	0.04	0.06

From the data, it is evident that most households are formed of metal/corrugated iron roof, which is very common in rural areas of Bangladesh. There is very small amount of makeshift materials house, which indicates that though there is higher than average poverty in Barguna, when compared to national scale, overall economic situation is decently stable.

4.7.9. Sensitive Public Place

There is graveyard, mosque within the selected site area.

7 https://bbs.portal.gov.bd/sites/default/files/files/bbs.portal.gov.bd/page/5695ab85_1403_483a_afb4_26dfd767df18/2021-02-22-16-57-c64fb3d272175e7efea0b02de6a23eaa.pdf

4.8. Stakeholder Consultations

The project has adopted a participatory approach. Participation is a process, through which stakeholders influence and share control over development initiatives, the decisions and the resources, which affects them. Participation of stakeholders in the projects is also a primary requirement in developing an appropriate management plan that addresses project's requirement and suited to the needs of the stakeholders. Stakeholder's involvement is also vastly increasing the probability of successful implementation of management plan. In order to make consultation and disclosure process effective and fruitful, comprehensive planning is required to assure that local government, NGOs, host population and project team interacts regularly and purposefully, throughout all stages of the project and contribute toward a common goal.

Public opinion has been collected through interview and focus group discussion meeting. For better Understanding the socio-economic and environmental condition of the project area stakeholder meetings were conducted in the project study area.

Objectives of Stakeholder consultations and Disclosure: The specific objectives of this report to:

- Summarize Developer, national and international legal & policy requirements for stakeholder engagement;
- Describe and identify the stakeholders affected and/or with an interest in the Project;
- Summarize stakeholder engagement and consultation conducted to date; and
- Describe how the views and issues raised have informed and influenced the development of the Project

Approach and Methodology of Stakeholder Consultations and Disclosure: The approach undertaken for consultation involved the following key processes.

- Mapping and Identification of key stakeholders such as primary (direct project influence) and secondary (indirect project influence) stakeholders;
- Undertaking questionnaire interviews with the probable affected and non-affected persons of the proposed project area;
- Assessing the influence and impact of the project on these stakeholder meetings; and
- Summarizing of key findings and observations from the consultations.

Stakeholder Consultation Meetings: Consultation is a formal process by which the Commission collects input and views from stakeholders about its policies. Consultation is a continuous process and formal stakeholder consultations complement the Commission's broader interaction with stakeholders (e.g. meetings or exchanges or through existing permanent platforms for dialogue). The term 'stakeholder consultation' applies to all consultations with stakeholders in the process of the evaluation or the preparation of a policy initiative or the implementation of an existing intervention. During the field survey, several stakeholder consultations were held with government officers and local representatives/respected persons regarding the planning and implementation of this project.

Table 43: Key Informant Interviews with Government Officials

Sl. No.	Official	Comments and Suggestions
i.	Upazila Nirbahi Officer.	• The proposed project is very important for the development of this area and to reduce the poverty • They were aware of this project and they can any help related to this project.
ii.	Executive Engineer, Bangladesh Water Development Board (BWDB), Barguna	• The project authority will have to adopt appropriate safety measures including river bank protection and shore stabilization to protect the facility as well as the surrounding area from natural disasters. • The project authority has to adhere to the level of protection that is offered by the existing embankment as any breach of this or disruption to the protection will endanger the lives and properties of the people living in the polder area. • As the industry will be ship breaking, requiring brining of ships by river on a regular basis, perhaps, embankment can be shifted further into the countryside, outside of the industry perimeter.
iii.	Upazila Social Service Officer; Taltali Upazila, Barguna	• People will be benefited for implementation of the project. • Local people will be engaged about the project activates
iv.	Upazila Coordinator; Taltali; Upazila; Barguna	• Key linkage between the community and the project proponent • Though there is no law regarding the number of compensated trees for plantation against each tree cut but at least 2 trees should be planted.
v.	Upazila Agriculture officer; Taltali; Upazila; Barguna	• Small trees should be planted at the project location. • During tree plantation involve the local Forest Department for suitable species selection and successful plantation Programme. • Every 500m distance a big tree (e.g., Ficus) should be planted inside the project Area. The big tree like Ficus attracts more than 50 species of birds and will play a good role for ecological balance.
vi.	Clester Facilitator; Social Development Foundation	• Controlling out-break of any major disease and monitoring the disease pattern • Plays important role in providing public opinion and sentiment on the project • Proper rehabitation and resettlement strategy must be followed due to project implementation phase
vii.	Chairman; 5 No. Borobagi Union Parishad; Taltali; Upazila; Barguna	• The proposed road project is a good initiative in terms of safe and reliable transportation. • Chairman assure it's essential for such type project for their effective future support • People of 5 no borobagi union will be benefited due to project activates.

		• Proper Land acquisition must be followed due to project • Concern about Fishing activities • Fisheries sector must be considered to implementation this project.
viii.	Chairman; 6 No. Nishanbaria Union Parishad; Taltali; Upazila; Barguna	• Compensation will be provided in monetary form and determined by the government based mouza prices on previous years estimates provided by the sub-register office • Increase local empowerment
ix.	Member; 3 no. Ward; 5 No. Borobagi Union Parishad; Taltali; Upazila; Barguna	• Asset valuation will be carried out by Public Works Division and crops, trees etc. by Forest department • No major opposition to the land acquisition process. People are forthcoming about the project
x.	Bit officer, Tengragiri wildlife Sanctuary	• • Though there is no law regarding the number of compensated trees for plantation against each tree cut but at least 2 trees should be planted. • Because of the implementation of this project impact on the fish cultivation/fish catching is moderate. • May be effect on plant species • River Erosion also a major issue to implement this project • The government published a gazette on 01 December 2016 and declared not to cut a single tree from natural forest till 2022. • Every year vultures visit this area. Sometimes we find wounded vultures and we catch them as soon as possible. After taking proper care we free them in the forest. •
10	Sub Assistant Engineer; DPHE, Taltali upazila, Barguna	• Minor Impact about this project • Minor impact on Groundwater • Change the local infrastructure nearer to the project • Concern about health and safety impacts • Along the project road there are very few numbers of roadside water bodies. • Migratory birds come to the water body during winter season in each year. • Proper waste management strictly monitored

Focus Group Discussions (FGDs) with group(s) of individuals was done to capture opinions about the project. The FGDs were conducted at multiple locations in and around the site area.

Table 44: Details of Consultations with Local People

Sl. No.	Location	Comments/Suggestions

01	Tetulbaria Bazar, 6 No. Nishanbaria union, up: Taltali; Dis: Barguna	▪ Fisheries activates would not be hampered ▪ Increases Employment opportunities for local people ▪ Willing to engaged this project ▪ Prefer local people to this project compare to the outer people. ▪ Compensation will be provided according to the government rules ▪ Proper land acquisition for their economic and livelihood ▪ No major influence on the project. ▪ Improvement in electrical supply and infrastructure in the area ▪ Minimize impact Medium scale fishing for livelihood ▪ Improvement in electrical supply and infrastructure in the area ▪ Increase in employment opportunities and preference in job ▪ No major restrictions around the project site especially with respect to grazing land ▪ Project will bring development to the area
02	6 No. Nisanbaria union parishad complex	
03	Joyalbhanga Bazar, 6 No. Nisanbaria union; upa: Taltali; Dis: Barguna	

Overall, the local community spoke positively about the project due to the prospect of improved economy that will make their lives better. They are also willing to let their land be acquired for the project as required. Their hope is to have a better life by getting work opportunities from the industry.

5. Impact Prediction and Evaluation

The project is considered have significant environmental risks and social impacts from the planned activities and processes. According to schedule-1 of ECR 2023, ship breaking activities, ship breaking yard is categorized as Red in Bangladesh, which is the highest risk category.

Impacts are primarily being considered for pre-construction, construction, and post-construction period.

Pre-Construction Phase

Activities during pre-constriction will be as follows:

- Clearing of land surface by removal of structures and cutting of trees
- Increased vehicular movements
- Stacking of construction materials
- Fencing of the site area

There will be air pollution be limited to the project boundary, possibly for a short period of time, during the pre-construction activities. The noise impact will be minimum and short term. The environmental quality of water resources may not be impacted significantly. At the proposed site where the road will be constructed, about 12 households and 5-6 shops including tea stall will be directly affected by the project implementation. A resettlement plan will be developed before implementation of the project. No significant anticipated impact would be observed on agricultural resources. The water bodies will be directly affected because of dismantling the ship. As a result, various toxic substances (such as Oily Sludge, oily water, paint and coating, Rubber packing, Insulation, glass, Asbestos, puff) which will cause permanent loss of large amount of fish production. Pollution from ship breaking activities may have significant impacts on marine ecosystem. Agricultural land will be significantly impacted during pre-construction for land development.

Construction Phase

Activities during constriction will be as follows:

- Construction of the industrial facilities in the site area including on the river bank
- Increased vehicular and waterway movement
- Increased movement and habitation of people
- Unitlity connections to the facility
- Testing of different parts of the facility

The consequence of air and noise pollution will be significant as the settlement is located adjacent to the project boundary. Oil spillage from the workshop, rainwater runoff, water vessel may contaminate surface water near the construction site. large number of labors will work, and huge domestic garbage and sanitary wastewater will be generated from various facilities such as workers shed units, which shall have to be properly managed. The construction of the road may affect the topography and geology of the area around the proposed site. Cutting and filling will cause erosion of the slope, but the affect will not be significant. Soil pollution will possibly be caused by leakages of oil and chemical materials at the construction site. Oil and

chemical materials will be stored at an appropriate storage site to prevent any permeation into the ground. Sediment pollution may occur in the case of construction wastewater flows into the river. No significant anticipated impact would be observed on agricultural resources during Construction phase. Oil and chemical materials can be released to the nearby river, ditches or pond from the construction site during construction phase. This may damage the fisheries ecosystem of the respective water body. Pollution from ship breaking activities may have significant impacts on marine ecosystem. Impacts on ecosystem are unlikely as construction works will be inside existing yards. A part of trees in the area will be cut down due to the road widening work, but it can be minimized and mitigated. The impact on flora and fauna will not be significant. Regarding fauna, habitat fragmentation is considered. Therefore, the impact on fauna will not be significant. Land acquisition may cause Property loss and loss of income generating activities of the Project Affected Persons (PAPs). The acquisition requires resettlement of households. A resettlement plan will be developed before construction start. The local economy may be affected by Liquid hazardous like Bilge, Oily Water discharged from the construction site.

Outflows of street dust and crude oil during rainy periods may also have certain effects. The oil water discharged from the construction site and any oil spills may affect the water quality of the river and ground water, and adequate mitigation measures shall be taken. Material, equipment and worker transportation may disturb existing road and water traffic including fishing boats. Local conflicts may occur between local residents who may feel that they have received unfair compensation and other local residents or conflict with staff of the Deputy Commissioner ‘s Office. Conflict may occur between local residents and external workers because of any changes to local customs if external workers cannot understand local customs.

Post-Construction Phase

Activities during constriction will be as follows:

- Increased vehicular and waterway movement
- Increased movement and habitation of people
- Breaking of ships for recycling
- Generate of pollutants like dust, paint, rust, oil, fumes, toxic wastes, human wastes
- Waste management including solid waste disposal, and liquid waste treatment
- Rainfall runoff, carrying harmful wastes

Emission from the boiler and generators stack may affect the ambient air quality due to unburned hydrocarbon and different gases like carbon dioxide (CO2), carbon monoxide (CO) and sulfur dioxide (SO2). The high temperature of flue gases also affects the air quality in terms of thermal pollution. This is a long-term adverse impact. Noise from construction vehicles and machines may not have significant impacts. Lots of equipment and materials in ships are made of PVC. PVC poses serious threats to environmental health at every stage of its existence (production, use and disposal). At the end of its life, PVC waste creates intractable disposal problems because it is expensive and unsafe to burn. It releases hazardous chemicals into groundwater and air when buried and is not so easily cheaply recycled. PVC can have a negative impact on the environment and human health. Bilge and ballast water may both contain metals which cannot be removed through treatment. Metals if

ingested can cause various human health problems such as lead poisoning and cancer. Bilge water may contain toxic organics, such as solvents and polychlorinated biphenyls (PCBs), which can cause cancer and lead to another serious ailment. Oil seeps into shallow or confined waters; fish can be seriously affected and may even die. Fish eggs may not hatch or may be totally destroyed, especially when the depth of water body is not so deep. Although erosion of slope is expected, the affects will be minimized by some protection work. The operation of the project will not have any impact on agricultural land type of the locality, as it will not alter the hydrological process and flood regime of the area. Only the project areas of 105 acres that is to be acquired for project development will no longer be used for agricultural and fishing farming practice.

Fishing ground change that occurs since construction phase and continue in the operational phase has potency to cause unrest among the local fishermen. It is envisaged that with the commencement of operation of the local fishermen will be restricted to fish in the vicinity. Only fishermen with engine ships or large boats will be able to fish at the farthest corner of the sea it has estimated about 300 fishermen will be severely impacted due to Ship recycling Industry. Therefore, the impact is identified as significant impact.

During operation runoff of exposed soil surfaces and drainage of wastewater from drainage channel into rivers is expected which can lead to the any unexpected substances contamination to the water body and destroy fisheries ecosystem. Appropriate protection measure from wastewater contamination to the rivers. Since the nearshore area around Tetulbaria; Taltali upazila; Barguna Ship Recycling Yard is designated as a port area; fishing activities are prohibited inside the designated port areas. While maximum fish traps were observed in the intertidal areas outside of the recycling yards, these are unlikely to be affected.

It is expected that air pollution will be caused from the exhaust gas generated from Ship. The major noise and vibration source will be vehicles, but the increase of traffic amount will not be significant. Project traffic load, human movement and other project activities may sometime disturb free movement of different wildlife like Mongoose, Ring lizards, Rats, Small Indian civet, etc. living in roadside vegetation. Lighting in the project area may disturb activities of nocturnal animals. On the other hand, green belt (to be developed) for the project shall provide important habitat to different wildlife, local common birds, and other aquatic birds. Socio-economic improvement will be the significant insights for the southern region in future. Decommissioning

Possible future decommissioning may require following activities:

- Dismantling of constructed facilities
- Carrying out materials from site to disposal locations

Potential Environmental and Social Impacts of these on the existing environment are discussed in detail in the following parts of this chapter.

5.1. Environmental Impacts

The project is predicted to have considerable negative environmental impacts due to involvement of toxic/hazardous wastes, posing the risk of environmental pollution, degradation, and public health hazards. Furthermore, as EOL ships will be brought to the facility by the river from the ocean, there are risks of surface water pollution. In addition, lots of trees will be cut from the area which itself is an environmental issue. Moreover, the land

surface will be changed, transforming agricultural land into industrial uses, which generates several environmental concerns. As such, the project needs to adopt a high degree of appropriate mitigation measures. A summary of potential environmental impacts and possible indicative mitigation measures are provided below:

5.1.1. Geology and Geography

The existing land use pattern will be changed from the implementation of the project. Trees will be cut down, river bank will be protected for stability, houses will be removed for construction of industrial facility.

Table 45: Impact on geology, geography

Project Phase	Pre-construction	Construction	Operation
Anticipated Impacts	▪ Land use change ▪ Land cover change ▪ Dust from Materials stacking	▪ Dust from construction activities ▪ Increased traffic and movement on the landmass	▪ Impact on river channel due to river bank protection/river training works ▪ Erosion on opposite bank
Type of Impact	Negative	Negative	Negative
Degree of Impacts	Moderate	Low	Moderate

5.1.2. Environmental Sensitive Areas

As the site is nearby from some environmentally sensitive areas like sanctuary, wildlife breeding ground, and not very far from Sundarbans, there are risks of impacts on these sensitive areas. Construction and operation of the facility will generate solid and liquid waste of different types, including toxic and hazardous materials. Lack of proper waste management may result in leakage of harmful waste or substances that affect surrounding areas by being carried via air or water. As all wastes will not be taken care of within the facility, but some disposed off outside landfill or third-party vendors, the risks extend to the final destination of these waste materials.

Table 46: Impact on environmental sensitive zones

Project Phase	Pre-construction	Construction	Operation
Anticipated Impacts	▪ Dust, noise from preparatory activities ▪ Increased population density in the region	▪ Dust, noise, emission from construction ▪ Increased traffic movement in the region	▪ Adverse impact on wildlife sanctuaries from exposure harmful substances from the ▪ Adverse impact on natural forestry from contamination of pollutants
Type of Impact	Negative	Negative	Negative

Degree of Impacts	Low	Moderate	High

5.1.3. Air Quality

Air quality impact is expected to throughout the lifecycle of the project due to construction and industrial operation, replacing agricultural and settlement areas.

Table 47: Impact on air quality

Project Phase	Pre-construction	Construction	Operation
Anticipated Impacts	▪ Dust from preparatory activities increasing SPM, $PM_{2.5}$, PM_{10} ▪ Emission from preparatory activities increasing SO_x, NO_x, CO	▪ Dust from preparatory activities increasing SPM, $PM_{2.5}$, PM_{10} ▪ Emission from preparatory activities increasing SO_x, NO_x, CO	▪ Dust from preparatory activities increasing SPM, $PM_{2.5}$, PM_{10} ▪ Harmful airborne particles like paint, rust ▪ Air quality degradation from spreading of toxic and hazardous materials. ▪ Fumes from waste oils ▪ Emission from preparatory activities increasing SO_x, NO_x, CO
Type of Impact	Negative	Negative	Negative
Degree of Impacts	Low	Moderate	High

5.1.4. Vibration

The planned construction and industrial works will generate considerable levels of vibration, which may bring some physiological change in the area.

Table 48: Impact from vibration

Project Phase	Pre-construction	Construction	Operation
Anticipated Impacts	Vibration from preparatory activities, primary from trucks	Vibration generated by construction equipment and heavy vehicles	Vibration generated from ship breaking, scrap metal handling, heavy equipment and vehicles
Type of Impact	Negative	Negative	Negative
Degree of Impacts	Low	Moderate	Moderate

5.1.5. Noise

Noise level in the area will increase due to construction and industrial activities.

Table 49: Noise Impact

Project Phase	Pre-construction	Construction	Operation
Anticipated Impacts	Noise from preparatory activities	Noise from construction, and increased vehicular movements	Noise from industrial activities, and increased vehicular and waterway movements
Type of Impact	Negative	Negative	Negative
Degree of Impacts	Low	Moderate	High

5.1.6. Hydrology

Local hydrology will be affected by the land use and land cover change from the project. But, it is primarily expected during the pre-construction stage.

Table 50: Impact on hydrology

Project Phase	Pre-construction	Construction	Operation
Potential Impacts	▪ Filling of ponds ▪ Obstruction to some water flow	Obstruction of some water flow	Increased use of water channel(s)
Type of Impact	Negative	Negative	Negative
Degree of Impacts	Low	Low	Low

5.1.7. Water

5.1.7.1. Surface Water

Due to river side establishment of industrial facility, there will be significant risks of surface water pollution. However, there is a lot of ongoing activity in the river channel due to fishing and nearby coal-powered power plant. Water quality testing has shown some pollutants already being higher than national standards. As such, risk of surface water pollution from this industry is not very high.

