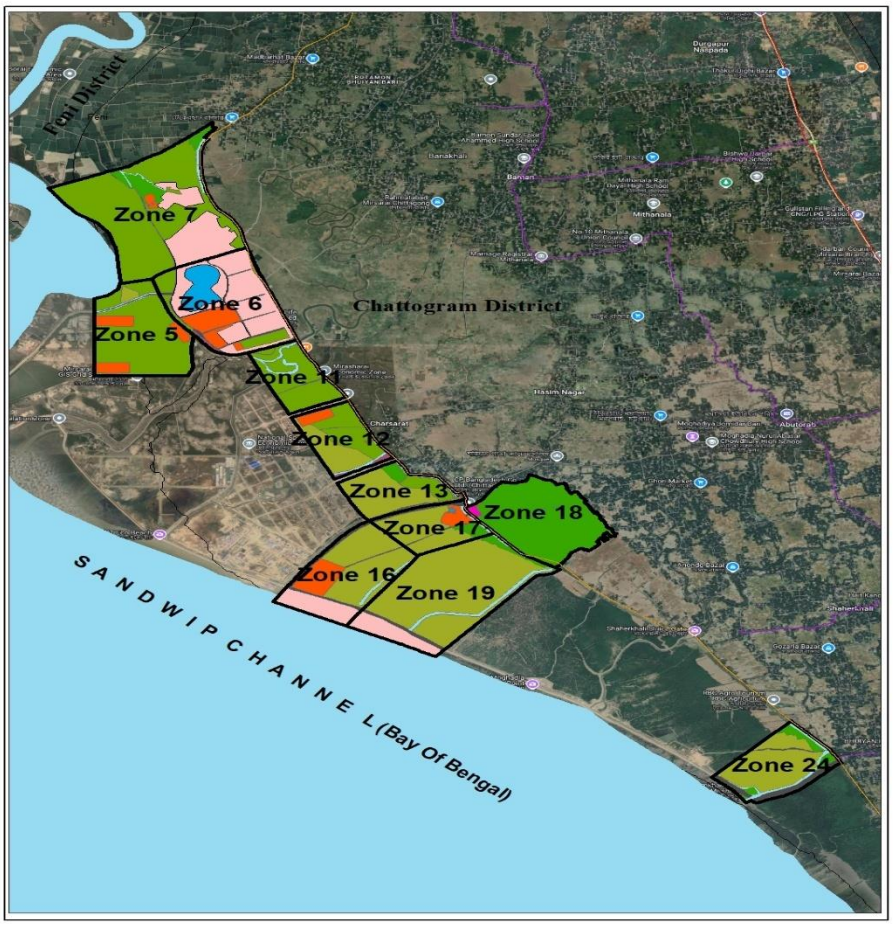
BANGLADESH ECONOMIC ZONES AUTHORITY (BEZA)
CHIEF ADVISOR'S OFFICE

NSEZ DEVELOPMENT PROJECT (PRIDE)

DRAFT ENVIRONMENTAL IMPACT ASSESSMENT (EIA)

Of

National Special Economic Zone
(Zone 5-7, 11-13, 16-19 & 24), Mirsharai, Chattogram



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Prepared By
BCL Associates Limited
Consulting Engineers & Planners

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ABBREVIATIONS

AOI	*Area of Influence*
BEZA	*Bangladesh Economic Zones Authority*
BEZA	*Economic Zone Authority*
BFD	*Bangladesh Forest Department*
BWDB	*Bangladesh Water Development Board*
CEMP	*Construction Environmental Management Plan*
CETP	*Central Effluent Treatment Plant*
CHS	*Community Health and Safety*
DAE	*Department of Agricultural Extension*
DIFE	*Department of Inspection for factories and establishments*
DOE	*Department of Environment*
DoF	*Department of Fisheries*
DSC	*Design and Supervision Consultant*
ECC	*Environmental Clearance Certificate*
ECR 2023	*Environmental Conservation Rules 2023*
EMoP	*Environmental Monitoring Plan*
EMP	*Environmental Management Plan*
EPZs	*Export Processing Zones*
ES	*Environmental Screening*
EIA	*Environmental and Social Impact Assessment*
ESMP	*Environmental and Social Management Plan*
EZs	*Economic Zones*
FDI	*Foreign Direct Investment*
FGDs	*focus group discussions*
GBV	*Gender Based Violence*
GIS	*Geographic Information System*
GOB	*Government of Bangladesh*
IESCs	*Important Environmental and Social Components*
NSEZ	*The National Special Economic Zone*
OHS	*Occupational Health and Safety*
OHS	*Occupational Health and Safety*
PCMs	*public consultation meetings*
PIU	*Project Implementing Unit*
PMU	*Project Management Unit*
PRIDE	*Bangladesh Private Investment and Digital Entrepreneurship*
RMG	*Bangladesh's textile and ready-made garment*
SCC	*Site Clearance Certificate*
ToR	*Terms of Reference*
TSDF	*Treatment, Storage and Disposal Facilities*

EXECUTIVE SUMMARY

Project Background

1. The Government of Bangladesh (GOB) has taken an initiative to extend industrial land and infrastructure, advancing increased private and foreign investment to support its progressive objectives. The government has a target to establish 100 economic zones in the next decade through diverse arrangements. The Bangladesh Economic Zones Authority (BEZA), operating under the Chief Advisor's Office, serves as the primary agency responsible for the establishment of Economic Zones (EZs). BEZA's goal is to set up EZs in all potential areas of Bangladesh, including reluctant and underdeveloped regions. The aim is to accelerate rapid economic development by encouraging increased and diversified industries, spawning employment, and enhancing production and exports.

2. The National Special Economic Zone (NSEZ) is considered as the first multi sector economic zone covering an area of around 30,000 acres under the BEZA, located in Sitakunda & Mirsharai Upazila of Chattogram district, and Sonagazi Upazila of the Feni district. However, the proposed project activities covering zone 5-7, 11-13, 16-19 and 24 is located in Ichakhali Union of Mirsharai Upazila, Chattogram. The NESZ area is strategically located, making it a focal point for development and investment. Its geographical advantages, coupled with its accessibility, position it as a key player in regional planning and economic growth.

Project Objectives

3. The broad objective of the project is to provide eminent facilities to investors for setting up the industries. The facilities will include establishment of gas supply networks to the areas covering 1200 customers, improving the road networks, landscape development, green belt development, landfilling, ensuring water supply to the industries and providing the industrial central effluent treatment system development etc.

Scope of EIA study

4. The scope of EIA study is evaluating the potential environmental and social impacts due to the project implementation and curtailing the impacts to a lower degree for the wellbeing of the natural environment comprising physical and ecological environments and social environment. The EIA serves as a critical tool for ensuring that project activities are conducted in an environmentally responsible manner, promoting sustainability and compliance with regulatory requirements.

5. The EIA has been prepared based on screening, scoping, collection and analysis of baseline data and information, stakeholder engagement, impacts identification and mitigation measures and monitoring and reporting procedures etc.

Policy Legal and Administrative Framework

6. In the EIA study, the relevant national rules and regulations such as ECA, 1995, Labor Act 2006, ECR 2023, Air Pollution (Control) Rule 2022, Noise Pollution (Control) Rule 2006, Biodiversity Conservation Act 2017, Solid Waste Management Rules 2021etc. relevant to the project were reviewed. In addition, the relevant national and international laws and regulations on environmental protection, biodiversity conservation, linking with the project activities were also holistically reviewed.

7. Following the ECR 2023, projects classified as Red Category are mandated to undergo a comprehensive EIA study. This process is crucial for identifying potential environmental impacts and developing strategies to manage and mitigate these effects. Before commencing construction works, it is essential to obtain a Site Clearance Certificate (SCC) from the Department of Environment (DOE). The SCC is granted based on the findings of the EIA, ensuring that all environmental concerns have been addressed and that the project complies with relevant regulations.

Project Location

8. The NSEZ site is located 200 kilometers (km) from Dhaka, 60 km from Chattogram, 70 km from Chattogram Port and the Shah Amanat International Airport and 330 km from Sylhet. The NSEZ Master Plan area is covered two districts of Chattogram and Feni, three Upazila of Sitakunda, Mirsharai under Chattogram district and Sonagazi in the Feni district.

Project Interventions

9. The major component of the project is mainly as follows:

Sub-project-1: Construction of arterial and non-arterial roads, footpath and plot entry culvert.
Sub-project-2: Construction of integrated storm water management network
Sub-project-3: Water supply network
Sub-project-4: Construction of Internal Power Distribution Network
Sub-project-5: Construction of a 30 KM Gas Pipeline Network within NSEZ areas
Sub-project-6**:** Site Upgradation or Land Development of Part of Precinct F (IMD Zone and Housing Facilities) and Precinct B of NSEZ
Sub-project-7: Construction of Treatment, Storage and Disposal Facilities for hazardous waste management of ship recycling industries within Zone 24 of the NSEZ areas.

Existing Environmental and Social Baseline Conditions

10. The project site falls under the Chittagong coastal plain physiographic unit. The soil of the subproject area is mainly formed from recent alluvial sediments, Grey Piedmont soils, & Calcareous Alluvium Soils. The geology of the project area can generally be classified as sedimentary with limestone including metamorphic rocks such as travertine. The site is close to the Sandwip channel and covered with clay and sand deposits. The land resource includes the overall project's area is approximately 19.65 sq km, of which 1.04 sq km are highland and 6.14 sq km are low land (or 4% of the total). Most of the project's area, of 26% of the total area, is flat ground.

11. The general hydrology of the study area comprised three canals (*khal*) such as Ichakhali khal, Daborkhali khal and Bamonsundar khal. Located in the project study area, lies in the flood plain of Feni River.

12. The Ichakhali khal passes within the project area Zone 2A and Zone 2B, and the shallow aquifer of about 20-50m thickness exists near the surface. Aquifers are semi-confined to confine in nature. To determine the baseline quality of the surface water, four water samples were collected. Of them, three (3) were from the canals and 1 (one) from the pond, surface water was analyzed on chemical and biological parameters and such as DO, TDS, TSS, EC, Turbidity, pH, Salinity, COD, BOD, Hg, Pb, Cd, Oil and Grease, FC, TC. The parameters tested were compared against the standard values set in ECR, 2023, Schedule 3 2 (A). (a) following the best standard practices in Bangladesh.

13. The results showed that most of the parameters complied with the national standard, while some parameters do not comply. The physical and chemical properties of all water samples, except TDS of Bamonsundar (SW1) and Daborkhali (SW 2) waters, were within the permissible limit. The tested results show the salinity of the Bamonsundar, Daborkhali, and Ichakhali were 2.1 ppt, 1.4ppt, and less than 0.1 ppt, respectively. Even the salinity concentration of the pond water was 0.2 ppt. Saline water of Sandwip channel connected with sea entrance into the canals that are controlled by the sluice/ regulators, and due to lack of proper maintenance, the sea water encroaches into the canals and mixes with fresh water. As a result, the water in these canals varies from fresh to brackish,

14. The tested groundwater parameters of the collected three samples have been compared with ECR, 2023, Schedule 2 (B) and found that the TDS in near CP More tube well (GW3) exceeded the national ECR 2023 standard, as well as turbidity and the number of EC of the GW3 water also surpassed the limit. Furthermore, the iron concentration in all samples slightly exceeds the standard set by the ECR. Nevertheless, other parameters indicate water quality suitable for drinking purposes.

15. The project area experiences a humid subtropical climate, marked by substantial fluctuations between summer and winter temperatures. The Sitakunda Meteorological station recorded data for 10 years period 2013-2022 are considered for the study area, which is closest distance from the study area. The average minimum and maximum temperature were 12.28°C & 32.94 °C, respectively. The average monthly rainfall was 898.5 mm during July. Monthly normal relative humidity in the project area varies between 72% in February and 87% in July. Cyclone Risk Zone Map of the coastal areas of Bangladesh indicates that, the project site is in the high-

risk area of Bangladesh. There are erosion problems in the project site area. However, super dike and embankments are protecting EZ from erosion and inundation.

16. **Ambient air quality:** In the EIA study, the ambient air quality, noise level and vibration measurement results show that the air quality parameters PM_{10} and $PM_{2.5}$ did not cross the standard limit set by the Air Pollution (Control) Rules 2022. Also, NOx, O_3, CO, SO_2 within the limit of ECR 2023 standards. Noise and vibration levels in the study areas, both during the day and night, conform to the standards outlined in the Noise Pollution Control Rules of 2006. The day-time noise values recorded in ANL02, ANL-08, and ANL-09 indicate that these areas fall under the status of a commercial zone. This classification is attributed to factors such as heavy traffic, significant human movement, and ongoing construction activities prevalent in these study areas. In contrast, the remaining locations are categorized within the standard residential zone status as per NPCR 2006.

17. **Ambient noise level:** The daytime highest noise level have been captured in Ichakhali Sluice gate Bazar, Ichakhali (ANL3, Commercial area) at 67.4 dB(A) and the lowest noise were captured in Abdul Kader Mia House, Charsarat village (ANL5, Residential area) at 38.5 dB(A). The daytime noise levels ranged between 38.5 dB(A) to 67.4 dB(A) for winter season and 38.5 dB(A) to 67.4 dB(A) for Monsoon season. All the observed values were within the Noise Pollution (Control) Rules 2006 day-time standards as well as IFC standards set for the respective zone, except winter season {ANL4, 62.4 dB(A)} and Monsoon {ANL5, 55.8 dB(A)}.

18. The night-time noise levels at all the locations ranged between 34.9 dB(A) to 50.5 dB(A) for winter season and 38.6 dB(A) to 43.5 dB(A) for Monsoon season. All the observed values were within the Noise Pollution (Control) Rules 2006 night-time standards as well as IFC standards set for the respective zone, except winter season {ANL4, 42.5 dB(A)} and Monsoon {ANL4, 43.5 dB(A)}.

Ecological Environment

19. The study area contains different types of habitats and landforms and ecosystems, including mangrove forest, mudflat, offshore, salt pan, cropland, freshwater aquaculture pond, sea beach, settlements, rivers, and so on. Terrestrial ecosystems are categorized based on their habitat. Each habitat supports various plant species and maximum plant species were identified in the study areas, and confirmed by close photographs of flowers, leaves, and stems and/or fertile specimens of leaves, stems and roots were collected through quadrat survey. However, implementation of this sub-project will not affect any forest, protected areas and trees, except some vegetations. There is no sensitive area such as ECAs, PAs, national parks or biological hotspots i.e., game reserve, wildlife sanctuary etc., in or around the proposed subproject sites. However, no Dolphin observed and not reported in the Sandwip Channel during field survey, and the spotted deer observed in the Chorsorot mangrove area which is far away from the 2A and 2B Zones and sub project works will not harm them. Fish resources are limited, particularly in the Ichakhali, Daborkhali and Bamonsundar canals (khals). No fish available in these waterbodies, since surface water in these canals' change from fresh water to brackish, and also khals are mostly dried up.

Social baseline conditions

20. To assess the present social baseline condition, a total of 112 HHs have been surveyed as sample basis in the study area those who are living outside the NSEZ premises but close nearby. The surveyed population was 491and their average HH size was 4.38%. Distribution of sample by gender and age group were 20.57% under 21 to 30 ages followed by 15.89% under 30-40 ages and so on. The total population aged between 0-14 and aged above 65 years constitute about 34.22% HHs who apparently are dependent on the rest 65.78% members of the same HHs. Thus, the dependency ratio comes around 52.01%. About 56.70%of total male and 34.43% of female are fully employed. In response to a question whether they know about Sexually Transmitted Diseases (STD), 23.08% women reported to have heard of HIV/AIDS and about 7.69% claimed to be aware of the reasons for spreading HIV/AIDS. About 98.21% of the respondents believe that migrant workers will come here for work in BEZA to fill the labor shortage. Local market, businessman and shop owners will also be benefited from the construction activity as a considerable number of manpower will engage in this project. About 95.54% of respondents said that local business will be improved for the NSEZ project. About 97.32% of people believe that the project will improve the livelihood facilities of the people living surrounding the project site.

Analysis of Alternatives

21. The location of NSEZ was strategically chosen to avoid private lands, thereby mitigating potential conflicts and socioeconomic impacts on local residents, particularly concerning the displacement of private landowners. Avoiding private rapid land acquisition, the project aims to foster better community connections and minimize the likelihood of legal disputes. This approach helps prevent displacement, loss of livelihoods, and disturbances to established social networks.

22. Despite the limited instances of land acquisition necessary for shaping the economic zones, utmost consideration was given to the affected populations, ensuring proper compensation, and implementing appropriate resettlement plans during the land development phase of NSEZ.

23. The proximity of existing infrastructure played a crucial role in the site selection process. The site was chosen based on its accessibility to roads, utilities, and other essential services, which can significantly reduce project costs and enhance operational efficiency. By ensuring that the site is well-connected to government infrastructure facilities, the feasibility of the project areas is strengthened, paving the way for positive future outcomes.

24. The project interventions such road networks development, storm water drainage facility, internal road network, water supply facility, internal power network facility, site upgradation, construction of gas pipeline network, and construction of Treatment, Storage and Disposal Facilities for hazardous waste management of ship recycling industries etc. are essential components to attract foreign investment, without these basic facilities, the development of the economic zone would be unfeasible. Investors require a solid foundation of infrastructure to operate efficiently and profitably. Therefore, there are no alternative options to bypass these fundamental requirements for attracting investment.

25. While the basic facilities are non-negotiable, there are opportunities to incorporate technological alternatives during the construction phase. These alternatives can help reduce the environmental footprint of the project. For instance, using micro tunnelling method for pipeline at the river/canal crossing, using sustainable materials, implementing energy-efficient construction practices, and employing waste reduction strategies can mitigate the impact on the natural environment.

26. In conclusion, the outlined project interventions are indispensable for the successful establishment of an economic zone. The necessity of basic facilities cannot be overstated, as they form the backbone of a thriving investment environment. While no alternative project options exist due to the selected site and ongoing operations, the integration of environmentally friendly technologies during construction can help balance development with ecological preservation.

Stakeholder Engagement and Information Disclosures

27. A combination of mixed methods of information disclosure and consultation process was adopted at this stage of EIA preparation. The method selected for consultation was designed to keep in mind the profile of the stakeholders, type of information desired and the level of engagement required. Nineteen KIIs, seven FGDs and two Stakeholder Consultation Meeting were conducted. The KIIs were conducted with the key Government agencies, like official of BEZA, KGDCL, BEPZA, DPHE, DoF, BWDB, BREB, Mirsharai BIWTA, DIFE, DOE Mirsharai Upazila Parishad etc., and local community and elites.

28. One out of seven FGDs was women group and other were different groups of projects impacted people focusing on information and environmental and risks and social issues due to the construction and development of economic zone in their areas. The 64 participants (54 males and 10 females) of FGDs provided feedback/suggestions and their expectations to mitigate the impacts. All participants expressed their appreciation towards the implementation of the project.

29. The stakeholders' opinion was mainly positive, and they are expected that they have tremendous employment and business opportunities once the NSEZ being fully operated. During the construction period, the local people believe that employment opportunities will be increased, development of communication systems, development of a business, and the overall quality of life will be improved.

30. However, the participants raised their concerns about environmental and social issues such as pollution and health hazards by the construction activities. The participants' concerns were regarding occupational and public health and safety, as well as infectious diseases caused by the number of workers (migrant labors) etc., at the construction sites. During the construction period, migrant workers will come from different areas of the country. So, there is also possibility of sexual harassment and enhance the gender-based violence's also, eventually, they will create additional burden in the area, because of migrants need food, shelter, school, medical facilities and market facilities.

Potential Impacts and Mitigation Measures

Pre-Construction Period and Construction Period:

31. **Air Pollution:** The local air quality will deteriorate due to construction of different kinds of subprojects such as excavation, trenching, pipelying, backfilling and other infrastructures facilities, causes dust emission and exhaust gas emissions from using vehicles and equipment in the project areas. To reduce this anticipated impact, watering and sprinkling can control dust suppression and ensure good engines will reduce the exhaust gas emissions and other mitigation measures mentioned in Chapter-8 should be applied.

32. **Noise Pollution:** The local noise level will increase due to use of high-generating noise equipment and vehicles such as dump trucks, excavators, batching plant etc. However, mitigating this problem, construction period shall be allowed only daytime, vehicle speed within 25-30 km/hr in the approach road and intersections, using mufflers and silencers, padding and noise isolators can reduce the excessive noise generation, and other measures mentioned in Chapter-8 should be applied.

33. **Water Contamination:** Surface water and groundwater contamination can occur from construction camps, labor camps, and contractor offices through releasing of liquid wastes into the water bodies. To mitigate this problem, toilets with septic tanks or sanitary pits must be provided by the contractor to minimize water pollution; overflows from storage tanks to surface water drains are not allowed. Cement, glues, diesel, and oil, paint, other hazardous chemicals, etc., must be handled carefully and all drains must be covered.

34. **Soil Contamination:** The release of oils, paints, chemicals, and other hazardous materials from construction equipment and vehicles can lead to soil contamination. To mitigate this problem, Storage spaces for fuel, lubricating oil, and used oil shall be in the assigned area, construction trash, debris, oil, gasoline spills, used oil, etc. are collected and disposed of in a designated areas selected by BEZA regularly.

35. **Soil Erosion:** Without proper protective measures during excavation and trenching, soil erosion is likely to occur. This can lead to further degradation of the land and negatively impact agricultural activities in the area. To mitigate this problem, using sandbags in the trenching and excavated sites and steel shuttering, and shoring can protect the soil erosion at the sites

36. **Ecological Resources:** The clearance of vegetation, excessive noise, and surface water pollution will adversely affect local flora and fauna. No trees will be affected due to construction activities the project has limited impacts to aquatic biodiversity during crossing the canal and ditches and low-lying areas etc. However, to lessen the effects on biodiversity, bubble curtains or creation of agitation in water should be carried out prior carrying out the construction to provide avoidance time and let the species move away from crossing point and to prevent any injury/mortality.

37. **Fisheries Resources:** During heavy rains**,** surface run-off can cause mixing with excavated material, debris, raw materials like paints, fuel, rusting of iron etc. site being in close vicinity to channel, khal, river and sea, dredged spoil water enter river & sea might impact the quality of the river & sea water and aquatic life. To mitigate this problem, temporary drainage systems shall be developed to control surface runoff and liquid waste disposal cannot be allowed into water bodies. Any kind of development activities like dredging in the Sandwip Channel shall be restricted during breeding season and others measures suggested in Chapter 8 shall be confirmed.

38. **Agricultural Resources:** One of the primary concerns is the management of construction waste. If not handled properly, waste materials can be inadvertently released into the environment, particularly affecting nearby agricultural lands. This can lead to soil contamination, which may adversely impact crop health and

yield. So, to reduce this impact, waste management shall be maintained with the Waste Management Plan (Vol-II, Annex-14).

39. **Social Implications:**

40. **Labor Influx**: The health and safety of the workers, who may be vulnerable to infectious diseases like HIV/AIDS and other contagious diseases, due to the influx of workers (about 30 to 40) at the project locations. To protect the health and safety of the workers, the sites should include a drinking water supply, toolbox meetings, and sanitary facilities for all employees, and female restrooms for female personnel and appropriate PPE (Hard boots, life vest, safety goggles, and hand gloves) for all etc.

41. **Occupational Health and Safety:** . Occupational Health and Safety can be jeopardized due to trenching, excavation, pipe laying, moving heavy equipment and materials, grading, stringing, coating, and wrapping, among other tasks. To mitigate this risk, the implementation of hard barricades, safety signage, portable restrooms and drinking water facilities, toolbox meetings, on-the-job safety training, accident-incidental records, emergency contact numbers, emergency vehicles, the use of forklifts and cranes for material handling, the insulation of electrical conductors with glass, rubber, or plastic, and appropriate PPE are all necessary to protect the health and safety of the workers.

42. **Child Labor:** There is a risk of child labor emerging as families due to work longer hours for minimal pay, perpetuating cycles of poverty and exploitation. However, any kind of child labor (<18 years) recruitment are strictly prohibited at the site and it is to be illegal offense.

43. **Community Health and Safety:** Heavy vehicle traffic, excessive noise production, dust emissions, traffic accidents, trenching, excavation, backfilling, pipe laying, wielding, and other activities will put risks for community health and safety. To reduce this anticipated risk, site security, local engagement, boundary fence (at least two meters high), safety signage and recruitment of local people can reduce the risks of communicable diseases shall be endorsed by the contractor and implement properly.

44. **Gender-Based Violence (GBV):** The risks of sexual exploitation, abuse, and harassment (SH) as well as gender-based violence (GBV) will arise from the influx of workers at the site. To address this issue, it is necessary to inform the workers about national laws and regulations, have them sign a Worker Code of Conduct as part of their employment contract, include penalties for non-compliance (such as termination), and notify the local law enforcement agency of any incidents that may occur at the sites. In addition, to avoid the GBV the PIU will consider the Gender Action of PRIDE project. a grievance mechanism on potential GBV/SEA/SH cases under the guidance of Project PIU and shall consider in submitting bid the provisions for service providers in case of potential GBV victims/cases.

45. **Traffic and Transport**: Utility shifting may cause disruptions, obstruct pedestrian access roads, endanger public and occupational safety, and result in accidents as a result of excavators, pay loaders, graders, and dump trucks moving about. To reduce this risk, vehicle speed should be limited to 25-30 km/hr. at the approach road and intersections, diversion and other measures such as, traffic signs and cautionary signs should be placed to prevent excessive traffic congestion, flagmen should be outfitted with red and green flags and an illuminating vest at night, especially near intersections, etc.

46. **Hazardous and Non-hazardous Waste:** The Project will generate both non-hazardous and hazardous wastes such as excavated material, broken aggregates, solid trash, filling materials, wastewater, etc. are examples of non-hazardous waste, and hazardous waste like discarded batteries, empty drums, paints, used oils and lubricants, chemicals or replaced parts of construction equipment. To reduce this impact, the contractor must supply enough containers for the temporary storage of solid waste and liquid waste including distinct containers for hazardous and non-hazardous waste, and they must be properly labeled to lessen the expected impact. E-waste and hazardous garbage should be gathered in steel drums and containers, kept in a separate roofed location, and disposed of at authorized waste disposal facilities on a regular basis.

Operation Period:

47. **Air Pollution:** Local air quality will deteriorate during the operation periods, whereas necessary maintenance works will require such as repairing drainage, roads, water lines, power lines and TSDF site, that will involve excavation, trenching etc. However, after internal road development, it will promote increase

vehicle movement which will also cause increasing air quality. To mitigate this problem, implement regular maintenance and inspection schedules, develop and practice emergency response plans at the project site. Provide personnel with the necessary training on handling pipeline leaks, implement automatic fire suppression systems, and use advanced leak detection systems for early identification and the installation of automatic shut-off valves to minimize gas release in the event of a leak. For traffic and transport, vehicle speed should be limited to 25/30 km/hr. within the project areas that will reduce dust and gas emission in the project areas.

48. **Noise and Vibration:** The valve of gas pipeline stations and other facilities can produce excessive noise, affecting the local terrestrial ecosystem and human health. To reduce this impact, all construction equipment will conform to a standard of less than 90 dB (A). Workers in the vicinity of high noise levels will be provided earplugs etc.

49. **Water Quality:** The local water quality will deteriorate due to releasing stagnant waters from storm water drainage, & water lines, hazardous waste leaks from TSDF site, etc. To mitigate this problem, drainage outfalls and capacity shall be maintained regularly and any kind of wastewater or sewerage effluent shall be strictly prohibited to release into the surface water sources, and others appropriate mitigation measures shall be applied based on ground condition etc.

50. **Ecological Resources:** Local ecological resources will not be significantly disturbed during operation phase, however, if hazardous waste can leak from TSDF site and release into nearest water bodies that will be disastrous. To protect the ecosystem, green buffer zone should be established around TSDF site through implementation of tree plantation plan (1:3) and other measures shall be taken based on ground conditions.

51. **Fisheries Resources: T**he fisheries resources will be disrupted due to surface runoff, effluent discharges, and other human activities. To reduce this anticipated impact, it is necessary to implement measures to control stormwater runoff, such as the construction of retention basins and vegetated swales, Collaborate with local fishing communities to promote sustainable fishing practices.

52. **Agricultural Resources:** The impact on agricultural resources is very limited. However, agricultural resources may be contaminated due to the discharge of effluent of project, and other industrial operation. To mitigate this problem, establish the buffer zones between the NSEZ and adjacent agricultural lands to reduce the risk of contamination from pollutants. Encourage the local farmers to engage in other jobs and provide support to affected farmers by the project during transitioning to alternative livelihoods or practices.

53. **Social Environment:**

54. **Occupational health and safety:** During the operation period, occupational health and safety will be affected by the gas pipe leakage, fire and explosions but to avoid this anticipated impact, maintenance like checking, re-testing of gas pipeline should be carried out regularly and if leakage is found, immediately shut down the gas supply and repair the line as early as possible etc. is required.

55. **Labor Influx:** During the operation period, numerous industries will be operative, employing thousands of local and migrant workers. This influx poses a potential challenge for the spread of infectious diseases within the project areas. However, the project has been ensuring that residential facilities are available for migrant workers, officials, and staff. These facilities aim to provide a safe and healthy living environment, reducing the risk of disease transmission.

56. **Community Health and Safety:** The community Health and Safety will be affected by pipeline rupturing, equipment failures, spillage accidents etc., In addition, gas pipe leakage can cause faulty construction, damage from excavation equipment or corrosion can also affect the community and workers' health and safety in the working areas. To mitigate this problem, regular maintenance is required and if any fault is found the operation should be shut down and an emergency period declared to take remedial measures.

57. **Hazardous and Non-hazardous waste:** The Project will generate both solid non-hazardous (broken aggregates, solid waste, filling materials, wastewater) and hazardous waste (used oils, greases, fuels, fuels, gas cylinder, chemicals, paints, empty drums etc.) throughout the operation period. To reduce this anticipated impact, the contractor shall provide sufficient containers for the temporary storage of solid waste including

separate containers for hazardous waste with proper labelling and e-waste shall collect in separate bins, steel drums and stored in a segregated roofed areas and disposed of in a designated areas selected by BEZA.

58. **Traffic and Transport: During** the operation period, vehicles movement will increase with increasing nos of accidents. To reduce this problem, vehicle speed should be limited (30 km/hr) within the project areas, necessary speed breakers, lighting, safety signage should be installed to control speed and increase awareness of drivers and staffs and unauthorized vehicles movement should be restricted also.

59. **Environmental Quality Monitoring:** A detailed monitoring plan is given in chapter 9. However, it is recommended that air quality, noise and vibration level, surface and groundwater, and soil quality should be monitored quarterly during the construction period with the responsibility of contractors and the same parameters shall be monitored by BEZA itself during the operational period. Other monitoring such as land resources, agricultural resources and ecological resources should be monitored regularly by the contractors during construction period by adoption of physical observation and social monitoring should be conducted regularly to avoid any kind of disturbance, mitigating unrest, and social conflict and local people should access employment opportunities to the site. And stakeholder consultation is a must and being conducted regularly with the local people, workers and others.

60. **Institutional Arrangement:** The environmental and social management will be carried out under the direct supervision of the Project Management Unit (PMU) of NSEZ and oversee the contractor works, The BEZA has appointed a Design and Supervision Consultant (DSC) and their qualified Environmental and Social specialists will daily monitor the contractors' activities in compliance of the Environmental Management Plan (EMP) and Environmental Monitoring Program (EMoP) and review the contractor's prepared report on the implementation of the EMP and will also ensure EMP, and EMoP are duly implemented during the Pre-Construction and Construction Phases.

61. For effective implementation of the project, a third-party consulting firm may be hired by the BEZA to evaluate the contractor's overall performance independently in complying with the provisions of the EMP as well as for satisfactory compliance with the World Bank's E&S framework and DoE requirement.

62. Before construction works begin, the Contractor (s) will prepare the C-EMP in accordance with the environmental and social specifications and EHS specialist of the contractor who will be assigned to implement the EMP following their site-specific C-EMP including environmental and social code of practices, labor management, waste, and traffic management plans; occupational health and safety plan; spill, and drainage management plans; tree planting, and greenery plans etc. Throughout the Construction and Operation Period, PIU of NSEZ and BEZA will take greater accountability for the social and environmental challenges.

1. INTRODUCTION

1.1 BACKGROUND OF THE PROJECT

1. To growth the economic development of the country, Export Processing Zones (EPZs) are such a tool where investors come forward in an aggregated way for successful economic development. Export Processing Zone (EPZ) model was initiated to attract Foreign Direct Investment (FDI) as part of a strategic instrument and deal with shortcomings of the overall investment climate in the country". However, it has some shortfalls and cannot achieve the goal and government's target as well. As an exporting enclave, EPZs provided little in the way of backward or forward linkages with the domestic economy, resulting in low technology and efficiencies, which normally accompanied foreign investment. In addition, investments in other sectors beyond the RMG segment did not materialize.

2. The Government of Bangladesh (GOB) has taken an initiative to offer industrial land and infrastructure, fostering increased private and foreign investment to support its developmental objectives. The government has a target to establish 100 economic zones in the next decade through diverse arrangements. The Bangladesh Economic Zones Authority (BEZA), operating under the Chief Advisor's Office, serves as the overarching agency responsible for the establishment of Economic Zones (EZs). BEZA's goal is to set up EZs in all potential areas of Bangladesh, including backward and underdeveloped regions. The aim is to stimulate rapid economic development by promoting increased and diversified industries, generating employment, and enhancing production and exports.

3. The National Special Economic Zone (NSEZ) is to be the first multi sector economic zone with an area of around 30,000 acres, located in Mirsharai Upazila of Chattogram district and Sonagazi Upazila of Feni district. The NESZ area is divided into several sub-zones considering the potential due to its strategic location.

4. The Government of Bangladesh has received financing from the World Bank (WB) toward the implementation of the NSEZ Project of Bangladesh Economic Zones Authority (BEZA) under Bangladesh Private Investment and Digital Entrepreneurship (PRIDE) project of the World Bank. PRIDE would provide support for construction of some basic infrastructure (such as internal road network, gas pipeline connection, water supply, storm drainage system, internal power networks, site upgradation, and TSDF facilities, focusing environment friendly green Economic Zone etc.) Some of Land development works have already been done by the Private Sector Development Support Project (PSDSP), the predecessor of PRIDE project, and some of development will be carried out under this proposed project.

5. This EIA report is prepared based on approved Termes of Reference (ToR) from the DoE **(Annex-1**) and following the Environmental Conservation Rules (ECR), 2023, other relevant rules and regulations both national and international.

1.2 PROJECT OBJECTIVES

6. The broad objective of the project is to provide the eminent facilities to the investors for setting up the industries. The facilities will include establishment of gas supply networks to the areas covering 1200 customers, improving the road networks, landscape development, green belt development, landfilling in the IMD zones, ensuring water supply to the industries and providing the central sewerage system development etc.

1.3 SCOPE OF WORK

7. The Scope of Work for this study covers mainly for carrying out a detailed environmental impact study (EIA) for the landscape development of the NSEZ. The specific objectives are as follows:

- Preparing Terms of Reference (ToR) for EIA study following the Environmental Conservation Rules 2023 (ECR 2023), Schedule-10 for approval by the Department of Environment (DOE).
- Conducting Environmental Screening (ES) and Identifying Environmental risks.
- Identifying the Valued Environmental and Social Components (VCs) which might be impacted due to project implementation.

- Collecting and updating the Environmental Baseline Conditions that include ambient air quality, noise and vibration level, surface water quality, soil and sediment quality, and identifying the types of habitats that could be at dangers and the effects on the ecological conditions.
- Assessing the socio-economic conditions of the project sites and conducting stakeholder consultation meetings with stakeholders at various levels including project affected people, governmental agencies, private organizations, and non-governmental organizations etc., and
- Carry out detailed Environmental Impact Assessments (EIA) & Environmental Plan (EMP).
- Preparing Occupational Health and Safety (OHS) Management Plan for all the proposed activities.
- To prepare Environmental specifications to be included in the contractors'/suppliers' bidding documents for all the contract packages.
- To undertake Stakeholder consultations in line with SEP during preparation of EMP in EIA and other instruments.

1.4 APPROACH AND METHODOLOGY

8. The EIA study of the proposed NSEZ project has adhered to the sequence of events depicted in Figure-1-1. The following sections provide descriptions of the tasks performed at each stage of the EIA process.

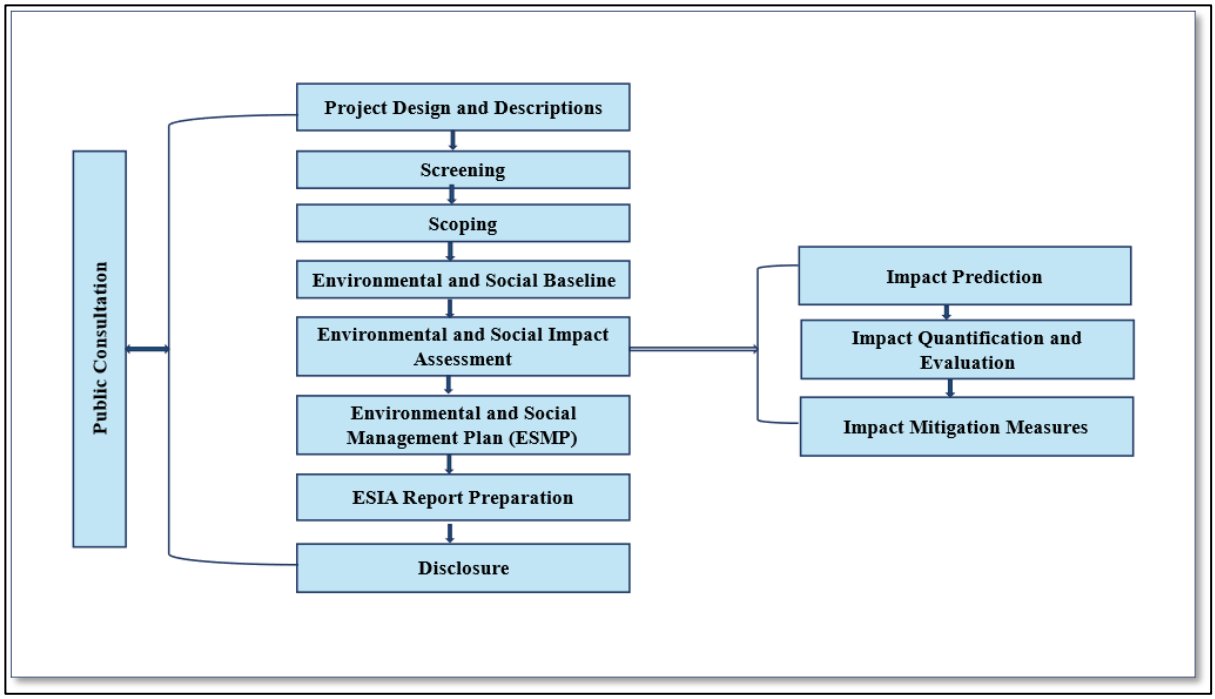


Figure 1-1: Steps for Environmental and Social Impact Assessment

Step-1: Sub-project design and description

- Physical interventions in human and natural systems can have an impact on the environment, hence while doing the EIA, it is crucial to comprehend the proposed interventions. The EIA team obtained comprehensive information about the project design from the Project Implementing Unit (PIU) of the NSEZ-BEZA, Mirsharai, which allowed us to gain a full knowledge of the proposed interventions and associated potential environmental and social effects.

Step-2: Screening

- The screening process was mainly involved Desk review of pertinent documents and information of the project site and its surrounding areas. Reconnaissance survey of the site, surrounding areas, approach road, and initial conversations with local stakeholders details;

Step-3: Scoping

- Discussion with BEZA and others relevant stakeholders must be used for defining scopes for the impact assessment, planning and implementation of mitigation and monitoring, reporting for the project that will satisfy the national regulatory requirements and as well as BEZA requirements.
- As part of national regulatory requirement, the Environmental Conservation Rule 2023 (ECR 2023) shall be rigorously considered on the type, scale, and working methods of the NSEZ project, consultations or stakeholder engagement with the primary and secondary stakeholders etc.
- Identification of the Valued (VCs) including environmental and social valued components (ESVC) for analysis of the environmental and social impacts.
- The VCs, which means specific physical environment, ecological, economic, and social attributes that may be potentially impacted by the proposed project activities and that were assessed based on baseline environmental and social conditions with associated proposed sub -project activities.

Step-4: Environmental baseline

- The environmental and social baseline information are collected following the existing status of VSEC1s. The project areas are contemplated as core areas and the remaining study areas are of buffer areas. Likely impacts and risks in the context of Area of Influence (AoI), a 5 km buffer2 zone around the NSEZ stipulated for establishment of the baseline condition. The project's AoI covers the project site and nearby areas where project activities could have an impact directly and indirectly to the receptors. The study areas contemporaneously stocking the existing physical environmental setting, ecosystems such as vegetation, fish diversity, aquatic breeding sensation, wetlands and surface water systems while social aspects contemplated the existing rural settlements. The project areas considered the holistic approach highlighting the proposed areas for development and related facilities and existing associated facilities and lives and livelihoods which might or might not affected due to the project development.
- **Physical and Ecological Environmental Data Collection**

  Environmental baseline data are gathered by primary baseline surveys and fill out with available secondary data. The primary physical environmental quality parameters like air, noise and vibration levels, surface and groundwater quality and soil quality are collected and analysed in the renowned laboratories. Secondary data also collected from Bangladesh Meteorological Department (BMD) and other revenant organizations and scientific reports.

  Ecological environmental data were collected through direct observations by transect walk for sourcing the available floral and faunal species. In addition to direct sightings, animal activity is detected by tracks, footprints, feeding signals, and calls. This exercise often employed suitable field guides and data forms to ensure that information is appropriately recorded. Many mammalians and reptilian species are cryptic and unlikely to be discovered by traditional field sampling methods. During the field survey, detailed interviews with local inhabitants are conducted to collect information on animal and plant existence, such as occurrences, behaviour, breeding, distribution, and seasonal appearance. In addition, the baseline data were collected mainly direct observations and consultation with the local people on the specific information.

- **Socio-economic Data Collection**

  Socioeconomic evaluation was held among the residents and community members living periphery of the project study area as sample basis both for random sampling and stratified sampling at HHs survey followed by the semi-structured questionnaire. Secondary data collected from Bangladesh Bureau of Statistics (BBS).

[1] Environmental and Social Valued Components

[2] Buffer zones- protected areas, important social structures, archaeological structures, eco sensitive areas, national highway, marine environment etc.

- **Consultations Process**

  In addition to consultation with local people, several consultations were carried out with officers of different GoB organizations; the Department of Environment (DoE), Bangladesh Forest Department (BFD), Department of Fisheries (DoF), Department of Social Welfare Services, Department of Agricultural Extension (DAE), Bangladesh Water Development Board (BWDB), Economic Zone Authority (BEZA), Department of Fire Service and Civil Défense, Department of Inspection for factories and establishments (DIFE), Department of Explosives, etc., to stay up to date on regulatory requirements, and other relevant to the project

- **Stakeholders Engagement**

  Several key informant information (KII) small group meetings, primarily focus group discussions (FGDs), were held during data collection, followed by public consultation meetings (PCMs) during baseline data collection. However, during the socioeconomic survey, many interviews with local inhabitants are conducted on environmental and social issues, as well as the status of the gender violence issues in the study area.

- **GIS Mapping**

  In the EIA study, GIS-based maps of existing physiography, land use and other are prepared using the most recent cloud-free Landsat 7 ETM+ satellite imagery and confirmed with high-resolution Google Earth pictures.

Step-4: Environmental Impact Assessment

- Impact Identification: The impacts are identified and assessed for intensity using modelling and/or matrix methodologies, and classified as Low, Moderate, high impacts on the environment and communities in the study region, in accordance with the ECR 2023. The impact assessment process predicted using prediction tools (Figure 1-2), as described below.

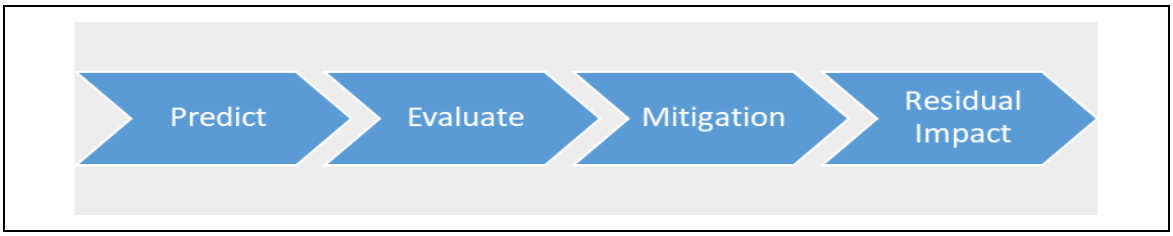


Figure 1-2: Impact Assessment Process

- Analysis of the environmental and social impacts was carried out based on collected primary data and secondary data on physical environment and ecological environment, as well as social issues at project study area through the assessed the Valued Components (VCs).
- Finally, assessing the potential environmental implications necessitates considerable data on ecosystems, biodiversity, and physical properties. It is also critical to learn how present environmental processes interrelate to form a complex ecosystem. This information shall be used to detect potential environmental changes by the project, as well as to offer strategies for avoiding, reducing, or managing such environmental consequences.

Impact Qualitative and Quantification, and Evaluation

- Qualitative assessment of potential consequences was conducted using the criteria to determine their significance. Potential consequences were determined based on their size and receptor sensitivity. The project's potential impacts are classified as Low, Moderate, and High based on factors such as duration, spatial extent, reversibility, likelihood, and legal standards and professional criteria. The quantitative assessment was assessed based on the magnitude of the anticipated impacts which was scored as for Low-1, Moderate-2, and High-3 based on expert's judgement. However, the impacts are evaluated based on magnitude, immediacy, sustainability and reversibility. A ±10-point scale is adopted, for example: (+)1 to (+)10 for beneficial impacts, 0 for no impact, (-)1 to (-)10 for negative impacts.
- The significant issues in the Scoping Phase were also examined using baseline information. Each issue has either positive or negative impacts on the project or the environment. The EIA evaluates potential

repercussions before and after mitigation measures are adopted, considering direct, indirect, and cumulative implications in the short and long term.

Environmental Monitoring Program or Plan

- The environmental management plan (EMP) was developed once the impact assessment was completed and mitigation strategies were identified. During the EMP compilation process, institutional arrangements for the project's environmental and social management were recommended, mitigation and monitoring plans were developed, documentation and reporting protocols were established, training requirements were assessed, and the cost of EMP implementation was estimated. The EMP include Environmental Monitoring Plan (EMoP) to ascertain the contractor's activities comply of the EMP.
- **EIA Report Preparation**

  Finally, the EIA report was prepared based on the ECR 2023 and other relevant regulatory policies.

1.5 THE PROPONENT OF THE PROJECT

9. The proponent of the project is the NSEZ. The name of the Project Director, official address, telephone number and email address of responsible Office, etc. is presented below;

Name:	Abdullah Al Mahmud Faruk
Position:	Joint Secretary Project Director National Special Economic Zone (NSEZ) Bangladesh Economic Zones Authority Level 7, 8 & 9; Biniyog Bhaban, E- 6/B, Sher-E-Bangla nagar, Dhaka- 1207
Email:	pd.NSEZ.pride@beza.gov.bd
Mobile:	+880 155015127

1.6 THE CONSULTANT

10. The BCL Associates Limited is appointed as the consultant for the PMC-16- NSEZ-BEZA. The details of the consulting firm are as follows.

Name:	Dr. Nahid Amin Acting Team Leader BCL Associates Ltd.
Address	Noorani Tower (2nd Floor) 1 Mohakhali Commercial Area, Bir Uttam A K Khandaker Sarak Dhaka 1212, Bangladesh
Email:	nahid.amin@bclgroup.com
Mobile:	01720958994

1.7 EIA STUDY TEAM

11. A multi-disciplinary EIA team was engaged to collect data, information, conduct baseline study, impact prediction and assessment and suggest mitigation measures during the EIA study based on the DOE's approved ToR included in Annex 1, Volume II. The professional members of the EIA team are as follows:

Table 1-1: EIA Team

Sl. No.	Name of the expert	Position in the team
1	Mrs. Nahid Amin, PhD	Acting Team Leader
2	Mr. Tajul Islam, PhD	Ecologist
3	Md. Kamrul Hasan Bhuiyan	Environmental Expert
4	Mr. Mamun Ur Rashid	Social Expert
5	Md. Mustafizur Rahman	Junior Environmental Expert

6	Mrs. Sadia Afrin Nitu	Quality Control Expert
7	Mr. Nahid Hasan	Junior Social Expert

12. Besides the expert team, a junior team was involved in conducting interviews with different types of stakeholder consultations following the semi-structured questionnaire and socio-economic survey at the project areas with data collection and analysis.

1.8 REPORT STRUCTURE

Chapter 1	Introduction
Chapter 2	Legal, Policy and Administrative Framework
Chapter 3	Project Description
Chapter 4	Existing Environmental Condition
Chapter 5	Stakeholder Consultations Plan
Chapter 6	Important Environmental and Social Components
Chapter 7	Impact Prediction and Evaluation
Chapter 8	Environmental Management Plan
Chapter 9	Environmental Monitoring Plan
Chapter 10	Conclusion and Recommendations

2 LEGAL, POLICY AND ADMINISTRATIVE FRAMEWORK

2.1 INTRODUCTION

13. The implementation and construction of this Project by the BEZA requires strict compliance with laws, rules and regulations pertinent to the environment. In Bangladesh, the DoE is responsible for ensuring the application of environmental laws and issuance of necessary clearances.

14. The procedures and requirements for EIA study are dictated by the Environment Conservation Rule (ECR), 2023, which introduced a requirement for any proposed "industrial unit or project" to obtain prior approval from the DoE.

15. The ECR 2023 has classified projects to be assessed (by the DoE) in four categories (green, yellow, Orange, and Red). Subject to a satisfactory review of the environmental assessment, the DoE issues an authorization for the project to proceed. The authorization consists of two parts: a "site clearance", which gives approval to the site proposed for the project, and "Environmental Clearance", which approves the content of the project.

16. The proposed project activities are mainly

- Construction of Road Network (27.7 Km),
- Storm Water Network (48Km),
- Power Network (41.44 km),
- Water Supply Network (41.44 km),
- Gas Pipeline Network (41.44 km),
- Resilient Site Upgradation and Building
- Development, and Security and Support Amenities and
- Construction of TSDF facilities for hazardous waste management of ship recycling industries etc. are considered as Red category project following Schedule-1 of ECR 2023 which requires a comprehensive Environmental Impact Assessment (EIA) study for DOE clearance.

17. Following the Schedule-10 of ECR 2023, BEZA prepared Terms of Reference (ToR) Referred to Annex-1, Volume II and received the approval from DOE for the purposes of Environmental Impact Assessment (EIA). This EIA report has been prepared following the Schedule-11 of ECR 2023.

18. The BEZA, as project proponent, is responsible for carrying out EIA study of the proposed project, and responsible for administering the environment assessment process through its Project Management Unit (PMU). This Chapter presents a review of the national policy, legal, and regulatory framework relevant to the environmental and social aspects of the Program.

2.2 ENVIRONMENTAL POLICIES AND LEGISLATION

2.2.1 National Environmental Policy, 1992 (amended in 2018)

19. Bangladesh adopted the National Environmental Policy (NEP) in 1992 to chart a path towards the country's sustainable development. The NEP 2018 is a revision of NEP 1992 in the context of the new reality of climate change. The NEP 2018 also outlines a more up to date understanding of the extent and magnitude of environmental degradation that has become a fact of life in the world in general, and in Bangladesh in particular. The NEP 2018 outlines the problems of population growth, poverty, illiteracy, lack of awareness and healthcare services, limitation of arable land, unplanned development and urbanization, and industrialization as the major impediments to the conservation of the environment. The NEP sets out the basic framework for environmental action together with a set of broad sectoral guidelines for action. Major elements of the policy are:

(i) maintaining the ecological balance for ensuring sustainable development.
(ii) protection against natural disasters.
(iii) identifying and controlling activities which are polluting and/or destroying the environment.
(iv) ensuring environmentally friendly development in all sectors.
(v) promoting sustainable and sound management of natural resources; and

(vi) active collaboration with international initiatives related to the environment.

20. The NEP, amongst other aims, seeks to ensure that transport systems, including roads and inland water transport, do not pollute the environment or degrade resources. The policy states that environmental impact assessment should be conducted before projects are undertaken. The NEP 2018 includes additional elements addressing climate change mitigation and adaptation as key environmental issues facing the country and integrating a comprehensive 3R approach to the massive and growing problem of industrial and household waste that has swelled along with the country's urbanization.

2.2.2 National Environmental Management Action Plan (NEMAP), 1995

21. The NEMAP was built on the NEP to address specific issues and management requirements during 1995-2005 and remains a backbone of efforts to articulate national sustainability strategies. The plan includes a framework within which the recommendations of a National Conservation Strategy (NCS) are to be implemented. The NEMAP was developed with the following objectives:

(i) Identify key environmental issues affecting Bangladesh.
(ii) Identify actions to halt or reduce the rate of environmental degradation.
(iii) Improve management of the natural environment.
(iv) Conserve and protect habitats and biodiversity.
(v) Promote sustainable development.
(vi) Improve the quality of life.

22. To this end, the NEMAP grouped all the relevant necessary actions under four heads: institutional, sectoral, location-specific, and long-term issues. The institutional aspects reflect the need for inter-sectoral cooperation to tackle environmental problems requiring new institutional mechanisms at national and local levels. The sectoral aspects reflect the way the ministries and agencies are organized and make it easier to identify the agency to carry out the recommended actions. The location-specific aspect focuses on particularly acute environmental problems at local levels. And the long-term issues include environmental degradation trends that threaten to emerge as serious threats to the country's environmental quality and well-being if not proactively addressed.

2.2.3 Environment Conservation (Amendment) Act, 2010

23. The Environment Conservation Act authorizes the DOE to undertake any activity to conserve and enhance the quality of the environment and to control, prevent and mitigate pollution. The DOE is designated as the regulatory body and enforcement agency for all environment-related activities. The Act enables the following critical components of DOE's remit:

(i) Declaration of Ecologically Critical Areas.
(ii) administration of the procedure for obtaining Environmental Clearance Certificates for new industrial projects.
(iii) regulations with respect to vehicles emitting smoke which are harmful to the environment.
(iv) environmental regulations for development activities.
(v) standards for the quality of air, water, noise, and soil (including riverbed materials) for different areas and for different purposes.
(vi) acceptable limits for discharging and emitting waste; and
(vii) formulation of environmental guidelines to control and mitigate environmental pollution, conservation, and improvement of the environment.

24. Amendments to the ECA in 2000, 2002 and 2010 added significant substantive and procedural scope, defining the following new areas of authority:

(i) ascertaining responsibility for compensation in cases of damage to ecosystems.
(ii) increased provision of preventive measures, including fines and imprisonment, and the authority to take cognizance of offences.
(iii) restrictions on polluting automobiles.
(iv) restrictions on the production and sale of environmentally harmful items like polythene bags.
(v) obtaining assistance from law enforcement agencies for environmental actions.
(vi) definition and enforcement of punitive measures.

(vii) authority to try environmental cases.
(viii) prohibition on hill cutting except were established to be in the national interest.
(ix) authority to regulate management of hazardous waste produced by ship breaking yards.
(x) prohibition of filling or alteration of waterways except when judged to be in the national interest; and
(xi) additional powers to compel compliance with emissions standards.

2.2.4 Environmental Conservation Rules 2023

25. The Environment Conservation Rules 2023 was enacted in March 2023 following the Bangladesh Conservation (Amendment) Act 2010. It is still the most important set of regulations giving procedural substance and tools of enforcement to the aims articulated in the ECA. The Rules specify standards for air quality and emissions, water quality and discharges, and noise (Table 2-1 and details in Annex 2, Volume -II **Error! Reference source not found.**), and establish norms enabling the inspection of industrial facilities, i ncluding collection of environmental samples, by the DOE. Importantly, the Rules (Schedule I) lay out a standard framework for categorizing, assessing, and regulating new industrial projects using four-level categories of impact potential such as Green, Yellow, Orange, and 'Red' category. This category is the basis for defining the national impact assessment requirements and necessary environmental clearances in relation to all proposed industrial facilities and infrastructure. Implementation of the environmental clearance and assessment processes as defined in the Rules by project proponents and consultants is given further practical guidance by the EIA Guidelines for Industries (2021), which indicate how to produce the assessment documents required to support environmental clearance applications. Environmental standards attached to ECR 2023 are shown in Table 2-1 regarding noise and air, the parameters indicated in the Noise Pollution Control Rules (2006) and Air Quality Control Act 2022 remain active although ECR has been updated from 1997 to 2023.standards specified in the Environment Conservation Rules.

Table 2-1:Environmental Standards under the ECR 2023

ECR Schedule	Standard name
Schedule 2	Standards for Air
Schedule 3	Standards for Water
	Inland surface water
	Coastal Surface water
	Drinking water
Schedule 4*	Standards for Sound
Schedule 5*	Standards for Sound Originating from Motor Vehicles or Mechanized Vessels
Schedule 6	Standards for Emission from Motor Vehicles
Schedule 7	Standards for Emission from Mechanized Vessels
Schedule 8	Standards for Odor
Schedule 9	Standards for Sewage Discharge
Schedule 10	Standards for Waste from Industrial Units or Project Waste
Schedule 11	Standards for Gaseous Emissions from Industries or Projects
Schedule 12	Standards for Sector-Wise Industrial Effluent or Emission

The Noise Pollution Control Rules 2006 and Air Quality Control Act, 2022 are still active.

2.2.5 Other Environment-Related Legislation and Rules

26. In addition to the ECA (Amendment) 2010 and ECR 2023, numerous laws and supporting rules have been passed and developed to regulate the use of natural resources and protect the natural environment from deleterious activity. A summary of environment-related laws and rules, any of which may be relevant or applicable to proposed infrastructure development, is provided in **Table 2-2**. Depending on the nature of project activities and infrastructure, No Objection Certificates (NOCs) may need to be obtained from the agencies overseeing environment-related laws and regulations as part of the environmental clearance process directed by DOE, to ensure compliance with all relevant national laws.

Table 2-2: Summary of Environmental Legislations Applicable to the Proposed Project

No	Environmental Legislation / Act	Objective	Relevance to the Project	Responsible Institution
1	National Environmental Policy, 1992 (2018)	Ensure that development components do not pollute the environment or degrade resources. It sets out the basic framework for environmental action together with a set of broad sectoral action guidelines. (2018) Include Climate Change issues and update previous framework for environmental action.	Restriction on operations which cannot be initiated in ecologically critical areas. Regulation on vehicles emitting smoke is harmful to the environment. Follow standards on quality of air, water, noise and soil. Set limits for discharging and emitting waste	Ministry of Environment and Forests, and Climate Change
2	Noise Pollution Control Rules (2006)	Under the ECA 1995 this rule is to ensure control of noise pollution in designated areas. This rule also revises the noise pollution standards mentioned in ECR 1997.	Regulation of construction noise at the construction site.	Department of Environment District Commissioner's Office
3	Air Pollution Control Rules, 2022	Provide comprehensive regulatory framework for the prevention and control of air pollution from stationery and mobile sources.	Applies to emissions from construction equipment, vehicles, backup generators, and industrial processes.	Department of Environment
4	Solid Waste Management Rules, 2021	Framework for municipal and industrial waste segregation, handling, and disposal.	Requires solid waste management plans during construction and operation	Department of Environment / Local Authorities
5	Medical Waste (Management and Processing) Rules, 2008	Control medical waste to protect public health and environment.	Applicable if any clinics, first-aid stations, or health facilities are included.	Department of Environment / Health Authorities
6	ECR 2023 Schedules (3, 4, 10)	Provide effluent and emission standards and waste classification.	Guides design of pollution control systems for effluent, air, and waste management. Provides structure for EIA report.	Department of Environment
7	Fire Safety (per BNBC and Fire Act, 2003)	Mandates fire prevention and response provisions, licenses, and drills.	Required for approval of building designs; ensures fire suppression and evacuation protocols.	Fire Service and Civil Defense / Local Authorities
8	Draft Hazardous Waste Rules, 2021	Manage generation, storage, transport, and disposal of hazardous wastes.	Relevant if any industrial or chemical wastes are generated.	Department of Environment
9	IFC 2007 (Environment, Health and Safety) Guidelines	These General EHS Guidelines are designed to be used together with the relevant Industry Sector EHS Guidelines which provide guidance to users on EHS issues in specific industry sectors. The applicability of the EHS Guidelines should be tailored to the hazards and risks established for each project based on the results of an	It is relevant to the project as project activities associated with occupational health and safety and public health safety will be jeopardized due to conducting project activities in the working areas.	BEZA will ensure the IFC Guidelines are integrated with the WB ESF.