Table 51: Impact on surface water

Project Phase	Pre-construction	Construction	Operation
Potential Impacts	Pollution of water channels from waste materials	▪ Pollution of water channels from solid and liquid wastes from construction	▪ Pollution from movement of ships ▪ Pollution from leakage of solid and untreated liquid wastes

		▪ Filling up of local small waterbodies like ponds	▪ Contamination from leakage of toxic/hazardous waste
Type of Impact	Negative	Negative	Negative
Degree of Impacts	Low	Moderate	High

Excessive pollution of the surface water in the river may have serious impact on the bio-diversity, especially fisheries. As the site is very close to the Bay of Bengal, it is also possible for polluting substances to reach the sea, and impact the natural environment there.

5.1.7.2. Groundwater

Due to change in land use, and establishment of industry, there may be some impacts on existing groundwater but as water demand of the industry is not very high, expected impact may be minimal with exception of the risks of pollution.

Table 52: Impact on groundwater

Project Phase	Pre-construction	Construction	Operation
Potential Impacts	▪ Change in water extraction pattern	▪ Oil leakage, ▪ Sewage leakage	▪ Contamination from Oil leakage, Sewage leakage ▪ Pollution from seepage of untreated liquid waste
Type of Impact	Negative	Negative	Negative
Degree of Impacts	Low	Moderate	High

5.1.8. Soil and Sediment

Impact of soil is possible due to serious change in land use, risk of exposure to different kinds of waste materials including chemicals or hazardous wastes. Accidental disposal of harmful industrial wastes may have degrading effect on the soil and may have impact on agriculture. Furthermore, the low lying area is protected by an embankment and if the level of protection cannot be ensure then there may be issues like salinity intrusion, flooding.

The river bed and sediment may also be impacted from the industry activities, especially if dredging is carried out in future.

Table 53: Impact on soil and Sediment

Project Phase	Pre-construction	Construction	Operation
Potential Impacts	▪ Increased erosion	Contamination from waste materials generated during construction period	▪ Contamination from Oil leakage, sewage leakage, heavy metals

			▪ Pollution from soild and liquid wastes including toxic/ hazardous wastes ▪ Degradation from disposal of industrial/chemical wastes, affecting agriculture ▪ Salinity intrusion from embankment damage/breach ▪ Contamination of river bed/sediment from pollutants, heavy metal ▪ Disturbance to the benthos on the river bed
Type of Impact	Negative	Negative	Negative
Degree of Impacts	Low	Moderate	Very High

5.1.9. Flora

A number of trees will be cut down from the site are which itself is a serious impact but there is little presence of any natural forest area or endangered plant species in the area. As such, the impact is mainly from the felling of trees, resulting from the proposed land use change.

Table 54: Impact on flora

Project Phase	Pre-construction	Construction	Operation
Anticipated Impacts	About 808 nos. trees will be cut.	Trees in the locality may be affected by dust, emissions	Some trees will be planted
Type of Impact	Negative	Negative	Positive
Degree of Impacts	High	Low	Low

5.1.10. Fauna

There will be some impact on local fauna due to cutting of trees, and industrializing the areas.

Table 55: Impact on fauna

Project Phase	Pre-construction	Construction	Operation
Possible Impacts	About 808 nos. trees will be cut, risking habitation of bids in the area.	Loss of habitats for some small animal species.	Habitation of some aquatic species including fish, dolphin, turtles may be disturbed by ships movement, pollution, and industry operation.
Type of Impact	Negative	Negative	Negative
Degree of Impacts	Moderate	Moderate	High

5.1.11. Biodiversity, Wildlife and Natural Habitat

The project may have some impact of local biodiversity and natural habitat. There is no significant natural habitat on the land surface or selected project area as it is entirely built-up from human habitation but the adjacent rivers have fish migration routes, movements areas of dolphins, turtles.

Table 56: Impact on biodiversity

Project Phase	Pre-construction	Construction	Operation
Possible Impacts	Disturbance to aquatic habitat from noise, pollution.	Disturbance to and aquatic and amphibian habitats from noise, pollution, increased movements.	Disturbance to, or loss of aquatic and amphibian habitats from noise, pollution, increased movements.
Type of Impact	Negative	Negative	Negative
Degree of Impacts	Low	Moderate	High

5.1.12. Natural Calamity Induced Catastrophe

The project site area is highly prone natural disasters like Cyclones, Storm surge, River erosion, Flood.

Table 57: Impact from natural disasters

Project Phase	Pre-construction	Construction	Operation
Potential Impacts	▪ Displacement of construction materials ▪ Increased accidents ▪ Increased erosion	▪ Displacement of construction materials ▪ Increased accidents ▪ Increased erosion ▪ Displaced construction materials causing accidents	▪ Displacement of harmful substances by high wind, rain water, storm surge ▪ Pollution of surrounding areas ▪ Increased accidents ▪ Increased need for shelters ▪ Increased risk of damage from disaster to the area due to different in protection measures
Type of Impact	Negative	Negative	Negative
Degree of Impacts	Low	Moderate	High

The industrial facility may not have significant impact on disaster probability, the increasing disaster risks may affect the area adversely, especially due to climate change and sea level rise. However, the risk of can be considered negligible until 2050.

5.1.13. Pollution

Numerous wastes will be generated from the facility including Asbestos, Glass wool/Mineral wool, PUF, waste oil, plastics, rubber, lubricating oil, Engine oil, slop oil, hydraulic oil, Grease, Iron scale.

Table 58: Environmentral Pollution

Project Phase	Pre-construction	Construction	Operation	
Anticipated Impacts	Waste generation from dismantling existing structures	○ Waste generation including construction wastes, industrial wastes, ○ Solid wastes from site ○ Liquid wastes ○ Emission from equipment	○ Waste generation including hazardous and toxic wastes ○ Solid wastes from the facility ○ Harmful liquid wastes ○ Emission of gas from equipment, ships ○ Residual oils, chemical substances, heavy metals onboard the ships	○ Reduction global pollution from recycle of end-of-life ships ○ Reduction in Greenhouse gas emissions
Type of Impact	Negative	Negative	Negative	Positive
Degree of Impacts	Low	Moderate	High	

Despite all measures in place, it is likely some pollutants will escape and cause environmental pollution of the area.

5.2. Socio Economic Impacts

Due to land acquisition and resettlement, the project is going to have a number of serious negative social impacts along with some other positive ones.

5.2.1. Economy

The project is expected to boost local economy by a considerable degree. In addition, the project will also create jobs and business opportunities that may benefit local people.

Table 59: Impact on economy

Project Phase	Pre-construction	Construction	Operation
Anticipated Impacts	▪ Work opportunities	▪ Work opportunities ▪ Business opportunities	▪ Work opportunities ▪ Business opportunities ▪ Possibility of new business creation ▪ Regional and national economic improvement
Type of Impact	Positive	Positive	Positive
Degree of Impacts	Low	Moderate	High

There is not many industrial activities in the project area. There is a power plant just upstream of the project site. This planned industry may facilitate new business opportunities, with potential for high economic growth for the region.

5.2.2. Land Acquisition and Resettlement

The chosen site area is currently private land, requiring acquisition, and resettlement of the current inhabitants.

Table 60: Impact of land acquisition

Project Phase	Pre-construction	Construction	Operation
Anticipated Impacts	▪ Acquisition of land ▪ Resettlement of people ▪ About 200 households may be affected	Access restriction of local people to the site area including roads	People being forced to adopt to alternate roads, routes
Type of Impact	Negative	Negative	Negative
Degree of Impacts	Very High	Moderate	Low

5.2.3. Livelihood

The project site is currently used for fishing activities, and agriculture. As such, acquisition of this land will result in loss of livelihood activity areas. Furthermore, ships movement may affect fishing in the river. However, there are considerable ship movement ongoing for the nearby powerplant so differential impact from project will not be high.

Table 61: Impact on livelihood

Project Phase	Pre-construction	Construction	Operation	
Anticipated Impacts	▪ Removal of local market ▪ Removal of small local shops	▪ Work opportunities ▪ Business opportunities	▪ Disturbance to fishing activities by ships movement ▪ Destruction of fish habitat and	▪ Work opportunities ▪ Business opportunities

	▪ Loss of agricultural lands ▪ Loss of grazing lands ▪ Disruption to fishing activities		migration from pollution	
Type of Impact	Negative	Positive	Negative	Positive
Degree of Impacts	Very High	Moderate	Moderate	Moderate

Though there are possibilities of issues to fishing activities due to ships movement, there are already a considerable number of ships navigating through the river for the nearby coal power plan, upstream to the site. As such, differential issues from this industry will be moderate.

5.2.4. Education

The project will have some impact on education due to some educational facilities being situated within the acquisition area (one madrasa within site area), and in the surrounding area.

Table 62: Impact on education

Project Phase	Pre-construction	Construction	Operation
Potential Impacts	Displacement/Re-location of educational facility that are within site area	Disturbance to nearby academic institutions	Disturbance to nearby academic institutions
Type of Impact	Negative	Negative	Negative
Degree of Impacts	Very High	High	High

5.2.5. Labor Influx

During the construction and operation stage, considerable number of people will come from outside of the region to work on the project. There may be possibility of conflict or friction with local people.

Table 63: Impact from labor influx

Project Phase	Pre-construction	Construction	Operation
Potential Impacts	Friction or conflict between local people and outside labors	Friction or conflict between local people and contractor(s), outside labors	Friction or conflict between local people and facility employees
	Increased risk of infectious diseases from external workers		
Type of Impact	Negative	Negative	Negative
Degree of Impacts	Moderate	Moderate	Low

5.2.6. Health and Safety

Ship breaking is dangerous work, posing serious risks of accidents, and other safety hazards. Removal, storage and treatment of various hazardous materials, generated in the ship recycling process comes with a range of risks including risks of explosion or fire accident caused by flammable gas.

Table 64: Health and safety risks

Project Phase	Pre-construction	Construction	Operation
Possible Impacts	Some safety risks	▪ Occupational safety risks from construction works ▪ Risk of fire incidents during construction works	▪ Occupational safety risks from ship breaking activities including accidents, fall from height ▪ Health risks from hazardous materials ▪ Risks of fire or explosion ▪ Long term health issues like hearing loss
Type of Impact	Negative	Negative	Negative
Degree of Impacts	Low	Moderate	Very High

Ship breaking facility is generally high-risk area, posing various elements that may cause accidents, injure people.

5.2.7. Pollution induced social impacts

There are risks of a range of environmental pollution and it may affect the local people in many ways like soil pollution may have impact on agriculture, water pollution may have impact on fisheries. Similarly, pollution of groundwater or improper disposal waste may affect public health.

Table 65: Pollution risks to social conditions

Project Phase	Pre-construction	Construction	Operation
Possible Impacts	▪ Pollution of soil affecting agriculture ▪ Pollution of river affecting fisheries	▪ Pollution of soil may affect agriculture ▪ Pollution of river may affect fisheries ▪ Dust, emission, increased traffic may affect livestock	▪ Pollution of soil may affect agriculture ▪ Pollution of river may affect fisheries ▪ Pollution of groundwater may affect public health ▪ Dust, emission, increased traffic may affect livestock
Type of Impact	Negative	Negative	Negative
Degree of Impacts	Low	Moderate	High

1.1.1. Sensitive Public Place

There is graveyard, mosque within the selected site area that will be affected by the project as the land area is planned to be acquired and closed to local people.

Table 66: Impact on community facilities

Project Phase	Pre-construction	Construction	Operation
Possible Impacts	▪ Loss of access to graveyard or resettlement of graveyard ▪ Loss of access to mosque	-	-
Type of Impact	Negative	None	None
Degree of Impacts	Moderate	N/A	N/A

5.3. Impact Evaluation

As illustrated above, the project will possibly have a range of negative impact against some positive impacts.

Though at first glance it may appear to be lots of negative but few positive, most of negative impacts are potential, and can be avoided or mitigated through taking necessary steps.

Table 67: Following is a generalized comparison of the impacts

Type of Impact	Impact Parameters	Key Impact(s)	Positive	Negative	Overall Significance	Remarks
Environmental	Geology and Geography	Land use change		√	Low	Unavoidable
	Environmental Sensitive Areas	Adverse impact on sanctuary		√	Moderate	Potential
	Air	Degradation of Air quality		√	Moderate	Unavoidable
	Vibration	Vibration generation		√	Moderate	Unavoidable
	Noise	Increase in noise levels		√	Moderate	Unavoidable
	Hydrology	Some change in local hydrology		√	Low	Unavoidable
	Water	Pollution of water risking public health, and biodiversity		√	Moderate	Unavoidable
	Soil	Contamination from chemicals, affecting agriculture and forestry		√	Moderate	Potential

Type of Impact	Impact Parameters	Key Impact(s)	Positive	Negative	Overall Significance	Remarks
	Flora	Cutting of trees for		√	Moderate	Unavoidable
	Fauna	Some disturbance to local and aquatic fauna		√	Low	Possible
	Biodiversity, Natural Habitat	Disturbance to fish migration, turtle breeding, frogs			Moderate	Possible
	Natural Calamity Induced Catastrophe	Accidents, and spreading of harmful substance		√	Moderate	Potential
Socio Economic	Economy	Improvement of local and regional economy	√		Very High	Unavoidable
	Land Acquisition and Resettlement	People losing homes and lands		√	High	Unavoidable
	Livelihood	Loss of agricultural lands, disruption to fishing	√	√	High	Unavoidable
	Education	Displacement of some education facility		√	Moderate	Potential
	Labor Influx	Issues from people coming from outside of the area to work		√	Low	Potential
	Pollution	Issue with agriculture, fisheries, public health		√	Moderate	Potential
	Sensitive Public Place	Access restriction to graveyard, mosque		√	Moderate	Potential

As outlined in this table, few environmental and social negative impacts like Air, Noise, Cutting trees, Land acquisition are unavoidable but the pollution of the surrounding natural environment and built-up area is a possibility that may occur if proper pre-cautions are not adopted from the beginning.

6. Mitigation Measures

Necessary mitigation measures are essential to counteract adverse impacts of the projects to maintain balance and ensure sustainability. Following are some initially identified mitigation measures that may aid in managing the impacts from the project:

Table 68: Ideal Required Mitigation Measures

Serial No.	Impact Parameters	Project Phase	Negative Impacts	Mitigation Measures	Remarks
			Environmental Impacts		
1)	Geology and Geography	Pre-construction	▪ Land use change ▪ Land cover change ▪ Dust from Materials stacking	Cover loose construction materials	
		Construction	▪ Dust from construction activities ▪ Increased traffic and movement on the landmass	▪ Minimize dust by spraying water ▪ Cover loose construction materials	
		Operation	▪ Impact on river channel due to river bank protection/river training works ▪ Erosion on opposite bank	▪ Monitoring of the river bank erosion pattern ▪ Take protective measures to reduce erosion risk	
2)	Environmental Sensitive Areas	Pre-construction	▪ Dust, noise from preparatory activities ▪ Increased population density in the region	○ Consult with Forest Department office(s) prior to initiating works	
		Construction	▪ Dust, noise, emission from construction ▪ Increased traffic movement in the region	○ Minimize dust by spraying water ○ Cover loose construction materials	

				○ Prepare and follow a traffic plan ○ Regular maintenance of machines to reduce emission ○ Limit construction activities within day time	
		Operation	▪ Adverse impact on wildlife sanctuaries from exposure harmful substances from the ▪ Adverse impact on natural forestry from contamination of pollutants	○ Adopt to the best practices for waste management ○ Maintain cautionary measures to avoid any leakage of waste materials outside compound ○ Ensure proper disposal or recycle of wastes by choosing suitable landfill location under TSDF or complaint vendors	
3)	Air	Pre-construction	▪ Dust, and emission from preparatory activities	○ Minimize dust by spraying water ○ Cover loose construction materials	
		Construction	▪ Dust, and emission from construction	○ Minimize dust by spraying water ○ Cover loose construction materials ○ Prepare and follow a traffic plan	

				○ Regular maintenance of machines to reduce emission ○ Limit construction activities within day time	
		Operation	▪ Dust generation from industrial works including harmful particles like paint, rust ▪ Air quality degradation from spreading of toxic and hazardous materials. ▪ Fumes from waste oils ▪ Emission from equipment	○ Minimize dust by spraying water ○ Maintain cover for toxic pollutants generating activities ○ Regular maintenance of tools, and equipment ○ Regular monitoring of air quality	Unavoidable
4)	Noise	Pre-construction	Noise from preparatory activities	Activities should be scheduled in daytime.	
		Construction	Noise from construction, and increased vehicular movements	○ Maximum allowable noise level regulation shall be maintained for areas near mosque, school, residences and other sensitive locations ○ Construction works near residential areas should during in daytime only, ○ Measures shall be taken to lower noise from equipment	

		Operation	Noise from industrial activities, and increased vehicular and waterway movements	○ Maximum allowable noise level regulation shall be maintained for areas near mosque, school, residences and other sensitive locations ○ Construction works near residential areas should during in daytime only, ○ Measures shall be taken to lower noise from equipment ○ Ships movement shall be limited to 10 PM	Unavoidable
5)	Surface Water	Pre-construction	Pollution of water channels from waste materials	Prevent dumping of any waste into waterbodies	
		Construction	▪ Pollution of water channels from solid and liquid wastes from construction ▪ Filling up of local small waterbodies like ponds	○ Rainfall run-off from the construction site need to be captured to prevent deposal into natural waterbodies ○ Wastewater shall be collected, re-used and/or disposed of off-site after oil/grease removal and settlement of suspended solids. ○ Site-specific management plan needs to prepared	

				before starting the work at Payra River for the ecological sensitivity.	
		Operation	▪ Pollution from movement of ships ▪ Pollution from leakage of solid and untreated liquid wastes ▪ Contamination from leakage of toxic/hazardous waste	○ Prevention of oil spills/leakage into natural water bodies by removing oil residues inside ships with MDS before breaking works. ○ Cutting works and equipment maintenance works to be undertaken only inside dedicated concrete-floor cutting area. ○ Oily parts to be stored inside dedicated concrete-floor storage area. ○ Monitoring of Water Quality	
6)	Ground Water	Pre-construction	Change in water extraction pattern		
		Construction	▪ Oil leakage, ▪ Sewage leakage	○ Extraction of groundwater shall be from optimum location to minimize impact on local tubewells ○ Areas of oil and liquid wastes shall be made impermeable to prevent leakage	

				○ Pollution prevention plan will be prepared and followed to prevent groundwater from contamination and protection of aquifer cross contamination.	
		Operation	▪ Contamination from Oil leakage, Sewage leakage ▪ Pollution from seepage of untreated liquid waste	○ Oil use or extraction areas shall be impermeable concrete-floor. ○ Rainfall runoff shall be prevented from draining without treatment. ○ Monitoring of water quality.	
7)	Soil	Pre-construction	▪ Increased erosion	Preparatory works shall be carried out during dry season	
		Construction	▪ Contamination from waste materials generated during construction period	Proper waste disposal practice shall be adhered to including: ○ Only dumping organic or kitchen waste in pits on the ground. ○ Prevent spillage of oil.	
		Operation	▪ Contamination from Oil leakage, sewage leakage, heavy metals ▪ Pollution from soild and liquid wastes including toxic/ hazardous wastes	○ Oil use or extraction areas shall be impermeable concrete-floor.	Potential

			▪ Degradation from disposal of industrial/chemical wastes, affecting agriculture ▪ Salinity intrusion from embankment damage/breach	○ Harmful wastes shall be contained at all stages. ○ Metal scraps shall not be stored directly on the ground but with some barriers	
8)	River bed/ Sediment	Pre-construction	Increased erosion		
		Construction	Contamination from waste materials generated during construction period	Construction works shall be carried out with caution to avoid disposing wastes into river(s)	
		Operation	▪ Contamination from Oil leakage, sewage leakage, heavy metals ▪ Pollution from soild and liquid wastes including toxic/ hazardous wastes ▪ Degradation from disposal of industrial/chemical wastes, heavy metals ▪ Disturbance due to dredging in future	○ Facility operation shall be done carefully to avoid disposing wastes into river(s) ○ Dredging shall be done in accordance with environmental regulations	
9)	Flora	Pre-construction	About 808 nos. trees will be cut.	Trees can be cut in phases, based on site specific needs than cutting all trees at once	
		Construction	Trees in the locality may be affected by dust, emissions	Plant some trees at empty spaces	
		Operation	Some trees will be planted	Plant and maintain trees	
10)	Fauna	Pre-construction	About 808 nos. trees will be cut, risking habitation of bids in the area.	Forest Department shall be consulted for discovery of any bid nest or other habitats	

		Construction	Loss of habitats for some small animal species.	○ Limit the construction works within the designated sites allocated to the contractors. ○ Minimize the tree removal during the bird breeding season (February-July). ○ Minimize the release of oil, oil wastes or any other substances harmful to migratory birds to any waters or any areas frequented by migratory birds. ○ Provide adequate knowledge to the workers regarding protection of flora and fauna, and relevant government regulations and punishments for illegal poaching	
		Operation	Habitation of some aquatic species including fish, dolphin, turtles may be disturbed by ships movement, pollution, and industry operation.	○ implementation code of conducts to workers, including no catching or hunting fish and wildlife, and no consumption of wildlife products.	Possible

				○ Training and awareness on the importance of biological diversity, and its relationships with sustainable development.	
11)	Biodiversity, Natural Habitat	Pre-construction	Disturbance to aquatic habitat from noise, pollution.	○ Minimize the tree removal during the bird breeding season (February-July). If works must be continued during the bird breeding season, ○ A nest survey shall be conducted by a qualified biologist prior to commence of works to identify and located active nests.	
		Construction	Disturbance to and aquatic and amphibian habitats from noise, pollution, increased movements.	○ Limit the construction works within the designated sites allocated to the contractors.	
		Operation	Disturbance to, or loss of aquatic and amphibian habitats from noise, pollution, increased movements.	○ Minimize the release of oil, oil wastes or any other substances harmful to migratory birds to any waters or any areas frequented by migratory birds.	