No	Environmental Legislation / Act	Objective	Relevance to the Project	Responsible Institution
		environmental assessment in which site-specific variables, such as host country context, assimilative capacity of the environment, and other project factors, are considered		
10	IFC Performance Standards (IFC PS)	IFC's Performance Standards on Environmental and Social Sustainability mainly focusing the performance standard *on its Sustainability Framework, to strengthen its approach and better align it with the challenges of today's dynamic and complex global environment*	It is aligned with the project activities focusing on the different important environmental and social valued components and its standard set out by WB ESF.	BEZA will ensure to implement the IFC PS with the WB ESF standards.
11	World Bank Environment and Social Framework	World Bank Environmental and Social Framework set out 10 different standards (ESS-1 to ESS-10) to manage and mitigate the potential impacts and monitor the ES standards during execution of project.	It is applicable with the project, as some components of the project is financed by World Bank	BEZA will ensure the project is being implemented following the WB ESF, however World Bank will monitor the progress of the ES standards during the implementation period.
12	ILO Core Conventions	The International Labor Organization's (ILO) Core Conventions represent fundamental principles and rights at work, considered essential for ensuring decent work conditions and social justice globally. They cover areas such as freedom of association, the right to collective bargaining, the elimination of forced labor, the abolition of child labor, and the elimination of discrimination in employment and occupation.	Labor compliance shall be met by the project following ILO Conventions and Local Labor Rules and Compliance Requirement.	BEZA will take responsibility to implement
13	National Safe Drinking Water Supply and Sanitation Policy of 1998	Ensures access to safe water and sanitation services at an affordable cost	Paurashava and water sanitation authorities will take actions to prevent wastage of water. They will take necessary steps to increase public awareness to prevent misuse of water. Paurashava shall be responsible for solid waste collection, disposal and their management	Ministry of Local Government, Rural Development, and Cooperatives

No	Environmental Legislation / Act	Objective	Relevance to the Project	Responsible Institution
14	National Water Act 2013	Ensures Bangladesh water sources are free from any type of pollution. Pollution from water in urban outfalls and reservoirs, e.g., lakes, canals, ponds and ditches may result in amenity losses, fisheries depletion, health problems and fish and aquatic species contamination.	Secure clearance certificate on water resource development subprojects	Ministry of Water Resources
15	Wetland Protection Act 2000	Advocates protection against degradation and resuscitation of natural waterbodies such as lakes, ponds, beels[3], khals, tanks, etc. affected by man-made interventions or other causes. Prevents the filling of publicly owned water bodies and depressions in urban areas for preservation of the natural aquifers and environment. Prevents unplanned construction on riverbanks and indiscriminate clearance of vegetation on newly accreted land.	In case of diversion of water from Naf River, detailed assessment will be done	Ministry of Water Resources
16	Bangladesh Labor Law, 2006 (amendment 2018)	It is a comprehensive law covering labor issues such as: conditions of service and employment, youth employment, benefits including maternal benefits, compensation for injuries, trade unions and industrial relations, disputes, participation of workers in company's profits, regulation of safety of dock workers, penalty procedures, administration and inspection. This Act pertains to the occupational rights and safety of factory workers and the provision of a comfortable environment for working. It also includes rules on registration of laborer's, misconduct rules, income and benefits, health and fire safety, and factory plan. The amendment of 2018 further ensured the occupational health and safety rights of the worker by replacing some of the	Compliance to provisions on employment standards, occupational health and safety, welfare and social protection, labor relations and social dialogue, and enforcement. Prohibition of employment of children and adolescents.	Ministry of Labor and Employment

[3] A beel is a billabong or a lake-like wetland with static water (as opposed to moving water in rivers and canals - typically called khals), in the Ganges - Brahmaputra flood plains of the Eastern Indian states of West Bengal, and Assam and in the country of Bangladesh.

No	Environmental Legislation / Act	Objective	Relevance to the Project	Responsible Institution
		clauses of 2006 law, such as: paid leave and associated facilities, parental leave etc.		
17	Bangladesh Labor Rules, 2015	Includes rules on registration of laborers, misconduct rules, income and benefits, health and fire safety, factory plan	Contractors to implement occupational health and safety measures. Contractor will be liable for compensation for work-related injuries	Department of Labor
18	The Paurashava Act 2009 / Ordinance issued for the amendment of local government (municipality) ordinance, 2009 and 2010; The Paurashava Ordinance, 1977; Municipal Administration Ordinance, 1960	Provides guidance for subproject integrated community and workers health and hygiene at the construction and operation and maintenance stages of the project	Coordinate with Paurashava committees on disaster management measures, water and sanitation and waste management	Local Authorities
19	Bangladesh Climate Change Strategy and Action Plan of 2009	Enhances the capacity of government ministries, civil society and private sector to meet the challenges of climate change	Integrate adaptation measures for buildings in consideration of extreme climatic events	Ministry of Environment, Forests and Climate Change
20	Building Construction (Amendment) Act and Building Construction Rules, Bangladesh National Building Code	Regulates technical details of building construction and maintain standards of building construction	Follow specifications to ensure structural integrity of buildings	Ministry of Housing and Public Works
21	Electricity Act 2018	Requires compensation for any damage, detriment or inconvenience caused by the project; Requires precautionary measures in laying down electricity supply lines near or where any metallic substance or line crosses to avoid electrocution; directs in powerline laying construction related activities to avoid public nuisance.	Secure permission to supply energy and lay down or place electricity supply lines for the conveyance and transmission of electricity from respective authorities before any work. Give full compensation for any damage, detriment or inconvenience caused by him or by anyone employed by him. Take precautions in laying down electricity supply lines near or where any metallic substance or line crosses to avoid electrocution	Ministry of Power, Energy and Mineral Resources
22	The National Energy Policy (1996 and Updated 2004)	Ensures environmentally sound sustainable energy development programs causing minimum damage to the environment, to encourage public and private sector participation in the development and management of the energy sector and to bring the entire country under electrification.	Public and private sector participation in the development and management of energy subprojects. Provides guidelines for renewable energy subprojects	Ministry of Power, Energy and Mineral Resources

No	Environmental Legislation / Act	Objective	Relevance to the Project	Responsible Institution
23	Standing Order on Disaster, 1999 (Updated 2010)	Enhance capacity at all tiers of government administrative and social structures for coping with and recovering from disasters	Geographical information system (GIS) technology will be applied	Ministry of Disaster Management and Relief
24	National Disaster Management Act of 2012	Establishes a framework for managing disasters in a comprehensive way.	Setting-up emergency response procedures	Ministry of Disaster and Relief
25	East Bengal Protection and Conservation of Fish Act 1950 (1982)	Protection and conservation of fishes in inland water bodies of Bangladesh	No wetland or canal should be encroached or obstructed due to construction and operation of the projects	Department of Fisheries
26	Embankment and Drainage Act (1952)	Consolidates laws relating to embankment and drainage to make better provisions for the construction, maintenance, management, removal and control of embankments and water courses for the better drainage of land and for their protection from floods, erosion and other damage caused by water	Relevant since most of the subprojects are drainage construction and operation	Ministry of Water Resources
27	Public Procurement Rule (2008)	Applies to the procurement of goods, works or services by any government, semi-government or any statutory body established under any law; includes measures regarding the safety, security and protection of the environment in construction works; requires contractors to take all reasonable steps to safeguard the health and safety of all workers on site, protect the environment on and off the site, and avoid damage or nuisance to persons or to property of the public or others	The PPR (2008) will be followed during procurement process of the subprojects	Ministry of Public Works

2.2.6 Community and Occupational Safety & Health Legislation

27. During construction, the subproject will conform to the occupational and health related rules as outlined in the **Error! Reference source not found.** below.

Table 2-3: Occupational and Health Safety Related Rules in Bangladesh

Title of Laws and Rules	Descriptions
Social Security under the Act, 1923 and an amendment in 1980	According to the Act social impact assessment includes the processes of analyzing, monitoring and managing the intended and unintended social consequences, both positive and negative of planned interventions (policies, programs, plans, projects) and any social change processes invoked by those interventions.
Bangladesh Labor Law of 2006	Compliance to the provisions on employment standards, occupational safety and health, welfare and social protection, labor relations and social dialogue, and enforcement Prohibition of employment of children and adolescent
The Employer's Liability Act, 1938	The Act declares that the doctrine of common employment and of assumed risk shall not be raised as a defense in suits for damages in respect of employment injuries. Under the Maternity Benefit Act, 1939, the Maternity Benefit Act, 1950, the Mines Maternity Benefit Act, 1941, and finally the rules framed thereunder, female employees are entitled to various benefits for maternity, but in practice they enjoy leave of 6 weeks before and 6 weeks after delivery.
Public Health (Emergency Provisions) Ordinance, 1994	The ordinance calls for special provisions with regard to public health. Whereas an emergency has arisen, it is necessary to make special provision for preventing the spread of human disease, safeguarding public health and providing them with adequate medical service and other services essential to the health of respective communities and workers in particular during the construction related work.
The Employees State Insurance Act, 1948	It has to be noted that health, injury and sickness benefits should be paid to people, particularly respective workers at the workplace under the Act.
Bangladesh Factory Act, 1979	The Act requires every workplace including small- or large-scale construction where women are employed to have an arrangement of childcare services. Based on this Act and Labor Laws - medical facilities, first aid and accident and emergency arrangements are to be provided by the authority to the workers at workplaces.
Water Supply and Sewerage Authority Act, 1996	The Act specifies WASA's responsibility to develop and manage water supply and sewerage systems for public health and environmental conservation.

2.3 ENVIRONMENTAL COMPLIANCE REQUIREMENTS

2.3.1 Legislation On Environmental Approval Processes and Procedures

28. The Project activities are subject to the environmental safeguard requirements of the Environmental Conservation Rules 2023, National Air Pollution (Control) Rule 2022 and National Noise Pollution (Control) Rule 2006. These requirements share some concepts and terminology and are non-contradictory. The two procedural frameworks for environmental impact assessment are described in turn below.

2.3.2 National Environmental Clearance Process

29. The ECR 2023 stipulates a four-level color-coded typology of impact potential as the basis for determining the environmental clearance process for different types of proposed projects, and the extent of environmental assessment work that must be done in support of clearance applications submitted by proponents. The categorization framework is outlined in Table 2-4.

Table 2-4: Categorization Scheme for Determining Environmental Clearance Requirements

Category	General Environmental Assessment Requirement
Green	No environmental assessment required to support application for environmental clearance
Yellow	No environmental assessment required, but detailed project information, including process flow diagrams and effluent treatment arrangement, must accompany application for environmental clearance

Orange	Initial Environmental Examination (IEE) required, and project can proceed to environmental site clearance application once IEE is approved by DOE
Red	Brief IEE required to establish ToR for comprehensive Environmental Impact Assessment (EIA), and project can proceed to environmental clearance application after EIA and Environmental Management Plan (EMP) have been approved by DOE, often subject to conditions

30. The Environment Conservation Rules 2023 (Schedule I) provide indicative lists of types of projects, facilities and infrastructure that would normally fall into each of the four assessment categories. Although new industrial units were added to all four categories in the 2023., These lists are not comprehensive, and the listed types may in many cases not apply unambiguously to a given proposed infrastructure element or project activity. Further, the matters of scale and context, which determine so much impact potential, are not strongly addressed by the indicative lists. Assigning an assessment category must be informed by expert judgement, based on the initial specifications of the planned project infrastructure and activities, and basic details of the project environment. DOE reviews preliminary infrastructure plans for proposed infrastructure investments and decides regarding the categorization on a case-by-case basis.

31. Regardless of the assessment category assigned, all applications for environmental clearance must be accompanied by a NOC obtained from local authorities (Union Parishad Chairman or Upazila Nirbahi Officer in rural locations, and from several entities in urban locations such as Dhaka), and by an application fee. NOCs may also be required from key agencies (e.g., Water Resources Planning Organization, Forests Department, Ministry of Fisheries) if the proposed project has any potential relevance for the natural resources under their remit. The proponent is responsible for obtaining the NOCs and paying the application fee. The proponent is also responsible for renewing the clearance certificate, once obtained, yearly, paying a fee for each renewal. Fines are levied when the proponent allows the clearance certificate to lapse.

32. For investments that require an environmental assessment report (Orange and Red projects), DOE reviews and approves the report (either an IEE or more detailed EIA) before approving the clearance application. The approval may be subject to certain conditions which the proponent is bound to meet to get the clearance certificate current. Review of clearance applications by DOE requires up to 30 days from receipt (**Figure 2-**1).[4]

[4] A useful and accessible reference on the clearance process is Department of Environment. 2010. A Guide to Environmental Clearance Procedure. Dhaka, August 2010.

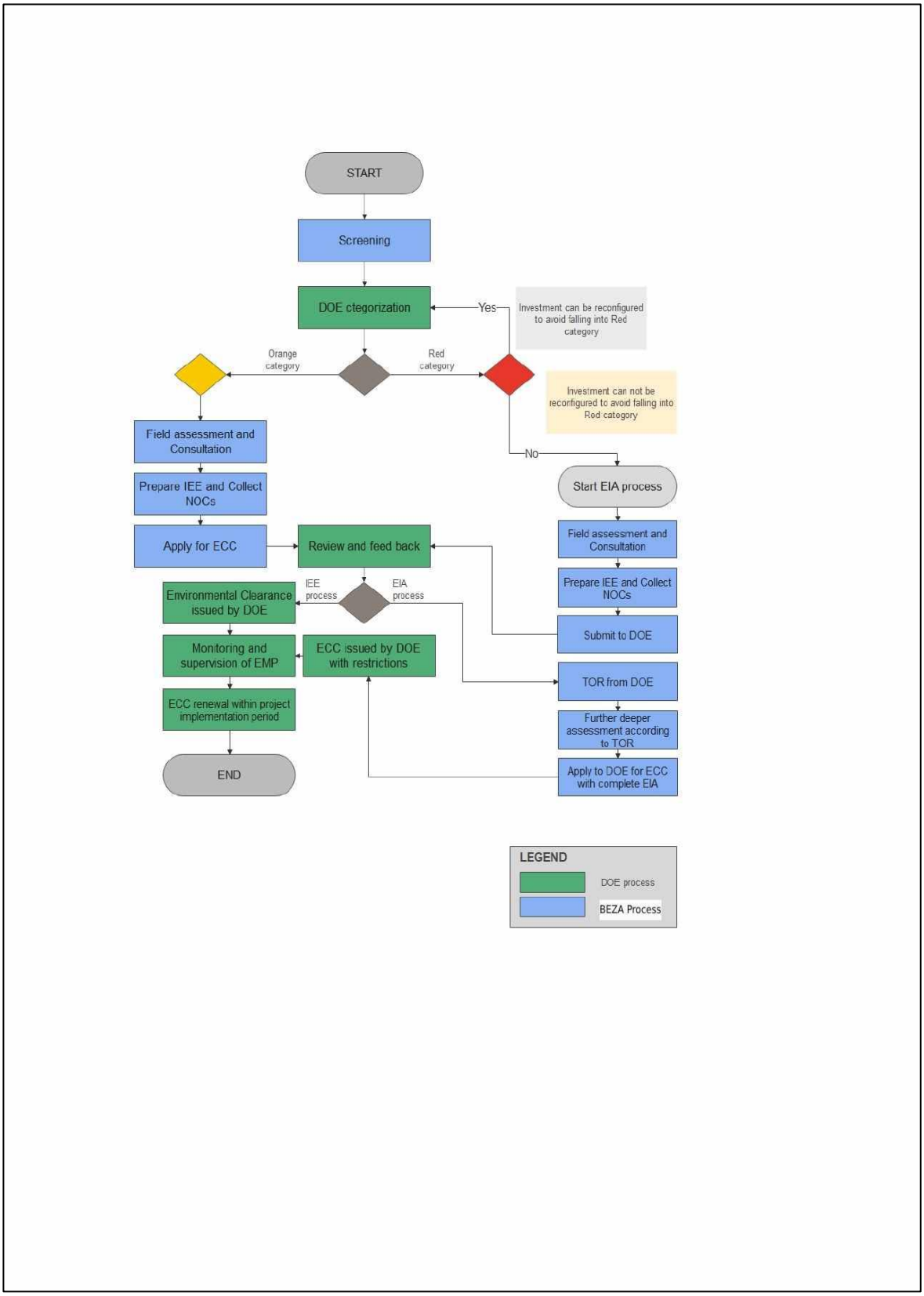


Figure 2-1: Flowchart of national clearance process as applicable to NSEZ

3 PROJECT DESCRIPTION

3.1 RATIONALE

33. The NSEZ is Bangladesh's flagship, SMART City/Economic zone project. Bangladesh Economic Zones Authority (BEZA) is developing large industrial city NSEZ in phases on an area under the World Bank financed Public Sector Development Support Project (PSDSP) at Mirsharai in Chattogram district. To develop the lands under the NSEZ, include land filling using dredged materials from the Sandwip Channel and/ or Muhuri Reservoir. Land development and Associated Infrastructures in Zone 5-7, 11-13, 16-18 and 24 of the NSEZ. The main importance of this sub-project is land development and establishment of associate infrastructures inside the NSEZ. Project aims to play a pivotal role in this endeavor by establishing a modern industrial hub capable of attracting both domestic and international investments, which will foster the economic growth of Bangladesh.

34. To develop the lands under NSEZ development project, including land filling using dredged materials from the Sandwip Channel and Muhuri Reservoir is the key Sub Project. Land filling activities will be conducted in the Zone 5-7, 11-13 16-18 and 24). Besides this, associated infrastructures i.e. road and drainage network; internal power networks development, gas pipeline, water supply network, sit upgradation and TSDF facilities construction are also components of the project. Project area's land filling is anticipated to be carried out using dredged materials. It has been indicated that Land development will require approximately 106,000 m3 of filling material and sand will be lifted/dredged from the Sandwip channel.

3.2 OBJECTIVES

35. The main objectives are as follows;

- Promoting private investment and job creation in economic zones of NSEZ and mainstreaming the environmental sustainability in the development of economic zones in Bangladesh. Specific goals included.
- Developing various infrastructures in Zone 5-7, 11-13, 16-18 and 24-2A & Zone-2B of the NSEZ to create an enabling environment for private investment.
- Enabling a greener and resilient NSEZ that will showcase the benefits of incorporating resilience and sustainability concepts in the development of economic zones; and
- Creating new employment opportunities by attracting investment in the economic zones of NSEZ.

3.3 BENEFITS

36. The NSEZ will offer several benefits to both the country and the businesses as follows (but not limited to).

- The NSEZ is a 'game changer' in economic zone design and development in the Bangladesh.
- To be the premier, international work, live, play location and an urban/industrial hub in South Asia.
- Strategically located for easy access to domestic and international markets.
- Offering a multi-modal transport and logistics platform incorporating port, rail, road and airport connectivity to reduce congestion, delays, costs and increase efficiency as well as strengthen supply chains.
- Spearheading state-of-the-art, green and resilient infrastructure, utilities and technology to make NSEZ competitive, efficient, sustainable and resilient.
- Targeting innovative foreign and domestic investors.
- Promoting exports, cleaning industry/manufacturing, value addition production utilizing cutting-edge technology, and supporting new industry trends and enhanced creativity.
- Aids in transferring knowledge, technology and innovation to local entrepreneurs, professionals and workers.
- Offering a safe and secure environment, which is monitored on a 24/7 basis for investors, residents, workers, and visitors.
- Offering an OSS with streamlined and fast-tracked processes and procedures as well as after-care facilitation.
- Offering a competitive labor pool with new types of professional, technical, skilled and unskilled jobs for Bangladeshi.

3.4 REQUIREMENT OF LAND

37. The total land amount of NSEZ is about 33804 acres for industrial development in the NSEZ areas. However, the proposed development will cover a total land of 4263.48 acres consisting of zone 5-7, 11-13, and 16-18. The detail is given below:

Table 3-1:Status of Land Amount [5]

Name of Zone	Unit (Acre)
Zone 5	565.27
Zone 6	670.55
Zone 7	696.85
Zone 11	228.65
Zone 12	390.18
Zone 13	279.15
Zone 16	490.7
Zone 17	275.8
Zone 18	666.33
Zone 19	894.90
Zone 24	62 (part of Zone 24)
Total (Acres)	**5220.38**

(Source: NSEZ)

3.4.1 Land ownership

38. The land designated for the NSEZ is under the ownership of BEZA, ensuring that the project can proceed without the complexities associated with private land acquisition. This strategic decision is expected to streamline the development process, allowing for a more efficient implementation of the economic zone. The focus on public land will facilitate the establishment of infrastructure and facilities necessary for attracting businesses and investors to the area.

39. The proposed development activities will be carried out in Zone 5-7, 11-13, and 16-19 and zone 24 which is owned by the NSEZ under jurisdiction of BEZA. So, no land acquisition will be required for this proposed development activities.

3.5 PROJECT LOCATION AND SURROUNDING ENVIRONMENT

40. The project site is located at Ichakhali Union under Mirsharai Upazila of Chittagong District. The zone-wise of the project area is presented in Figure 3-1.The surroundings of the project area are described as the following:

- **North:** Feni river, switch gate of Feni River, agricultural land, mangrove forest, etc.
- **East:** Dhaka-Chattogram Highway (10 km from the study area), EZ connecting road, Ichakhali khal switch gate, Mangrove Forest, CDSP Bund, etc. While the next railway station is located 11.5 kilometers to the west.
- **South**: Bay of Bengal, super dyke, etc. The Chattogram City is located 60 km to the south,
- **West**: Bay of Bengal, Super dyke of Economic zone, Industry,
- In the southern direction, the Shah Amanat International Airport at Chattogram is about 79 km away, and the seaport at Chattogram is situated 67 km to the south of the site.
- The subproject site is along the coastline and stretches 25 kilometers within the Sandwip Channel on the eastern edge of the Bay of Bengal.
- Because of its advantageous position, the NSEZ area has a lot of potential. Merely 10 kilometers to the west lies the Dhaka-Chattogram highway, while the next Mirsharai Railway station is located 11.5 kilometers to the west.

[5] https://nsez.gov.bd/?page_id=639

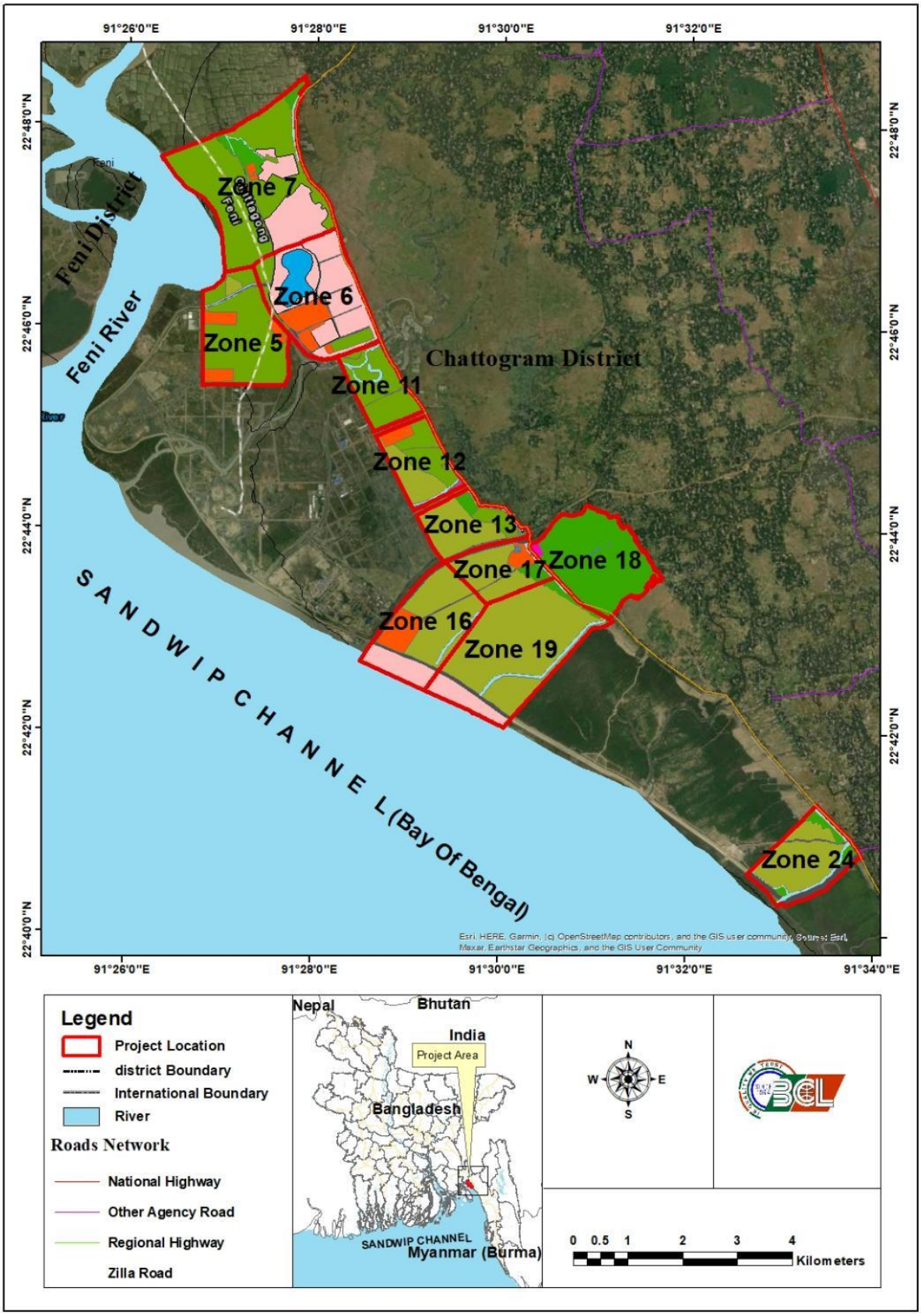


Figure 3-1: Zone-wise Project Location Map

3.6 PROJECT MAJOR ACTIVITIES

41. The major sub-project activities are mainly construction of Road Network (27.7 Km), Storm Water Network (48Km), Power Network (41.44 km), Water Supply Network (41.44 km), Gas Pipeline Network (41.44 km), Resilient Site Upgradation and Building Development, and Security and Support Amenities and construction of TSDF facilities for hazardous waste management of ship recycling industries and Land development, etc. Zone wise project interventions are as follows (Table 3-2):

Table 3-2: List of Zone-wise Project Interventions[6]

Sub-Project	Zone 5	Zone 6	Zone 7	Zone 11	Zone 12	Zone 13	Zone 16	Zone 17	Zone 18	Zone 19	Zone 24	Total (km)
Unit	**kilometers**											
Road Network	-	7.35	2.78	2.81	3.53	1.0	2.6	1.2	6.5			27.77
Strom Water Network (Drain)	-	14.7	5.56	5.62	7.06	2.0	-	-	13			47.94
Power Network	-	14.7	5.56	5.62	7.06	2.0	-	-	6.5			41.44
Water Supply Network	-	14.7	5.56	5.62	7.06	2.0	-	-	6.5			41.44
Gas Network	-	14.7	5.56	5.62	7.06	2.0	-	-	6.5			41.44
Unit	**Acres**											
TSDF											62	
Land Development	350			112.51	368.61	311.16		189.128				
Rainwater harvesting												

Note: Other zones have no associate work till now, so it has not been considered in the above table

3.6.1 Subproject-1: Construction of Road Network Within NSEZ Areas

42. It is planned to construct approximately 30 kilometers of arterial and non-arterial roads, footpaths, and plot entry culverts within NSEZ, focusing mainly on durability and functionality, particularly in response to the challenges posed by heavy rainfall and truckloads typical in the NSEZ zones. The specifications for the road network include both main and minor roads, ensuring adequate infrastructure to support economic activities. The Road Layout Plan of 2B Zone is presented in Figure 3-2.

Main Road

- **Width**: 30 meters.
- **Carriageway**: Divided into two lanes for each direction of traffic, with each lane measuring 9 meters.
- **Central Median**: A landscaped median will separate the two directions of traffic, enhancing safety and aesthetics.
- **Sidewalk**: A 5-meter-wide sidewalk will be provided on both sides of the road to accommodate pedestrians.
- **Street Lighting**: Lighting fixtures will be installed along the median to ensure visibility and safety during nighttime.

Minor Road

- **Width**: 20 meters.
- **Carriageway**: An undivided 2-lane configuration with a total width of 10.5 meters.
- **Sidewalk**: A 4.75-meter-wide sidewalk will be provided on both sides of the road to facilitate pedestrian movement.
- Street lighting is to be provided on both sides of the sidewalk.

[6] Source: Approved Terms of Reference for Environmental Impact Assessment of Mirsharai Economic Zone (sub zone 5,6,7,11,12,13,16,17, 18 and 19)

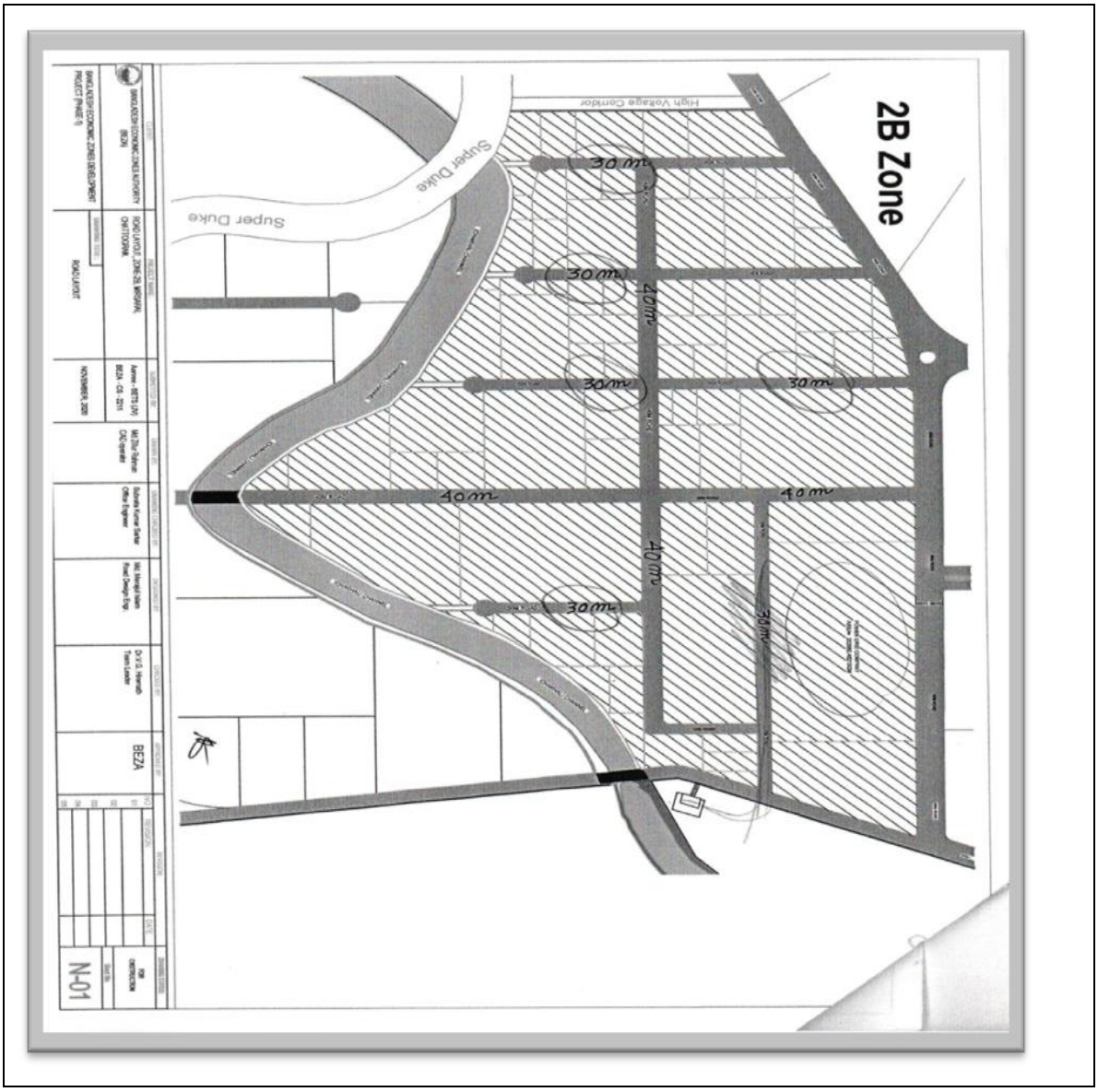


Figure 3-2: Road Layout Plan of 2B Zone

3.6.2 Subproject-2: Construction of Storm Water Networks (Drain) Within NSEZ Areas

43. The construction of approximately 48 km storm water management network includes resilient drains, infiltration, and retention facilities will be designed to effectively manage stormwater runoff and strategically routed along major and minor roads through utility ducts. Whereas the stormwater will be discharged into Ichakhali khal, ensuring efficient water management and environmental protection.

44. The proposed storm water management network aims to mitigate flooding and improve water quality in the surrounding areas. The network will consist of:

- **Resilient Drains:** These drains are designed to withstand extreme weather conditions and will be installed along the roads to facilitate the quick removal of excess stormwater;
- **Infiltration Facilities:** These facilities will allow stormwater to percolate into the ground, replenishing groundwater supplies and reducing surface runoff;
- **Retention Facilities:** These structures will temporarily hold stormwater, allowing for controlled release and reducing the risk of downstream flooding.

45. The stormwater management network will be integrated into existing infrastructure by incorporating utility ducts along major and minor roads. This approach minimizes disruption to the surrounding environment and ensures that the network is accessible for maintenance and monitoring. However, the final discharge point for the stormwater management network will be Ichakhali khal to ensure that the stormwater is released into a water body capable of handling the flow, thereby reducing the risk of flooding and promoting ecological

balance. The natural drainage system within project area is presented in Figure 3-3.. The Layout Plan of storm water drainage (2B Zone) is presented in Figure 3-4.

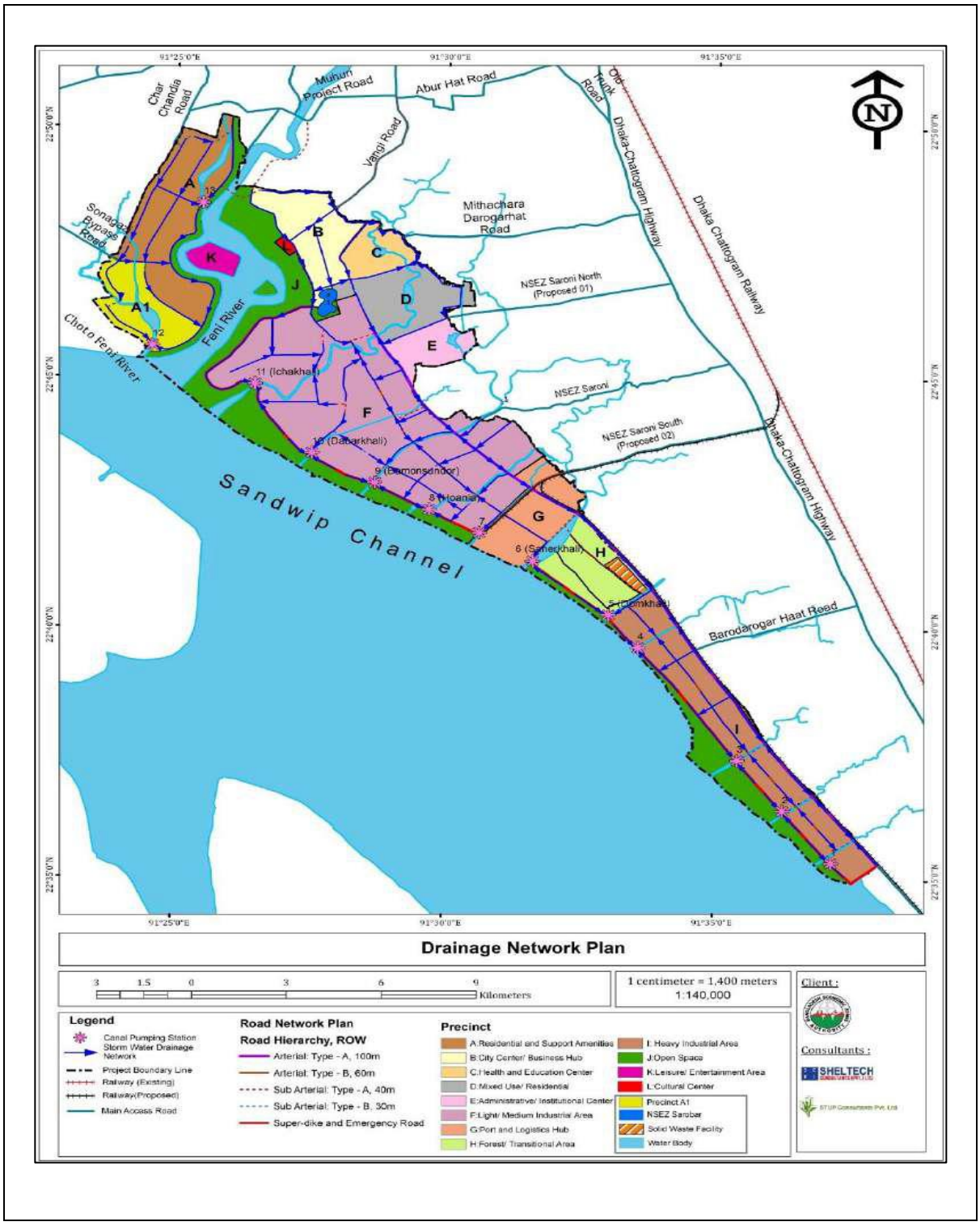


Figure 3-3: Drainage system within project area

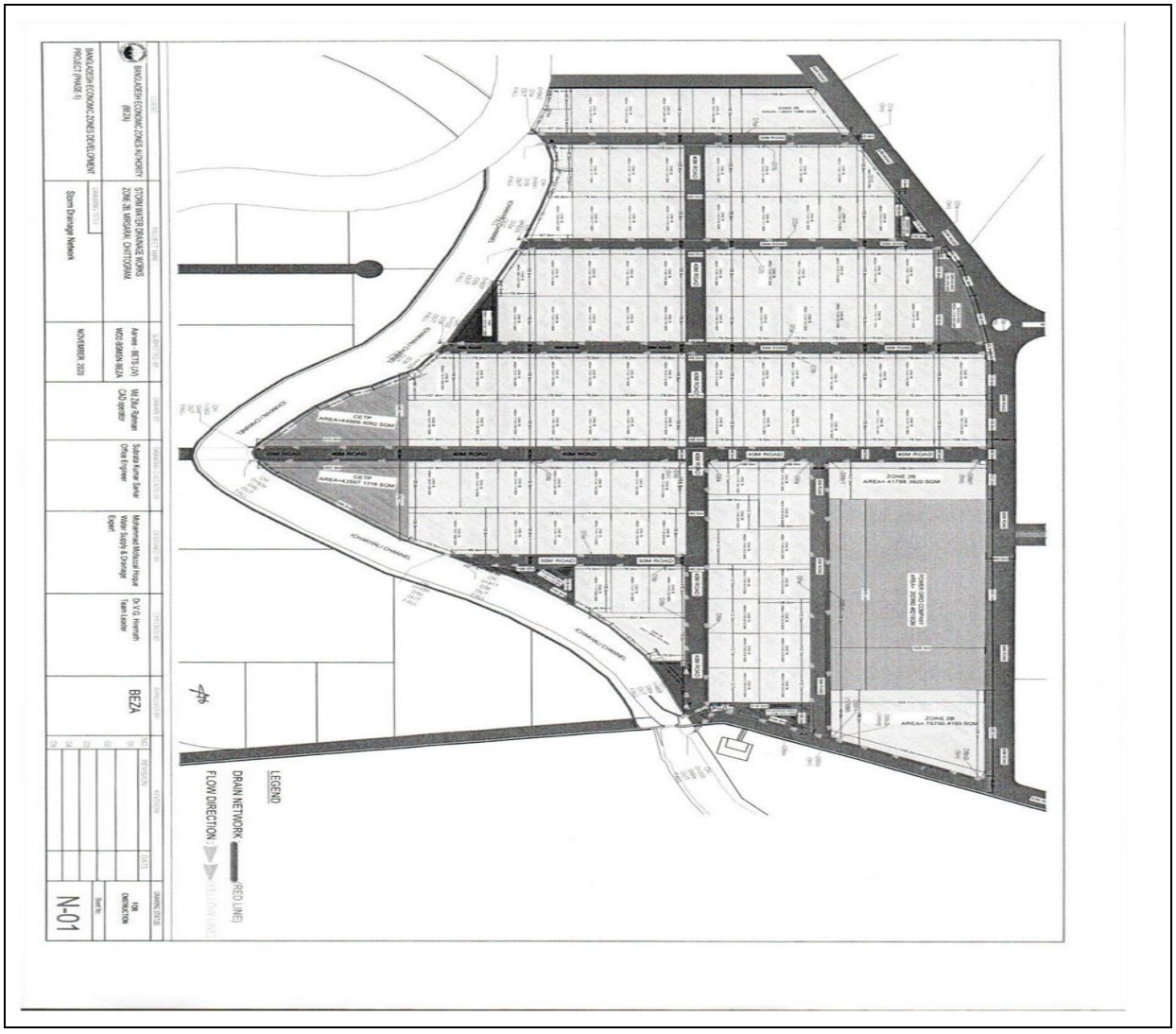


Figure 3-4:Layout Plan of storm water drainage (2B Zone)

3.6.3 Subproject-3: Construction of Water Supply Networks

46. A surface water treatment plant with a capacity of 50 MLD (Phase-1) will be constructed at Poshchim Ichakhali Mouza, located on the east side of the CDSP embankment. The project involves the withdrawal of water from the Feni River, the establishment of transmission mains for raw and treated water, and the distribution of treated water to industrial plots.

The summary of water supply networks is as follows[7]:

Location	• **Site:** Poshchim Ichakhali Mouza; • **Proximity:** East side of the CDSP embankment.
Water Source	• **Source**: Feni River; • **Withdrawal Point**: Approximately 2.5 km upstream of the Feni Regulator.
Raw water **Transmission Main**	• **Length**: Approximately 9.5 km; • **Purpose**: To transport river water to the treatment plant.

[7] Environmental and Social Assessment (ESA), PRIDE project

Treated Water Transmission Main	• **Length**: Approximately 12.4 km; • **Purpose**: To carry treated water to distribution points near Zone 2A & 2B.
Distribution	• **Target**: Industrial plots in the vicinity will receive the water treated for various uses.

47. In addition, groundwater has been identified as a viable source of water to support economic activities in the designated zones. Specifically, it is proposed to construct 10 production tube wells (PTWs) in Zone 2A and 6 PTWs in Zone 2B, based on comprehensive hydrogeological assessments that were carried out in the area.

48. The average thickness of the deeper aquifer in the project area ranges from 120 meters to 205, indicates a significant volume of groundwater that can be tapped for various uses, ensuring a reliable supply for industrial operations.

49. Each proposed PTW is designed to have a capacity of 1 cusec, equivalent to approximately 28.3 liters per second. This capacity is deemed sufficient to meet the water demands of industries operating within the economic zones. The water supply network in 2A and 2B zones are presented in Figure 3-5 and Figure 3-6, respectively.

50. The quality of groundwater extracted from the deep aquifer in these zones has been assessed and found to be quite good. Notably, the concentrations of Iron and Arsenic in the water are within the acceptable limits set by the Bangladesh Standard (ECR 2023). This ensures that the water is safe for industrial use and complies with health and environmental regulations.

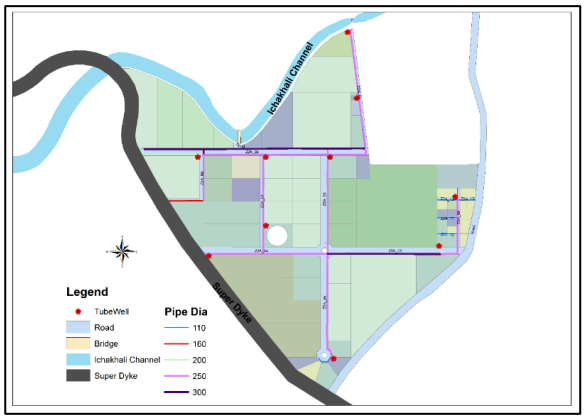


Figure 3-5: Water Supply Network in 2A.

Source: Master Plan of NSEZ, IWM

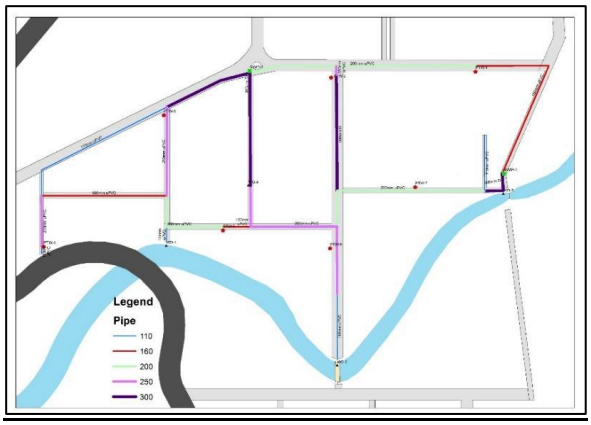


Figure 3-6: Water Supply Network 2B

3.6.4 Sub Project-4: Construction of Internal Power Distribution Networks Within NSEZ Areas

51. The preliminary plans for the construction of approximately 41 kilometers of internal power distribution infrastructure, including transformers, street lighting (LED/Solar), internal substations, and fire hydrants. The alignment and designs of the power distribution network are currently in the process of being finalized. The Power Network Plan within NSEZ area is presented in Figure 3-7.

52. The subproject aims to establish a comprehensive internal power distribution system that will enhance the electrical infrastructure of the designated area. Key components of the subproject include:

- **Internal Power Distribution**: A network of cables and equipment designed to distribute electrical power efficiently throughout the area;
- **Transformers**: Essential for stepping down high voltage electricity to usable levels for residential and commercial use;
- **Street Lighting**: Installation of energy-efficient LED and solar-powered streetlights to improve safety and visibility in public spaces;
- **Internal Substation**: A facility that will house transformers and other equipment necessary for the distribution of electricity;
- **Fire Hydrants**: Installation of fire hydrants to ensure adequate fire safety measures are in place.

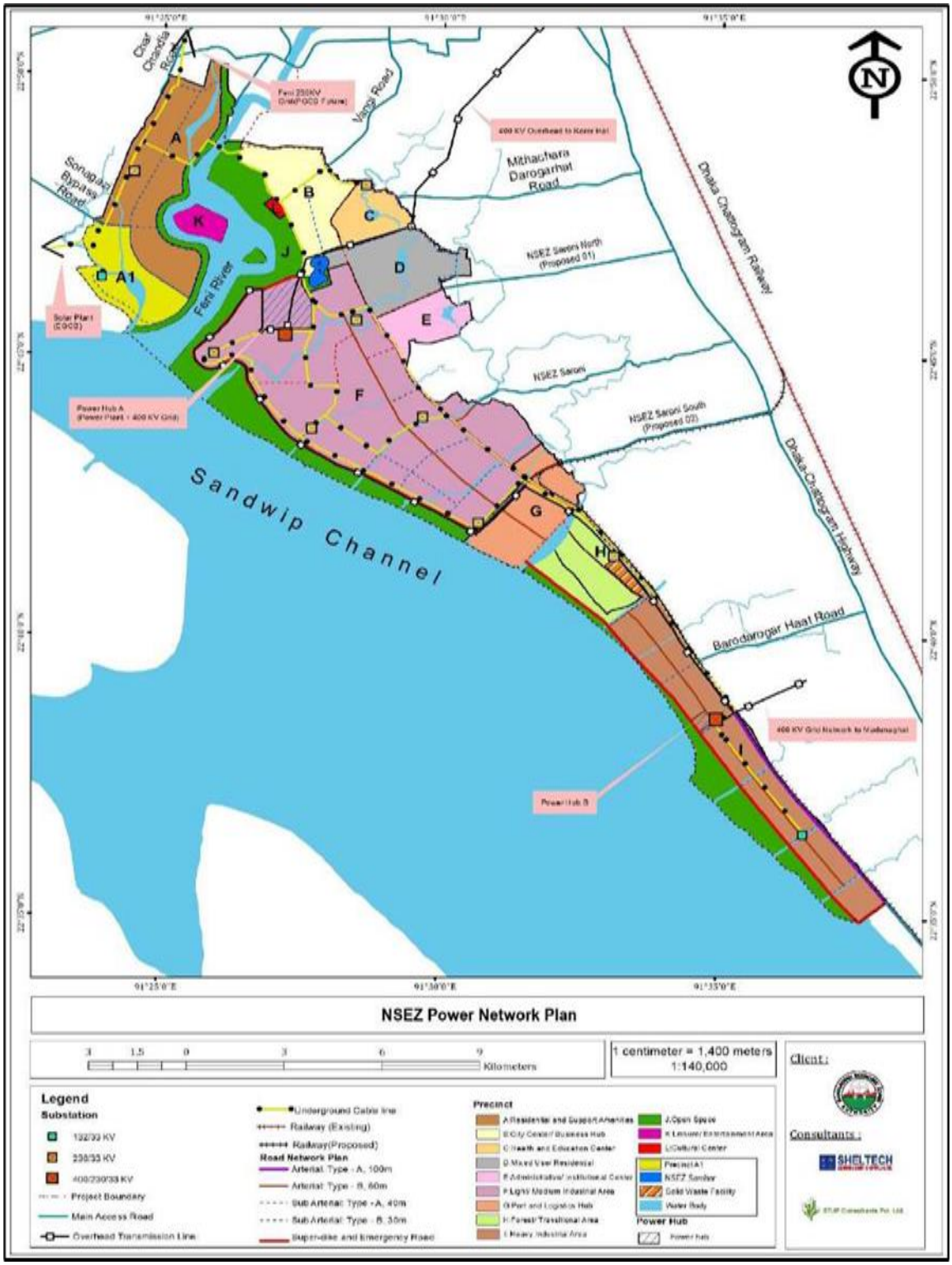


Figure 3-7: Power Network Plan Within NSEZ

3.6.5 Sub-Project-5: Construction of a 30 KM Gas Pipeline Network within NSEZ areas

53. BEZA has developed industrial plots in the NSEZ, Mirsharai, Chattogram and planned to construct utility facilities for the industrial plots. The facility includes the construction of gas pipeline networks to supply natural gas to 2A (Zone-6, 8, 22,), 2B (zone-10, 19, 23) and the adjacent industrial economic zones of NSEZ by the KGDCL, connecting the Bakhrabad-Chattogram Transmission line of GTCL along the Dhaka-Chattogram Highway via Sheikh Hasina Sarani. This will be implemented under the PRIDE project of the BEZA. Construction of Gas Pipeline at 2A, 2B and adjacent Zones of BEZA, Mirsharai Chattogram has been undertaken to expand the gas distribution network to meet customer demands. 350 psig and 150 psig pipe networks. The Gas pipelines Networks Plan with the NSEZ is shown in Figure 3-8.

Table 3-3: Basic Information on Construction of Gas Pipeline Networks

No	Item	Description
1	Name of the Project	Environmental and Social Impact Assessment of Gas Pipeline
2	Proponent	Bangladesh Economic Zones Authority (BEZA)
3	Contract	Contract[8] for Design, Supply, Installation, Testing & Commissioning of gas pipeline networks, DRS and ancillary works as Turnkey basis in 2A2B Zone and adjacent areas at Mirsharai BEZA, Chattogram
4	Project Location	Zone 2A and Zone 2B, NSEZ, Mirsharai
5	Gas suppliers	Karnaphuli Gas Distribution Company Limited (KGDCL).
6	Pipeline size	8-to-24-inch diameter
7	Pipeline length	About 30 kilometers
		Construction of gas pipeline of 24-inch diameter and 350 psig pressure, 6 km
		Construction of gas pipeline of 16-inch diameter and 350 psig pressure. 6 km
		Construction of gas pipeline of 10-inch diameter and 150 psig pressure, 13 km
		Construction of gas pipeline of 8-inch diameter and 150 psig pressure, 7 km
8	Mainline Pipe Specification	24" & 16" OD, Wall Thickness 9.53 mm and 10" & 8" OD, Wall Thickness 7.80 & 7.04 respectively. Pipe Spec.: API 5LX52 (PSL-2), LSAW Carbon Steel, Coating 3LPE (3.5 mm) for 24" & 16" OD only End Plain Ends beveled approximately to an angle of 300, +50, -00 with a root face of 1.6mm +06mm -0mm.
9	Total Pipeline Length including khal & road crossing	Around 12 kilometers for 350 psig; and Around 20 kilometers for 150 psig.
10	Construction of Valve Stations	5 Valve Station area will be 40 Ft x 20 Ft.
11	Construction of High-Pressure District Regulating Stations (HP-DRS)	2 No. DRS area will be 200 Ft x 200 Ft
12	RMS inlet Pressure	150 to 350 PSIG pressure
13	Design Pressure	740 psig for NPS 24" and 16" pipe 285 psig for NPS 10" and 8" pipe
14	Maximum Allowable Operating Pressure	740 psig for NPS 24" and 16" pipe 285 psig for NPS 10" and 8" pipe
15	Flowing Fluid though Pipeline	Natural Gas/Re-gasified Liquefied Natural Gas (R-LNG)
16	Operating Temperature	0 to 55 ^{0}C
17	Casing Pipe Specification	30", 20", 14" & 12", API 5L

[8] Bid Document: Design, Supply, Installation, Testing & Commissioning of gas pipeline networks, DRS and ancillary works as Turnkey basis in 2A-2B Zone and adjacent areas at Mirsharai BEZA, Chattogram, 2023. BEZA

18	Induction Bend Specification	Radius of Curvature: 8D, Wall Thickness 9.53 mm Pipe Spec. API 5LX52 (PSL-2), Coating: None. Tangent length 150 mm. End: Plain Ends beveled approximately to an angle of 30º, +5º, -0º with a root face of 1.6mm +06mm -0mm.
	Civil works for DRS and Valve Station by Contractor	
1	Temporary store	1 no.
2	Construction of 02 (Two) storied control building	224 sqm.
3	Boundary wall in RCC Frame	1.80m in height and 616 Rm
4	Installation of Deep tube well with water pump inside DRS area	02 nos.
5	Construction of RCC surface drain of 600 x 300mm clear width (top & bottom) and 600 mm (av.) depth with side slope 2:1 trapezoidal section	488 Rm
6	Spiral-type barbed wire in fencing work	of 600 mm dia, 616 Rm
7	Construction of shed building (40'-0" x 20'-0") with RCC column foundation with internal electrification	1 no. storied
8	Construction of (10'-0" x 10'-0") CP room with RCC column foundation with internal electrification	2 nos.
9	4000mm wide x 150mm thick RCC in plant road to be constructed within the station area to facilitate vehicle movement.	500 sqm
10	Related other Civil Works	2 storied Operator building, Boundary wall, Base for DRS, temporary store, lighting, drains etc.

Figure 3-8: Gas pipelines Networks Plan Within NSEZ

3.6.5.1 Method Of Gas Pipeline Installation:

54. The land for construction of the proposed gas pipeline is owned by BEZA and Right of Way (RoW) was selected by Karnaphuli Gas Distribution Company Limited (KGDCL). The gas pipeline will follow the Natural Gas Safety Rules, 1991. In the case of the excavation, it should be designed properly to take care of existing buildings, utility lines and available techniques. Whenever any soil improvement measures are taken

or pile is driven, at least one plate load test at column location where vertical load is maximum to ensure that the bearing capacity and settlement of in situ soil. The proposed gas pipeline will be built using the open cut approach, including road crossing, a railway crossing, a river/stream/khal crossing/ a canal/drainage/nala crossing, and a utility crossing, During the installation of the gas pipeline, public access will be restricted, and an alternative route should be open for the local community to use on a regular basis. All crossing work will be done in consultation with the community, and appropriate notice will be issued to ensure their understanding. The following activities will be carried out for the installation of the proposed gas pipeline networks (Table 3-4).

Table 3-4: Activities to be carried out for Installation of the Proposed Gas Pipeline Networks

Activities	Brief Description
Pipeline Route and Working Area selection.	To physically verify the identified roads and confirm their suitability for pipeline construction. To identify restrictive areas and suggest modifications/detouring to the identified routes. To establish the route on the ground.
Clearing and Grading of Right of Way	Collecting information required for obtaining clearance of RoW in the identified routes. Identify RoW, length, elevation, alignment of the proposed route.
Manpower Engagement.	Identify types, and periods of engagement of required manpower.
Preparation of Base camp, storage areas & Field camp for workers.	Identifying and select the suitable locations for construction of base camp, storage areas and labor camps
Installation of sanitary toilets and drinking water facilities to the labor camps.	Necessities of installation of submersible pump at the labor camp for drinking water and other purposes like bathing, and household work. Identify and select suitable locations for the installation of sanitary toilets adjacent to the labor camps.
Site security (Fencing) etc.	Identify and select the points for installation of Fencing
Preparation of site development	Necessary preparation will undertake.
Transportation and hauling of pipes.	Identify and select the transportation ways to carry out different materials at the site.
Temporary Storage in Stockyard – pipe fittings & other material.	Identify and select the stockyard locations.
Stringing of line pipe.	Necessary stringing of pipeline will be carried out.
Pipe bending using a bending machine.	Necessary pipe bending will be undertaken.
Equipment and Vehicle Mobilization.	Equipment and vehicle mobilization will be carried out.
External cleaning of pipe.	Necessary external cleaning will take
Welding, Cleaning of welding area of mainline pipe by sand blasting.	Welding and cleaning will be undertaken.
Grading, Installation of Coating of Pipeline or Cathodic protection.	Grading, installation, coating or cathodic protection will take.
River, Road & Rail crossing by thrust boring versus open cutting, and Metering Stations etc.	Crossing sections will be conducted by thrust boring method to avoid negative effects.
Tightness and leak testing of pipelines (hydrostatic testing)	Hydrostatic testing will take.
Trenching, Lowering in Gas Pipe Laying, Tying up.	Trenching, and tiding up will take.
Backfilling, Re-instatement and Clean-up.	Backfilling, re-instatement and cleanup will take.
Pipeline Commissioning	Commission will take place after installation.
Metering station and other permanent structures above ground facilities.	Excavation, backfilling, concrete work, finishing works and painting will take during construction period.

3.6.5.2 Pipeline Routes:

55. According to detailed topographic the land used alongside the gas pipeline route is mainly vacant land with rising terrain, internal roads, earthen road, etc. Based on the terrain configuration, surface features and land use for both Spur line routes have been considered as one section, as follows (Table 3-5)

Table 3-5: Land use of the Gas pipeline Routes

Section	Terrain	Terrain
(Total Pipeline Length: 30 km)	Gently Rising terrain. Surface soil is silty clay interspersed with marshy land & weathered rocks with seasonal	The proposed Pipeline route has been considered parallel to Internal Road, Asphalted, RCC, earthen, Metaled Road within RoW limit. However, the Communication network is very good in the selected routes

56. The pipeline route has been proposed parallel to existing roads from take-off to terminal point. According to the topo survey, a few structures and boundary walls of different categories of structures were found with the survey area with a number of major & minor crossings. On the left side 10 building structures and on the right side 16 buildings are built up there. Similarly, six (6) and five (5) boundary walls are noted and left side and right side, respectively. A total of five (5) ditches is located within the survey area; of them one is on the left side and the rest are on the right side. In addition, pipelines cross the canal at seven (7) locations of same three (3) canals and ten (10) low-lying areas. About, 509 electricity poles, 74 electric light posts, and 9 water pipelines are located within surveyed ROW at different distances from the proposed alignments The major canals crosses are shown in Table 3-6.

Table 3-6:Gas Pipeline Canal Crossings

Sl. No	Canal Name	Location, GPS Reading
1	Ichakhali canal	Besides BEZA Office, Zone-1, N 22.76075˚, E 091.47124˚
		Ziro point, N 22.76540˚, E 091.46287˚
		Near REB Substation, N 22.75126˚, E 091.45914˚
		Near the Super dyke, N 22˚ 44′33″, E 91˚ 27′02″
2	Susham	South Bank N 22.750948226, E 91.4591270681, North Bank N 22.7512402282 E 91.4591240655
3	Bashundhara Canal	South Bank N 22.73156008, E 91.4663240433, North Bank N222.7321837275, E91.4654432171
		South Bank N 22.7206489267, E 91.4818004432, North Bank N 22.7210055782, E 91.4813503277

Source: Topo-survey of the Gas pipelines networks, 2023

3.6.6 Sub-Project 6:- Land Development of Part of Precinct F (IMD Zone and Housing Facilities) and Precinct B of NSEZ

57. Most of the lands of the NSEZ are low lying char area and reclaimed land. The land elevation on the site varies at -3.33-meter MSL to the highest point at +8.7 m MSL. BEZA divided the NSEZ in different 25 zones in their Master Plan. Among these zones 5, 6, 7, 8, 11, 12, 13, 16, 17, 18 are considered for the land development with construction of the associated infrastructures (road network, drainage network, electricity and gas pipeline network, water supply network etc.).

58. The proposed sub-project involves the development of the low-lying lands, comprised partly of Precinct F comprised of the `IMD Zone (Zones 12 and 13), Zone 5, Zone 17, Zone 18, and Precinct B (Zone 7) for the proposed housing facilities areas. The land development will be done by dredging materials from the Sandwip Channel. Presently, the total area of land development will be about 1560 acres as shown in Table 3-7:

Table 3-7: Total area of land to be developed

Land Use of Precincts	Zone	Area (Acres)
F- Light/ Medium Industrial Area (IMD Zone)	Zone 12	550
F- Light/ Medium Industrial Area (IMD Zone)	Zone 13	
F- Housing Facilities	Zone 18	660
F- Housing Facilities	Zone 5	350
Total		**1560**

Source : PIU, NSEZ, 2025, NSEZ Master Plan 2020

59. According to DPP, the land filling using dredged materials from the Sandwip Channel requires 10,000,420.98 cum (Table 3-8). Land filling activities will be carried out in the zones 11-13 and 17.