				○ Provide adequate knowledge to the workers regarding protection of flora and fauna, and relevant government regulations and punishments for illegal poaching.	
12)	Natural Calamity Induced Catastrophe	Pre-construction	▪ Displacement of construction materials ▪ Increased accidents ▪ Increased erosion	A flood risk study of the site shall be carried out to determine flood quantities within the plant area and to estimate peak flood to determine the peak flow for the return period of 25 years.	
		Construction	▪ Displacement of construction materials ▪ Increased accidents ▪ Increased erosion ▪ Displaced construction materials causing accidents ▪ Increased risk of disasters due to replacing embankment	Disaster preparedness including construction and maintenance of embankment with bank/shore protection	
		Operation	▪ Displacement of harmful substances by high wind, rain water, storm surge ▪ Pollution of surrounding areas ▪ Increased accidents ▪ Increased need for shelters	▪ Maintenance of disaster risk reduction infrastructures ▪ Monitoring of river banks for erosion ▪ Liaison with early warning providers ▪ Periodic drills for fire, evacuation,	

				emergency site management ▪ Identify shelter areas	
Socio Economic Impacts					
13)	Economy	Pre-construction	Work opportunities	Provide some opportunities to local people.	
		Construction	▪ Work opportunities ▪ Business opportunities	○ Allocate some work to the local poor and affected people during recruitment. ○ Gender equity and equal wage have to be ensured.	
		Operation	▪ Work opportunities ▪ Business opportunities ▪ Possibility of new business creation	○ Allocate some work to the local poor and affected people during recruitment. ○ Gender equity and equal wage have to be ensured.	
14)	Land Acquisition and Resettlement	Pre-construction	▪ Acquisition of land ▪ Resettlement of people ▪ About 200 households may be affected	○ Land acquisition and resettlement plan has to be prepared ○ Proper compensation and other necessary support have to be allocated in accordance with Resettlement Plan (RP)	Unavoidable

15)	Livelihood	Pre-construction	▪ Removal of local market ▪ Removal of small local shops ▪ Loss of agricultural lands ▪ Loss of grazing lands Disruption to fishing activities	A compensation program for employment of affected households may be undertaken.	
		Construction	▪ Work opportunities ▪ Business opportunities	Provision shall be kept for economic opportunities to be accessed by local people	
		Operation	▪ Disturbance to fishing activities by ships movement ▪ Destruction of fish habitat and migration from pollution ▪ Work opportunities ▪ Business opportunities	Some quota for work opportunities of local people can be provisioned.	Unavoidable
16)	Education	Pre-construction	Displacement/Re-location of educational facility that are within site area	Consult with the affected madrasa to determine amicable solution to their relocation	
		Construction	Disturbance to nearby academic institutions	Minimize construction activity during day time, limit construction activity within designated areas	
		Operation	Disturbance to nearby academic institutions	Maintain liaison with educational institutions that maybe affected	
17)	Labor Influx	Pre-construction	Friction or conflict between local people and outside labors	Stakeholder consultation and disclosure of the facility plan	
		Construction	Friction or conflict between local people and contractor(s), outside labors	○ Engage a communication	

				officer to maintain liaison with local community ○ Keep an option for people to submit any complaints ○ Train and inform labors about being cautious regarding mixing with local communities	
		Operation	Friction or conflict between local people and facility employees	○ Engage a communication officer to maintain liaison with local community ○ Keep an option for people to submit any complaints ○ Train and inform facility personnel about being cautious regarding mixing with local communities	
18)	Pollution Induced Social Risks	Pre-construction	▪ Pollution of soil affecting agriculture ▪ Pollution of river affecting fisheries	○ Keep an option for people to submit any complaints ○ Compensate for any damage caused by facility activity	
		Construction	▪ Pollution of soil may affect agriculture ▪ Pollution of river may affect fisheries ▪ Dust, emission, increased traffic may affect livestock	○ Keep an option for people to submit any complaints ○ Compensate for any damage	Potential

				caused by facility activity	
		Operation	▪ Pollution of soil may affect agriculture ▪ Pollution of river may affect fisheries ▪ Pollution of groundwater may affect public health ▪ Dust, emission, increased traffic may affect livestock	○ Keep an option for people to submit any complaints ○ Compensate for any damage caused by facility activity	
19)	Sensitive Public Place	Pre-construction	▪ Loss of access to graveyard or resettlement of graveyard ▪ Loss of access to mosque	Consult the local community, users of these places to find out an amicable solution for relocation or allow restricted access	Potential

7. Environmental Monitoring

The monitoring program includes of making systematic observation, collection, examination, measurement and evaluation of both physical view and chemical aspects of Environmental Quality Key Parameter ‘s pollution levels in water, soil/sediment and air in and adjacent areas of ship scrapping yards. The purpose is to provide an authentic record/data of the baseline water, soil and air quality along with oily wastes discharges, solid waste disposal and domestic sewage quality levels associated with the operational activities of the yards. The monitoring of the following ‗Environmental Quality Key Indicators ‘will have to be carried out by the yards on regular or periodical basis as deemed necessary and be recorded for inspection and evaluation as and when necessary:

- Oily wastewater effluent discharges
- Ambient water and sediment quality
- Smoke emission to air
- Public complaints regarding impacts on flora and fauna.

Table 69: Environmental Monitoring of adjacent areas of ship scrapping yards

Key parameters to be monitored: (i). Oily wastewater effluents discharge analysis			
A	B	C	D
Samples of oily effluent to be collected from separator tank after treatment before discharge to the environment.	Routine analysis	Oil & grease, BOD, COD, TDS, TSS.	Report compilation for BSBA record.
Key parameters to be monitored: (ii). Ambient water quality analysis			
A	B	C	D
Coastal water samples from selected sites within yards jurisdiction.	At least twice in a year (one in wet and other in dry season)	DO, BOD, COD, Oil & Grease, heavy metals, pesticides etc.	Report compilation for BSBA record.
Key parameters to be monitored: (i). Ambient sediment quality analysis			
A	B	C	D
Sediment samples from selected sites within yards jurisdiction.	At least twice in a year (one in wet and other in dry season)	Organic content, Oil & Grease, Nutrient, Metals, Pesticides, etc.	Report compilation for BSBA record.
Key parameters to be monitored: (ii). Smoke emission to air			
A	B	C	D

Emission mode	As and when required	SPM, SOx, NOx	Report compilation for BSBA record.
Key parameters to be monitored: (iii). Public complaints regarding impacts on flora and fauna will be handled appropriately.			

Table 70: Periodic monitoring requirements of the essential environmental parameters

Serial No.	Monitoring Parameter	Frequency	Responsibility
9	Air quality	Quarterly	BSEC/Industry authority
10	Noise level	Monthly	BSEC/Industry authority
11	Surface Water Quality	Quarterly	BSEC/Industry authority
12	Ground Water Quality	Bi-annually	BSEC/Industry authority
13	Soil and Sediment quality	Annually	BSEC/Industry authority
14	Health checkup	Bi-annually	BSEC/Industry authority
15	Disturbance to Forest area	Bi-annually	BSEC/Industry authority (in coordination with Forest Department)
16	Public liaison	As needed	Communication option for local community people shall kept open for them to be able to submit any complaints or concerns
Other	Other tests may be needed for specific reasons like complaints or accidents		

Monitoring reports shall be prepared and submitted to higher authority of BSEC for record keeping. The report will be shared with external stakeholders if needed or requested.

8. Environmental Management Plan

The Environmental Management Plan (EMP) is a comprehensive set of process, practice, guidelines to ensure implementation of the required mitigation measures for sustainable industrial practices.

8.1. Introduction

The EMP will outline a practical action step to address the environmental compliance. This will serve as an instrument to sustainable project implementation throughout the lifecycle of the project. It is also essential to obtain and renew environmental clearance.

8.2. Environmental Policy

The Implementing Agency BSEC is committed to ensuring sustainable industrial operation.

Health and Safety: The Health, Safety, and Environment (HSE) Management System is an essential and integral component of the environmental management system for a safe and secure working environment assuring sustained development. HSE issues and aspects are outlined in ESMP with mitigation measures based on principles of best management practices. To oversee the matters about environment, health, and safety, it is recommended that the proponent set up a unit dedicated to the environment, health, and safety management of the project. Alternatively, the management may hire and appoint an environmental office for the project to look after the environmental and health safety aspects of the project.

Resource Conservation:

- Water conservation practices shall be followed during the construction and operation phase of the project.
- Reduce, reuse, and recycle approaches shall be used to minimize waste generation.
- Recyclable waste shall be segregated and handed over to the recycling contractor.
- Energy-efficient equipment and lighting shall be preferred.
- Construction workers shall be sensitized to switch off the machinery/equipment when not in use to save energy and fuel.

Landscaping and Green Belt Development Plan: The site restoration phase will include landscaping of the project area and the development of a green area with grass and plantation of trees in the project vicinity. This will improve the aesthetics of the microenvironment and increase local flora. The objective shall be to ensure a green cover providing a conducive ambient environment. During the plantation, local species will be selected. The general guidelines the for development of greenbelt are:

- Trees able to grow up to 5 m or more should be planted along the premises and the roadsides
- Plantation should be done in rows.
- Open areas inside the plant boundary should be covered with grass lawns.
- Local species of the plants should be selected for plantation.

8.3. Environmental Compliance Requirements

Following standards need to be complied with by the industry:

- Environmental and social laws, rules, and regulations of the Government of Bangladesh including ECR 2023, ARIPA 2017

- Minimize adverse impacts on the society and environment by adopting appropriate cautionary measures
- Ensure environmental and social sustainability
- Counteract any anticipated impact from the project

8.4. Environmental Management Procedures

An Environmental Management Plan (EMP) is essential to implement the mitigation measures during the project works. A preliminary EMP is provided below:

Table 71: Planned Actions under Environmental Management Plan

Phase	Impacts requiring Mitigation	Management Plan	Responsibility
Pre-construction phase	Land acquisition	Coordination with DC office to ensure timely payment of affected people	BSEC
	Resettlement	Allow necessary time to affected people for removing their houses and other properties	BSEC
	Cutting trees	○ Consult forest department before cutting down trees, and ○ Contact forest department if any wildlife or bird presence	BSEC, Contractor
	Dust, Noise from preparation	○ Fencing of site area before commencing any activities, ○ Water spraying system need to be made available ○ Covering of loose materials like sand with tarpaulin or similar sheets	Contractor
	Cutting Embankment	○ Consult with BWDB before cutting existing embankment and any other hydraulic structure ○ Consult BWDB for the protection requirements of the area	BSEC, Contractor
Construction phase	Dust Reduction	○ Onsite dust suppression measures for dust catchment and reduction of dust should be implemented. In this case, spray water, mist and good-quality equipment should be used during construction. ○ Heavy machines like excavator, soil compactor, sand-filling trucks, drilling apparatus should be effectively used so that dust propagation is minimum	Contractor
	Noise Reduction	Noise reduction efforts will be made in the forms of : ○ Covering parts of noise generating Equipment (e,g. Rock/brick breaking machine)	Contractor

		○ Operating some loud noise creating equipment within enclosed rooms (e.g. generator) ○ Use of ear mufs mandatorily for workers engaged during construction should be practiced	
	Emission	○ Regular maintenance of Equipment to reduce emission ○ Use Gas-free masks, and respirators should be mandatorily used by workers during construction work	Contractor
	Solid and Liquid waste	○ Industrial wastes like oil and lubricants, metals type substances shall be sold to outside vendors for backward linkage uses ○ Local bio-degradable wastes can be dumped in pits or landfilled ○ Proper sanitation practices must be maintained to avoid any risk of fecal contamination ○ Toilets must be installed at least 10m away from tubewells or other water sources, ○ Toilets shall be at adequate distance from river bank to avoid risk of getting wastes into river ○ Liquid construction wastes, slurry shall not dumped directly into water channels	Approved/Certified Waste Contractor
	Increased traffic	○ Awareness campaign shall be arranged for local areas ○ A traffic management plan should be adopted including ○ Flag man/signalman shall be appointed ○ Safety signage on boards shall be installed ○ Walkways shall be segregated for man entry and exit ○ Road signage shall be effectively used for entry and exit of heavy vehicles	Contractor
	Increased people onsite	○ People coming for site work should refrain from making any unnecessary engagement with the local community to avoid local conflict, and commotion ○ A communication officer should be appointed to maintain liaison with local people	Contractor

		○ Workers need to be trained and instructed to avoid unnecessary mix with local people	
	Health and Safety risks	○ Maintain provison for Personal Protective Equipment (PPE), Safety boots, Ear muffs/plugs, ○ Provision of Fire Fighting equipment, on site ○ Safety goggles and gloves for welding, and electrical works ○ Regular training on safety, fire fighting, disaster and emergency management procedures	Contractor
	Local Involvement	○ Some quota should be provisioned for employing local people	Contractor
Operation phase (During the Scrapping/Dismantling of Ships	Air, Noise, Dust pollution	○ Onsite availability of suppression systems like spraying water, and mist should be applied ○ Covering noisy equipment, and regular maintenance of mechanical equipment for emission control ○ Taking adequate measures during gas and LPG cutting of ships, secondary plate cutting for ensuring less emission of smoke–surface treatment, and detergent based scrubbing or cleaning of the ferrous and non-ferrous metals for eradication of fumes during cutting should be maintained. ○ During heavy equipment operations and noisy jobs, proper PPE with a noise barrier mechanism within the yard has to be ensured. Ear muffs/ear plugs should be provided to the engaged staff	Industry
	Increased vehicular and waterway movement	○ Maintain traffic management plan for land vehicles, and maintain laison with local people to avoid commotion or unnecessary public intervention. In this case, designated Security officer or Facility supervisor should take the responsibility ○ Coordinate water movement to minimize the impact on fishing activities ○ Aware and in advance notification to local fishermen to stop fishing activities during the day of an EOL ship's arrival so	Industry

			that chances of any unforeseen accidents and hazardous situations may be avoided	
	Increased movement and habitation of people	○	People coming for site work should refrain from making any unnecessary engagement with local community to avoid local conflict, and the facility should have communication officer to maintain liaison with local people	Industry
	Breaking of ships that will generate harmful pollutants like paint, rust, oil, toxic wastes, human wastes	○	Take all possible pre-cautionary measures to confine all toxic and harmful waste within the facility, and regularly dispose of waste materials that are planned to be disposed outside. In this case, as per MEPC guidelines, a detailed mapping for disposal and treatment of hazardous wastes has been elaborated which must be strictly followed to comply with the HKC	Industry
	Health and Safety risks	○ ○ ○ ○ ○ ○ ○ ○	Maintain provison for Personal Protective Equipment (PPE), Safety boots, Ear muffs/plugs, Hand gloves, Safety Goggles during work at all times Ensure that not more than a 4 hour hot work permit is given to only designated cutters Fire fighting equipment, safety goggles, hazmat suits, training, emergency management plan, disastr prevention, and emergency response during dangerous situation should be adequately practised as drills during regular operations Standby paramedics with ambulance must be stationed Regular toolbox meetings should be addressed All should practise assembling at the emergency points during the advent of any emergency preparedness Welding gloves, goggles should be strictly worn during all electrical or welding works, and also during performing incineration activities Hazmat suits/equipment for handling toxic/hazardous wastes	Industry

		○ Self contained breathing apparatus (SCBA) must be used during confined space cutting inside of ships, and during rescue and search operations ○ Proper light and visibility shall be ensured during ship cutting at dark and confined spaces or small places where entry is done by manholes ○ Proper safety harness shall be fitted during working at height in order to prevent accidents ○ Multi-gas meters and other safe ship cutting practices shall be strictly followed during gas cutting at ships onboard and especially at the aft part – engine room cutting ○ Slips and trips should not occur and only designated or marked areas for walkways and vehicular movement plan shall be strictly maintained or followed	
	Accidents	○ On site medical facility must be kept operational to treat minor injuries ○ Treatment plan must be in place for all kidns of injuries including provision of hospitalisations for serious situations ○ Compensation plan shall be in place for death of any working person during industry related services	Industry, BSEC
	Disaster Management	○ Ensure construction of disaster protection measures like embankment and bank/shore protection ○ Evacuation plan for safety during cyclones/earthquakes, ○ Identify shelter locations ○ Prepare emergency facility shut down procedures	Industry, BSEC
	Waste management	○ Non-toxic industrial wastes like glass wool (intact), oils and lubricants shall be sold to outside vendors ○ Organic waste like kitchen waste will be dumped in a pit on the ground ○ Liquid wastes will be treated in ETP and then incinerated as per guideline or standard	Industry/Approved or Certified HAZMAT Handlers/Municipal Corporation

		○ HAZMAT wastes like PCBs, TBTs, ODS, Radioactive substances, and metal chips shall be stored in the HAZMAT rooms designated until disposed of and transferred to the TSDF facility.Rest IHM Part 1 to 3 treatement and storage shall be done as per the MEPC guidleines which are elaborated in this report ○ Oil and bilge along with balasst water shall be treated in the Oily Water Separator (OWS) Facility ○ Solid and liquid HAZMATS will be visually inspected, and sampled for testing as a part of the IHM procedures by certified HAZMAT handlers ○ Proper management of all facility waste including kitchen waste, human waste, industrial waste shall be ensured. STP shall be used to treat grey and black water ○ All process of toxic and hazardous waste management shall be followed as per the project plan ○ Rainfall runoff carrying of waste materials to the river must be prevented by treatment of the water retain the water onsite for facility use ○ Proper drainage facility will be implemented to ensure the containment of waste water and easy discharge of fresh or treated water back to the river	
	Local improvement/ Involvement	○ Some quota should be provisioned for employing local people	Industry
	Tree plantation	○ Adequate number of trees must be planted and nurtured to balance for the cutting of trees	Industry

	Environmental Monitoring and Management	○ Periodic environmental monitoring and taking necessary mitigation measures for any newfound environmental issue	Industry

Most of the impacts on the environment can be mitigated or at least minimized by implementing the environmental management and monitoring plans strictly. However, the major residual impact of the excavation program is the disturbance to the benthos on the bed of the river. The upper layer of the bed will be excavated and the benthos living there will be destroyed temporarily. The benthic environment is very important for the ecosystem. Macro-faunal communities typical of environmentally stressed or high energy habitats are more resilient than those of more environmentally stable habitats. Invertebrate recovery following excavated material disposal in relatively unstressed marine environments generally takes between 1 and 4 years, while in more naturally stressed areas, recovery is generally achieved within 9 months.