Table 3-8: Volume of dredged material requirement for the land development within NSEZ Areas[9]

Zone no.	Area (Acres)	Filling Hight (m)	Volume (cum)
Zone-11	122.510	2.166	1073940.081
Zone-12	368.614	2.758	4102966.553
Zone-13	311.160	2.289	2881757.128
Zone-17	189.128	2.537	1941757.22
Total	990.412	-	10000420.98

(source: DPP, NSEZ, 2016)

60. Presently, the land development area in Zones 5, 12, 13, and 18 of the sub-project is shown in Figure 3-9.

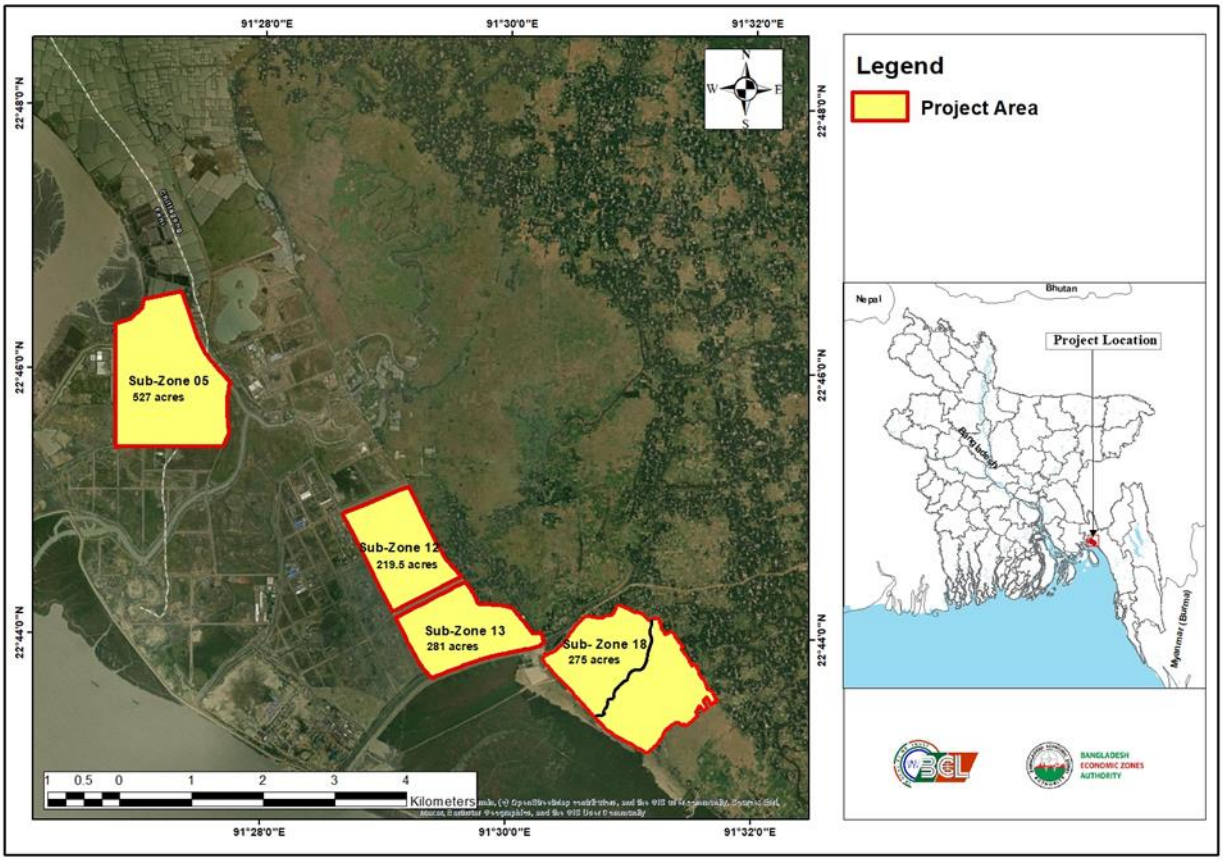


Figure 3-9: Land Development area in Zones 5, 12, 13, and 18 of the sub-project

61. An ancient embankment borders the area's eastern side, while a new super dyke has been built along the sea's western edge. Because of its advantageous position, the NSEZ area has a lot of potential. Merely 10 kilometers to the west lies the Dhaka-Chattogram highway, while the next railway station is located 11.5 kilometers to the west. The surroundings of Precinct F (IMD Zone and Housing Facilities) and Precinct B are described as follows:

- North: Feni River, switch gate of Feni River, fellow lands, etc.
- East: Dhaka-Chattogram Highway (10 km from the study area), EZ connecting road, Ichakhali khal switch gate, Mangrove Forest, CDSP Bund, etc.
- South: Bay of Bengal, super dyke, etc.

[9] DPP, NSEZ, 2016

- West: The Bay of Bengal, Super dyke of Economic zone, Industry, etc.

62. Various on-site and off-site activities are currently underway, including the construction of embankments, internal roads, access roads, telecommunication infrastructure, power and water supply facilities, and drainage management infrastructure. The location is positioned at the eastern end of the Bay of Bengal, and a super dyke has been built along the western boundary of the Zone 2A & 2B to safeguard the site from water ingress during high tide and surges.

3.6.7 Sub-Project-7: Development of Treatment, Storage, Disposal Facilities in NSEZ areas

63. There is another sub-project of the NSEZ is treatment, storage, disposal facilities (TSDF) for hazardous waste management of ship recycling. Bangladesh recycles about 200 ships per year with a global market share of about 30% (in terms of light displacement tonnage) and has become one of the dominating players in the ship recycling industry and a preferred destination of end-of-life of ships. The industry located in Chattogram has made significant contributions to the country's national economy. Realizing its immense importance, the Government of Bangladesh has enacted the Bangladesh Ship Recycling Act, 2018 with a view to assist the industry to achieve international standards and for the sustainable development of the industry. The safe disposal of hazardous materials from the ship recycling activities is crucial to protect the health of the employees at the Ship Recycling Facility (SRF) and to prevent environmental degradation. Proper disposal of hazardous waste is also a mandatory obligation of the Hong Kong International Convention for the Safe and Environmentally Sound Recycling of Ships, so-called Hong Kong Convention, 2009 (HKC, 2009). The HKC was adopted in a diplomatic conference of the International Maritime Organization (IMO) and Bangladesh is one of the signatories of this convention. It is difficult for the individual ship recycling industry to ensure appropriate disposal of hazardous materials in the yard generated from ships recycling following IMO regulations. Therefore, a central Treatment, Storage, and Disposal Facility (TSDF) is an important requirement for the effective management of hazardous waste generated in the ship recycling industry. The TSDF is also planned to accept industrial wastes from other industrial sectors in Chattogram and other regions in Bangladesh. In response to these challenges, the Ministry of Industries (MoIND) of the Bangladesh government undertook a feasibility study (F/S) of the TSDF in 2021, which among others included site selection and preliminary design of the TSDF, cost estimation, economic and financial analysis, and environmental and social studies. As a possible funding agency for the TSDF, the Japan International Cooperation Agency (JICA) is subsequently providing technical assistance to MoIND which includes reviewing and updating the TSDF plan/design and environmental and social studies. The estimates of hazardous waste quantities generated from the Chattogram Ship Recycling Yards is shown in Table 3-9 and estimates of hazardous waste from the industry by generation waste types is shown in Table 3-10.

Table 3-9: Estimates of Hazardous Waste Quantities Generated from the Chittagong Ship Recycling Yards[10]

Disposal Method	Recent Trend Minimum (MT/yr.)	Recent Trend Maximum (MT/yr.)	Average of the Range (MT/yr.)	10-yr lifetime capacity 4% growth rate (MT)
Incinerable Wastes	5,400	6,400	5,900	71,000
Landfillable Wastes (Toxic + Inert)	7,500	10,300	8,900	107,000
Alternate gainful use or send to Municipal Solid Waste landfill	-	-	-	-
Grand Total			**14,800**	**178,000**

64. The inventory assessment reveals a significant trend: the ship recycling sector produces substantial quantities of landfillable waste. This is largely attributed to the nature of ship dismantling, which involves the removal of various materials, many of which are not readily recyclable or reusable with current technologies and infrastructure. These materials often end up being disposed of in landfills. While the ship recycling sector generates sizable quantities of incinerable waste, the industrial sectors collectively produce significantly larger amounts.

[10] https://wwwcdn.imo.org/localresources/en/OurWork/PartnershipsProjects/Documents/.pdf

Table 3-10: Estimates of Hazardous Waste Quantities Generated by Industries in Chittagong by Waste Type and Disposal Method

Waste Type	Total waste generation rate (MT/yr	Disposal Method			
		Incineration (MT/yr)	Land filling		Alternate gainful use or Municipal Solid Waste landfill (MT/yr)
			Toxic waste landfill (MT/yr)	landfill (MT/yr)	
Tundish lining	25192				25192
ETP sludge	19165	3443	324		15397
APC Dust	11131				11131
Contaminated solid waste	3965	3965			
Contaminated packaging	3626	3626			
Oily crude tank sediments	1459	1459			
Contaminated plastic waste	1282	707			575
Bleaching earth	910				910
Spent Lubricants	251	251			
Flesh	222				222
Maintenance scrap	124	124			
Oil and grease	89	89			
Chemical residues	88	88			
Trimming dust	72				72
Raw hides cutting	66				66
Shaving dust	54				54
Asbestos	40			40	
Other contaminated materials	25	24		1	
Waste glass wool & insulation	8			8	
Episodic and aperiodic waste	678	138	3	0	536
Yearly Total (MT/yr)	68600	14000	327	49	54200
10-yr lifetime capacity @ 6% growth rate (MT)	904200	184500	5300		714400

Note: In addition to the results shown above, biomedical waste generation from the hospital and health sector is estimated at 800 MT/yr (based on 6'400 beds). A dedicated facility will have to be created for it in Chittagong.

65. Layout Plans for TSDF for hazardous waste management of ship recycling industries and the Layout Plan of the TSDF at Zone-24 within NSEZ areas are presented in Figure 3-10 and Figure 3-11.

66. **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.

67. **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 wash. Recovered oils, oily water, and bilge water shall be collected in suitable tanks or drums and transferred onshore by service barge.

68. 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. 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.

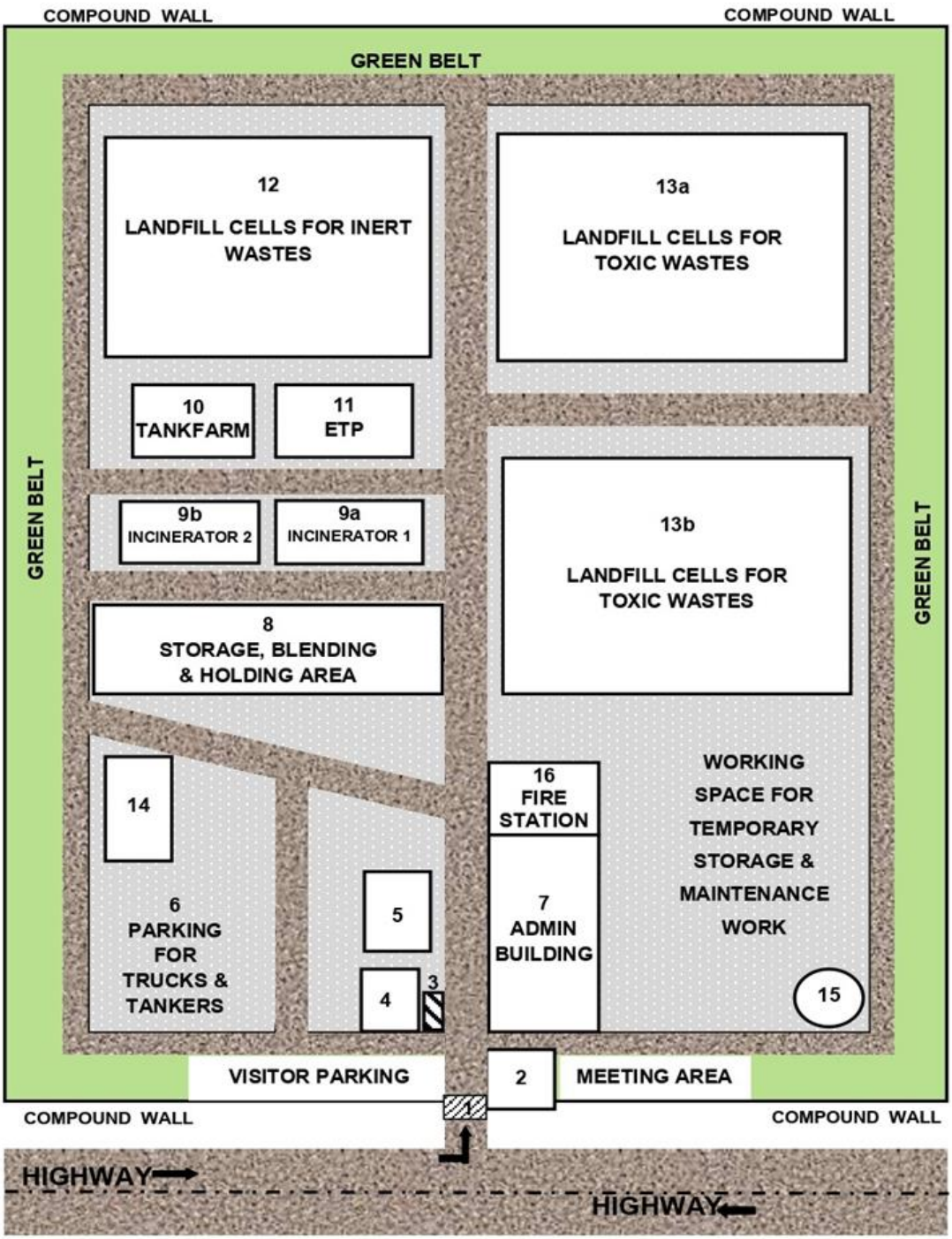


Figure 3-10: Layout Plan for TSDF of hazardous waste management of ship recycling industries in Zone-24

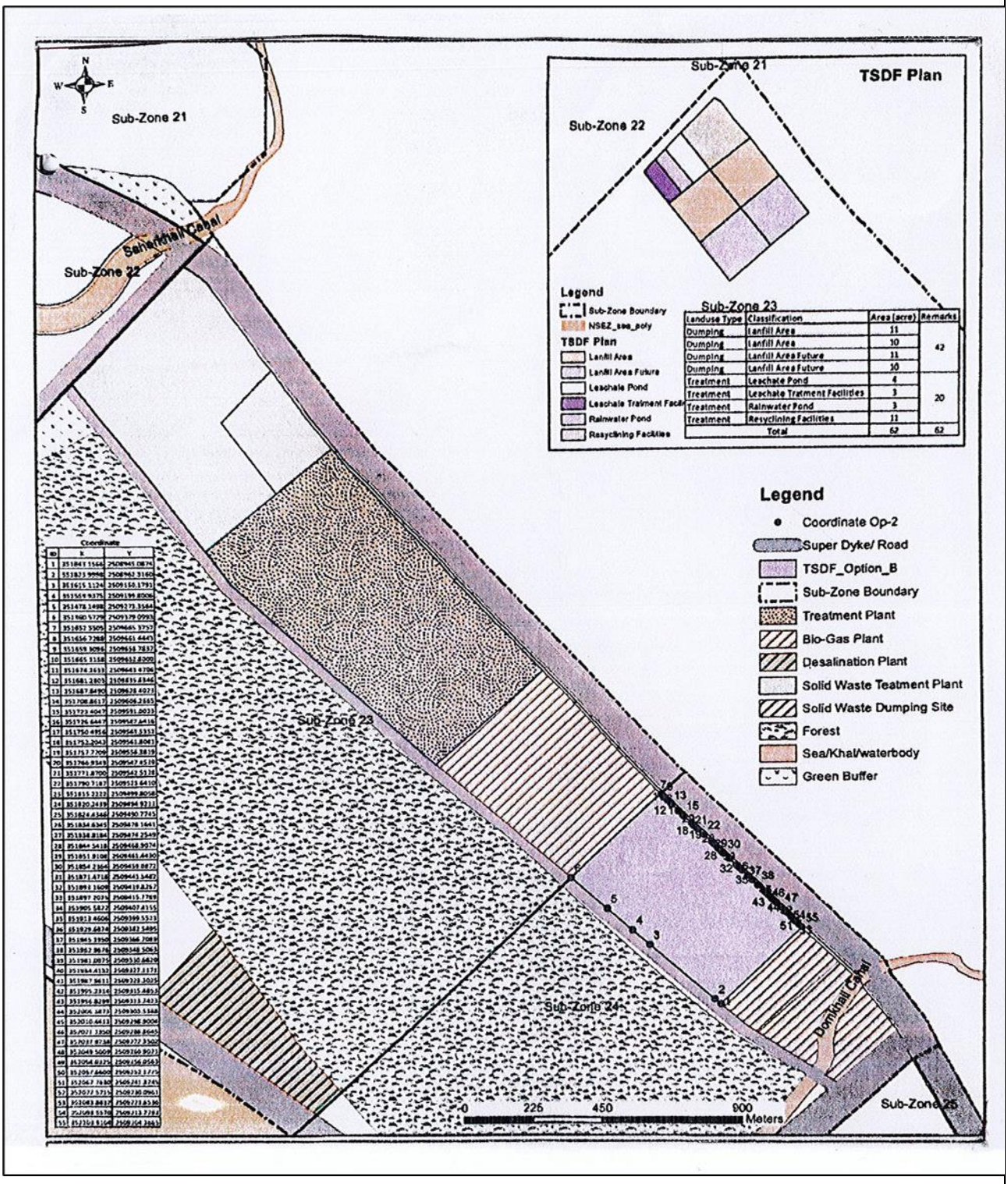


Figure 3-11: Layout Plan of TSDF at Zone-24 within NSEZ areas

69. **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 work 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 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).

70. **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.

71. **Rainwater Harvesting**: Rainwater in the rainwater storage 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 oil collected from the separator and the remaining sludge in the oily water tank will be sent to ETP for further treatment.

72. **Hazardous waste management:** The hazardous materials need to be transferred to the Treatment, Storage, and Disposal Facility (TSDF), the process can be managed efficiently

73. **Segregation and Storage**: The hazardous materials designated for transfer to the TSDF, 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.

74. **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.

75. **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.

76. **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

77. **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

78. **Landfill disposal:** Solid waste 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.

79. Since the type and quantity of waste 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.

80. **Storage Facilities:** 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

81. As regulations, all storage areas of the ship recycling facility shall be located on concrete floors. Outdoor storage areas should 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.

82. 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 with areas which required 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 separate rooms which are designated for storing different materials such as asbestos, glass wool, plastic, plastic, chemical, broken lamp, lead acid battery, paint, radiation materials (smoke detector), PCB, ODS, oily rags, hazardous liquids, etc.

3.6.7.1 Major Risks:

83. Risk assessments are conducted to identify potential hazards associated with TSDFs and landfills and to evaluate the likelihood and consequences of those hazards. Major findings typically include:

- **Groundwater Contamination:** The risk of leachate migrating from the landfill and contaminating groundwater is a primary concern. Risk assessments evaluate the effectiveness of liner systems, leachate collection systems, and groundwater monitoring programs in preventing and detecting contamination.
- **Surface Water Contamination:** The risk of stormwater running off carrying pollutants from the landfill and contaminating surface water bodies is another significant concern. Risk assessments evaluate the effectiveness of surface water management systems in controlling runoff and preventing erosion.
- **Air Emissions:** Landfills can emit methane gas, a potent greenhouse gas, as well as other volatile organic compounds (VOCs) that can contribute to air pollution. Risk assessments evaluate the effectiveness of gas collection systems in capturing and controlling emissions.
- **Fire and Explosion:** Methane gas can also pose fire and explosion hazards. Risk assessments evaluate the effectiveness of gas monitoring and safety systems in preventing and mitigating these risks.
- **Soil Contamination:** The risk of soil contamination from spills or leaks of hazardous materials is a concern at TSDFs. Risk assessments evaluate the effectiveness of containment and cleanup procedures in preventing and addressing soil contamination.
- **Human Health Risks:** Risk assessments evaluate the potential for human exposure to contaminants through various pathways, such as ingestion of contaminated water, inhalation of air pollutants, or direct contact with contaminated soil.

84. **Groundwater Protection:** Groundwater protection is a critical aspect of TSDF and landfill management. Key measures include:

- **Liner Systems:** The use of composite liner systems, consisting of a geomembrane (e.g., HDPE) and a compacted clay layer, is essential to prevent leachate from migrating into the subsurface.
- **Leachate Collection Systems:** These systems collect leachate generated within the landfill and transport it to a treatment facility. The systems typically consist of a network of perforated pipes embedded in a gravel layer above the liner.
- **Groundwater Monitoring:** A network of monitoring wells is to be installed around the perimeter of the landfill to detect potential groundwater contamination. Water samples are collected regularly and analyzed for a range of parameters, including pH, conductivity, heavy metals, and organic compounds.
- **Leak Detection Systems:** Some landfills incorporate leak detection systems between the liner layers to provide early warning of potential liner failures.
- **Corrective Action:** If groundwater contamination is detected, corrective action measures are implemented to remediate the contamination and prevent further migration. These measures may include pump-and-treat systems, in-situ bioremediation, or containment barriers.

85. **Leachate Treatment Strategy:** Leachate is a complex mixture of organic and inorganic compounds that can pose a significant threat to water quality. A comprehensive leachate treatment strategy is essential to remove pollutants and protect the environment. Common treatment methods include:

- **Pre-treatment:** This may involve physical and chemical processes such as screening, sedimentation, and pH adjustment to remove solids and prepare the leachate for further treatment.
- **Biological Treatment:** This uses microorganisms to break down organic pollutants in the leachate. Common biological treatment processes include activated sludges, trickling filters, and sequencing batch reactors.
- **Chemical Treatment:** This involves the use of chemicals to remove specific pollutants from the leachate. Common chemical treatment processes include coagulation, flocculation, and precipitation.
- **Membrane Filtration:** This uses membranes to separate pollutants from the leachate. Common membrane filtration processes include reverse osmosis, ultrafiltration, and nanofiltration.
- **Evaporation:** This involves evaporating the water from the leachate, leaving behind a concentrated residue that can be disposed of in a landfill.

86. **Closure/Post-Closure Monitoring:** Closure and post-closure monitoring are essential to ensure the long-term safety and stability of TSDFs and landfills. Key activities include:

- **Final Cover Installation:** A final cover is installed over the landfill to prevent infiltration of rainwater and control erosion. The cover typically consists of a layer of compacted clay, a geomembrane, and a layer of topsoil.
- **Leachate Management:** Leachate collection and treatment continue during the post-closure period to prevent groundwater contamination.
- **Gas Monitoring and Management:** Gas monitoring continues to detect methane emissions. Gas collection systems may be operated to capture methane for energy recovery or flaring.
- **Groundwater Monitoring:** Groundwater monitoring continues to detect potential contamination.
- **Settlement Monitoring:** Settlement monitoring is conducted to detect any significant settling of the landfill surface, which could damage the final cover or other infrastructure.
- **Maintenance:** Regular maintenance is performed to ensure the integrity of the final cover, leachate collection system, and other infrastructure.

87. **Design and Drawings**[11]: Selected method of shipbreaking 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 cradles 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, winches, heavy lifting cranes and cutting tools. There also will be storage facilities for scrapped and

[11] EIA report for establishment of environmental friendly ship recycling industry, BSEC, December 2024

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 proper drainage system.

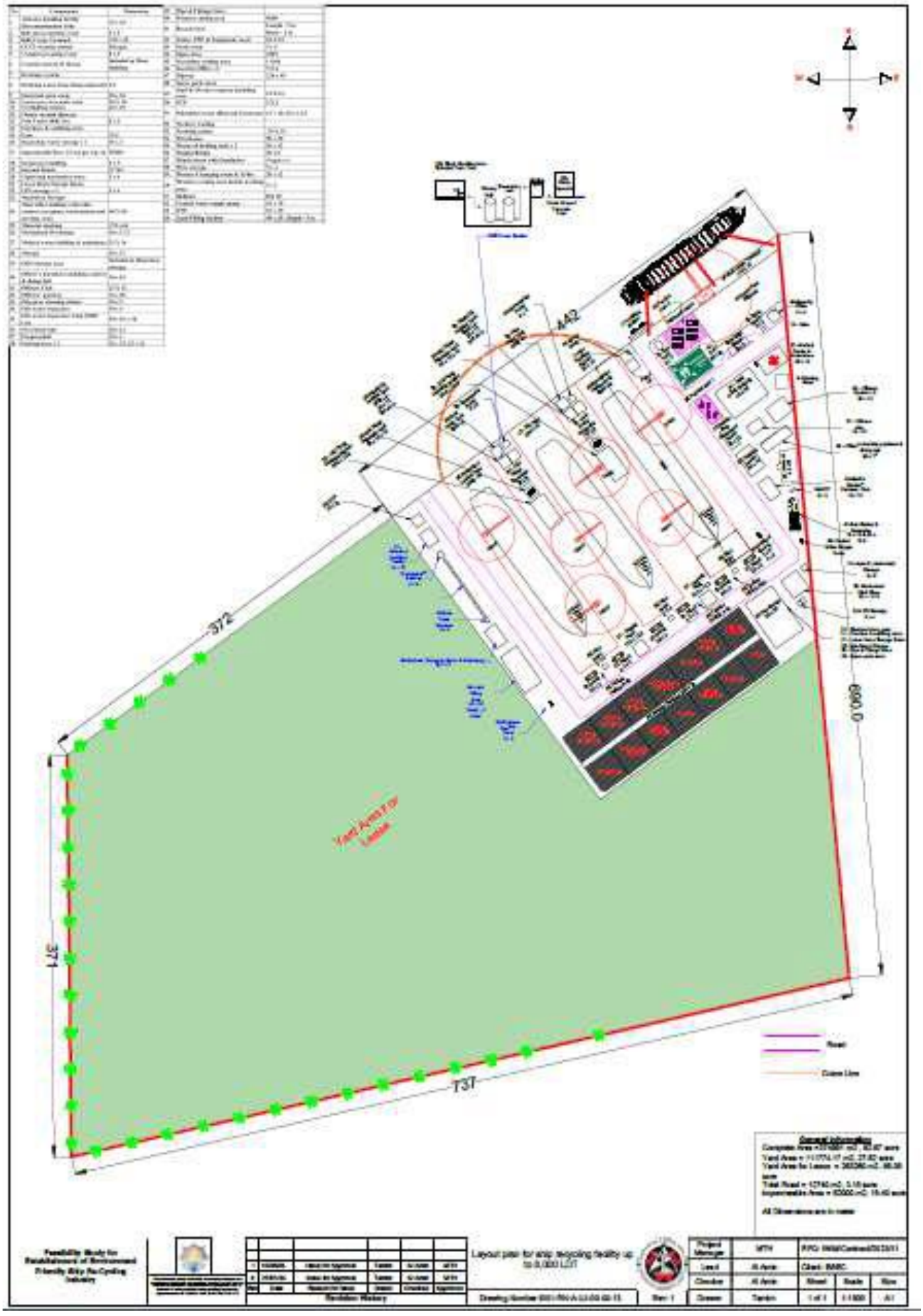


Figure 3-12: Draft design for construction of TSDF at Zone-24

3.7 IMPLEMENTATION PHASES

88. The key implementation stages for the development of the National Special Economic Zone (SEZ) in Mirsharai, Chattogram, Bangladesh are categorized into three main phases: Pre-Construction, Construction, and Operation Period. Each phase plays a crucial role in ensuring the successful establishment and functioning of the SEZ, which aims to boost economic growth, attract foreign investment, and create job opportunities in the region. The details of implementation stages are given below:

Table 3-11: Details on Implementation Stages

Implementation Phases	Major activities
Pre-Construction Phase & Construction Phase	• **Design and Planning**: Developing detailed architectural and engineering designs for the NSEZ, including zoning plans, utility layouts, and transportation networks; • **Regulatory Approvals**: Obtaining the necessary permits and approvals from government authorities to ensure compliance with local, regional, and national regulations; • **Stakeholder Engagement**: Engaging with local communities, businesses, and other stakeholders to gather input and address concerns related to the NSEZ development. • **Site Preparation**: Clearing and grading the land, as well as establishing access roads and utility connections; • **Infrastructure Development**: Constructing essential infrastructure such as roads, drainage systems, power supply, water supply, and telecommunications. • **Building Construction**: Erecting the facilities and structures that will house businesses and services within the NSEZ, including factories, warehouses, and administrative offices; • **Quality Control and Safety Management**: Implementing quality assurance measures and safety protocols to ensure that construction meets the required standards and regulations; • **Project Management**: Coordinating all construction activities, managing timelines, and ensuring that the project stays within budget.
Operation Phase	• **Business Development**: Attracting businesses to set up operations within the NSEZ through marketing efforts, incentives, and support services; • **Operational Management**: Establishing a management authority to oversee the day-to-day operations of the NSEZ, including maintenance, security, and regulatory compliance; • **Monitoring and Evaluation**: Continuously assessing the performance of the NSEZ in terms of economic impact, job creation, and investment attraction, and making necessary adjustments to strategies; • **Community Engagement**: Maintaining ongoing communication with local communities to ensure that the NSEZ contributes positively to the local economy and addresses any social concerns; • **Sustainability Initiatives**: Implementing environmentally sustainable practices within the NSEZ to minimize ecological impact and promote responsible development.

3.8 IMPLEMENTATION SCHEDULE

89. The tentative implementation schedule is as follows:

Table 3-12: Implementation Schedule

Subproject's name	Year					
	2025	2026	2027	2028	2029	2030
Subrpoject-1: Construction of 30 Km of Road Network within NSEZ areas						
Subproject-2: Construction of 31 Km Storm Water Network within NSEZ areas						
Subproject 3: Construction of Water Supply Networks						

Subject-4: Construction of Internal Power Distribution (OHT)						
Subproject-5: Construction of a 28 KM Gas Pipeline Network within NSEZ areas						
Subproject-6: Site Upgradations- Land Development of Part of Precinct F (IMD Zone and Housing Facilities) and Precinct B of NSEZ						
Sub-project-7: Construction of TSDF for hazardous waste management of ship recycling at Zone-24						

Legend:

	Preparation stage including tendering
	Implementation stage

3.9 RAW MATERIALS AND SOURCES

90. Key Raw Materials Required

- **Rods**: Used primarily for reinforcement in concrete structures, rods are essential for ensuring the strength and durability of buildings and infrastructure;
- **Cement**: A fundamental component in construction, cement acts as a binding agent in concrete and is vital for the construction of roads, drainage, and other structures;
- **Steel**: Steel is used extensively in construction for its high tensile strength and versatility. It is crucial for frameworks, reinforcements, and various structural elements;
- **Stone**: Natural stone is often used in construction for its durability and aesthetic appeal. It is commonly utilized in road construction and landscaping;
- **Bricks**: Bricks are a traditional building material used and other structures. They provide thermal insulation and are widely available in local markets;
- **Sand**: An essential ingredient in concrete and mortar, sand is necessary for various construction activities, including road and land development.

91. **Local Sourcing:** To promote sustainability and support the local economy, all these materials will be sourced from local markets. This approach not only reduces transportation costs and environmental impact but also fosters community engagement and economic growth within the region. By utilizing local resources, the development of the NSEZ can contribute to the overall prosperity of the area while ensuring that NSEZ is completed efficiently and effectively.

3.10 ELECTRICITY, GAS, OIL, FUEL, WATER

92. **Demand for electricity**:

Table 3-13: Demand for Electricity

Precinct	Demand KVA		Max. Demand
	KVA	KW	(MW)
A	958439.30	862595.37	517.56
B	323930.88	291537.79	204.08
C	148202.60	133382.34	93.37
D	367710.98	330939.88	198.56
E	159082.56	143174.30	100.22
F	1836875.04	1653187.54	1322.55
G	217591.88	195832.69	137.08
H	213014.45	191713.01	134.20
I	720055.70	648050.13	518.44
J	0.00	0.00	0.00
K	35089.00	31580.10	22.11
L	0.00	0.00	0.00
Total demand			**3248.17**

Source: Master Plan of NSEZ, 2020

93. **Gas Demand:** The tentative demand of gas within the study area is presented in Table 3-14

Table 3-14: Gas Demand in the Project Areas

Industrial Category	Total Gas Demand (m3/day)	Total Gas Demand (in mmcfd)
Chemical	4222.64	0.15
Chemical, Foam	020.37	0.04
Chemical, Paints	93014.45	3.28
Garments	18482.21	0.65
Auto Mobile, Mango	-	14.42
Bashundhara	-	79.79
Chemical	504.89	0.02
Food and Beverage	9111.93	0.32
Garments	1726421.55	60.96
Garments Accessories	248.36	0.01
Light and Medium Industrial Area	585541.58	20.68
Light Engineering	491.48	0.02
LNG Petro Chemical	0	0
Pharmaceuticals	1508.81	0.05
Power Plant, B-R Power	-	40.25
Power Plant, B-R Power Extension	-	107.75
Power Plant, BSRM Power	-	52.97
Steel Industry, BSRM	-	2.06
Steel Industry, PHP	-	121.7
Steel Product	16036.52	0.57
Textile	1247592.86	44.05
Utility	-	0
Port/ Logistics/ Light/Medium Industrial	33049.06	1.17
Total demand		**584.03**

Source: NSEZ, 2020

94. **Water for Demand:**

Table 3-15: Estimated Water Demand in the Project Areas

Sl. No.	Description	Cumulative Water Requirement (MLD)			
		2025	2030	2035	2040
1	Industrial water demand	242	337	474	665
2	Domestic and non-domestic water demand	57	82	119	174
3	Net water requirement at user end	299	419	594	839
4	Required production Capacity	343	482	683	965
5	Water is required to be withdrawn for treatment	360	506	717	1013
	Gross Demand	360	506	717	1013

Source: BEZA, 2020

3.11 POLLUTION POTENTIAL

95. **Source of Air Pollution:**

- **Road Construction:** The construction of roads involves extensive earth-moving activities, which generate significant amounts of dust. This dust can contain particulate matter that adversely affects air quality and poses health risks to nearby residents.
- **Drainage and Water Supply Facilities:** The excavation and installation of drainage systems and water supply facilities often lead to the release of dust and other pollutants. The machinery used in these processes also contributes to exhaust emissions.

- **Power network Facilities:** The construction of power lines and telecommunication infrastructure requires heavy machinery and equipment, which can emit harmful exhaust gases. The disturbance of soil during these activities can further increase dust emissions.
- **Gas Pipeline Installation:** Installing gas pipelines involves trenching and excavation, which can release both dust and volatile organic compounds (VOCs) into the air, impacting local air quality.
- **Site Upgrades and Land Development:** Upgrading existing sites or developing new land often requires significant land clearing and grading, leading to increased dust and emissions from construction vehicles.
- **Landfill Site Development:** Developing landfill sites for hazardous waste management can release asbestos, PCBs, heavy metals, LPG and other gas cylinders, and waste oil, in addition construction dust, which can significantly impact air quality and health and safety etc.
- **Transportation of Materials and Goods:** The transportation of materials and goods to construction sites is a critical aspect that contributes to air pollution. Heavy trucks and vehicles emit exhaust fumes, while the movement of materials can create additional dust.

96. **Source of Water Pollution:**

- **Surface Runoff:** During construction activities, the natural landscape is often altered, leading to increased surface runoff. Rainwater can wash away soil, debris, and pollutants from the construction site, transporting them into nearby streams, rivers, or lakes. This runoff can carry sediments, chemicals, and other harmful substances, significantly degrading water quality and harming aquatic ecosystems.
- **Liquid Waste from Construction Camps:** Construction camps generate various types of liquid waste, including wastewater from washing equipment, cooking, and sanitation facilities. If not properly managed, this liquid waste can seep into the ground or be discharged directly into water bodies, introducing pollutants such as oils, grease, and pathogens. The improper handling of these wastes poses a serious risk to both human health and the environment.
- **Unauthorized Disposal of Solid Waste:** Another critical issue contributing to water pollution at construction sites is the unauthorized disposal of solid waste. Construction debris, packaging materials, and other refuse are sometimes discarded improperly, leading to contamination of the surrounding area. Rain can wash these materials into drainage systems or directly into water bodies, resulting in litter and toxic substances entering the aquatic environment.

97. **Source of Soil Pollution:**

- **Leaching of Oil and Grease**: Motor vehicles and machinery often leak oil and grease, which can seep into the soil. This contamination can lead to the degradation of soil quality and harm local ecosystems.
- **Chemical Runoff:** Chemicals used in construction, such as solvents, adhesives, and paints, can wash away during rain or irrigation, leading to soil contamination. These chemicals can disrupt soil health and affect plant growth.
- **Construction Activities:** The construction industry is a significant contributor to soil pollution. Activities such as excavation, demolition, and the use of heavy machinery can disturb the soil and introduce pollutants.
- **Liquid Waste from Construction Camps:** Construction camps generate liquid waste from kitchens and toilet facilities. If not managed properly, this waste can leach into the soil, introducing pathogens and harmful substances that can compromise soil integrity.
- **Sanitary Facilities:** Improper disposal of waste from toilets can lead to soil pollution. Contaminants from human waste can introduce harmful bacteria and chemicals into the soil, posing risks to human health and the environment.

3.12 ALTERNATIVE ANALYSIS

3.12.1 Description of Alternative Options

3.12.2 No Project Alternatives

98. Bangladesh has experienced significant economic transformation, driven by various factors that have positioned it as a key player in the global economy. The demographic dividend, mainly young and vibrant workforce, has provided a solid foundation for economic activities. The ready-made garment sector has been a cornerstone of this growth, contributing substantially to exports and employment. Furthermore, remittances from Bangladeshis working abroad have bolstered the economy, providing essential financial support to families and communities.

99. The establishment of the National Special Economic Zone (NSEZ) is a strategic move to accelerate industrialization in Bangladesh. The NSEZ is designed to serve as an investment hub, bridging the gap between

domestic and foreign investments, creating a conducive environment for businesses, the NSEZ will attract both local and international investors to capitalize on Bangladesh's growth potential.

100. The NSEZ will play a pivotal role in promoting rapid industrialization by providing the necessary infrastructure and facilities for manufacturing and production. This initiative is expected to enhance economic development significantly, contributing to job creation and increased productivity. As industries flourish within the NSEZ, the overall national economy will benefit, paving the way for Bangladesh to achieve its ambitious goal of becoming a middle-income nation by 2031.

Key Impacts of the NSEZ Project:

Job Creation:	The implementation of the NSEZ is projected to create approximately 1.4 million job opportunities throughout the project lifecycle. This surge in employment will not only enhance economic gains but also provide social benefits through construction and operational jobs.
Diverse Employment Opportunities:	The project will cater to a wide range of labor needs, offering positions for skilled, semi-skilled, and unskilled workers, as well as professionals. This inclusivity is expected to improve the quality of life for many individuals and reduce health and social risks associated with unemployment.
Establishment of a Planned Industrial City:	NSEZ is anticipated to be the first planned industrial city in the country, setting a precedent for the development of a world-class business and industrial center. This will attract both local and international investments, fostering a competitive economic environment.
Partnerships with the Private Sector:	BEZA aims to forge strong partnerships with the private sector and local entrepreneurs, which will facilitate knowledge transfer, innovation, and the growth of small and medium enterprises (SMEs) in the region.
Comprehensive Infrastructure Development:	The NSEZ will include essential infrastructure such as a seaport, rail connectivity, marine drive, residential areas, hospitals, schools, and universities. This development will significantly enhance the transportation and communication networks in the region, making it more accessible and attractive for businesses and residents alike.
Boosting Local Industries:	BEZA's vision includes improving the quality and increasing the export quantity of local products by establishing various industries. These include garments and supporting industries, agro-products and processing, integrated textiles, leather products, shipbuilding, motorbike assembly, food and beverage production, paint and chemicals, paper products, plastics, light engineering (including auto-parts and bicycles), and pharmaceuticals. This diversification will help reduce the country's reliance on imports.

3.12.3 Location Alternatives

101. The location of NSEZ was strategically chosen to avoid private lands, thereby mitigating potential conflicts and socioeconomic impacts on local residents, particularly concerning the displacement of private landowners. Avoiding private rapid land acquisition, the project aims to foster better community connections and minimize the likelihood of legal disputes. This approach helps prevent displacement, loss of livelihoods, and disturbances to established social networks.

102. Despite the limited instances of land acquisition necessary for shaping the economic zones, utmost consideration was given to the affected populations, ensuring proper compensation, and implementing appropriate resettlement plans during the land development phase of NSEZ.

103. The proximity of existing infrastructure played a crucial role in the site selection process. The site was chosen based on its accessibility to roads, utilities, and other essential services, which can significantly reduce project costs and enhance operational efficiency. By ensuring that the site is well-connected to government infrastructure, the feasibility of the project areas is strengthened, paving the way for positive future outcomes.

104. Rigorous stakeholder engagement was a fundamental aspect of the land development process at the NSEZ project site, focusing mainly on the effects on local ecosystems, communities, and economies, aligning with social and environmental goals. Involving local stakeholders not only provides valuable insights but also fosters a sense of ownership among community members, which is essential for the long-term success of the project.

105. The NSEZ location is strategically positioned on the coastal area of Bangladesh, which offers several advantages:

- **Ease and Low Cost of Transportation**: The proximity to major transportation routes facilitates the efficient movement of inputs and raw materials necessary for industrial operations. This accessibility is crucial for maintaining a steady supply chain and reducing operational costs;
- **Reduction of Greenhouse Gases (GHGs)**: By minimizing the distance that raw materials need to travel, the NSEZ can contribute to a decrease in greenhouse gas emissions associated with transportation. Shorter travel distances mean less fuel consumption, aligning with global sustainability goals;
- **Continuous Availability of Inputs/Raw Materials**: The selected coastal site ensures a reliable and uninterrupted supply of necessary resources, which is essential for the smooth functioning of industries within the NSEZ.

106. The most important thing while exploring the alternative sites in Chattogram and other districts is that no suitable local was found to set up a large industrial city meeting expected demand. One of the crucial reasons was scarcity of land for a such big industrial plan and other infrastructure facilities for transportation facilities road connection, utility supply, port connection, river and sea connection etc. explores the pressing issue of land scarcity in Bangladesh, particularly concerning the establishment of large industrial cities. Finally, NSEZ site was selected to meet the industrial capabilities and economic growth, the availability of suitable land remains a significant challenge. This analysis delves into the factors contributing to this scarcity and its implications for industrial development.

Site selection for NSEZ:

- In recent years, Bangladesh has witnessed a surge in demand for industrial development, particularly in regions like Chattogram. However, one of the most significant challenges faced is the scarcity of land suitable to other sites for large-scale industrial projects.
- Second, the alternative sites lacked essential infrastructure, such as transportation facilities, road connections, utility supply, and port access, further complicates the establishment of industrial cities.
- Thirdly, avoiding the massive land acquisition for land ownership disputes, bureaucratic hurdles, and local opposition can also impede the acquisition of land for industrial purposes. These factors can create an uncertain environment for potential investors.
- Finally, the NSEZ has been identified as a desired site due to its strategic location, which is crucial for facilitating industrial activities. The zone is designed to provide a conducive environment for businesses, offering various incentives and support mechanisms that can help attract both domestic and foreign investments.

3.12.4 Selected Options

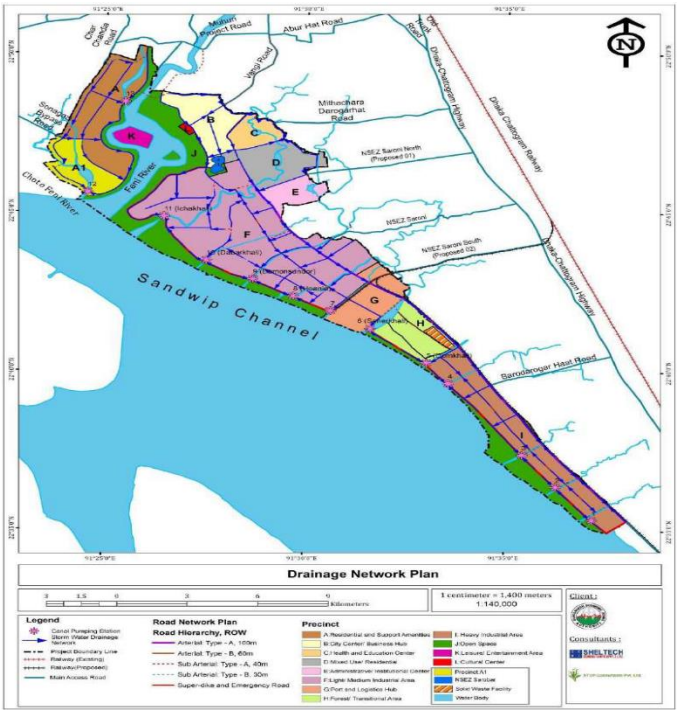
3.12.4.1 Subproject -1: Construction of 30 Km of Road Network within NSEZ areas

107. A total of 30 KM internal road network will be developed covering all the Precinct in the NSEZ areas. The NSEZ site is about 10 km from the Mirsharai-Chattogram highway and 67 km from the Chattogram port city. The connecting roads are mainly from Dhaka Chattogram Road and can be listed as Muhuri Project Road (Zorarganj - Muhuri), Bamonsundar Road, NSEZ Sarani, and Mohan Nagar Barodarogarhat Road.

108. At present, the capacity of the local access roads adjacent to NSEZ is quite limited and the number of existing links to NSEZ are inadequate to cater to the new volume of traffic likely to be generated by NSEZ. To make an easier and desirable communication in the NSEZ areas internal road network should be developed in considering the future traffic volume in the economic zone. Access to the northern side of NSEZ will be from NSEZ North Road (Bhangi Road). A 6-lane bypass for Sonagazi would be required from Precinct A.

109. The traffic volumes from the access roads connecting the Dhaka-Chattogram Highway will be inadequate by 2025. For proposed freight/cargo traffic, a separate access-controlled link from the Dhaka-Chattogram Highway connecting to the port and logistic area in NSEZ (Precinct G) will be required. The proposed Dhaka Chattogram Expressway will be located approximately 80m west of the present highway (N1).

- Though some amount of regional traffic will be shared by the expressway, the present 4-lane highway is required to be widened to 6-lanes. To have direct connectivity to Chattogram from NSEZ, a new link is proposed. This road will start near the Port (Precinct G) and follow the coast down to Chattogram. This will reduce pressure on the Dhaka-Chattogram Highway and create a special link for a future mass transit solution.
- Therefore, the alternative option is not feasible for the development of road network in and around the NSEZ areas. However, good materials, construction methods and equipment should be up to the mark, that will reduce the burden on the natural environment as well as consultation with the local community to inform the local people regarding the proposed plan and make them aware of avoiding or reducing the accidental cases or incidents in the working areas.



3.12.4.2 Subproject -2: Construction of Storm Water Drainage Network within NSEZ areas

110. Chattogram is recognized as one of the regions in Bangladesh most susceptible to heavy rainfall, particularly influenced by the monsoon season. The climate in this area features a dry season from November to March and a rainy season from May to October, with an annual average rainfall of 116.7 inches. The peak rainfall occurs from May to September, averaging 19.4 inches, which often leads to significant water logging in various project areas. To address this challenge, the construction of a storm water drainage network is deemed essential.

111. To effectively manage storm water runoff and reduce the incidence of water logging, a total of 31 km of storm water drainage network will be constructed. This network is designed to connect various infrastructures, industries, facilities, open spaces, and vegetated areas within the NSEZ. By efficiently capturing and discharging storm water, the drainage system will facilitate uninterrupted industrial operations and enhance the overall functionality of the zone.

112. The drainage network will be strategically designed to ensure that all storm water is directed towards the Bay of Bengal, located along the project boundaries. This dedicated storm water management system will be constructed with the utmost care to prevent any contamination from wastewater. The Bangladesh Economic Zones Authority (BEZA) will enforce strict monitoring protocols, conducting quarterly assessments and laboratory tests to ensure that the drainage waters remain free from any contaminated wastewater.

113. The establishment of this storm water drainage network is a critical component of the NSEZ project. Given the historical records of tropical cyclones and heavy rainfall in the region, the proposed drainage system is not only necessary but also irreplaceable. Alternative options for storm water management are not viable, making this initiative imperative for the sustainability and operational efficiency of the industries within the zone.

3.12.4.3 Subproject- 3: Construction of Water Supply Networks

114. The water demand for the NSEZ project areas is expected to rise significantly over the coming years, with estimates indicating the following requirements:

- 2025: 343 million liters
- 2030: 482 million liters
- 2035: 683 million liters
- 2040: 965 million liters

Water Sources

- **Feni River Reservoir-** Currently, the Feni reservoir has an active storage capacity of approximately 17.4 million cubic meters (mm^3). Under average rainfall and stream flow conditions, utilizing 100 million liters per day (MLD) from this reservoir to meet industrial needs after satisfying agricultural water requirements poses a significant challenge. During the dry months of February and March, withdrawing 100 MLD for industrial use could further deplete the reservoir, impacting water availability later in the year.
- **Meghna River-** According to estimates from CWASA, it is feasible to extract and purify 950 million liters (95 crores liters) of water daily from the Meghna River in Chandpur. This water could be transported to the NSEZ through a 132 km long transmission line.

115. However, surrounding khals and canals, such as Ichakhali and Bamonsundar Khal, along with water from Mohamaya, Bawa Chhara, Boroomoldoho, and Sahasradhara reservoirs, are not viable options for extracting the required water due to their limited capacities.

- **Alternative Options-** Another potential source is the extraction of saline water from the Sandwip Channel or the Bay of Bengal, which could then be treated at a desalination plant for industrial use. However, this method is expected to be costly and may not be the most efficient solution.
- Given the challenges associated with sourcing adequate water sources, establishing a dedicated water supply network in the project zones is crucial. While the specifics of this network are not yet finalized, it is a major component of the project. The BEZA will conduct further studies to determine the best supply network and explore alternative options.

3.12.4.4 Subproject-4: Construction of Internal Power Distribution Networks within NSEZ areas

116. The Bangladesh Rural Electrification Board (BREB) is responsible for power network distribution within the NSEZ as per agreement with the Bangladesh Economic Zones Authority (BEZA). BREB provides all sorts of electrical services for the NSEZ. Apart from installing and providing electrical services, BREB also built substations from the BEZA fund. Further, the organization is constructing a 10 MVA substation from its own fund for the NSEZ. The maximum power demand in the project areas is 3248.17 MW.

117. To supply power to the NSEZ, a reliable transmission infrastructure has been proposed to be constructed internally in the industrial hub by the BEZA through the Power Grid Company of Bangladesh (PGCB) along with the upgradation of the existing grid network. To provide a reliable power supply to NSEZ, transmission utilities have already been extended to the grid network by constructing a 7 km dedicated 400 kV overhead line, presently powered by 230 kV voltage and a 230/33 kV substation at the site. In infrastructure planning, more links in 400 kV and 230 kV voltage levels may be considered with the national grid network to enhance the power supply reliability.

118. A 230/33 kV Substation having a capacity of 2 x 120/140 MVA (+ Future: 2x120/140 MVA) has been commissioned on 20th May 2020, feeding through a 400 kV architecture transmission line for reliable power supply in the NSEZ. The substation is for 400/230/33 kV, with the rest of the 400/230kV substation section having a capacity of 2x1000 MVA. The present power supply capacity through the Mirsharai-BSRM 230kV Double circuit line is around 1100 MW (conductor: Twin ACCC, 3000 Amp).

119. In light of the above developments, an internal power distribution network shall be established within the project areas to ensure an uninterrupted power supply for the industries. The transmission line is already in place, and the distribution network is now underway to connect the industrial plots. Therefore, there is no alternative to skipping this major component. However, the installation method, materials, conductors, and other associated issues shall be considered according to international standards for long-term use.

3.12.4.5 Component-5: Construction of a 30 KM Gas Pipeline Network within NSEZ areas

120. **Proposed Alignment:** The proposed designed gas pipeline network is about 30 km in length, starting from the Central Gas Station (CGS) as shown in Figure 3-13. The number of major road crossing-at 3 points at 22°45'25"N 91°28'40"E, 22°45'02"N 91°27'32"E, and 22°43'54"N 91°30'10"E. and the water body crossing at 4 points; 22°44'25"N 91°27'02"E, 22°45'23"N 91°26'22"E, and 22°45'45"N 91°27'07"E' and 22°45'04"N 91°27'33"E. These canals are Ichakhali, Bamonsundar and Susham /Daborkhali. No building structures will be affected since the gas pipeline will pass alongside the existing and proposed future roads network.

121. Alternative-I for considering another new alignment for the installation of gas pipelines, which will pass through the existing road networks as well other sides within the Zone 2A-2B and its adjacent areas as zigzag to connect a wide area of coverage as shown in Figure 5-2. The new gas pipelines will pass from the CGS of a tentative length 42.70 km, along roadside or middle of roads with crossing the canals at least nine (9) locations.

122. The number water body crossing- at 9 points at 22.7425587N, 91.4510999E, 22.7509447N, 91.4592012E, 22.7342654N, 91.4758789E, 22.7493938N, 91.4396783E, 22.7584367N, 91.4385892E, 22.7350636N, 91.4467007E, 22°44'25"N 91°27'02"E, 22°45'23"N 91°26'22"E, and 22°45'45"N 91°27'07"E' and 22°45'04"N 91°27'33"E etc. In addition, this unplanned alignment may create many obstacles and interference with the industrial infrastructures and other building development stages, in future.

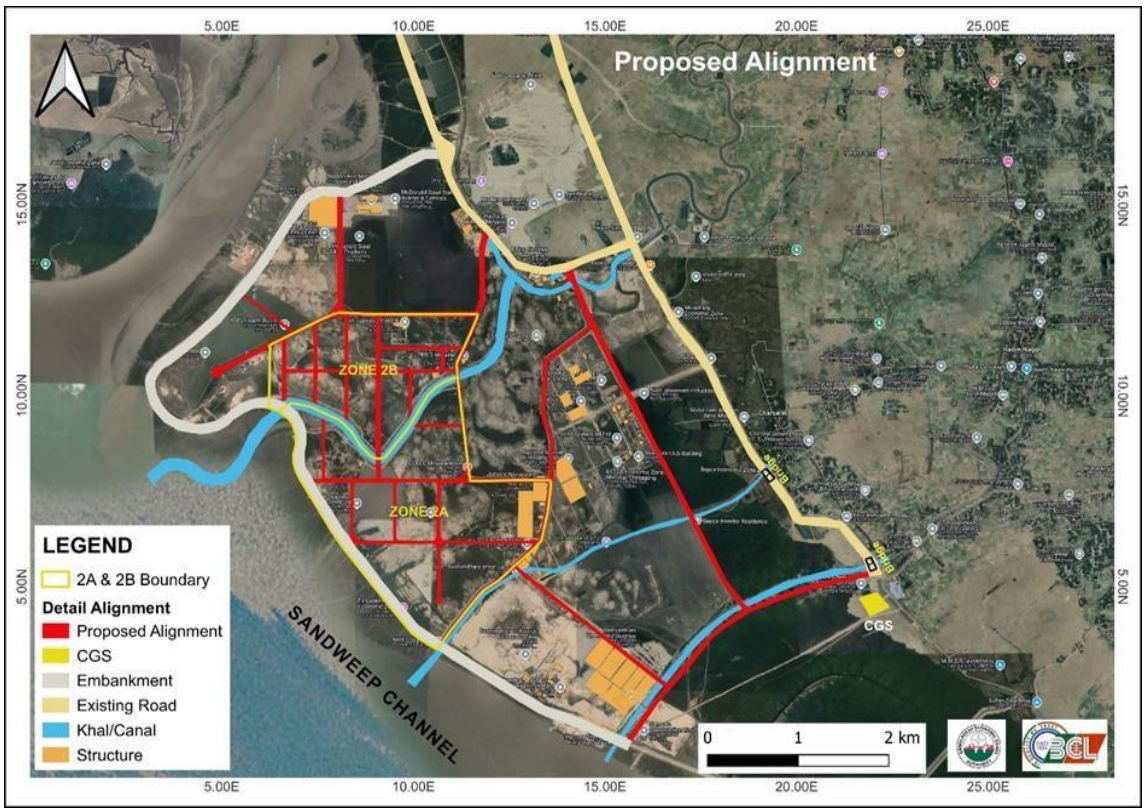


Figure 3-13: Proposed Gas pipeline network within Zone 2A-2B and its adjacent area for Alt-I option

123. **<u>The Alignment of alternative 2</u>** starts at the same location as the proposed alignment and passes along another main road (Figure 5-3). The length of this gas pipeline network will be about 35km. The new gas pipelines will pass along the roadside or the middle of roads and cross the canal at least six (6) locations. In addition to four (4) canals within the proposed alignment, another two canals are at 22°43'57.50"N, 91°30'15.94"E and 22°44'30.99"N, 91°29'32.54"E. Over these canals two bridges are constructed. The number of major road crossing-at 3 points.

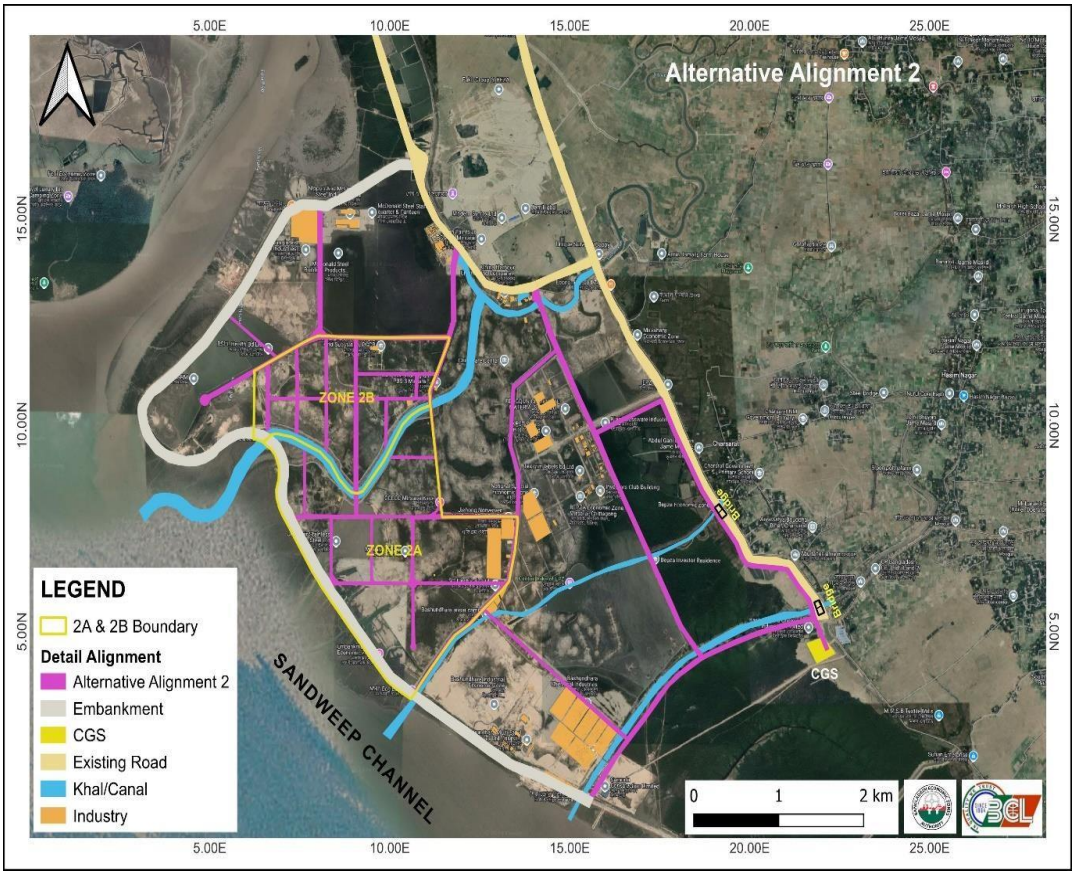


Figure 3-14: Proposed Gas pipeline network within Zone 2A-2B and its adjacent area for Alt-2 option.

124. The proposed network alignment is deemed superior due to its ability to significantly reduce the number of road and water body crossings, as well as minimizing potential obstacles and interferences. This reduction not only simplifies the construction process but also lowers the overall construction costs associated with the project. Furthermore, the proposed alignment is expected to have a less detrimental effect on the local environment and social settings compared to Alternative-1 and Alternative-2.

3.12.4.6 Subproject-6: - Land Development of Part of Precinct F (IMD Zone and Housing Facilities) and Precinct B of NSEZ

125. To identify the suitable dredging source locations, about 29.534 km stretch of Sandwip Channel to adjacent to the NSEZ's PRIDE project area was studied. and its downstream up to 1 (one) km of the NSEZ Project site, which is about 26 km away from the Bay of Bengal at downstream. The PRIDE Project authority is planning to dredge the Sandwip channel to fill land. The Consultant has been identified 12 probable dredging source locations based on available secondary data, site observation and visualization, assessment, overlay, and creation of geospatial data through using Google Earth Pro image.

126. The distance from proposed 12 dredging locations to landfilling sites is also studied (Figure 3-15). Out of 12 proposed locations, Site No.10, Site No.11, Site No.12, are at the Sandwip Channel confluence and the locations numbers Site No.9, Site No.7, Site No.6, Site No.5, Site No. 4, Site No.3, Site No.2 and Site No.1 are located onward at the Sandwip Channel downstream.

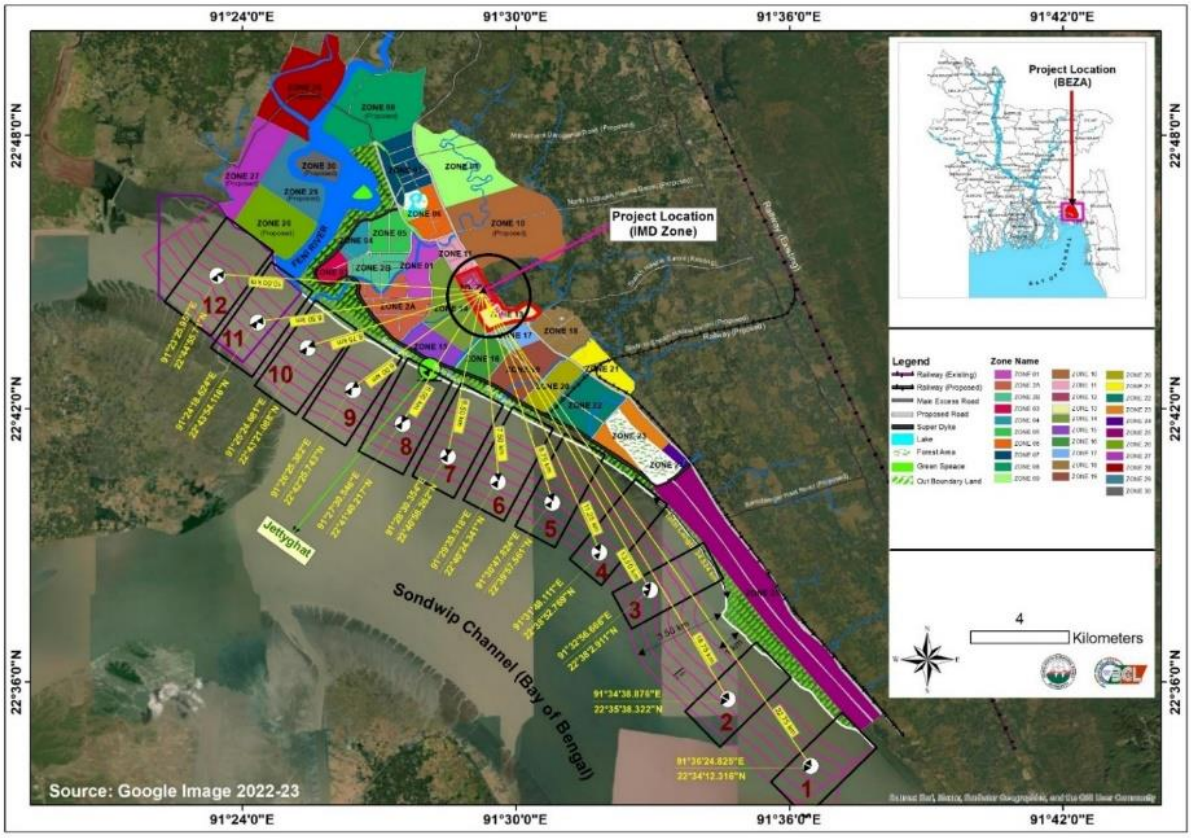


Figure 3-15: Distance of dredging sources in Sandwip Channel to the land filling sites

Option-1: Unsuitable locations for dredging

127. All sites require special attention while conducting dredging. Therefore, the sampling sites were selected as representative covering both upstream and downstream of the channel. Eight out of 12 locations are identified as non-suitable sources for dredging, a few of those (site 1, site-2, site-3, and site 4) are downstream from the sub-project locations far away from the land filling zones. The downstream sea ecosystems span vast expanse of the ocean floor, significantly contribute to extensive biogeochemical cycles and offer crucial ecosystem services such as carbon sequestration, nutrient recycling, waste accumulation, fisheries and marine habitat. Therefore, these sites can deem as not be viable for dredging activities.