Safety: All contractors, sub-contractors, and contract workers will be made aware of environmental aspects and the Emergency Response Plan before commencing the work. Before leaving the site contractors, sub-contractors and contract workers will ensure that their work area is in a safe position. On emergency calls, they will report in the assembly area. Written procedures or standards will be prepared for all activities, where the absence of such procedures and standards could result in not following HSE policy, the law, or the contract. Safe Working Procedures should be based on the following four aspects of job safety:

a) Safe Place: The work site will be designed, and controls set up to ensure that the working environment provides no significant risk to personnel, property, and the environment.
b) Safe Equipment: All equipment for any job, including tools, machinery, and protective equipment will be specified and/or designed to ensure that it poses no significant risk to personnel, property, or the environment. All equipment will comply with legislative standards for conformity and testing. Standard Operating procedure of all equipment will be documented and made available on site.
c) Safe Procedure: Procedures will be designed for all aspects of the job to facilitate the use of the equipment at the work site to complete tasks with no significant risk to personnel, property, or the environment. The design of the procedure will be based on a step-by-step analysis of the tasks involved (Job Safety Analysis), identification of associated hazards, and elimination of control of those hazards. Procedures should allow for work in ideal conditions as well as under aggravating conditions e.g., adverse weather.
d) Trained Personnel: Suitable job-specific, safety skills and supervision training will be provided to personnel involved in construction and operation activities so that they can use the procedure and equipment at the worksite with no significant risk to personnel, property, and environment.

Safe Working Procedures will be available to contractors and sub-contractors, who will adopt the relevant labor laws of the country.

Training: This is a very important part of EMP implementation. All the employees will be required to be trained appropriately to work on ESMP effectively. Employee training can help workers minimize waste generation, and conserve resources such as water. The HSE Officer will determine the training requirements in consultation with senior managers. Regular biweekly safety training for all workforce shall be ensured in accordance with the IMO Regulations or training modules adopted by JICA. Specific activity-based practical ship-cutting training with video demonstration or physical demonstration by trainers should be

incorporated. In addition, all workers will be trained in the proper use of PPE, equipment or devices, and cutting tools or apparatus for electrical or welding-related works. Also, emergency medical training or rescue training at times of severe hazardous situations should be conducted once every month. Besides, daily toolbox talks, fire, and mock drills should be emphasized. BSBRA training for workers or staff along with IMO awareness training programs conducted by the Ministry of Industries shall be adopted at least twice a year.

8.5. Environmental Surveillance, Monitoring and Auditing

Implementation and Supervision: During project operations, the main responsibility for environmental performance will be supervised by the General Manager while the daily management will be performed under the Admin Manager supervising the HSE Officer.

Monitoring: During operations, the Project Manager will follow the monitoring plan as mentioned in the ESMP. He will keep a record of all environmental non-compliances and report them along with the corrective actions in meetings with the top management.

Meetings: Meetings are an important source of information exchange and will be held periodically during the project to discuss any hang-ups in the project. Environmental monitoring and performance will also be taken up in such meetings to evaluate the extent the ESMP requirements are being met. The following meetings will take place during the project in addition to other meetings:

- Project initiation meetings (once for each of the contractors).
- Fortnightly meetings

The purpose of the project progress meetings will be to discuss the progress of ESMP and ensure full understanding and commitment from concerned parties for its implementation. Meetings will be held periodically during the construction phase. The purpose of the meetings will be to discuss the progress of construction, any non-compliance observed, and any environmental, health, or social issues identified at the project site. The remedial measures will also be discussed and agreed upon during these meetings. The meetings will be recorded in the form of a report prepared by the designated Officer.

Audit: Environmental auditing will be carried once every year by an outside professional/firm.

8.6. Contingency Emergency Response Planning

Procedures for times of emergency need to be established and followed.

Emergency Response Plan (ERP) for pre-construction and construction phase, and for operation phase are provided below:

i. ERP for Construction Period

ERP for construction period includes the following components:

1). Accidents

- On-site medical facilities including first-aid

First-aid boxes will be kept at the facility with the medicines being updated regularly.

- On call doctors

The contractor will have agreement with a qualified doctor from the area who will be available to visit the industry for routine checkups of workers, and treatment or moderate injuries.

Routine health checkups:

- Hearing
- Blood Pressure
- Heart rate

Moderate injuries:

- Fractures
- Concussion

➢ Ambulance facilities

The contractor will have agreement a local Ambulance service providers to ensure 24x7 ambulance service for emergency medical situations.

➢ Nearby hospitals

The contractor will have agreement with a local hospital/clinic to provide necessary treatments for emergency medical situations.

1). Fire and Electrical Hazards

➢ On-site firefighting equipment

Adequate firefighting equipment must be in place. Extinguishers must be changed when expired.

➢ Electrical Safety

Temporary electrical lines will be checked regularly. Emergency shut down procedure must in place for events of electrocution.

2). Natural Disasters

➢ Evacuation

Evacuation routes and assembly points for events of fire needs to be identified and marked appropriately.

➢ Shelter

Shelter for natural calamities must be identified and everyone onsite should be informed.

➢ Drills

Periodic disaster safety drill must be carried out, especially for cyclones, and earthquakes. Procedures for the aftermath of disasters shall be as following:

Issue	Post Disaster Measures
Project area is situated beside big river and as such it is prone to hazard of cyclonic storm surge and wave action. Tidal flood and monsoon rain may also affect the area.	• Assessment of damages and rectification • Carry out recovery procedure • Evaluation of functioning of disaster management plan

The time of recovery for rehabilitation after a disaster depends on the type and magnitude of the impact. The damage can be recovered within 2-3 days if proposed ship recycling industry is inundated and partly affected by a flood, storm or fire event. However, if there is more severe disaster such as impact by super cyclone, then clearing the debris safely after the incidence will take a few days (5-15 days) and reconstruction may take about 10-20 days. Moreover, repair of an equipment's will require about 5 days since maintenance engineer is expected to be on spot as part of the contingency plan. But it may take more than one month depending on damage/requirement and availability of the parts.

ii. ERP for Operation of Ship Breaking-Recycling Facility

Ship breaking is a serious industrial operation, posing high risks of harm to humans and surrounding environment. It is imperative to take necessary pre-caution in order to ensure safety and security of the people and the area. The Emergency Response Plan (ERP) includes the procedures for all the anticipated issues that may arise or incidents that may occur during the operation of industry. The procedures are comprised of different steps that's needs to be followed sequentially, as required.

Objectives of the ERP are the following:

- ❖ To provide guidelines during the times of emergency situations
- ❖ To provide the necessary information during the times of emergency situations
- ❖ To provide different tiers of solutions to hazardous incidents

Dismantling activities at the ship breaking facilities may result in several incidents and accidents, which may cause several types of damage. Oil residues and vapors may cause fire/explosion during cutting, falling objects may result in a variety of injuries. A survey of potential incidents and accidents will need to be carried out. A plan for response to incidents, injuries and emergencies should be prepared. Response to emergencies should ensure that:

- The exposure of workers should be limited as much as possible during the operation
- Contaminated areas should be cleaned and if necessary disinfected
- Limited impact on the environment at the extent possible.

Table 72: Anticipated Emergency Situations for the Facility

Serial No.	Situation	Category	Level of Risk
1.	Accident during ship docking	Health and Safety	Moderate

2.	Accident ship cutting	Health and Safety	High
3.	Accident during operating vehicles inside the industrial compound	Health and Safety	Moderate
4.	Sickness of Staff or Workers	Health and Safety	Low
5.	Fire inside industrial facilities	Industrial	Very High
6.	Fire outside facilities but inside the industrial compound	Industrial	Moderate
7.	Electrical Hazards	Industrial	Low
8.	Leakage of Gas	Industrial	Low
9.	Cyclone	Natural Disaster	High
10.	Earthquake	Natural Disaster	Low
11.	Flood	Natural Disaster	Moderate
12.	Leakage of toxic waste	Environmental	Very High
13.	Leakage of untreated solid waste	Environmental	Moderate

Incidents, accidents and emergency preparedness should be accounted during the entire ship breaking process. This shall be a part of Emergency Management System. Emergency Preparedness Plan (EPP) should be prepared following the national environmental emergency plan and OSHA guidelines. The purpose of having an Emergency Response Plan (ERP) is to:

- Assignment of the duties and responsibilities among the authorities, participating agencies, the response team and coordinators and/or those responsible for the pollution incident
- Relationship with other emergency plans
- A reporting system that ensures rapid notification in the event of a pollution incident
- The establishment of a focal point for co-ordination and directions connected to the implementation of the plan
- Response operations; should always cover these four phases
- Discovery and alarm
- Evaluation, notification and plan invocation
- Containment and countermeasures
- Cleanup and disposal
- Identification of expertise and response resources available for assistance for the implementation of the plan
- Directions on the necessary emergency provisions applicable to the handling, treatment or disposal of certain pollutants
- Link to the local community for assistance, if necessary

- Support measures, such as procedures for providing public information, carrying out surveillance, issuing post incident reports, review and updating of the plan, and periodic exercising of the plan

Steps of Emergency Response Plan shall be as following:

Steps	Procedures
Step 1	○ Determine the potential hazards associated with the incident, substance or circumstances and take appropriate action identify the type and qualities of dangerous goods involved and any known associated hazards. ○ Determine potential hazards stemming from local conditions such as inclement weather water bodies etc. and ensure that the initial response team is aware of these conditions.
Step 2	○ Determine the source/ cause of the event resulting to the emergency and prevent further losses.
Step 3	○ Conduct an assessment of the incident site for any further information on hazards or remedies.
Step 4	○ Initiate redress procedures.
Step 5	○ Report the incidence its nature cause impact applied redress procedures and any further assistance required etc. to the appropriate company, government and/or land owner.
Step 6	○ Take appropriate steps with respect to hazards to wildlife, other resources and addressing public and media concerns and issues, as applicable. Response priorities are to protect human lives, property and the environment.

Written procedures for different types of emergencies should be prepared and the entire workforce should be trained in emergency response. All relevant emergency response equipment should also be readily available.

With regard to dangerous spills, associated clean-up and fire-fighting operations should be carried out by specially allocated and trained personnel.

1). Accidents

➢ On-site medical facilities including first-aid.

First-aid boxes will be kept at the facility should with the medicines being updated regularly. In addition, a medical practitioner will be available onsite for treating minor injuries to staff or workers. Minor injuries include the following:

- Cuts
- Bruises
- Sprains

➢ On call doctors

The facility should have agreement with 2 qualified doctors from the area who will be available to visit the industry for routine checkups of workers, and treatment or moderate injuries.

Routine checkups:

- Hearing
- Blood Pressure
- Heart rate

Moderate injuries:

- Fractures
- Concussion

➢ Ambulance facilities

The facility should have agreement with 2 local Ambulance service providers to ensure 24x7 ambulance service for emergency medical situations.

➢ Nearby hospitals

The facility should have agreement with at least 1 local hospital to provide medical care for emergency medical situations.

2). Fire, Explosion

➢ On-site firefighting equipment

The facility should must have adequate firefighting equipment including fire suppression systems inside the facilities, and portable fire suppression systems including fire extinguishers (cylinders and balls) and sand buckets at appropriate places.

Fire extinguishers must be checked regularly to replace when expired. Fire suppression systems must be check regularly as part of plant maintenance.

➢ Fire Service and Civil Defence

Communication will be kept with local Fire Service and Civil Defence office to provide their services when needed included firefighting and rescue of trapped personnel. This is particularly important as there are chances explosion or serious incidents during ship breaking works.

➢ Evacuation

Evacuation routes and assembly points for events of fire needs to be identified and marked appropriately. Adequate number of fire wardens will be assigned to cover all areas of the industry.

➢ Fire Drills

The facility should will conduct fire drills every 3 months.

3). Natural Disasters

- Drills

Periodic disaster safety drill must be carried out, especially for cyclone, and earthquakes.

- Evacuation

Evacuation routes and assembly points for events of natural disasters need to be identified and marked.

- Emergency shut-down/closing procedures

Procedures will be in place to shut down the facility operation during the event of a natural disasters along with designated personnel to take the necessary steps.

4). Environmental Disasters

- Emergency Mitigation Measures

Some emergency mitigation measures will be identified and implementation preparations will be put in place to take necessary action during events of environmental disasters. Emergency measures will be applied within 48-72 hours of a relevant incident.

Sl. No.	Environmental Issue	After Event Measures for Business Continuity
1	Accident during the project construction phases	• Determination of the reason of accident • Revisit and revise the Accident preventions plan • Clearing the debris safely after the incidence
2	• Release of sediment laden water into the river during excavation/ dredging increasing turbidity of water • Sediment leakages from disposal pipes • Release of sediment laden water into the river during excavation/dredged materials disposal increasing turbidity of water.	• Notify to Department of Environment • Notify to the Fisheries Department • Take necessary enhancement actions to compensate the loss
3	Leakage or spillage of oil from equipment's and leakage of untreated waste from the industry	• Notify to Department of Environment • Notify to the Fisheries Department • Take necessary enhancement actions to compensate the loss
4	Health hazards of the project staff and labors during the construction and operation phase	• Ensure proper medical treatment of staffs

Sl. No.	Environmental Issue	After Event Measures for Business Continuity
5	Increase of noise during construction and operation phase	• Notify to Department of Environment
6	Degradation of air quality	• Notify to Department of Environment

Environmental specialist of the facility should will be responsible for implementing emergency mitigation measures.

- Assessment and Management for long term recovery

All environmental disasters resulting from the facility should will be assessed to identify appropriate mitigation measure to counteract the short, and long-term impacts of the incidents. Assessment of environmental disasters will be carried out by a panel of experts formed by external and internal professionals.

Written procedures for different types of emergencies should be prepared and the entire workforce should be trained in emergency response. All relevant emergency response equipment should also be readily available. With regard to dangerous spills, associated clean-up and fire-fighting operations should be carried out by specially allocated and trained personnel.

Response team: It is important to setup an Emergency Organization. A senior executive who has control over the affairs of the plant would be heading the Emergency Organization. He would be designated as Site Controller. Manager (Safety) would be designated as the Incident Controller. In the case of stores, utilities, open areas, which are not under the control of the Production Heads, Senior Executive responsible for maintenance of utilities would be designated as Incident Controller. All the Incident Controllers would be reporting to the Site Controller. Each Incident Controller organizes a team responsible for controlling the incidence with the personnel under his control. Shift In-charge would be the reporting officer, who would bring the incidence to the notice of the Incidence Controller and Site Controller. Emergency

Coordinators would be appointed who would undertake the responsibilities like firefighting, rescue, rehabilitation, transport and provide essential and support services. For this purposes, Security In-charge, Personnel Department, Essential services personnel would be engaged. All these personnel would be designated as Key personnel. In each shift, electrical supervisor, electrical fitters, pump house in -charge, and other maintenance staff would be drafted for emergency operations. In the event of power or communication system failure, some of staff members in the office/facility would be drafted and their services would be utilized as messengers for quick passing of communications. All these personnel would be declared as essential personnel.

Emergency Communication: Upon noticing any emergency situation such as fire, growth of fire, leakage, the person would inform his/her immediate superior, Emergency Control Center and local authorities. Also, there must be a provision for alarm system. The person on duty in the Emergency Control Center, would appraise the Site Controller. Site Controller verifies the situation from the Incident Controller of that area or the Shift In-charge and takes a decision about an impending On-site Emergency. This would be communicated to all the Incident

Controllers, Emergency Coordinators. Simultaneously, the emergency warning system would be activated on the instructions of the Site Controller. Further, emergency control centre would alert the ambulances and medical assistance group.

Emergency Responsibilities: The responsibilities of the key personnel should be defined for the following:

- Site controller
- Incident controller
- Emergency coordinator - rescue, fire fighting
- Emergency coordinator-medical, mutual aid, rehabilitation, transport and communication
- Emergency coordinator - essential services
- Employers' responsibility

Emergency Actions:

- Emergency Warning
- Evacuation of Personnel
- All Clear Signal
- Public information and warning
- Coordination with local authorities
- Mutual aid
- Mock drills
- Periodic maintenance and testing of safety equipment 's

8.7. Organizational Structure

The project will be initially implemented by BSEC, and then when operational, a new set of manpower will be responsible for the industry.