128. Similarly, the dredging sources site L-10, L-11 and L-12 are not suitable due to sites 10 and L12 are predicted Hilsa breeding ground, also the ecologically sensitive habitat, should avoid these sites for dredging (Islam et al., 1987; Hossain et al., 2014).

129. Distance of dredging locations to the land development site are also considered. At the downstream (site no 1, 2, 3, 4, 11, 12) are far away from the IMD zone land filling site, will not be viable for dredging activities (Figure 3-16: Un-suitable dredging source locations under Option-1.). The downstream sea ecosystems span vast expanse of the ocean floor, significantly contribute to extensive biogeochemical cycles and offer crucial ecosystem services such as carbon sequestration, nutrient recycling, waste accumulation, fisheries and marine habitat.

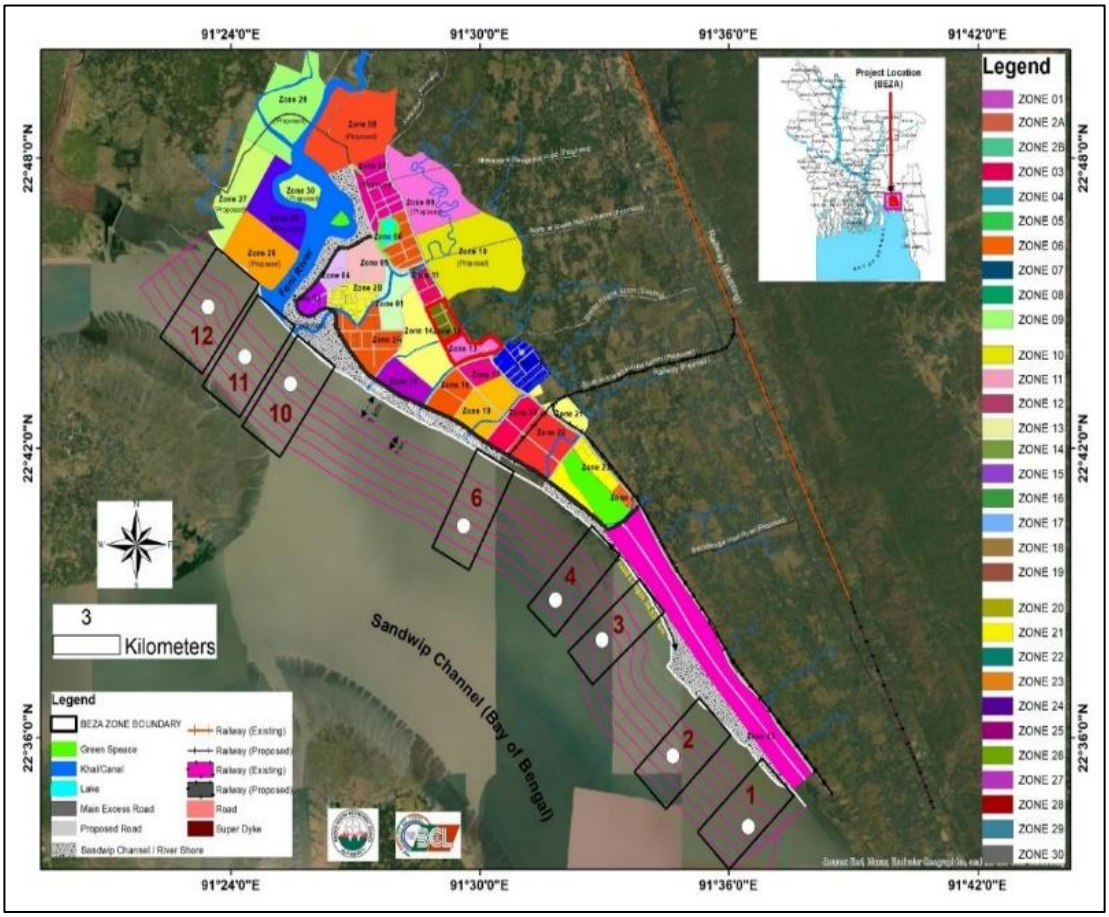


Figure 3-16: Un-suitable dredging source locations under Option-1.

Option-2: Suitable locations for dredging

130. After screening in line with the ecological points, physical environmental and morphological views, the four (4) out of 12 locations were identified as potential for dredging sources considering less significant impacts on the marine ecological biodiversity, physical environment, short distance from the land filling site and other factors due to the dredging activities for the land filling. These four locations are Sites. L-05, L-07, L-08 and Site L-09 in Sandwip Channel and considered as Option 2.

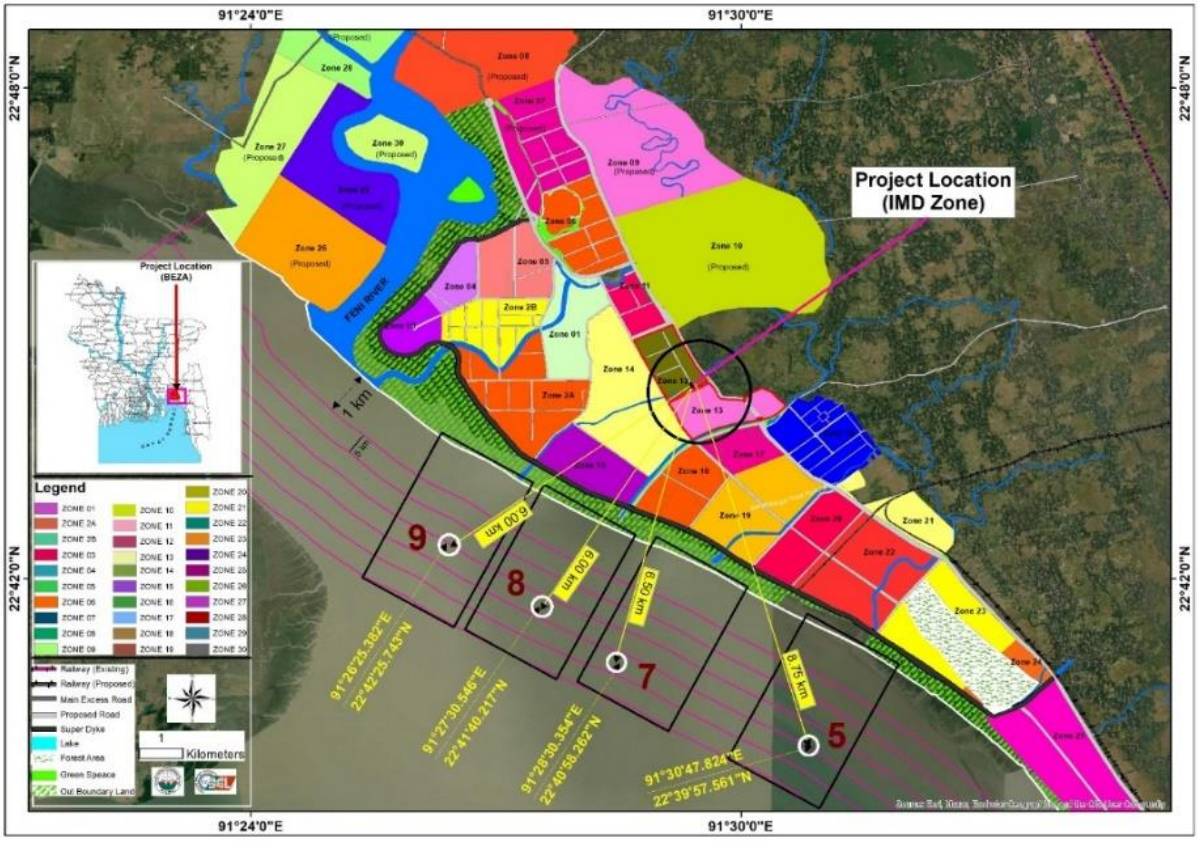


Figure 3-17: Suitable dredging source locations under Option-2.

3.12.4.7 Subproject-7: Development of Treatment, Storage, Disposal Facilities for management of hazardous wastes of ship recycling industry at Zone-24 of NSEZ areas12

131. Establishing certain criteria and following the site selection protocol are crucial because failing to do so would negatively impact human-environment interaction. The identification and definition of the decision problem is the first step in any procedure. The decision dilemma, in its broadest sense, is the perceived difference between a system's desired and current states. According to decision makers, it is the difference between the intended and actual states. The intelligent phase of decision-making overlaps with the problem definition.

132. Sitting a landfill or other facility necessitates considering a wide range of criteria, considerations, and regulations because the required site for a hazardous waste landfill must satisfy all environmental, social, and economic requirements. To sitting waste facilities, large volumes of spatial data are thus processed. Because of their tight environmental restrictions, these challenges are made considerably more onerous when it comes to hazardous waste dump sitting. For selection of suitable site, a series of preliminary study was conducted such as Digital survey and topography, coastal regulation zone and flood map, meteorological and seismic data, soil and geotechnical survey, ground water and hydrogeological survey, background environmental parameters, biodiversity and forest data, traffic survey and transportation planning, and socioeconomic aspects of the project are among the data that must be gathered from secondary sources as well by commissioning specific studies.

133. **Screening Criteria:** It is a component of the process of choosing a location for a hazardous waste landfill. Shortlisting the potential locations found in and around Chittagong is the main goal of the screening criterion. Only after specific "screening criteria" have been developed can it be accomplished. When assessing and choosing a study area, a wide range of characteristics that represent the issues pertinent to the decision

[12] Source: Safe & Environmentally Sound Ship Recycling (SENSREC) Project, Phase-I, Work Package 5b)

problem must be considered. Based on a comprehensive set of attributes, various study areas that are the result of screening criteria are then compared with one another.

134. Different buffering distances are applied to various attributes in a screening criterion, which are based on the community's perception of risk, the level of treatment given to hazardous waste, safety precautions taken when building a landfill, the opinions of experts based on their experience, transportation risk, and hazard. Depending on their significance to the site, a number of characteristics, including lakes or ponds, rivers, water supply wells, water resources, ground water table levels, wetlands, flood plains, urban development, regulatory zones, airports, populated areas, fault zones, land slopes, road networks, land costs, etc., were also considered for screening criteria.

135. **Sensitivity Analysis:** Sensitivity analysis was used to assess robustness and produce a rating of locations. Sensitivity analysis is a process for figuring out how changes in the study's inputs impact the suggested course of action. Its specific goal is to determine how changes in the input geographic information and decision makers' preferences—affect the outputs, which include ranking the options. The decision-makers gain a greater knowledge of the problem's structure through the exploration process of sensitivity analysis. To identify the most favored option, it is helpful to demonstrate how the different decision components interact. The suitable sites were selected based on subsoil investigation, ground water/ hydrogeological investigation, hydrological investigation, topographical and geological investigation, air quality data, public acceptance etc.

136. Elements for "Exclusionary Criteria": The exclusion criteria were mainly considered the following parameters within the proposed TSDF site such Lake and Pond > 200 m, River > 500 m, Water supply well > 500 m, Ground water level > 2m, Flood plains > 100 years, Urban development > 150 m, public parks > 500 m, Highway > 500 m, Historical or cultural sites > 500 m, Habitation > 500 m, Airports > 4000m, Populated area > 2.5 km for population greater than 300,000, Land slope < 40% and Road network accessibility < 1,000 m etc.

137. **Preferred Locations:** Following the above discussions, the Government of Bangladesh intends to establish a TSDF at Zone-24 of NSEZ areas as a preferred locations which met all the criteria of Exclusionary Criteria mentioned above. It was preliminary decided to shift the location of CHW-TSDF at Zone-24 of NSEZ in considering the one of the best alternative sites for 20-year operating life and available land is made the site is feasible for moving forward to take further development steps. The basic criteria for selection of TSDF at Zone-24 of NSEZ areas are as follows:

- Through topographical surveys, the highest flood level and mean sea level are determined. At least a 100-year return period for the highest flood has been considered for the siting of TSDF projects.
- The average level of the sea surface, calculated by the mean of hourly tide levels and used as the standard determining terrestrial and atmospheric elevations and ocean depths at the TSDF new location.
- The gradient or slope is also an important factor of site selection since higher slopes would increase runoff of pollutants particularly from the landfills and thereby contaminate areas further away from the landfill sites. A slope which is less than 12% is suited for the prevention of pollutant runoff which is favorable in the new location at Zone-24 of NSEZ areas.
- It is identified that the land for TSDF site at Zone-24 remains out of reach of floods and inundations and does not spoil the coastal zone and ecology in Chittagong region.
- The TSDF site at Zone-24 considered the land features including coastline bluffs, dunes, and beach for developing a holistic picture of coastal development in Chittagong encompassing the flood hazards.
- The details of the TSDF site, its morphology, frequency of wind orientation and pattern of the study area were considered during the site selection criteria. The morphological aspect was determined in degrees, and the wind frequency is in meters/seconds.
- For designing the hazardous waste disposal facility (TSDF) at Zone-24, the major siting criteria must include permeability and porosity of base material, the profile of groundwater and surface water (flow, direction and quality) etc.
- Landfill design is highly dependent on physical characteristics, such as topography, geology, and groundwater depth etc., are favorable for the new proposed site at Zone-24 of NSEZ areas.

138. **Unsuitable locations:** The pre-feasibility/feasibility study were conducted in several locations of Sitakunda, Chattogram, to undertake the TSDF project however, the sites were not considered establishing the TSDF project due to densely populated areas, close proximity of surface water sources, flood plains and other

urban infrastructures and other factors which were not meeting the IOM rules and regulations, the summary is given below.

- It is reported that areas with high slopes are not suitable for construction of landfill sites or TSDF plants at Sitakundo areas
- Odor from the landfill sites is considered as the major problem that affects the nearby local communities
- Aesthetically and logically a buffer of 100 meters should not be met for sitting at the facility at Sitakunda areas.
- Economic factors for site are based in three areas, explicitly, acquisition costs, and development and operation costs of each site were very high that it could not be feasible to undertake TSDF facilities at Sitakunda areas.
- The construction and maintenance of TSDF on a steep slope is difficult and expensive, since higher slopes would increase the runoff of pollutants particularly from the landfills and thereby contaminate areas further away from the landfill sites.
- The estimation of the exposure of coastal communities in and around Chittagong to flooding could be a critical task for long term planning and risk assessment and site selection for CHW-TSDF project at Sitakunda and its adjacent areas etc.

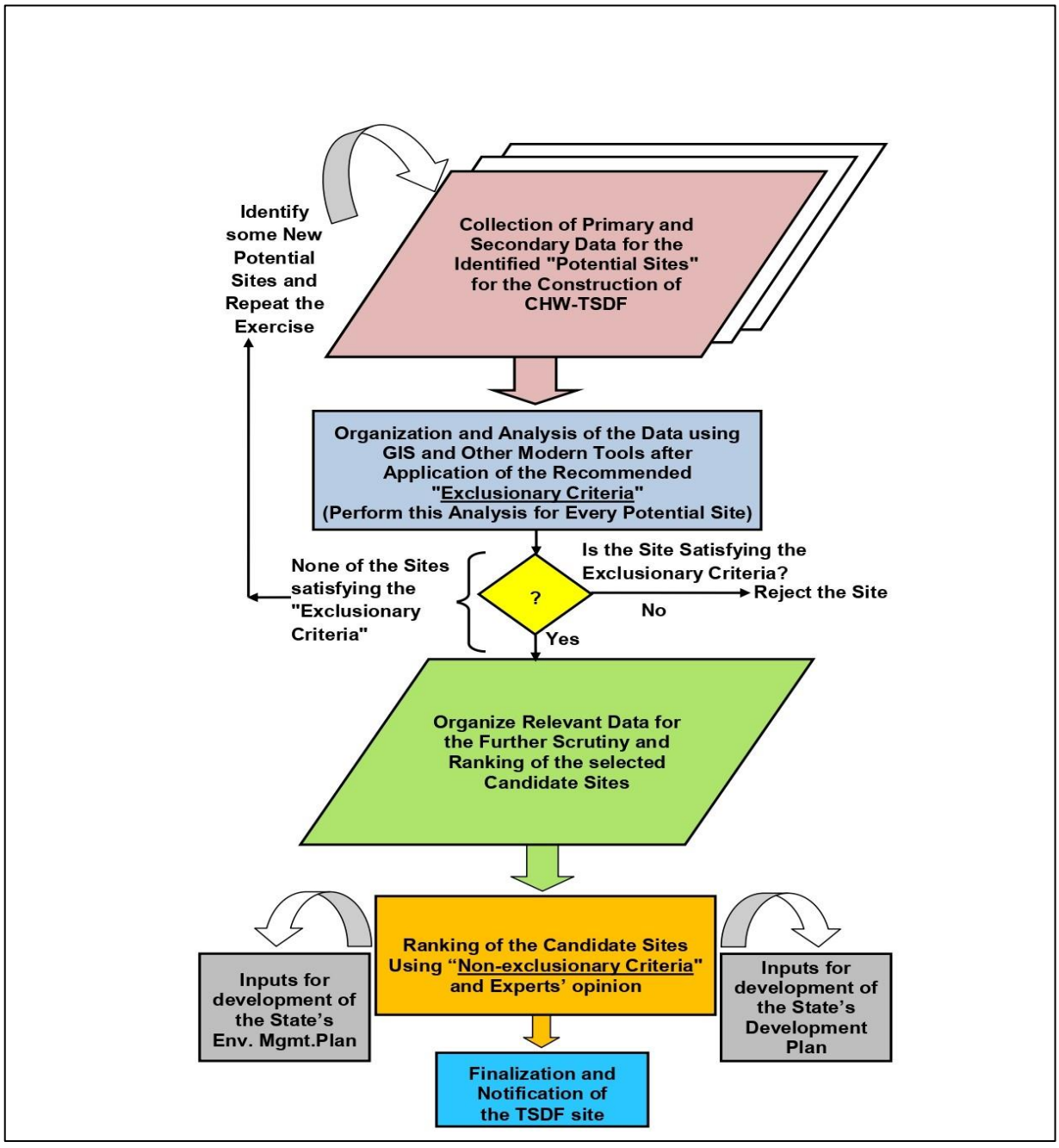


Figure 3-18: Process Flow Diagram for Implementation of the Site Selection Protocol[13]

(Source: Safe & Environmentally Sound Ship Recycling (SENSREC) Project, Phase-I, Work Package 5b)

3.13 GENERAL ENVIRONMENTAL GUIDELINES[14]

139. All development within NSEZ must have all of its environmental clearances before any development is permitted. In addition, the following environmental considerations must be met along with all other mandatory environmental and green resilient guidelines, rules and regulations:

- Within NSEZ, a minimum of 10% of the total land area must be reserved for open space.
- All roads within NSEZ must have sidewalks, as well as pedestrian and street lighting and must be lined with a single or double row of trees depending upon the location of the road and how wide the road is. All trees shall be planted no more than 4 meters apart.
- Heavy vehicles and cargo transportation shall not be permitted in Precincts A, B, C, D, E and L.
- NSEZ must be designed to be eco-friendly, environmentally responsible, and resilient.
- Solar, renewable energy, recycling, and green technology must be incorporated into the design of the NSEZ project.
- Within NSEZ, an uninterrupted supply of potable water (maintaining drinking water quality, as per DOE, GOB or WHO) is mandatory as well as grey water. Water plants, transmission and distribution networks and wastewater treatment plants must be constructed in accordance to international standards.
- All sewage within NSEZ must be properly-managed/treated. Hence a Sewage Treatment Plant (STP), (per DOE, GOB, and STP guidelines) must be constructed within the zone in accordance with international standards.
- Land within or outside NSEZ must be reserved for a Municipal Solid Waste Management Treatment Plant/Disposal / Sanitary Landfill site for the project.
- NSEZ is a plastic-free zone. The use of polythene bag / plastic bag shall be prohibited within NSEZ.
- Solar lighting is mandatory within NSEZ. Hence, street lighting / boundary lighting etc. must be solar powered.
- To promote energy conservation, the use of energy efficient lights / high efficiency light systems (IE. T5 Tri phosphor Fluorescent, LED etc.) is mandatory within NSEZ.
- Fire services/emergency services for fire-fighting and medical facilities must be present in each Precinct.
- All power sub-stations must be properly fenced and buffered with landscaping to reduce impacts on the road and improve security of the infrastructure.
- As much as possible, green and resilient technology must be used for all large buildings/plots within NSEZ.
- All water channels within NSEZ must be designed to capture and drain water from the surrounding areas outside NSEZ into the Bay of Bengal. These channels shall be kept active and shall be lined, planted and enlarged to become water features/lakes/streams, and water reservoirs/harvesting/collection within NSEZ.
- A rainwater harvesting system designed to capture roof run off from a minimum of 200m^2 (or 50% of the available roof catchment area for roof areas less than 400m^2) during regular rainfall events must be incorporated into each building. The collected rainwater shall be plumbed to supply a seasonally independent water use. IE. Toilet flushing and landscaping etc.

13

14 National Special Economic Zone (NSEZ) Master Plan, 2020

- Most of the components in NSEZ require environment clearance from DOE, GOB (Orange –B category) as per The Environment Conservation Rules, 1997 and its amendments.
- No construction / developmental activities within NSEZ shall be permitted until environment clearance is granted/received from DOE.

3.14 RESILIENCE OPTIONS FOR NSEZ'S INFRASTRUCTURE[14]

140. Based on overall resilience considerations and principles highlighted above, specific infrastructure measures have been developed for NSEZ. The following infrastructure resilience options must be integrated into the design and implementation of all infrastructure within NSEZ.

a. Infrastructure for Flood and Earthquake Protection and Management

Given that NSEZ is a new, large, coastal development located on previously uninhabited reclaimed lands facing the Bay of Bengal, flood and earthquake protection and management are three of the most critical core infrastructure requirements needed to support the NSEZ's development, operations, sustainability and viability. Therefore, understanding and enhancing the ability to protect and manage floods and earthquakes, as well as, implement measures, which can minimize the potential loss and damages in the face of growing climate and disaster risks are critical resilience options to consider within NSEZ.

Risk considerations. Flood and earthquake protection infrastructure and its management must be designed so that the NSEZ site is protected against earthquakes and floods. For floods, to the level of a 1 in 100-year coastal flood, a 1 in 25-year river flood, and to historical maximums of pluvial floods. Given its function for protection, resilient infrastructure must be developed in high flood-prone areas along the sea and rivers in NSEZ, which may be vulnerable to extreme weather events and measures must be taken throughout the site to minimize impacts of earthquakes.

Resilience measures. Various detailed measures to enhance resilience against flooding and earthquakes within NSEZ,

b. Coastal Embankments and River Dyke Guidelines

Key resilience measures for NSEZ include:

- **Capacity design.** Apply a higher design level for floods in NSEZ. IE. River dykes must be engineered to a 25-year return period based on historical observations. This could be enhanced, in order to take in to account unexpected high tides, river flooding and /or increasing sea levels due to global warming.
- **Redundancy design**. Prepare for unexpected failures. Impose high redundancy to mitigate unexpected or extreme high tides, river flooding, as well as seismic events.
- **Structural design**. Monitor the actual settlement anticipated by the installation of PVDs to ensure that design capacity has been met. Resilience could be enhanced, particularly for unexpected high tides and river flooding.
- **Real time monitoring systems.** Develop real-time monitoring systems for water levels and the collection of geo-technical data. This could reduce the impact of heavy floods and earthquakes on zone inhabitants and facilities and improve/promote site-specific and more accurate water levels and soil stability /liquefaction estimates.
- **Enhanced maintenance.** Monitor the movement of concrete blocks on the ocean side of the coastal embankment area and install bigger blocks and/or add more concrete blocks, if the integrity of the dyke is compromised.

c. Pumps and Gates Guidelines

Key resilience measures for NSEZ include:

- **Installation of flap valves/gates or pump stations.** In order to prevent water backflow from the outfall and to make the drainage systems within NSEZ more flood resilient, installing flap valves/gates at the outfall or constructing a pumping station may be an option to be considered.

- **Utilization of mobile pumps.** For NSEZ, a mobile pump or a pump vehicle is proposed for instances when rainfall intensity exceeds the capacity of the drainage network. Emergency pumping equipment is a useful counter-measure against local, water inundations due to heavy rainfall (IE. Inundation of water around the base of buildings).
- **Measures against high water levels.** Provide gates and water retention ponds, when needed at drainage outfalls to control water discharge into channels and to prevent water backflow/ subsequent inland flooding due to high water levels of the channels caused by heavy rainfall, strong storms or high tides.

d. Storm water Drainage Guidelines

Key storm water drainage resilience measures for NSEZ include:

- **Earthquake resilient drain joints.** Earthquake resilient drain joints (flexible and/or expandable joints) are recommended for underground drain pipes or box-culverts in order to resist large ground movement caused by earthquakes.
- **Real-time monitoring systems.** Develop real-time monitoring systems for rainfall to enhance location-specific information and analysis of rainfall, return period, etc.
- **Rainwater harvesting, storage, and utilization**. Rainwater harvesting, storage, and utilization through the installation of water retention ponds, tanks, and permeable surfaces in parks, open spaces, parking lots and road networks etc. can temporarily hold, store and reduce the concentration of storm water, which could overflow drainage systems in NSEZ during a sudden and/or long, consecutive-days of heavy rainfall. These water sources and open spaces can also serve as disaster resilience measures in case of earthquakes or drought events, as well as, general evacuation sites.
- **Maintenance.** Develop a regular maintenance plan to keep the drainage network, pond, retention areas, permeable surfaces etc. in NSEZ clean and to remove debris and obstructions in order to secure the expected water flows throughout the site.

4 EXISTING ENVIRONMENTAL CONDITION

4.1 PHYSICAL ENVIRONMENT

141. To establish a baseline biophysical condition, the primary data collected from analytical testing of samples from site and secondary data from various sources such as Bangladesh Meteorological Department (BMD), Geological Survey of Bangladesh (GSB), and other governmental departments, reports, and journals were collected and analyzed. Secondary data on climate (weather), disaster risks and ecological diversity were also analyzed. The area of influence was considered 5 km within NSEZ areas to understand the extent of the impact during baseline analysis. Details of the baseline study given in Annex-3.

4.1.1 Environmental Quality

4.1.1.1 Groundwater

142. Groundwater is heavily used for irrigation to compensate for the insufficient surface water in the project area. Shallow groundwater, located 2 to 4 meters below the ground surface, is accessible but of variable quality. Shallow tube wells are employed for irrigation, while deep tube wells with hand pumps are utilized for drinking water. Groundwater recharge happens through slow vertical percolation of rain and irrigation water, as well as seepage from rivers, canals, streams, and stored water. There is a net groundwater inflow from the north, serving as a primary source of recharge. However, the percolation rate is hindered by the thickness and impermeability of the upper clay layer. Recharge begins in May, peaks in August, but much potential recharge is lost due to quick saturation of the upper water-bearing layers and rejection by heavy surface soil.15 Approximately 88% of the population in Mirsharai relies on tube well water, ensuring that the majority do not encounter any issues with their drinking water supply. Merely 1% of the residents utilize Chara water in this region[16].

143. **Groundwater Quality:** The groundwater samples were collected from three tubewells located at Charsarat Village (GW1), BEZA Office (GW2) and Near to CP Mor (GW3) during January 2024 (during winter season) and August 2025 (during monsoon season) as shown in **Error! Reference source not found.**. The o bjective was to comprehend the current state of groundwater and evaluate potential impacts of the proposed project activities on the subsurface aquifers. The selection of groundwater sampling locations was primarily guided by factors such as the slope of the area, a comprehension of the local groundwater flow regime, understanding of groundwater use in the study area, and the availability of tube wells/bore wells for groundwater abstraction. In January 2024, three groundwater samples were collected; the GW1 sample was collected from 650-700 feet; GW2 was 680-feet and GW3 was collected from 550-600 feet. To identify the seasonal variation of the groundwater quality, the water samples were also collected from same three locations during August 2025. After collecting, the samples were placed into an appropriate and labeled black bottle and kept in an ice cooler. Then the samples were submitted to the recommended laboratory, i.e., BCSIR for analysis of parameters.

Table 4-1: Location of Groundwater Samples

SN	Sampling Location	Code	Geographical Location	Sampling Date (Winter)	Sampling Date (Monsoon)
1.	Charsarat Village	GW1	22°44'34.01"N, 91°29'33.45"E	13.12.2023	17.08.2025
2.	BEZA Office	GW2	22°45'40.00"N, 91°28'13.00"E	13.12.2023	17.08.2025
3.	Near CP Mor	GW3	22°44'5.64"N, 91°30'32.35"E	13.12.2023	17.08.2025

Source: Field Survey

[15] Environmental and Social Assessment (ESA) Report, BEZA, 2020
[16] Physical Infrastructure survey, Mirsharai Upazila Development Plan (MUDP), 2018 [10] Bangladesh Environment Conservation Rules, 2023, Schedule-2(B).

144. The result of groundwater analysis is given in **Error! Reference source not found.** and the location m ap, laboratory analysis report and photographs are given in Annex-3, Groundwater results have been compared with national standard [ECR, 2023-Schedule 2 (B)].