8.7.1. Implementation Period

The direct responsibility for implementation of the project will be by a project management office (PMO), that will be set up with the full authority and responsibility for the implementation of the project which shall have been endured since the time of approval of the DPP until the first day starting its intended operation. The PMO will be headed by a Project Director (PD) who shall have the full authority and responsibility for carrying out all activities and for successful completion of the project

A structure of the PMO is provided below:

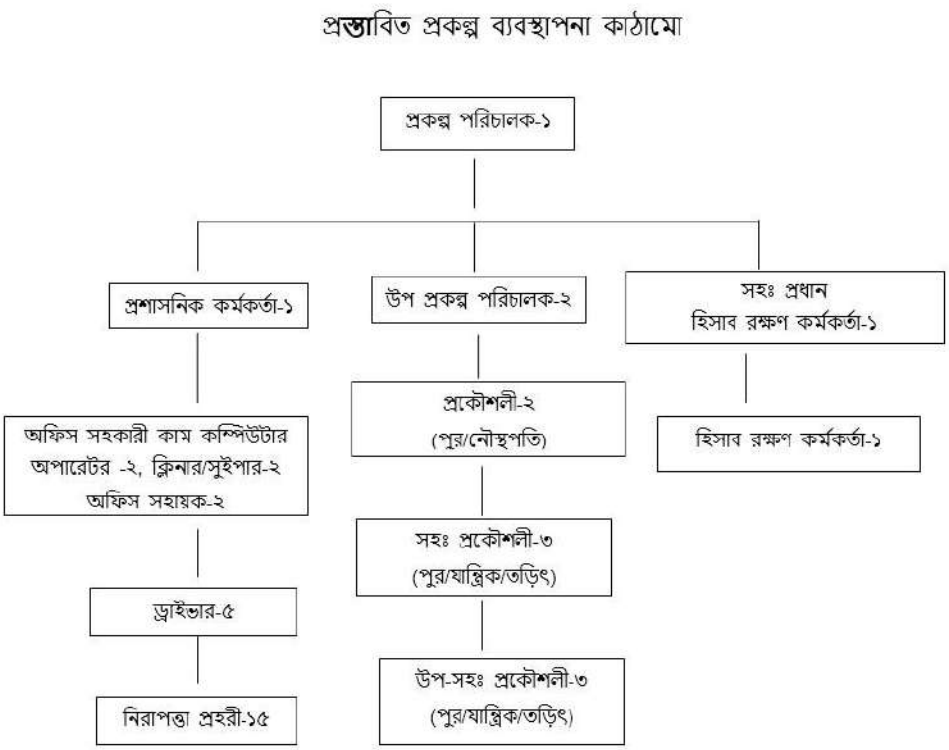


Figure *64*: Structure of Project Management Office (PMO) during Implementation

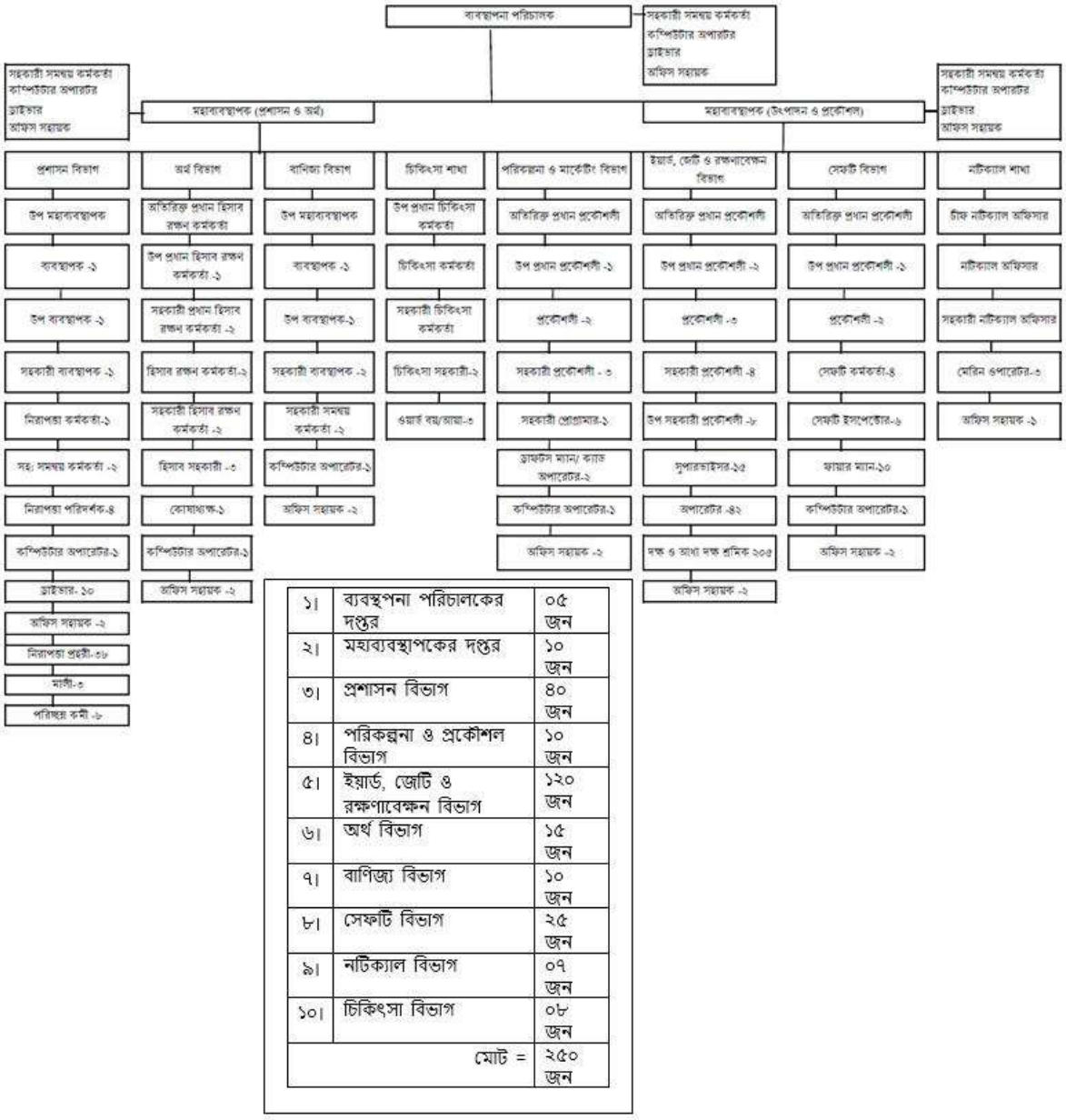
8.7.2. Operation Phase

The proposed ship recycling industry will become an industrial enterprise and will be operated under management of BSEC. The industry will be headed by as managerial director (MD), directly appointed by BSEC, who will have full authority and manage the overall activities of ship breaking yard. The management body will be divided in two wings overseeing by MD. The administrative, financial, trade, store and medical sectors will be governed under Admin and Finance wing. Ship breaking activities along with planning and marketing, navigational aspects and fire safety will be managed by Production and Engineering wing.

The estimated requirement of manpower is around 408 personnel including staff and workers. The staff will be directly employed. However, the workers would be outsourced to licensed contractors. Some operation and maintenance activities could also be outsourced to licensed contractors such as oil recovery, asbestos removal, etc.

Among the workers, skilled workers will be engaged in breaking works, winching of ship, hazardous material removal & handling and operation of material handling equipment. Other workers are semi-skilled workers or unskilled workers who will engaged in dismantling of detachable items, material sorting, loading and sundry works.

An organogram of the facility is provided below:



১।	ব্যবস্থপনা পরিচালকের দপ্তর	০৫ জন
২।	মহাব্যবস্থাপকের দপ্তর	১০ জন
৩।	প্রশাসন বিভাগ	৪০ জন
৪।	পরিকল্পনা ও প্রকৌশল বিভাগ	১০ জন
৫।	ইয়ার্ড, জেটি ও রক্ষণাবেক্ষন বিভাগ	১২০ জন
৬।	অর্থ বিভাগ	১৫ জন
৭।	বাণিজ্য বিভাগ	১০ জন
৮।	সেফটি বিভাগ	২৫ জন
৯।	নটিক্যাল বিভাগ	০৭ জন
১০।	চিকিৎসা বিভাগ	০৮ জন
	মোট =	২৫০ জন

Figure *65*: Organogram for operation and maintenance of the ship recycling facility

The environmental compliance implementation plan will be implemented by engaging the following personnel:

Table 73: Personnel requirement for EMP Implementation

Sl. No.	Required Professional	Qualifications	Employer
Construction Phase			
1	Environmental Specialist	- Bachelor's degree in environmental science, engineering or similar - Minimum 10 years of professional experience	Contractor
2	Safety Engineer	- Bachelor's degree in engineering or similar - Minimum 10 years of professional experience	Contractor
3	Social and Resettlement Specialist	- Bachelor's degree in social science or similar - Minimum 10 years of professional experience	BSEC
4	Communication Specialist	- Bachelor's degree in journalism or similar - Minimum 10 years of professional experience	Contractor
5	3rd Party Monitoring Consultant	- Master's degree in environmental science, engineering or similar - Minimum 10 years of professional experience	BSEC
Operation Phase			
1	Environmental Specialist	- Bachelor's degree in environmental science, engineering or similar - Minimum 10 years of professional experience	Industry authority
2	Safety Engineer	- Bachelor's degree in engineering or similar - Minimum 10 years of professional experience	Industry authority
3	Health Officer	- Para-Medical education or similar - Minimum 5 years of professional experience	Industry authority
4	Social Specialist	- Bachelor's degree in social science or similar	Industry authority

		- Minimum 10 years of professional experience	
5	Communication Specialist	- Bachelor's degree in journalism or similar - Minimum 10 years of professional experience	Industry authority
6	Hazardous waste management specialist	- Bachelor's degree in civil engineering, chemical engineering or similar - Minimum 10 years of professional experience	Industry authority
7	Environmental Auditor	- Master's degree in environmental science, engineering or similar - Minimum 10 years of professional experience - Environmental auditing license/accreditation	BSEC

Individuals hired by BSEC will report to the Chairman of BSEC regarding progress and compliance, mentioning any issue, and possible solutions.

8.8. Budget and Implementation Programme

Table 74: Estimated cost for EMP implementation

Serial No.	Items	Unit	Unit Cost	Quantity	Total Cost
1.	Pre-construction Phase				
1.1.	Landscape/topography	Covered from engineering cost			-
1.2.	Natural Calamities	Covered from resettlement plan cost			-
1.3.	Land Acquisition and Resettlement	Covered from resettlement plan cost			-
1.4.	Agricultural Production Loss	Covered from resettlement plan cost			-
1.5.	Damage to Public Utilities	Covered from resettlement plan cost			-
1.6.	Tree Cutting and Wildlife	Covered from resettlement plan cost			-
1.7.	Change in Local Hydrology/Drainage Congestion	Covered from resettlement plan and engineering cost			-
1.8.	Waterbodies and Fisheries	Covered from engineering cost			-
1.9.	Labor Standard	Covered from engineering cost			-
1.10.	Environmental Capacity Enhancement (Workshop)	Nos.	25,000	1	25,000
Sub-total EMP Cost for Pre-construction					25000
2.	Construction Phase				
2.1.	Landscape/Topography	Monitoring by EHSO			-
2.2.	Loss of Top Soil	Monitoring by EHSO			-
2.3.	Dredging and Dredged Materials	Nos.	35,000	4	140,000
2.4.	Soil Erosion and Siltation	Monitoring by EHSO			-

2.5.	Soil Contamination	Nos.	22,000	4	88,000
2.6.	Air Pollution and Dust	Nos.	25,000	5	125,000
2.7.	Noise and Vibration	Nos.	5,000	10	50,000
2.8.	Surface Water Quality	Nos.	20,000	10	200,000
2.9.	Groundwater Quality	Nos.	10,000	7	70,000
2.10.	Drainage Congestion	Monitoring by EHSO			-
2.11.	Vegetation	Monitoring by EHSO			-
2.12.	Terrestrial Fauna	Monitoring by EHSO			-
2.13.	Aquatic Species	Nos.	20,000	7	140,000
2.14.	Fisheries	Monitoring by EHSO			
2.15.	Loss of Agricultural Production	Monitoring by EHSO			
2.16.	Pollution from Wastes	Lumpsum	400,000	1	400,000
2.17.	Asphalt Hot Mix, Rock Crushing, and Bitumen Supply	Monitoring by EHSO			-
2.18.	Construction Waste Disposal (Waste water, Oil, Hazardous waste and others)	Lumpsum	400,000	1	400,000
2.19.	Construction Yards	Monitoring by EHSO			-
2.20.	Occupational Health and Safety (OHS)	Month	5,000	20	100,000
2.21.	Community Health and Safety	Month	2,000	20	40,000
2.22.	Health and Vector Borne Diseases	Month	2,000	20	40,000
2.23.	Traffic Congestion	Month	4,000	20	80,000
2.24.	Road Accidents	Monitoring by EHSO			-
2.25.	Income/Job Opportunities	Monitoring by EHSO			-
2.26.	Tree Plantation	Nos.	1,200	500	600,000
2.27.	Water Spraying for dust suppression	Month	60,000	20	1,200,000
2.28.	Transportation for environmental monitoring	Month	20,000	20	400,000
2.29.	Reporting and report production	Nos.	2,000	20	40,000
2.30.	Remuneration of EHSO	Month	50,000	20	1,000,000
Sub-total EMP Cost for Construction					5,113,000
3.	Operating Phase (Years 1, 3, 5)				
3.1.	Construction Period Decommissioning	Covered from engineering cost			
3.2.	Climate Change	Covered from resettlement plan cost			
3.3.	Landscape/Topography	Covered from engineering cost			
3.4.	Air Quality	Nos.	25,000	9	225,000
3.5.	Noise and Vibration	Nos.	5,000	12	60,000
3.6.	Water pollution (surface water)	Nos.	20,000	18	360,000
3.7.	Water pollution (ground water)	Nos.	10,000	6	60,000
3.8.	Cultural/Sensitive Structures	Monitoring by Contractor			-
3.9.	Road Accidents/Road Safety	Monitoring by Contractor			-
3.10.	Split of Communities	Monitoring by Contractor			-
3.11.	Disaster Management Plan (DPM) Monitoring	Monitoring by Contractor			-

3.12.	Income/Job Opportunities	Monitoring by Contractor	-
3.13.	Terrestrial Ecology	Monitoring by Contractor	-
3.14.	Sediment	Monitoring by Contractor	-
3.15.	River Bed Sediment	Monitoring by Contractor	-
Sub-total EMP Cost for Operating Phase (Years 1, 3, 5)			780,000
Total			5,918,000
Contingency (5%)			295,900
Grand Total			**6,213,900**

Estimated total cost of EMP implementation from the project is 62.139 lakh taka. The EMP cost shall be updated during final design phase, based on updated market rates.

9. Concluding Remarks

All the data related to the project and the site have been collected and assessed to identify potential impacts of the project in order to determine the required mitigation measures. The proposed Environment Friendly Ship Re-cycling Industry shall comply with the specified national and international regulations, especially Hong Kong Convention and EU Ship Recycling Regulation, in order to be recognized and certified as a Safe and Environmentally Sound Ship Recycling Industry.

The project is not expected to have long-term significant or irreversible negative environmental impacts either at the construction, or operation phases. The project is also within the boundaries of the Hong Kong Convention and as it is a slipway-based ship recycling site, under the EUSRR, there will be no direct exposure to communities as the communities will be located away from the site.

The Environment Friendly Ship Re-Cycling Industry will have treatment plants for waste from ships and shipyards such as oil-water separators, incinerators and ETP. However, wastes for landfill should be sent to an authorized TSDF because the landfill is required for a large area. It is suggested that a TSDF should be established near the site to serve not only the ship recycling industry but also for the other industries and residents in the region.

The establishment of the Environment Friendly Ship Re-Cycling Industry will have great responsibility of saving the environment and offering better working standards. Since the ships will be hauled out of water into dry land, no waste from ship breaking will be fallen into or discharged to the sea. Wastes from ship breaking such as asbestos, bilge water, waste oils, sludges, etc. will be collected, contained, and transferred to shore-based treatment plants. Hazardous wastes generated during ship recycling will be segregated, packed, and transported to a TSDF for safe disposal. Personal protection equipment (PPE), tools and material handling equipment will be provided to enhance the workers' working conditions. Besides, training, and stringent safety measures will be practiced protecting the workers from accidents.

The bulk cargo terminal proposed in this study will be used to transfer scraped materials for onward use and disposal. This concrete jetty will provide berthing arrangement including quick loading facilities to inland water as well as coastal vessels of 160m length for single ship and 90m for twin ships. The proposed water borne transportation arrangement will easily transport the scraped materials to the seaports and large river ports of Bangladesh. Basically, there should be multi-modal transportation including road connections for smooth dismantling operations of decommissioned vessels. The development of road connections is thus a necessity, and the Roads & Highways Department may be approached to develop a load bearing road connection. Road connection will also be helpful to transport ready-used materials including furniture and nonferrous materials to the end users. In addition, there is a necessity to establish a steel mill close to the green shipyard in order to reduce the steel production cost in turn the price of steel plates, profiles, angle frames, channels, rods, etc. BSEC itself can take the initiative to develop a mill under the Ministry of Industry in the South region of Bangladesh.

The establishment of the Environment Friendly Ship Re-Cycling Industry will improve the socio-economic conditions of the local people by generation direct and indirect employment and open up opportunities for new business and industries which will all lead to economic

growth. Taltali Upazila under Barguna district is a very backward area that needs social elevation in terms of employment generation, women empowerment, and associated privilege which this project will accrue.

The establishment of the Environment Friendly Ship Re-Cycling Industry will supply the recycled steel and other materials to the market. This will reduce the pressure on limited natural resources and lead to significant energy savings and will definitely open up the opportunity for different types of backward and forward linkage industry associated with ship recycling like steel mill, furniture, electrical accessories market etc.

Environmental impact assessment study indicates that conventional pollution and concentrations of heavy metals in and around the yards are not significantly detrimental to the environment. Their concentration in the ambient environment seems to be within tolerable limits of the ecosystems and biotic communities. The environmental attributes need to be monitored to ensure proper implementation and effectiveness of various mitigation measures adopted during operation. In this connection, short term monitoring of surrounding environment (air, water, soil) as well as long term monitoring of biota are essential, as most of the pollutants (metals, PCBs, TBTs) have characteristics of bioaccumulation and biomagnification through the food chain.

9.1. Economic Viability

The economic analysis of the project indicates that the economic internal rate of return (EIRR) and financial internal rate of return (FIRR) are 14.84% and 12.52%, respectively. This implies that the project is economically and financially viable, as it secures a rate of return that exceeds 12%, i.e., the opportunity cost of capital, presently used by all sectors of the economy in Bangladesh.

9.2. Recommendations

Some recommendation for the project is as follows:

- A detailed planning and design of slipway shall be carried out prior to the initiating construction. The cost of the project components should be updated based on the detailed design.
- Supervising engineer(s) shall be engaged to oversee the construction work including environmental compliance.
- The access channel is highly sediment prone. It is suggested to conduct hydrographic surveys in access channel on a regular basis in order to assess navigability condition.
- The riverbank is erosion prone. If any sign of erosion appears nearby posing a threat to the stability of the waterfront, BSEC shall be prepared for implementing suitable preventive measure.
- Environment Management Plan: The contractor shall follow the environmental management plan (EMP) for the implementation period. For operation period, BSEC shall strictly follow the EMP.
- Emergency Response Plan: The contractor shall follow the emergency response plan for implementation period. For operation period, BSEC shall follow it in due course.

References

1) Disaster Prone Area Atlas Bangladesh (Barguna Zila): https://bbs.portal.gov.bd/sites/default/files/files/bbs.portal.gov.bd/page/e6939121_4299_4924_b7a6_20500eebfd67/Disaster_Barguna.pdf
2) Household Income and Expenditure Survey 2022: https://bbs.portal.gov.bd/sites/default/files/files/bbs.portal.gov.bd/page/b343a8b4_956b_45ca_872f_4cf9b2f1a6e0/2023-12-23-11-15-1b221684b3d6eabaa1969237888fe5e2.pdf
3) Agriculture Census 2019 (Barguna district report): https://bbs.portal.gov.bd/sites/default/files/files/bbs.portal.gov.bd/page/c645bd51_3cb5_4f53_86f9_7d29244caa4e/2023-02-01-07-38-dfbf643496e1b51c98f0d3ac7e8348f3.pdf
4) Population & Housing Census 2022: https://bbs.portal.gov.bd/sites/default/files/files/bbs.portal.gov.bd/page/b343a8b4_956b_45ca_872f_4cf9b2f1a6e0/2024-01-31-15-51-b53c55dd692233ae401ba013060b9cbb.pdf
5) MEPC guidelines [MEPC. 269(68)]

Annex-I: Approval of Terms of Reference from DoE

Government of the People's Republic of
Bangladesh
Ministry of Environment, Forest and Climate
Change
Department of Environment
Environment Clearance Section
www.doe.gov.bd

Record Number: 22.02.0000.018.72.033.24.112 Date: 19/11/2024

Subject: Approval of Terms of Reference (ToR) for the EIA of the Environment-Friendly Ship Re-cycling Industry at Taltoli, Bagruna

Reference: 22.02.0000.018.72.033.24; Dated: 06.06.2024

With reference to the subject mentioned above, the Department of Environment hereby givesapproval of the Terms of Reference (ToR) for the Environmental Impact Assessment (EIA) of the **Environment-Friendly Ship Re-cycling Industry** at Taltoli, Bagruna subject to fulfilling the following terms and conditions:

I. The project authority shall conduct a comprehensive Environmental Impact Assessment (EIA) considering the overall activity of the said project in accordance with the ToR submitted to the Department of Environment (DoE). The EIA study shall be conducted as per the provision laid down in the Environmental Conservation Rules, 2023.
II. The EIA report shall be prepared in accordance with the guidelines provided in the schedule-11 and Rules-15, 16 of the ECR, 2023.
III. Consultation with Stakeholders/Public Consultation should be done in accordance with Rule 16 of the Environmental Conservation Rules, 2023.
IV. The project authority shall submit the EIA report to the Head Office of DoE in Dhaka.
V. Without approval of the EIA report by the Department of Environment, the project authority shall not make any land and infrastructure development.

19-11-2024
Masud Iqbal Md Shameem
Director
222218342
direc@doe.gov.bd

Chairman, Bangladesh Steel and Engineering Corporation, BSEC Bhaban, 102, Kazi Nazrul Islam Avenue, Karwan Bazar, Dhaka.

Record Number: 22.02.0000.018.72.033.24.112/1 (2) Date: 19/11/2024

Copy for Kind Information and Necessary Action (Not in the order of seniority):

1. Director, Department of Environment, Barishal Divisional Office, Nathullabad, Barishal Sadar, Barishal and
2. Assistant Director, Office of the Director General, Department of Environment, E-16, Agargaon, Sher-E-Bangla Nagar, Dhaka..

19-11-2024
Masud Iqbal Md Shameem
Director

Annex-II: Terms of Reference of the EIA as submitted to DoE

Terms of Reference

of

Environmental Impact Assessment

for

Feasibility Study of Environment Friendly Ship Re-cycling Industry at Taltali Upazila, Barguna District

Background:

To improve the life standard of people from southern region, government has taken numerous steps to create employment through industrialization. Over two decades ship-recycling industry in Bangladesh has received considerable attention via providing raw materials to steel industry, shipbuilding industry and some other industries in Bangladesh and some other countries of South Asia.

The ship breaking industry started its operations in the 1960s whne a Greek ship 'MD Alpine' was stranded on the shores of Sitakunda, Chittagong after a severe cyclone. The ship remained there for a long time before the Chittagong Steel House brought the vessel and scrapped it. During the Liberation Was in 1971, a Pakistani ship 'Al Abbas' was damaged by bombing. It was later salvaged and brought to the Fauzdarhat seashore. In 1974, Karnafully Metal Works Ltd bought it as scrap, introducing commercial ship breaking in Bangladesh. The industry flourished during the 1980s. Today it has become large and profitable industry in Bangladesh.
However, when recycling and re-using goods and products has become an important requirement now, the ship breaking method has also witnessed the recycling of the parts of the vessel. As a viable alternative to other methods of ship breaking that makes negative effects on the environment, green ship recycling has been introduced across the world. As a way of responsible ship recycling in proposed green ship recycling industry, this method reduces the amount of waste and also keeps the waste materials from ship breaking out of beaches, reducing its impact on the environment.

The valuable components of a ship that are reused include steel, aluminum, silver and brass, among others. Since a major part of a ship's weight is in steel, the steel scrap from the vessel is being converted into bars and rods for several other uses. However, in addition to the metal that can be recycled, there are a number of the toxic components inside a vessel. These harmful substances include lead, asbestos, mercury and oil sludge etc. The inefficient ship breaking methods, especially those carried out on beaches than the dry-dock ship recycling facilities, allow these toxic and hazardous waste to be disposed off unsafely. However, one of the major harmful materials that are safely disposed off with the help of green ship recycling process is asbestos. Asbestos has been banned from being used in ships from the past two decades. But the ships in which asbestos had been used initially need to be recycled now. Since, continuous exposure to asbestos can cause problems not just to the marine life forms but also to the people abord the ship, this toxic component is being recycled with greater caution in the proposed green ship recycling industry.

1. Project Authority

The project is initiated by Bangladesh Steel Engineering Corporation (BSEC) with a plan to establish a ship recycling industry at Taltali, Barguna.
Focal person at BSEC for any enquiry regarding EIA is as follows:

Name	Designation	Email	Contact Number
Engineer Shamim Ahmed	Divisional Head, Steel and Ship building division, BSEC	shamim_engr@yahoo.com	+8801712093366

2. EIA Team

The Team carrying out the EIA is as follows:

Serial No.	Name	Academic Qualification	Professional Experience	Designation
1.	S. M. Mehedi Hasan	• MS in GIS for Environment and Development • BSc. in Civil Engineering	11 years	Team Leader/ Environmental Specialist
2.	Shaumik Sharif	• Masters in Environmental Economics • BSc. in Naval Architecture and Marine Engineering	5 years	Ship Recycling Industry Expert
3.	MD. ratan Ali	• B.Sc in Civil Engineering • Diploma in Civil Engineering	12 years	Surveyor
4.	Md. Yusuf Parvez	• B.Sc in Civil Engineering • Diploma in Civil Engineering	14 years	Surveyor
5.	Rubel Hossain	• B.Sc in Civil Engineering • Diploma in Civil Engineering	7 years	Surveyor

Project

I) Purpose and Application of the Terms of Reference

This Terms of Reference has been prepared to outline the scope of works of the Environmental Impact Assessment (EIA) for the Feasibility study for Environment Friendly Ship Re-cycling Industry at Taltali Upazila, Barguna District. The EIA will be done in compliance with the Rules and Regulations of the Government of Bangladesh (GoB). More specifically, the EIA will be undertaken as per the requirements of Environmental Conservation Rules 2023 (Schedule-10).

3. Statement of Need for and Objectives of the Proposal

Bangladesh derives 80-90% of its steel from end-of-life ships. Ship breaking industries generate a number of employment opportunities for Bangladesh too. The green ship recycling, which carries great responsibility of saving the environment, offers a better recycling standard. It will help us to achieve SDG's by reducing poverty in a great extent. Keeping this in mind, our Honorable Prime Minister Sheikh Hasina declared in a public meeting at Rangabali in Patuakhali District to establish Ship-recycling Industry near Bay of Bengal of southern region. At present, Ship breaking activities in Bangladesh is concentrated in Sitakunda (Bhatiary to Barwalia), just north of Chittagong on the Bay of Bengal.

In line with this plan, decision has been taken to construct a new ship breaking and recycling facility in the Barguna District for development of life style in southern part of Bangladesh as well as meet the environmental pollution. For a Greenfield site, there are a number of

technical and financial considerations that would need to be addressed as part of preliminary design and impact hydraulic studies to establish an environmental friendly Green Ship Breaking and Ship Recycling Facility in the Barguna District.

Coastal region of Bangladesh comprises of nearly one-third of the country where significant amount of the population lives. However, due to vulnerability to natural disasters and climate change, coastal areas have seen much industrial development. Ship recycling is an emerging sector in Bangladesh that has been growing with potential for economic and social benefits, especially for coastal region as it is essential to have for maritime navigation. Similarly, establish of ship recycling industry in Taltali upazila of Barguna district is expected to provide a boost to the local economy. In addition, the proposed industry will also create jobs for local people.
The industry will produce ferrous and non-ferrous scraps. 60% of total weight of a ship can be obtained in the form of re-rollable scrap. This scrap metal can be used as raw materials for steel re-rolling mills, which provides an added benefit to the cycle of industrial manufacturing in Bangladesh.
BSEC is planning to establish a ship recycling industry in Barguna. Ship recycling is considered as high-risk in Bangladesh, and as such categorized as Red, as per applicable rules, laws, and regulations. It is essential to undertake EIA to identify any adverse impact on the environment, and determine necessary mitigation measures.

4. Project Description

The core activities are as follows:

- ✓ Land Acquisition and Resettlement
- ✓ Prepare the site for establishment of the industrial facilities including land filling, and tree plantations
- ✓ Construction of docking and mooring facilities, and primary cutting areas
- ✓ Construction of impenetrable floor for ship-part cutting areas, and areas where there is chance of oil leakage on the ground
- ✓ Construction of rain water collection facilities
- ✓ Construction of storage facilities for scraps
- ✓ Construction of winch foundation
- ✓ Establishment of firefighting and medical facilities
- ✓ Construction of office building
- ✓ Construction of Dormitory, Warehouse, Workshop
- ✓ Construction of Sewage Treatment Plant
- ✓ Establishment of gas storage, fuel storage, flammable liquid storage, waste oil storage

The project is not against any development plan or rules or regulation of the government. 105 acre land will need be acquired. The site location falls in Nishanbaria Union under Taltali Upazila of Barguna district. Proposed site location is provided below:

Figure-1: Location of Proposed BSEC Ship Recycling Industry Site

A process flow is as follows:

- Docking and mooring
- Primary Cutting
- Secondary Cutting
- Decontamination of hazardous materials
- Scrapping using proper tools
- Lifting and transportation of scraps

A tentative layout plan of the site is provided below:

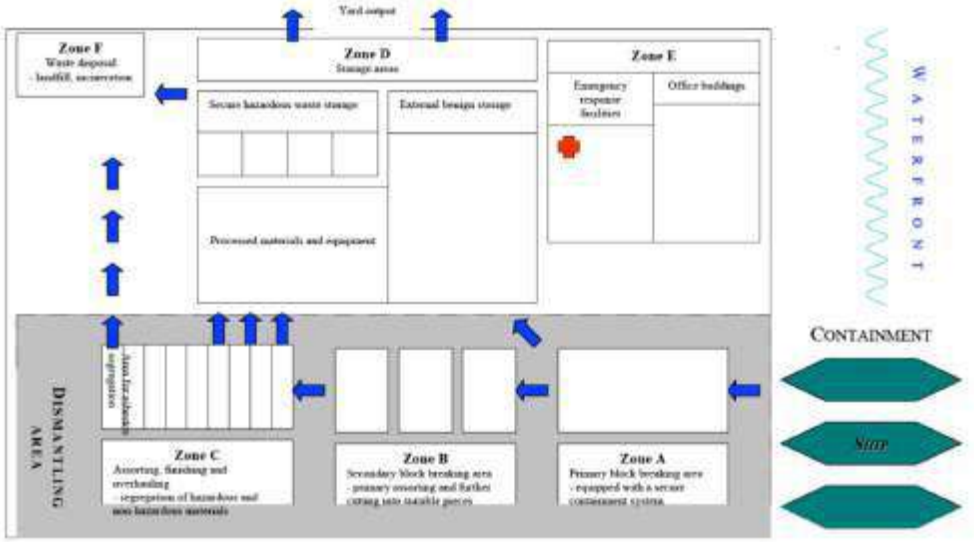


Figure-2: Layout

I) Project Timeline

Project plan is to commence construction activities from September 2024 which will require about 27 months. Afterwards, industrial production may begin from January 2027.

5. Project Options

Different options of recycling method have been considered and analyzed to minimize adverse impacts:

Criteria	Landing method	Slipway method	Alongside method	Dry-dock method
Construction Cost	Lowest construction cost	Construction cost higher than landing method	Construction cost higher than landing method	Highest construction cost
Operation Cost	➢ Lowest operation and maintenance cost for mobile crane and small barge	➢ Higher than landing method for maintenance costs of slipway.	➢ Highest operation and maintenance costs for slipway, winch, jetty/quay and material handling equipment	➢ Highest operation and maintenance costs for dry-dock, gate, pumping system and equipment
Influence of Tide	➢ Need high tide to pull ship to land ➢ Easy to pull ships in case of large tidal range.	➢ Only need high tide to pull ship to land on slipway. ➢ Increase slipway length in case of large tidal range	➢ Only need high tide to pull ship to land on slipway. ➢ Increase jetty / quay level by high tide	➢ Not affected by tide
Scrapping Time	Average	Same as landing method	Faster than landing method	Fastest
Main pollution risks	➢ Pollution from ship paints ➢ Water pollution ➢ Flooding of impermeable floor due to unexpected high tide	➢ Pollution from ship paints ➢ Water pollution ➢ Less risk of flooding from unexpected high tide	➢ Pollution from ship paints ➢ Water pollution ➢ Less risk of flooding from unexpected high tide	➢ No pollution from ship ➢ Water pollution ➢ No risk of flooding from unexpected high tide
Main impacts on natural environment	➢ Possible pollution and impacts on marine organisms ➢ Loss of habitat due to extended concrete slipway ➢ Water pollution	➢ Possible pollution and impacts on marine organisms ➢ Loss of habitat due to extended concrete slipway ➢ Water pollution	➢ Possible pollution and impacts on marine organisms ➢ Loss of habitat due to extended concrete slipway ➢ Water pollution	➢ No pollution impact on marine organisms ➢ Loss of habitat due to construction of dry-dock ➢ Water pollution
Main health risk to workers	There are health risks associated with expose to gas-cutting fumes and dusts			

Other factors	Construction difficulty less than Dry dock method	Construction difficulty less than Dry dock method	Construction difficulty less than Dry dock method	Construction is difficult

Considering operation & construction costs, environment and scrapping time, the **slipway method** is preferred for this ship recycling facility.

6. Description of Existing Environment

The project site is located in the Tetulbaria Village, 6 no. Nishanbaria Union of Taltali Upazila, Barguna. The total area is about 317,638 m2 with length of each plot edge: 243m; 705m; 662m; 783m. The GPS Coordinate for the Four Points of the Project is:

- Corner-1 (P-1): 21.948068° N, 90.041437° E
- Corner-2 (P-2): 21.945888° N, 90.041473° E
- Corner-3 (P-3): 21.945390° N, 90.048292° E
- Corner-4 (P-4): 21.951347° N, 90.048158° E
- Middle point (Mid): 21.946220° N, 90.0044158° E

The plot location has an intertidal mudflat in front of the site with a difference of about 2 meters between low tide point and high tide. The site is spread across the Mouza: Modhupara, Char Nisanbaria and Nisanbaria. It's about 8km away from Kalapara upazila and 39km away from Patuakhali. The only economic activities are agriculture, fisheries & plantation. The site is away from any notified eco sensitive area like Natural Park, wild life sanctuary, buildings of archaeological importance etc. There are some environmentally important areas nearby the site: Sundarbans reserve forest (~ 7.79 km) and Tengragiri wildlife sanctuary (~ 11.37 km). The nearby water is one of the fish breeding grounds of upazila area. The area is located in a fisherman‘s village and there are residence areas around the site.

The site plot is a flat area nearby the seashore (at the river mouth) is suitable for construction of the ship recycling yard. The dredging soil can be re-used for site levelling. The location can be accessed by both on land roads and water way. It locates in the Bengal bay that can be accessed from Indian ocean which lines on the global sea trading route, so that scrapped ships can be brought easily and scrapping materials from the recycling yard can be sent by ship to other industrial zones such as Chittagong and Dhaka.

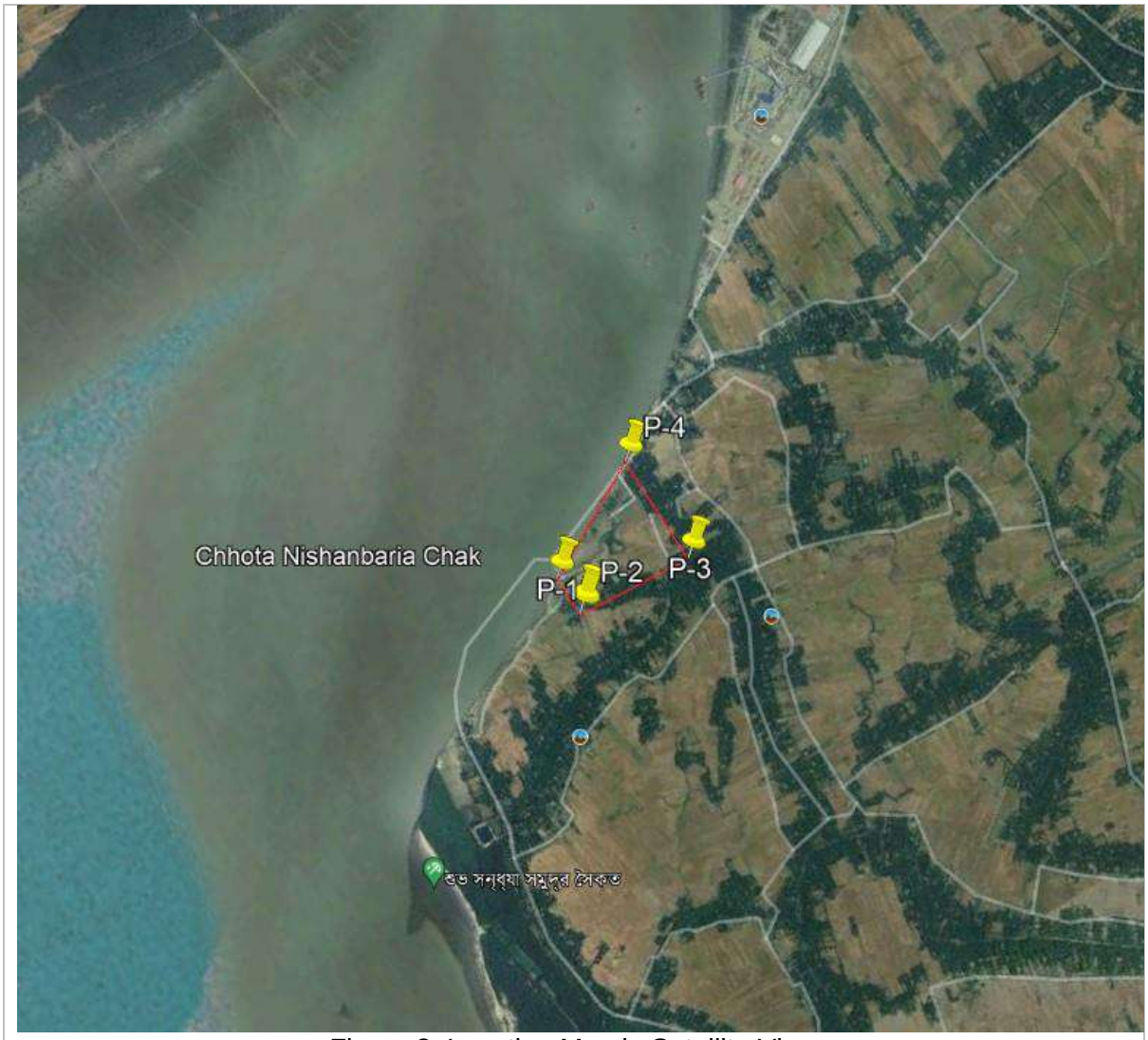


Figure 3: Location Map in Satellite View

7. Baseline Study

I) Extent of Study Area or Impact Zones

In accordance with the applicable laws, and anticipated project impacts, the study will cover the surrounding area of the project site that may be affected during any stage of the project.

II) Applicable Policy and Institutional Considerations

All relevant policies related to industry operation in Bangladesh will apply to this planned ship recycling industry, including requirements to carry out an Environmental Impact Assessment, followed by an Environmental Management Plan (EMP), in accordance with the rules of the Department of Environment (DoE) of Bangladesh. Following are some of the most important Laws, Rules, and Regulations of the Government of Bangladesh that applies to the project:

- National Environmental Policy
- Environment Conservation Act 1995 (amended in 2000, 2002, & 2010)
- Environmental Conservation Rules 2023
- Bangladesh Solid Waste Management Rules 2021
- Bangladesh Air Pollution Control Rules 2022
- Ship Breaking and Recycling Rules 2011
- Bangladesh Ship Recycling Act 2018

III) Studies to be Carried out

All required studies for a comprehensive EIA will be carried out. Following is a satellite image of the area around the site showing important features:

a. Survey and Data Collection on Existing Environment
   i. Topography,
   ii. Land use,
   iii. Geography,
   iv. Forestry,
   v. Weather and Climate

b. Baseline study

Parameters	Method of Data Collection and Analysis
Air quality	On-site air quality test
Soil type	Soil boring, followed by laboratory testing
Ground water	Laboratory test of ground water sample from on-site well
Surface water	Laboratory test of surface water sample from river
Noise levels (dB)	On-site test
Flora and fauna	Field survey and data collection from relevant organizations
Wildlife including birds	Field survey and data collection from relevant organizations
Biodiversity	Field survey and data collection from relevant organizations
Ecology	Field survey and data collection from relevant organizations

c. Socio Economic data
   i. Local community including vulnerable population,
   ii. Local infrastructures including cultural and religious establishments,
   iii. Livelihood characteristics,
   iv. Residential areas and
   v. Commercial activities,
   vi. Communication and media usage,
   vii. Transportation facilities,
   viii. Education levels.

d. Household level data
   i. Housing structures with available facilities,
   ii. Household income levels including Poverty (in comparison to national average).

Data collection will be carried out through Field Survey, Secondary data, Key Informant Interviews, Focus Group Discussions.

8. Site Location and Land Use

Figure-4: Site Area in Satellite Image View

9. Potential Impacts and Issues to be Studied

Following are the potential impacts that will be studied:

- Impact on Physical Environment:
  - Geology,
  - Topography,
  - Soil Quality,
  - Surface Water Quality,
  - Ground Water Quality,
  - Air Quality,
  - Noise levels.
- Impact on Biological Environment:
  - Flora and fauna
  - Natural habitats
  - Wildlife
  - Biodiversity
- Impact on Socio-Economic Environment:
  - Infrastructures,
  - Livelihood,
  - Household income,
  - Residential areas,
  - Commercial activities,
  - Communication,
  - Transportation,
  - Education,
  - Health and Safety risks to staffs, workers, and local residents.
- Impact on Local Communities:
  - Public health,
  - Vulnerable groups.

- Physical and Cultural Heritage:
  - Cultural heritage establishments,
  - Religious establishments,
  - Graveyards/Burial grounds/Crematorium

Impacts will be considered in 4 different stages for the following activities:

Stage	Major Activities	Anticipated Negative Impacts	Anticipated Positive Impacts
Pre-construction	Site preparation: ▪ Land Acquisition and Resettlement ▪ Cutting of trees ▪ Filling up ponds ▪ Fencing the area ▪ Plantation	▪ Resettlement ▪ Loss of Trees ▪ Increased traffic ▪ Dust ▪ Soil ▪ Air pollution ▪ Movement restrictions ▪ Livelihood	▪ Livelihood opportunities
	Construction preparation: ▪ Transportation of materials ▪ Stacking of materials ▪ Site facilities including Site office, Workers' camps	▪ Increased traffic ▪ Dust ▪ Noise pollution ▪ Air pollution	▪ Livelihood opportunities
Construction	Civil works: ▪ Transportation of materials ▪ Construction of structures, and roads ▪ Movement of project officials and workers'	▪ Increased traffic ▪ Dust ▪ Noise ▪ Air pollution ▪ Water pollution ▪ Soil contamination ▪ Waste generation ▪ Health and safety risks ▪ Labor influx	▪ Livelihood opportunities
	Installation of equipment: ▪ Transportation of equipment ▪ Stacking and installation of equipment ▪ Testing and commissioning	▪ Noise ▪ Air pollution ▪ Health and safety risks ▪ Electric hazard risk ▪ Fire risk ▪ Disruption of maritime traffic	-
Operation and Maintenance	Ship recycling: ▪ Transportation of ships for recycling ▪ Cutting of ships ▪ Process waste materials including decontamination, treatment ▪ Process scraps	▪ Increased traffic ▪ Dust ▪ Noise ▪ Air pollution ▪ Water pollution ▪ Soil contamination ▪ Solid Waste generation ▪ Liquid Waste generation ▪ Hazardous Waste generation ▪ Health and safety risks ▪ Increased resource utilization	▪ Livelihood opportunities ▪ Economic development
Decommissioning	▪ Salvaging of equipment ▪ Demolition of structures	▪ Dust ▪ Noise ▪ Air pollution ▪ Water pollution ▪ Soil contamination	▪ Livelihood opportunities

		▪ Waste generation including hazardous wastes ▪ Health and safety risks	

10. Mitigation and Abatement Measures

Appropriate mitigation measures to manage all the anticipated adverse impacts will be identified and corresponding plan will be outlined in the Environment Management Plan (EMP). All required mitigation measures will be addressed in the EMP to later incorporate into operating procedures of the plant.

The waste management will be done in an environmentally friendly way to avoid any harm to public health. An Effluent treatment plant, along with an Incinerator will be included to treat relevant wastes. Hazardous wastes will be decontaminated within the industrial compound. Some solid waste that are not hazardous will be dumped in landfill outside of the industrial compound at the proposed Govt. TSDF.

11. Residual Impacts

The analysis will look into any possible residual impacts.

12. Environmental Management Plan

The Environment Management Plan (EMP) will include action plans for implementing mitigation measures. EMP provisions will be divided into Pre-construction, Construction, and Operationalization phases of the project. Special focus will be given to the operational phase as it will be the longest. The EMP will also include emergency management plan.

13. Monitoring and Follow-up Plan

Periodic monitoring requirements, and responsibilities will be outlined in EMP. There will be recommendation for provisioning following personnel to monitoring and addressing environmental issues:

- Environmental Specialist
- Health and Safety Specialist
- Medical personnel
- Social and Communication Specialist
- Public liaison officer

14. Decommissioning

The study will consider the requirements for decommissioning and include some procedural guidelines in EMP.

Annex-III: Air Quality Test Results

GLOBAL ENVIRONMENT CONSULTANTS LTD.

Cert NO:.05.007.20

AMBIENT AIR QUALITY ANALYSIS REPORT

Client Name	:	Bangladesh Steel & Engineering Corporation (BSEC).
Office Address	:	BSEC Bhaban, 102 Kazi Nazrul Islam Avenue, Dhaka-1215, Bangladesh.
Project Name	:	Consultancy services for Preparation & Submission of DoE (Department of Environment) Approved Environmental Impact Assessment (EIA) with Terms of Reference (ToR) for Establishment of Environment Friendly Ship Recycling Industry at Taltoli, Barguna.
Description of Sample	:	Ambient Air Quality Analysis Report
Sampling date	:	20-22 October 2024
Reporting date	:	27 October 2024

Description of analysis

Sample Locations and GPS Coordinates	Concentration present of different parameter for ambient air quality. All units are considered in µg/m³								
	SPM	PM_{10}	$PM_{2.5}$	NO_x	SO_2	CO	NH_3	O_3	Pb
Test result of Ambient Air Quality, Choto Nishanbaria Union Parishad GPS Coordinate: 21°56'35.6"N 90°03'04.8"E	82	53	25	14	9	156	15	12	<0.01
Test result in Ambient Air Quality Nolbonia Gorapara Primary School. GPS Coordinate: 21°56'27.15"N 90°02'23.22"E	72	47	23	11	7	137	12	10	<0.01
Test Duration (hours)	24	24	24	24	24	24	24	8	24
Method of Analysis	Gravimetric (EPA Standard)			NEDA-Visible at 540nm	TCM-Visible at 560 nm	Iodine penta-oxide Method	TCM-Visible at 560 nm	UV - method 352 nm	AAS after acid digestion
Air Pollution Control rules 2022 (schedule 3 & 5, rule-1), Govt. of Bangladesh (SRO No 255-law/2022)	NYS	150	65	80	80	5000	400	100	0.5
IFC/WBG, Environmental, Health, and Safety Guidelines for Ambient air quality (APRIL 30, 2007)	NYS	150 24(h)	75 24(h)	200 (1h)	125 24(h)	NYS	NYS	100 8(h)	NYS

Abbreviation: IFC/WBG= International Foundation Corporation/ World Bank Group, NYS=Not yet set.

Comments: High volume air sampler has been used for collecting ambient air from Choto Nishanbaria Union Parishad and Nolbonia Gorapara Primary School areas. Total mass (micro-gram) of pollutants (SMP, PM_{10}, $PM_{2.5}$ NO_2, NH_3, O_3 SO_2, CO & Pb) is divided by volume (m^3) to get micro-gram per cubic meter (µg/m^3) concentration of above-mentioned air quality parameters. As per Ambient Air Quality Standard under air pollution (control) rules 2022, (schedule 3 & 5, rule-1), Govt. of Bangladesh (SRO No 255-law/2022), the values of ambient air quality parameters were within the standard limit of these two locations.

Md. Golam Mostafa
Chief Executive Officer
Environmental Analysis & Development
Global Environment Consultants Ltd (GECL).

MOHD NUR E ALAM SIDDIQUE
Director (Analysis & Development)
Analytical & Environmental Laboratory (GECL)
B.Sc (Hons) M.Sc (SUST) M. Phil (DU),
PhD Research Fellow (NU).

A House of Environmental Monitoring, Research, Pollution Control, Management & Development

www.gecibd.org House # 3/E, (6th Floor), South Kallyanpur, Dhaka-1207 Tel :+88-02-8091314, 01715225159, 01793322929, 01715592414 info@gecibd.org; gecl.org@gmail.com

GLOBAL ENVIRONMENT
CONSULTANTS LTD.

Cert NO:.05.007.20

AMBIENT AIR QUALITY ANALYSIS REPORT

Client Name	:	Bangladesh Steel & Engineering Corporation (BSEC).
Office Address	:	BSEC Bhaban, 102 Kazi Nazrul Islam Avenue, Dhaka-1215, Bangladesh.
Project Name	:	Consultancy services for Preparation & Submission of DoE (Department of Environment) Approved Environmental Impact Assessment (EIA) with Terms of Reference (ToR) for Establishment of Environment Friendly Ship Recycling Industry at Taltoli, Barguna.
Description of Sample	:	Ambient Air Quality Analysis Report
Sampling date	:	20-22 October 2024
Reporting date	:	27 October 2024

Description of analysis

Sample Locations and GPS Coordinates	Concentration present of different parameter for ambient air quality. All units are considered in $\mu g/m^3$								
	SPM	PM_{10}	$PM_{2.5}$	NO_x	SO_2	CO	NH_3	O_3	Pb
Test result of Ambient Air Quality, Settlement 500m North of Site Boundary Area. GPS Coordinate: 21°57'05.4"N 90°03'06.5"E	62	42	21	8	7	142	13	16	<0.01
Test result in Ambient Air Quality Agapara Madrasah. GPS Coordinate: 21°56'18.6"N 90°02'53.5"E	70	48	24	10	8	155	16	12	<0.01
Test Duration (hours)	24	24	24	24	24	24	24	8	24
Method of Analysis	Gravimetric (EPA Standard)			NEDA-Visible at 540nm	TCM-Visible at 560 nm	Iodine penta-oxide Method	TCM-Visible at 560 nm	UV - method 352 nm	AAS after acid digestion
Air Pollution Control rules 2022 (schedule 3 & 5, rule-1), Govt. of Bangladesh (SRO No 255-law/2022)	NYS	150	65	80	80	5000	400	100	0.5
IFC/WBG, Environmental, Health, and Safety Guidelines for Ambient air quality (APRIL 30, 2007)	NYS	150 24(h)	75 24(h)	200 (1h)	125 24(h)	NYS	NYS	100 8(h)	NYS

Abbreviation: IFC/WBG= International Foundation Corporation/ World Bank Group, NYS=Not yet set.

Comments: High volume air sampler has been used for collecting ambient air from the above-mentioned two locations. Total mass (micro-gram) of pollutants (SMP, PM_{10}, $PM_{2.5}$ NO_2, NH_3, O_3 SO_2, CO & Pb) is divided by volume (m^3) to get micro-gram per cubic meter ($\mu g/m^3$) concentration of above-mentioned air quality parameters. As per Ambient Air Quality Standard under air pollution (control) rules 2022, (schedule 3 & 5, rule-1), Govt. of Bangladesh (SRO No 255-law/2022), the values of ambient air quality parameters were within the standard limit of these two locations.

Md. Golam Mostafa
Chief Executive Officer
Environmental Analysis & Development
Global Environment Consultants Ltd (GECL).

MOHD NUR E ALAM SIDDIQUE
Director (Analysis & Development)
Analytical & Environmental Laboratory (GECL)
B.Sc (Hons) M.Sc (SUST) M. Phil (DU),
PhD Research Fellow (NU).

A House of Environmental Monitoring, Research, Pollution Control, Management & Development

www.gecibd.org House # 3/E, (6th Floor), South Kallyanpur, Dhaka-1207 Tel:+88-02-8091314, 01715225159, 01793322929, 01715592414 info@gecibd.org; gecl.org@gmail.com

GLOBAL ENVIRONMENT CONSULTANTS LTD.

Cert NO:.05.007.20

AMBIENT AIR QUALITY ANALYSIS REPORT

Client Name : **Bangladesh Steel & Engineering Corporation (BSEC).**
Office Address : **BSEC Bhaban, 102 Kazi Nazrul Islam Avenue, Dhaka-1215, Bangladesh.**
Project Name : Consultancy services for Preparation & Submission of DoE (Department of Environment) Approved Environmental Impact Assessment (EIA) with Terms of Reference (ToR) for Establishment of Environment Friendly Ship Recycling Industry at Taltoli, Barguna.

Description of Sample : Ambient Air Quality Analysis Report
Sampling date : 20-22 October 2024
Reporting date : 27 October 2024

Description of analysis

Sample Locations and GPS Coordinates	Concentration present of different parameter for ambient air quality. All units are considered in µg/m³								
	SPM	PM_{10}	$PM_{2.5}$	NO_x	SO_2	CO	NH_3	O_3	Pb
Test result of Ambient Air Quality, Taltoli Ship Breaking Area GPS Coordinate: 21°56'57.4"N 90°02'46.1"E	72	51	23	11	7	149	12	12	<0.01
Test result in Ambient Air Quality Trees/Houses Tetolbaria. GPS Coordinate: 21°56'46.9"N 90°02'36.5"E	69	43	21	9	7	138	10	14	<0.01
Test Duration (hours)	24	24	24	24	24	24	24	8	24
Method of Analysis	Gravimetric (EPA Standard)			NEDA-Visible at 540nm	TCM-Visible at 560 nm	Iodine penta-oxide Method	TCM-Visible at 560 nm	UV - method 352 nm	AAS after acid digestion
Air Pollution Control rules 2022 (schedule 3 & 5, rule-1), Govt. of Bangladesh (SRO No 255-law/2022)	NYS	150	65	80	80	5000	400	100	0.5
IFC/WBG, Environmental, Health, and Safety Guidelines for Ambient air quality (APRIL 30, 2007)	NYS	150 24(h)	75 24(h)	200 (1h)	125 24(h)	NYS	NYS	100 8(h)	NYS

Abbreviation: IFC/WBG= International Foundation Corporation/ World Bank Group, NYS=Not yet set.

Comments: High volume air sampler has been used for collecting ambient air from the above-mentioned two locations. Total mass (micro-gram) of pollutants (SMP, PM_{10}, $PM_{2.5}$ NO_2, NH_3, O_3 SO_2, CO & Pb) is divided by volume (m^3) to get micro-gram per cubic meter (µg/m^3) concentration of above-mentioned air quality parameters. As per Ambient Air Quality Standard under air pollution (control) rules 2022, (schedule 3 & 5, rule-1), Govt. of Bangladesh (SRO No 255-law/2022), the values of ambient air quality parameters were within the standard limit of these two locations.

Md. Golam Mostafa
Chief Executive Officer
Environmental Analysis & Development
Global Environment Consultants Ltd (GECL).

MOHD NUR E ALAM SIDDIQUE
Director (Analysis & Development)
Analytical & Environmental Laboratory (GECL)
B.Sc (Hons) M.Sc (SUST) M. Phil (DU),
PhD Research Fellow (NU).

A House of Environmental Monitoring, Research, Pollution Control, Management & Development

Annex-IV: Noise Level Test Results

GLOBAL ENVIRONMENT CONSULTANTS LTD.

Cert NO:.05.007.20

AMBIENT NOISE LEVEL REPORT

Client Name	:	**Bangladesh Steel & Engineering Corporation (BSEC).**
Office Address	:	**BSEC Bhaban, 102 Kazi Nazrul Islam Avenue, Dhaka-1215, Bangladesh.**
Project Name	:	Consultancy services for Preparation & Submission of DoE (Department of Environment) Approved Environmental Impact Assessment (EIA) with Terms of Reference (ToR) for Establishment of Environment Friendly Ship Recycling Industry at Taltoli, Barguna.
Description of Sample	:	Ambient Noise Level Report
Sampling date	:	20-22 October 2024
Reporting date	:	27 October 2024

Description of analysis

SL. NO	Sample Locations and GPS Coordinates	Measured Noise Level (LAeq) dBA (Day time)		
		Average	Maximum	Minimum
1.	Test result of Ambient Noise Level at Taltoli Ship Breaking Area GPS Coordinate: 21°56'57.4"N 90°02'46.1"E	48.2±7.1	58.1	44.9
2.	Test result of Ambient Noise Level at Trees/Houses Tetolbaria. GPS Coordinate: 21°56'46.9"N 90°02'36.5"E	57.1±2.4	61.1	51.1
Bangladesh Standard according to the Sound Pollution (Control) Rules-2006 (day time)				
Industrial Area		75		
Commercial Area		70		
Mixed Area		60		
Residential Area		55		
IFC Standard; General EHS Guidelines (Noise Management) - April 2007				
Industrial, Commercial		70		
Residential, Institutional, Educational		55		

Note: *Bangladesh Noise Pollution Control Rules 2006; Day Time: 06.00 to 21.00 hrs, Night Time 21.00 to 06.00 hrs. IFC Noise Management, April 2007; Day Time 07:00 to 22.00 hrs,*

Comments: The standard level of ambient noise has set up by Bangladesh as Noise Pollution (Control) Rules 2006 ("SRO no 212-law/2006"). According to the Noise Pollution (Control) Rules 2006, average noise levels were within mixed and residential at Taltoli Ship Breaking and Tetolbaria areas.

Md. Golam Mostafa
Chief Executive Officer
Environmental Analysis & Development
Global Environment Consultants Ltd (GECL).

MOHD NUR E ALAM SIDDIQUE
Director (Analysis & Development)
Analytical & Environmental Laboratory (GECL)
B.Sc (Hons) M.Sc (SUST) M. Phil (DU),
PhD Research Fellow (NU).

A House of Environmental Monitoring, Research, Pollution Control, Management & Development
www.gecl.org House # 3/F (6th Floor), South Kallyanpur, Dhaka-1207 Tel: +88-02-8091314, 01715225159, 01793322929, 01715592414 info@gecl.org, gecl.org@gmail.com

GLOBAL ENVIRONMENT
CONSULTANTS LTD.

Cert NO: 05.007.20

AMBIENT NOISE LEVEL REPORT

Client Name	:	**Bangladesh Steel & Engineering Corporation (BSEC).**
Office Address	:	**BSEC Bhaban, 102 Kazi Nazrul Islam Avenue, Dhaka-1215, Bangladesh.**
Project Name	:	Consultancy services for Preparation & Submission of DoE (Department of Environment) Approved Environmental Impact Assessment (EIA) with Terms of Reference (ToR) for Establishment of Environment Friendly Ship Recycling Industry at Taltoli, Barguna.
Description of Sample	:	Ambient Noise Level Report
Sampling date	:	20-22 October 2024
Reporting date	:	27 October 2024

Description of analysis

SL. NO	Sample Locations and GPS Coordinates	Measured Noise Level (LAeq) dBA (Day time)		
		Average	Maximum	Minimum
1.	Test result of Ambient Noise Level at Choto Nishanbaria Union Parishad GPS Coordinate: 21°56'35.6"N 90°03'04.8"E	52.2±4.1	61.1	47.2
2.	Test result of Ambient Noise Level at Nolbonia Gorapara Primary School. GPS Coordinate: 21°56'27.15"N 90°02'23.22"E	57.1±4.8	63.2	52.1
Bangladesh Standard according to the Sound Pollution (Control) Rules-2006 (day time)				
Industrial Area		75		
Commercial Area		70		
Mixed Area		60		
Residential Area		55		
IFC Standard; General EHS Guidelines (Noise Management) - April 2007				
Industrial, Commercial		70		
Residential, Institutional, Educational		55		

Note: *Bangladesh Noise Pollution Control Rules 2006; Day Time: 06.00 to 21.00 hrs, Night Time 21.00 to 06.00 hrs. IFC Noise Management, April 2007; Day Time 07:00 to 22.00 hrs,*

Comments: The standard level of ambient noise has set up by Bangladesh as Noise Pollution (Control) Rules 2006 ("SRO no 212-law/2006"). According to the Noise Pollution (Control) Rules 2006, average noise levels were within mixed and residential Area as per Noise Pollution (Control) Rules 2006 at Choto Nishanbaria Union Parishad and Nolbonia Gorapara Primary School Areas.

Md. Golam Mostafa
Chief Executive Officer
Environmental Analysis & Development
Global Environment Consultants Ltd (GECL).

MOHD NUR E ALAM SIDDIQUE
Director (Analysis & Development)
Analytical & Environmental Laboratory (GECL)
B.Sc (Hons) M.Sc (SUST) M. Phil (DU),
PhD Research Fellow (NU).

A House of Environmental Monitoring, Research, Pollution Control, Management & Development
www.gecibd.org House # 3/F, (6th Floor), South Kallyanpur, Dhaka-1207 Tel: +88-02-8091314, 01715225159, 01793322929, 01715592414 info@gecibd.org; gecl.org@gmail.com

GLOBAL ENVIRONMENT
CONSULTANTS LTD.

Cert NO:.05.007.20

AMBIENT NOISE LEVEL REPORT

Client Name	:	**Bangladesh Steel & Engineering Corporation (BSEC).**
Office Address	:	**BSEC Bhaban, 102 Kazi Nazrul Islam Avenue, Dhaka-1215, Bangladesh.**
Project Name	:	Consultancy services for Preparation & Submission of DoE (Department of Environment) Approved Environmental Impact Assessment (EIA) with Terms of Reference (ToR) for Establishment of Environment Friendly Ship Recycling Industry at Taltoli, Barguna.
Description of Sample	:	Ambient Noise Level Report
Sampling date	:	20-22 October 2024
Reporting date	:	27 October 2024

Description of analysis

SL. NO	Sample Locations and GPS Coordinates	Measured Noise Level (LAeq) dBA (Day time)		
		Average	Maximum	Minimum
1.	Test result of Ambient Noise Level at Settlement 500m North of Site Boundary Area. GPS Coordinate: 21°57'05.4"N 90°03'06.5"E	47.2±4.2	54.3	42.2
2.	Test result of Ambient Noise Level at Agapara Madrasah. GPS Coordinate: 21°56'18.6"N 90°02'53.5"E	62.4±5.4	67.6	55.3
Bangladesh Standard according to the Sound Pollution (Control) Rules-2006 (day time)				
Industrial Area		75		
Commercial Area		70		
Mixed Area		60		
Residential Area		55		
IFC Standard; General EHS Guidelines (Noise Management) - April 2007				
Industrial, Commercial		70		
Residential, Institutional, Educational		55		

Note: *Bangladesh Noise Pollution Control Rules 2006; Day Time: 06.00 to 21.00 hrs, Night Time 21.00 to 06.00 hrs. IFC Noise Management, April 2007; Day Time 07:00 to 22.00 hrs,*

Comments: The standard level of ambient noise has set up by Bangladesh as Noise Pollution (Control) Rules 2006 ("SRO no 212-law/2006"). According to the Noise Pollution (Control) Rules 2006, average noise levels were within mixed and commercial area at as per Noise Pollution (Control) Rules 2006 at the two locations.

Md. Golam Mostafa
Chief Executive Officer
Environmental Analysis & Development
Global Environment Consultants Ltd (GECL).

MOHD NUR E ALAM SIDDIQUE
Director (Analysis & Development)
Analytical & Environmental Laboratory (GECL)
B.Sc (Hons) M.Sc (SUST) M. Phil (DU),
PhD Research Fellow (NU).

A House of Environmental Monitoring, Research, Pollution Control, Management & Development
www.gecl.org House # 2/F, (6th Floor), South Kallyanpur, Dhaka-1207 Tel: +88-02-8091314, 01715225159, 01793332929, 01715592414 info@gecl.org; gecl.org@gmail.com

Annex-V: Ground Water Quality Test Results

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

Lab Memo: 425/ CC, DPHE, CL, Dhaka — Date: 11-11-2024

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2024110020	Sample Receiving date: 28-10-2024
Ref. Memo No: BSEC/2024/Nill & Dated: 27-10-2024	Sample Source: Ground Water
Sent by:Engr. Shamim Ahmed ,Divisional Head , Bangladesh Steel & Eng. Corporation, Dhaka.	Dist:Barguna, Upa:
Care Taker: Bangladesh Steel & Eng. Corporation.(S : GW)	Union:, Vill.:Taltali
Sample Collection date:	Date of Testing: 28/10/2024-11/11/2024

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Alkalinity	-	140	mg/L	Titrimetic	-
2	Arsenic (As)	0.05	0.001	mg/L	AAS	0.001
3	Chemical Oxygen Demand (COD)	4.0	4	mg/L	CRM	4.0
4	Colour	15	2.0	Hazen	UVS	-
5	Hardness	200-500	355	mg/L	Titrimetic	-
6	Iron (Fe)	0.3-1	0.23	mg/L	AAS	0.05
7	Manganese (Mn)	0.1	0.03	mg/L	AAS	0.03
8	pH	6.5-8.5	7.7	-	pH Meter	-
9	Salinity	-	0.97	‰	Multimeter	-
10	Total Dissolved Solid (TDS)	1000	970	mg/L	Multimeter	-
11	Total Suspended Solid (TSS)	10	1	mg/L	Gravimetric Method	-
12	Turbidity	10	1.3	NTU	Turbidity Meter	-

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

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	Alam 11.11.2024	1.) Name: Mita Sarker Designation: Senior Chemist	11/11/2024
2.) Name: Taslima Akhter Designation: Sample Analyzer	11.11.2024	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	11/11/2024 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

Page 1 of 1

(Department of Environment) Approved Environmental Impact Assessment (EIA) with Terms of Reference (ToR) for Establishment of Environment Friendly Ship Recycling Industry at Taltoli, Barguna.

Description of Sample: Groundwater quality parameters
Sampling date : 20 October, 2024
Reporting date : 07 November, 2024

Table 1.0 Groundwater (Deep tube -well) quality parameters

Location	SN	Parameter	Unit	Results	Drinking Water Standard as per schedule -2 rules 31 ECR 2023
Ground water (Deep Tube well)	1	Biochemical Oxygen Demand (BOD) at 20 °C	mg/l	0.03	NF
	2	Fecal Coliform (FC)	CFU/100 ml	0	0
	3	Total Coliform (TC)	CFU/100 ml	0	0

Comments: The parameters of groundwater (deep tube well) quality found within the ranges of standard limit as per ECR 2023, standard for drinking water (schedule -2 rules 31).

Md. Golam Mostafa
Chief Executive Officer
Environmental Analysis & Development
Global Environment Consultants Ltd (GECL).

MOHD NUR E ALAM SIDDIQUE
Director (Analysis & Development)
Analytical & Environmental Laboratory (GECL)
B.Sc (Hons) M.Sc (SUST) M. Phil (DU),

Annex-VI: Surface Water Quality Test Results

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

Lab Memo: 425/ CC, DPHE, CL, Dhaka — Date: 11-11-2024

Physical /Chemical/ Bacteriological Analysis of Water Sample

Sample ID: CEN2024110021	Sample Receiving date: 28-10-2024
Ref. Memo No: BSEC/2024/Nill & Dated: 27-10-2024	Sample Source: Surface Water
Sent by:Engr. Shamim Ahmed ,Divisional Head , Bangladesh Steel & Eng. Corporation, Dhaka.	Dist:Barguna, Upa:
Care Taker: Bangladesh Steel & Eng. Corporation.(S : SW)	Union:, Vill.:Taltali
Sample Collection date:	Date of Testing: 28/10/2024-11/11/2024

LABORATORY TEST RESULTS:

Sl.#	Water quality parameters	Bangladesh Standard	Concentration present	Unit	Analysis Method	LOQ
1	Alkalinity	-	90	mg/L	Titrimetic	-
2	Chemical Oxygen Demand (COD)	4.0	16	mg/L	CRM	4.0
3	Colour	15	6.2	Hazen	UVS	-
4	Dissolved Oxygen (DO)	6.0	5.40	mg/L	Multimeter	-
5	Hardness	200-500	125	mg/L	Titrimetic	-
6	Iron (Fe)	0.3-1	5.65	mg/L	AAS	0.05
7	Manganese (Mn)	0.1	0.14	mg/L	AAS	0.03
8	pH	6.5-8.5	7.8	-	pH Meter	-
9	Salinity	-	0.13	‰	Multimeter	-
10	Total Dissolved Solid (TDS)	1000	132	mg/L	Multimeter	-
11	Total Suspended Solid (TSS)	10	18	mg/L	Gravimetric Method	-
12	Turbidity	10	547	NTU	Turbidity Meter	-

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

Test Performed by:	Signature	Countersigned/Approved by:	Signature
1.) Name: Md. Saiful Alam Khosru Designation: Sample Analyzer	11.11.2024	1.) Name: Mita Sarker Designation: Senior Chemist	11/11/2024
2.) Name: Taslima Akhter Designation: Sample Analyzer	11.11.2024	2.) Name: Md. Biplab Hossain Designation: Chief Chemist	11/11/2024 Md. Biplab Hossain Chief Chemist Department of Public Health Engineering Central Laboratory Mohakhali, Dhaka

Page 1 of 1

of Environment) Approved Environmental Impact Assessment (EIA) with Terms of Reference (ToR) for Establishment of Environment Friendly Ship Recycling Industry at Taltoli, Barguna.

Description of Sample: Surface water quality parameters
Sampling date : 20 October, 2024
Reporting date : 07 November, 2024

Description of analysis

Table 1.0 Surface water (Payra River) quality parameters

Name of sample & Location	SN	Parameter	Unit	Results	Liquid waste discharge standards of industrial establishments or projects as per ECR 2023 Schedule -4 Rules -32		
					Inland surface water	Public Sewerage system connected to treatment at second stage	Coastal areas
Surface water (Payra River)	1	BOD_5 at 20 ^0C	mg/l	5.2	30	250	100
	2	Fecal Coliform (FC)	mg/l	15	NYS[1]	NYS	NYS
	3	Total Coliform (TC)	mg/l	3	NYS	NYS	NYS
	4	Oil and grease	mg/l	2.7	10	22	20

[1]NYS=Not yet set.

Comments: The values of BOD_5 and oil & grease were within the limit of ECR 2023 for surface water (schedule -4 rules 32) quality standard (Inland surface water).

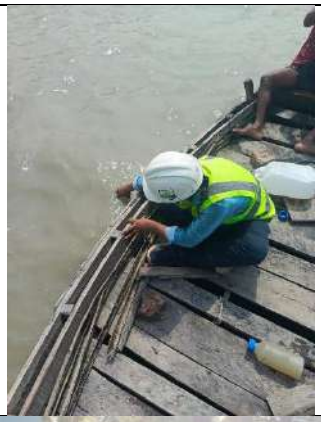
Annex-VII: Pictures from Field Works

pictures from the ongoing surveying:

Pictures of environmental testing:

Air Quality test		
Noise Level test		

Pictures of water sample collection:

Surface Water Sample Collection	
Ground Water Sample Collection	

Pictures of consultations:

Consultations with Government Officials and Elected Authorities	
	
Consultation with UNO, Taltali; Barguna	Consultation with social officer Taltali Upazila; Barguna

	
Consultation with Upazila coordinator, Ekti Bari Ektti Khamar prokolpo; Taltali Upazila; Barguna	Consultation with chairman, Borobogi union parishad; Taltali Upazila; Barguna
	
Consultation with in charge officer Heed Bangladesh NGO, Taltali; Barguna	Consultation with Agriculture Officer, Taltali; Barguna
	

Consultation with Cluster Biswas, Taltali Upazila; Barguna	Consultation with Chairman, Nisanbaria union parishad Taltali Upazila; Barguna
	
Consultation with Forest Bit Officer, Taltali; Barguna	Consultation with Sub Assistant engineer DPHE, Taltali; Barguna
	
Consultation at 6 No. Nisanbaria union parishad complex	Consultation with Executive Engineer, BWDB, Barguna

Community Consultations

	
Consultation at Tetulbaria Bazar, 6 No. Nisanbaria union; up: Taltali; Dis: Barguna	Consultation at Joyalbhanga Bazar, 6 No. Nisanbaria union; up: Taltali; Dis: Barguna
	
Consultation at the site area	Consultation at the site area

Annex-VIII: NOC from Local Union Parishad

গণপ্রজাতন্ত্রী বাংলাদেশ সরকার
৬ নং নিশানবাড়ীয়া ইউনিয়ন পরিষদ কার্যালয়

স্মারক নংঃ ইউ.পি নিশানবাড়ীয়া/৫৯ তারিখঃ ৩১/১০/২০১৭

<u>পরিবেশগত ছাড়পত্রের জন্য স্থানীয় কর্তৃপক্ষ কর্তৃক প্রদেয় অনাপত্তি পত্রের ছক</u>

১। আবেদনকারীর নামঃ জনাব মোঃ সাইদুর রহমান, প্রকল্প পরিচালক
২। সংস্থার নামঃ বাংলাদেশ ইস্পাত ও প্রকৌশল কর্পোরেশন
৩। আবেদনকারীর ঠিকানাঃ বিএসইসি ভবন ,১০২ কাজী নজরুল ইসলাম এভিনিউ, ঢাকা-১২১৫।
৪। প্রকল্পের অবস্থানগত ঠিকানাঃ **Feasibility Study of Environment Friendly Ship Re-Cycling Industry at Taltali Upazila, Barguna District.**

৫। প্রকল্পের তফসিলঃ

জেলার নাম	থানার নাম	মৌজার নাম	খতিয়ান নং	দাগ নং	জমির ধরন	মোট জমির পরিমান
বরগুনা	তালতলী	-	-	-	-	১০৫.১০

৬। কারখানা/প্রকল্পের উৎপাদিত/উৎপাদিতব্য পন্যের নামঃ **Environment Friendly Ship Re-Cycling Industry.**

উপরোক্ত তথ্যাদির আলোকে **"Feasibility Study of Environment Friendly Ship Re-Cycling Industry at Taltali Upazila, Barguna District"** শীর্ষক উন্নয়ন প্রকল্পকে নিম্নবর্ণিত শর্তসাপেক্ষে অনাপত্তিপত্র প্রদান করা হল।

<u>শর্তাবলী</u>

১। প্রকল্প স্থাপন ও পরিচালনার ক্ষেত্রে পরিবেশ সংরক্ষণ আইন ও বিধি যথাযথভাবে অনুসরণ করতে হবে।
২। পরিবেশ অধিদপ্তর হতে বিধি দ্বারা নির্ধারিত পদ্ধতিতে ছাড়পত্র গ্রহণ করতে হবে।
৩। কর্মরত শ্রমিকদের পেশাগত স্বাস্থ্য ও নিরাপত্তা নিশ্চিত করতে হবে।
৪। উপযুক্ত অগ্নি নির্বাপক ব্যবস্থা রাখতে হবে এবং অগ্নিকান্ড কিংবা অন্য কোন দুর্ঘটনার সময় জরুরী নির্গমন ব্যবস্থা থাকতে হবে।
৫। বায়ু ও শব্দ দূষণ করা যাবেনা।
৬। প্রকল্প সৃষ্ট তরল বর্জ্য অপরিশোধিত অবস্থায় বাইরে নির্গমন করা যাবেনা।

উল্লিখিত যে কোনো শর্ত লঙ্ঘন করলে যথোপযুক্ত কর্তৃপক্ষ কর্তৃক প্রকল্পের বিরুদ্ধে আইনানুগ ব্যবস্থা নেওয়া যাবে।

(মো: দুলাল ফরাজী)
চেয়ারম্যান
৬ নং নিশানবাড়ীয়া ইউনিয়ন পরিষদ
ফোনঃ +৮৮০১৭৪০৮১০৮৫৩

প্রকল্প পরিচালক
বাংলাদেশের বরগুনা জেলার তালতলী উপজেলায় পরিবেশবান্ধব জাহাজের পুনর্ব্যবহারযোগ্য শিল্প নির্মাণের সম্ভাব্যতা যাচাই প্রকল্প।
বিএসইসি ভবন ,১০২ কাজী নজরুল ইসলাম এভিনিউ, ঢাকা-১২১৫।