Table 4-2: Groundwater Quality Analytical Results

Parameters	Unit	GW1	GW2	GW3	Bangladesh Standard[10]	Test Method (APHA)
Groundwater Analysis Result in Winter (January, 2024)						
TDS	mg/L	374	332	2544	1000	2540.C
EC	µS/cm	590	587	5580	-	2510.B
Turbidity	NTU	1.1	0.83	90.8	5.0	Turbidimeters
pH		7.52	7.30	7.31	6.5-8.5	4500-H+. B
Salinity	ppt	0.3	0.3	2.4	-	
Total Hardness as $CaCO_3$	mg/L	82.0	118	944	-	2340.C
Iron	mg/L	1.14	1.82	7.18	0.3-1.0	3111.B
Arsenic	mg/L	< 0.005	< 0.005	< 0.005	0.05	3114.C
Manganese	mg/L	< 0.05	< 0.05	0.38	0.4	3111.B
Odor	-	Agreeable	Agreeable	Agreeable	-	In-house
Fecal Coliform	MPN/100ml	<1.8	<1.8	<1.8	2.0 indicates (absent) as per BDS Standard 1240:2021	9221B-C
Total Coliform	MPN/100ml	<1.8	<1.8	<1.8	2.0 indicates (absent) as per BDS Standard 1240:2021	9221B-C
Groundwater Analysis Result in Monsoon (August, 2025)						
TDS	mg/L	320	284	327	1000	2540.C
EC	µS/cm	356	337	384	-	2510.B
Turbidity	NTU	4.2	4.6	4.1	5.0	Turbidimeters
pH		7.18	7.86	8.02	6.5-8.5	4500-H+. B
Salinity	ppt	0.004	0.002	0.003	-	
Total Hardness as $CaCO_3$	mg/L	215	237	222	-	2340.C
Iron	mg/L	0.64	0.53	0.74	0.3-1.0	3111.B
Arsenic	mg/L	<0.002	0.008	0.006	0.05	3114.C
Manganese	mg/L	0.64	0.53	0.74	0.4	3111.B
Odor	-	1	2	1	-	In-house
Fecal Coliform	MPN/100ml	1	3	2	2.0 indicates (absent) as per BDS Standard 1240:2021	9221B-C
Total Coliform	MPN/100ml	2	5	3	2.0 indicates (absent) as per BDS Standard 1240:2021	9221B-C

Results Analysis:

145. The analysis of groundwater samples collected during winter and monsoon seasons revealed the critical insights into the quality of water available for consumption. In both seasons the quality of different chemical parameters is more or less same. The following parameters were evaluated:

- **Total Dissolved Solids (TDS):** In the sample labeled GW3, the TDS concentration was found extremely high in winter or dry season, exceed the national standard set by the ECR, 2023. The tested results of other two tube wells were within the standard of Bangladesh. Whereas, the testing water sample from same tubewell (GW3) in the monsoon season, the concentration of TDS was found within the standard of the ECR. High concentration of TDS reveals a potential concern for water quality, can affect taste and may indicate the presence of harmful substances.

- **Turbidity:** Similarly, the turbidity levels in GW3 also surpassed the permissible limit established by the ECR, 2023. Elevated turbidity can hinder water clarity and may be indicative of contamination or the presence of suspended particles, which can pose health risks. In winter season, the turbidity concentrations were within the permissible limit.
- **Iron (Fe) Concentration:** The concentration of Iron (Fe) in all collected samples was found to exceed the standards outlined in the ECR, 2023, Schedule 2 (B) in dry season. While iron is a common element in groundwater, excessive levels can lead to undesirable taste and staining, as well as potential health implications if consumed over long periods. The concentration of iron was below the 1 mg/l in all ground water samples during testing in monsoon season
- **Other Parameters:** Despite the concerns raised by TDS, turbidity, and iron concentration, other evaluated parameters (EC, salinity, total hardness, as, Mn, FC, TC) indicated that the overall water quality remains suitable for drinking as their concentration within the limit. This suggests that while specific contaminants are present, the groundwater may still be safe for consumption under certain conditions.

4.1.1.2 Surface Water Quality

146. Four sampling sites for surface water were selected based on the convergence points of stream courses, areas with high-water velocity, and permanent water bodies/ponds. All samples were collected from designated sites within the project area and analyzed for various biological and chemical parameters

Table 4-3: Surface Water Sampling Locations

Sampling code	Sampling locations	GPS Coordinates	Sampling Date (Winter)	Sampling Date (Monsoon)
SW-01	Bamansundar Canal	22°43'36.06"N 91°29'14.67"E	14.12.2023	17.08.2025
SW-02	Daborkhali Canal	22°44'30.96" N 91°28'9.60"E	14.12.2023	17.08.2025
SW-03	Ichakhali Canal	22°44'41.63"N 91°27'11.03"E	14.12.2023	17.08.2025
SW-04	Shaherkhali Canal	22°41'13.6"N 91°31'23.8"E	14.12.2023	17.08.2025

- **Sampling Method**: The sampling process involved careful collection, composite sample mixing, and proper preservation, labeling, and storage to ensure accurate record-keeping labeled with the date, time, name of the sampling point, and their coordinates during the sampling process. Sample was collected by USEPA standard for storage, preservation, transportation and testing purposes. During surface water collection USEPA surface water sampling guideline (https://www.epa.gov/quality/surface-water-sampling) followed. Water samples were collected as grab samples in a pre-washed 5-litre plastic can and a 1-litre sterilized clean PET bottle for complete Physico-chemical tests respectively. Samples wear labeled properly. After that, the samples were sent to the recommended laboratories, i.e., BCSIR for analysis of parameters.

147. The location map, laboratory analysis report and photographs are given in **Annex-3**. Surface water quality analytical results of water samples collected during winter and monsoon seasons are presented in Table 4-4.

Table 4-4: Surface Water Quality Analytical Results

Parameters	Unit	SW1	SW2	SW3	SW4	Bangladesh Standard[17]	Test Method (APHA)
Surface Water Quality Analysis Results in Winter							
DO	mg/L	5.39	7.56	7.51	6.47	≥5	4500-O-G
TDS	mg/L	2168	1332	166	304	1000	2540.C
TSS	mg/L	84	34.0	6.0	5.0	-	2540.C
EC	µS/cm	3910	2750	327	540	-	2510.B
Turbidity	NTU	42.8	81.2	65.6	46.9	-	Turbidimeter
pH	-	7.32	8.02	7.09	7.08	6-9	4500-H^+.B
Salinity	ppt	2.1	1.4	<0.1	0.2	-	-
COD	mg/L	5.64	1.88	2.82	3.76	50	5220.B

[17] Bangladesh Environment Conservation Rules, 2023- Schedule 2 (Standards for Inland Surface Water, Water Usable for Fisheries).

Parameters	Unit	SW1	SW2	SW3	SW4	Bangladesh Standard[17]	Test Method (APHA)
Surface Water Quality Analysis Results in Winter							
BOD	mg/L	2.32	<0.2	<0.2	0.58	≤30	5210.B
Mercury	mg/L	< 0.001	<0.001	<0.001	<0.001	-	3112.B
Lead	mg/L	< 0.001	< 0.001	<0.001	<0.001	0.1	3111.B
Cadmium	mg/L	< 0.001	< 0.001	<0.001	<0.001	-	3111.B
Oil and Grease	mg/L	<2.0	< 2.0	<2.0	<2.0	-	5520.B
Fecal Coliform	MPN/100ml	2.0	<1.8	2.0	<1.8[18]	2.0 indicates (absent) as per standard 1240:2021	9221B-C[19]
Total Coliform	MPN/100ml	2.0	2.0	2.0	<1.8	Same as FC	9221B-C
Surface Water Quality Analysis Results in Monsoon							
DO	mg/L	6.03	6.08	5.08	5.06	≥5	4500-O-G
TDS	mg/L	425	389	460	430	1000	2540.C
TSS	mg/L	12.5	17.8	19.6	21.2	-	2540.C
EC	µS/cm	328	286	382	346	-	2510.B
Turbidity	NTU	5.0	5.3	5.2	5.04	-	Turbidimeter
pH	-	7.49	7.36	8.5	7.65	6-9	4500-H^+.B
Salinity	ppt	0.03	0.02	0.03	0.02	-	-
COD	mg/L	66.4	106	115	128	50	5220.B
BOD	mg/L	24.2	19.8	26.4	21.1	≤30	5210.B
Mercury	mg/L	0.003	0.004	0.005	0.006	-	3112.B
Lead	mg/L	0.04	0.06	0.05	0.07	0.1	3111.B
Cadmium	mg/L	0.3	0.5	0.4	0.6	-	3111.B
Oil and Grease	mg/L	6.23	5.18	5.07	5.3	-	5520.B
Fecal Coliform	MPN/100ml	22	27	31	27	2.0 indicates (absent) as per standard 1240:2021	9221B-C
Total Coliform	MPN/100ml	11	14	17	13	Same as FC	9221B-C

Results

148. The results of the all samples were then compared to the standards outlined in the ECR, 2023.

- **Physical and Chemical Properties**: All parameters collected during winter and monsoon seasons, including pH, turbidity, and dissolved oxygen, were found to be within the acceptable limits set by the ECR, 2023, except TDS.
- **Total Dissolved Solids (TDS)**: Notably, the TDS levels in samples SW1 (Bamonsunder canal) and SW2 (Daborkhali) exceeded the standard limits, indicating potential issues with water quality in these locations;
- **Biological Parameters**: The biological analysis showed compliance with the national standards for most parameters, although specific tests may require further monitoring.

[18] As per MPN (most probable number) chart (APHA-22nd edition), MPN <1.8 indicates absence of test organism in the supplied sample.

[19] 20th edition of the "Standard Method for Examination of Water and Wastewater," published by the American Public Health Association (APHA). United States Environmental Protection Agency (USEPA)

149. The findings indicate that while the overall water quality in the project area is largely compliant with the ECR standards, the elevated TDS levels in certain samples warrant further investigation. Continuous monitoring and management strategies should be implemented to address these discrepancies and ensure the sustainability of water resources in the region. Results of inland surface water analysis are presented in **Table**

4.1.1.3 Air Quality

150. The main objectives of the ambient air quality monitoring program were to establish the baseline air quality in the study area. The selection of air quality measuring locations took into consideration the site of settlements and receptors within the project area. Additionally, air quality modeling has been done (Annex-8) to identify the source and receptors through the project area.

Table 4-5: Air Quality Measurement Locations

Location Name	Station ID	Latitude	Longitude
Adjacent to CP Mor, NSEZ, Mirsharai, Chattogram	AAQ1	22°43'46.55"N	91°30'21.17"E
East side of the project location, Daborkhali Point, Mirsharai	AAQ2	22°44'29.00"N	91°29'36.00"E
Ichakhali Sluice gate Bazar, Ichakhali, Mirsharai	AAQ3	22°45'45.79"N	91°28'46.02"E
Adjacent to the main road, Bodiullah Para, Magadia, Mirsharai	AAQ4	22°44'25.81"N	91°31'7.90"E
Charsarat Village, Ichakhali, Mirsharai	AAQ5	22°45'2.00"N	91°30'18.00"E
Charsarat Village, Ichakhali, Mirsharai	AAQ6	22°46'39.47"N	91°29'50.97"E
In front of Nippon and McDonald Steel Industries limited, NSEZ, Mirsharai	AAQ7	22°46'7.79"N	91°26'48.35"E
Baitur Rahman Panjegana Mosque, Tekerhat, Mirsharai	AAQ8	22°47'30.38"N	91°52'44.81"E

151. **Measurement Methodology:** Sampling locations were selected considering the area's background, accounting for potential point sources and other interferences. The height of sampling points was determined based on the presence of walls and other obstructions around the project location. Before installing the machine, environmental factors such as free-flowing air, wind direction, and well-mixed air were observed. Elevation angles of nearby buildings and obstructions were considered during site selection. All steps were executed in accordance with the ECR 2023 and IFC guidelines for the Ambient Air Quality Monitoring Program. Air quality data was gathered at eight (8) locations within the project area over a 4-hour duration. Subsequently, the collected data was converted to represent a 24-hour period using an approved methodology, with the conversion details provided in the methodology section of this report. Ambient air quality measurements were conducted from December 8, 2023, to December 14, 2023, for dry season and July to August 2019 for wet season data. Wet season data was collected from secondary sources of BEZA (RESA[20] Report). Analysis is carried out based on the measurement data with the standard time frame with application of a conversion equation Pasqual's (1961) air mass dispersion data and six air mass stability classes and corresponding meteorological conditions. Schroeder and Jugloff (2012) outlined a conversion approach using the simple power law to transform eight-hour readings into 24-hour/annual values. The location map, details of the air quality calculation, laboratory analysis report and photographs are given in **Annex-4.** The results of the air pollutants are as follows (**Table 4-6**).

[20] REGIONAL ENVIRONMENTAL AND SOCIAL ASSESSMENT FOR NATIONAL SPECIAL ECONOMIC, MIRSHARAI, BEZA 2020.

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Table 4-6: Results Analysis of Ambient Air Quality

Ambient Air Quality Measurement Results During Winter						
Station Code	$PM_{2.5}$ µg/m³	PM_{10} µg/m³	SO_2 µg/m³	NO_2 µg/m³	CO ppm	O3 µg/m³
AQ1	7.93	17.50	274.47	10.26	0.80	8.79
AQ2	10.95	15.22	387.44	7.22	0.52	24.11
AQ3	10.47	13.07	273.75	18.36	0.72	24.11
AQ4	26.65	33.61	225.32	11.90	0.59	50.83
AQ5	18.37	30.27	90.54	8.75	0.50	15.15
AQ6	7.55	16.06	384.89	10.34	0.55	13.99
AQ7	20.61	32.75	268.74	2.48	0.82	37.34
AQ8	19.62	30.26	255.06	1.68	0.63	36.01
Duration (hours)	24	24	24	24	8	8
Weather	Sunny					
Ambient Air Quality Measurement Results During Monsoon						
AAQ1	9.2	16.5	41.3	22.36	0.43	14.72
AAQ2	9.9	19.2	30.5	15.97	0.29	9.97
AAQ3	8.97	23.8	39.3	19.78	0.29	26.92
AAQ4	9.09	20.5	33.5	27.66	0.42	27.3
AAQ5	10.6	22.1	29.8	17.35	0.18	27.36
AAQ6	8.76	19.2	28.6	22.34	0.42	25
AAQ7	7.33	18.7	42.8	24.28	0.24	37.8
AAQ8	9.42	23.8	28.9	17.04	0.25	29.47
Weather	Cloudy					
Bangladesh Standard[21]	65	150	80	80	5	100
WHO Standard[22]	15	45	40	25	10	100

152. The analytical results from the analysis of air quality parameters reveal that all measured values comply with the national standards set forth by the Air Pollution Control Rule 2022, with the notable exception of SO_2 concentrations at locations AAQ-1 to AAQ-8. The elevated levels of SO_2 in these areas can be attributed to frequent vehicular movement, using fire wood in coking on that areas, and industrial operations that contribute to excessive emissions. Analysis of the testing data are presented graphically in

- **Particulate Matter 10 Micron or Less (PM_{10}):** The PM_{10} concentration was measured in the same eight locations as SPM. The same machine was used to monitor the PM_{10} concentration over a standard period. The 24-hourly PM10 concentration in ambient air in the study region was recorded in the range of 16.06 µg/m3 to 33.61 µg/m3 and 16.50 µg/m3 to 23.80 µg/m3 during winter and monsoon seasons, respectively. From the measuring data, it is observed that PM_{10} concentrations were found within the standard value of Air Pollution (Control) Rules, 2022 and WHO standard**.** The measured data reveals that the PM_{10} emissions at AAQ2 and AAQ3 sampling locations were higher value than the monsoon data, whereas at all other locations the emissions were less in monsoon than those in winter.
- **Particulate Matter 2.5 Micron or Less ($PM_{2.5}$):** $PM_{2.5}$ was measured in the same areas by the same machine the tested results showed that the emission at all locations were below the Bangladesh standard, but the emission at four out of eight locations were exceeded WHO standard (AAQ4, AAQ5 , AAQ7 and AAQ8). The 24-hourly PM2.5 concentration in ambient air in the study region was recorded in the range of 7.93 µg/m3 to 26.65 µg/m3 during winter and 7.33 µg/m3 to10.6 µg/m3 during monsoon season, respectively. The emission rate during seasonal variation showed that at all locations PM2.5 emission were lower during the monsoon than the winter season, except AAQ1.
- **Nitrogen Dioxide (NO_2):** From the measurement data, it is observed that NO_2 concentrations at eight locations were found within the standard value of Air Pollution (Control) Rules, 2022 and at AAQ4 location the value was exceeded the IFC/WB standard**.** The concentrations of nitrogen oxide were higher during the monsoon than those of the winter season. The 24-hour NO_2 concentration in ambient air in the study region was recorded in the range of 1.68-11.9 µg/m3 and the range of 15,97-27.66 µg/m3 during the winter and monsoon seasons, respectively.

[21] Air Pollution (Control) Rules, 2022

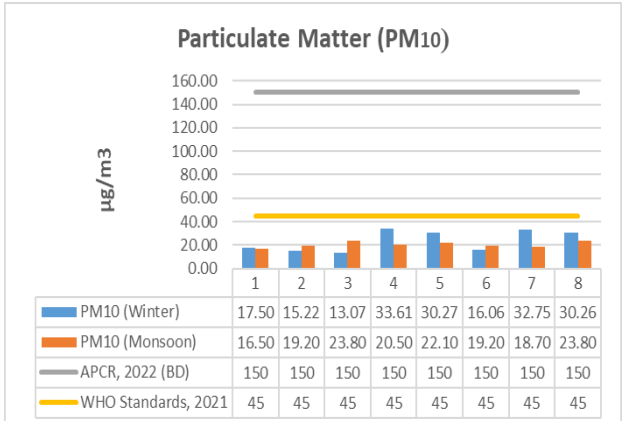
[22] WHO Ambient Air Quality Guideline Values (2021), which are also being referred in the World Bank and IFC's General EHS Guidelines

- **Ozone (O_3):** Ozone was monitored by an ozone meter and the data has been represented for 8 hours. The concentrations are significantly lower than the standard value of Air Pollution (Control) Rules, 2022, and IFC/WB. The O3 concentration in ambient air in the study region was recorded in the range of 8.79 – 50.83 µg/m3 and 9.97-37.8 µg/m3 during the measurement period in winter and monsoon seasons, respectively. The maximum O3 concentration was reported at AAQ-4 50.83 and the minimum concentration was reported from AAQ-2 of 24.11µg/m3 during in winter season.
- **Carbon Mono-oxide (CO):** Eight hourly CO concentrations are reportedly low at the measuring locations while comparing with the standard value of Air Pollution (Control) Rules, 2022 on 8-hour basis (5 mg/m^3)**.** The 8-hour CO concentration in ambient air in the study area was recorded in the range of 0.32 mg/m3 to 0.82 mg/m3 during the winter season and at the range of 0.18 mg/m3 to 0.42 mg/m3 during the monsoon season. The maximum CO concentration was reported 0.82 mg/m3 at AAQ -7 during winter season. All the testing results were within the IFC/WB Guidelines.
- **Concentration of Sulphur Dioxide (SO2**): The 24-hour SO2 concentration in ambient air in the study region was recorded in the range of 90.54µg/m3 of 387 µg/m3 and range of 28.9-39.3 µg/m3 during winter and monsoon seasons. In monsoon, all location's results were within the Bangladesh standards for SO2 and standard mentioned in the IFC/WB Guidelines.

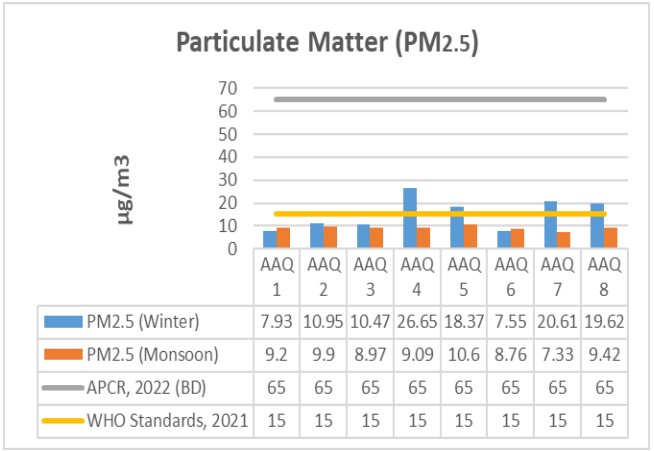
153. Additionally, air quality modeling has been carried out and presented in **Annex-8** to identify the sources and receptor throughout the project area.

154. In conjunction with air quality assessments, the study also monitored several climatic variables to gain insights into the current climatic conditions of the study area. Although there are no established standards for climatic variables in Bangladesh, the findings provide valuable data:

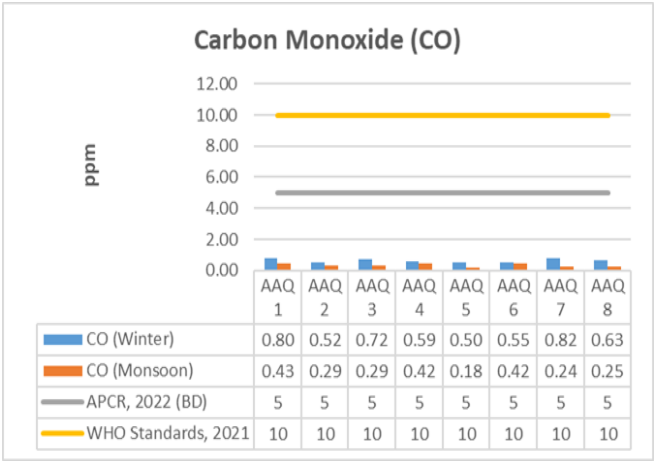
- **Air Temperature**: The recorded air temperature ranged from 23.30°C to 34.12°C, indicating a typical variation for the region;
- **Relative Humidity**: The relative humidity levels were found to be closely linked to air temperature and vapor content, showing reasonable values during summer days;
- **Air Pressure**: The air pressure in the study area fluctuated between 1001.56 hPa and 1014.65 hPa, aligning well with previously recorded data from the Bangladesh Meteorological Department (BMD) for the years 2013-2022 during summer;
- **Wind Speed and Direction**: Real-time data on wind speed and direction were recorded and illustrated in plots, providing a clear representation of the wind dynamics in the study area are presented in Annex-3. Volume II.



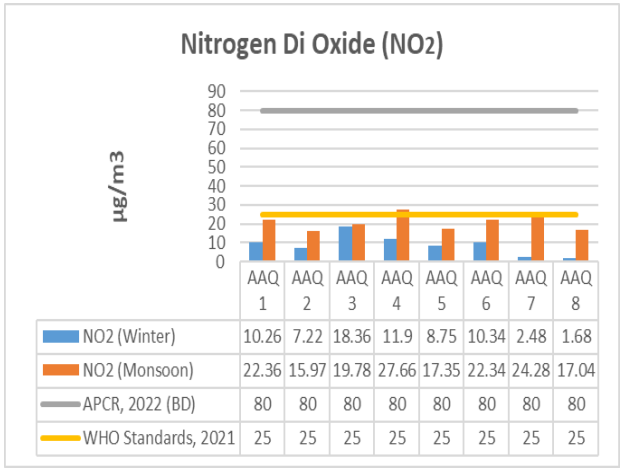
	1	2	3	4	5	6	7	8
PM10 (Winter)	17.50	15.22	13.07	33.61	30.27	16.06	32.75	30.26
PM10 (Monsoon)	16.50	19.20	23.80	20.50	22.10	19.20	18.70	23.80
APCR, 2022 (BD)	150	150	150	150	150	150	150	150
WHO Standards, 2021	45	45	45	45	45	45	45	45



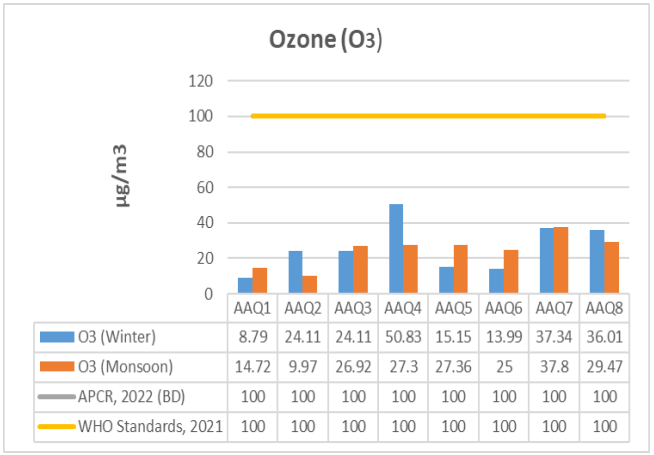
	AAQ 1	AAQ 2	AAQ 3	AAQ 4	AAQ 5	AAQ 6	AAQ 7	AAQ 8
PM2.5 (Winter)	7.93	10.95	10.47	26.65	18.37	7.55	20.61	19.62
PM2.5 (Monsoon)	9.2	9.9	8.97	9.09	10.6	8.76	7.33	9.42
APCR, 2022 (BD)	65	65	65	65	65	65	65	65
WHO Standards, 2021	15	15	15	15	15	15	15	15



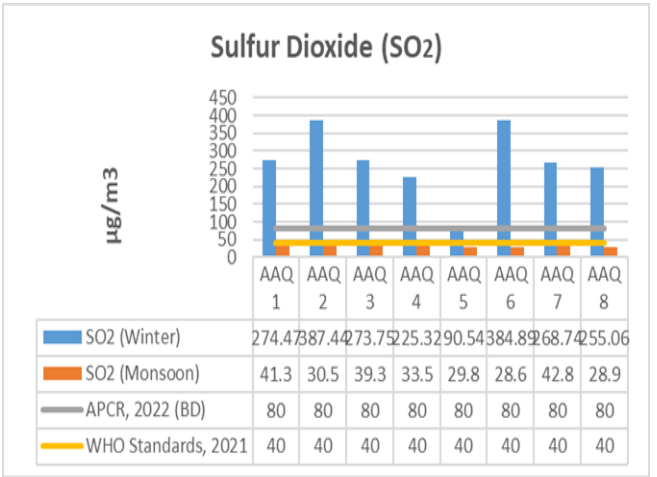
	AAQ 1	AAQ 2	AAQ 3	AAQ 4	AAQ 5	AAQ 6	AAQ 7	AAQ 8
CO (Winter)	0.80	0.52	0.72	0.59	0.50	0.55	0.82	0.63
CO (Monsoon)	0.43	0.29	0.29	0.42	0.18	0.42	0.24	0.25
APCR, 2022 (BD)	5	5	5	5	5	5	5	5
WHO Standards, 2021	10	10	10	10	10	10	10	10



	AAQ 1	AAQ 2	AAQ 3	AAQ 4	AAQ 5	AAQ 6	AAQ 7	AAQ 8
NO2 (Winter)	10.26	7.22	18.36	11.9	8.75	10.34	2.48	1.68
NO2 (Monsoon)	22.36	15.97	19.78	27.66	17.35	22.34	24.28	17.04
APCR, 2022 (BD)	80	80	80	80	80	80	80	80
WHO Standards, 2021	25	25	25	25	25	25	25	25



	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7	AAQ8
O3 (Winter)	8.79	24.11	24.11	50.83	15.15	13.99	37.34	36.01
O3 (Monsoon)	14.72	9.97	26.92	27.3	27.36	25	37.8	29.47
APCR, 2022 (BD)	100	100	100	100	100	100	100	100
WHO Standards, 2021	100	100	100	100	100	100	100	100



	AAQ 1	AAQ 2	AAQ 3	AAQ 4	AAQ 5	AAQ 6	AAQ 7	AAQ 8
SO2 (Winter)	274.47	387.44	273.75	225.32	90.54	384.89	268.74	255.06
SO2 (Monsoon)	41.3	30.5	39.3	33.5	29.8	28.6	42.8	28.9
APCR, 2022 (BD)	80	80	80	80	80	80	80	80
WHO Standards, 2021	40	40	40	40	40	40	40	40

Figure 4-1: Ambient Air Quality Testing Results during Winter and Monsoon seasons

4.1.1.4 Noise Level

155. The primary goal of measurement of the ambient noise levels was to establish a baseline in the project area. The objective was to assess sound intensity at various monitoring locations across the project site, carefully chosen to capture representative data. Selection criteria for these locations considered potential sources of construction activities and proximity to important receptors such as industrial, residential, commercial, mixed, and silent areas according to DOE/IFC classifications. The noise monitoring locations are Adjacent to CP Mor, Ichakhali at east side of the project location (NL1 Mixed /Commercial area), Daborkhali Point, Ichakhali at Ichakhali Sluice gate Baz (NL2 Mixed /Commercial area) Ichakhali Sluice gate Bazar, Ichakhali (NL3 Commercial area) Adjacent to the main road, Dakshin Maghadia (NL4, Silent/Institutional), In front of Abdul Kader Mia House, Charsarat (NL5, Residential area), In front of BR Powergen (NL6, Industrial area), In front of Nippon and McDonald Steel Industries limited (NL7, Industrial area), Baitur Rahman Panjegana Mosque (NL8, Mixed area) and Tekerhat Bazar (NL9, Commercial area) as shown in Table 4-7. The location map, details of the noise level monitoring results, laboratory analysis report and photographs are given in **Annex-3.** Additionally, noise level modeling has been done (**Annex-9**) to identify the source and receptor throughout the project area.

Table 4-7: Sampling locations of Noise level

SN	Code	Locations	Geographic location	Location setting (DOE/IFC)
1.	ANL1	Adjacent to CP Mor, NSEZ, Mirsharai, Chattogram	22°43'46.55"N 91°30'21.17"E	Mixed Area/Commercial
2.	ANL2	East side of the project location, Daborkhali Point, Mirsharai	22°44'29.00"N 91°29'36.00"E	Mixed Area/Commercial
3.	ANL3	Ichakhali Sluice gate Bazar, Ichakhali, Mirsharai	22°45'45.79"N 91°28'46.02"E	Commercial
4.	ANL4	Adjacent to the main road, Bodiullah Para, Magadia, Mirsharai	22°72'30.38"N 91°52'40.32"E	Silent/Institutional
5.	ANL5	Charsarat Village, Ichakhali, Mirsharai	22°45'2.00"N 91°30'18.00"E	Residential
6.	ANL6	In front of BR Powergen, NSEZ	22°46'1.57"N 91°27'36.74"E	Industrial
7.	ANL7	In front of Nippon and McDonald Steel Industries limited, NSEZ	22°46'7.76"N 91°26'48.45"E	Industrial
8.	ANL8	Baitur Rahman Panjegana Mosque, Tekerhat, Mirsharai	22°47'54.2"N 91°27'36.5"E	Mixed Area
9.	ANL9	Tekerhat Bazar, Mirsharai	22°48'28.16"N 91°28'4.10"E	Commercial
Source: Field Data collection by BCL Associates Limited, December, 2023 and August, 2025				

Measurement Methodology: The sound levels were recorded as A-weighted equivalent continuous sound pressure level values, employing A-weighting filters in the noise measuring instrument (Table 4-8**).** All measured ambient noise levels were analyzed and found to be within safe and permissible limits as defined by Bangladesh's Noise Pollution (Control) Rules, 2006. Different locations showed varying noise levels due to different settings and environmental conditions.

Table 4-8: Results of Noise Level Measurement at different location Within NSEZ

Sample Code	Noise level (dB(A))[23]						Bangladesh Standard (dB(A))[24]		IFC EHS Guideline (2007)[25]		Category of Area/Receptor
	Leq_{day}	L_{max}	L_{min}	Leq_{night}	L_{max}	L_{min}	Day	Night	Day	Night	
Noise Level Measurement Result during Winter											
ANL1	52.7	68.2	35.1	37.9	55.6	32.5	60	50	70	70	Mixed Area/Commercial
ANL2	53.3	78.4	38.3	38.1	55.3	33.1	60	50	70	70	Mixed Area/Commercial
ANL3	67.4	84.2	38.6	44.3	57.0	33.8	70	60	70	70	Commercial
ANL4	62.4	81.5	39.2	42.5	54.8	32.3	50	40	55	45	Silent/Institutional
ANL5	38.5	61.5	33.1	34.9	51.3	32.6	55	45	55	45	Residential
ANL6	57.3	77.6	41.4	50.5	56.6	41.4	75	70	70	70	Industrial
ANL-7	60.5	78.0	30.5	50.3	57.1	41.7	75	70	70	70	Industrial
ANL-8	53.4	79.4	30.5	38.4	47.1	30.1	60	50	70	70	Mixed
ANL-9	54.0	73.7	30.4	42.8	54.8	30.7	70	60	70	70	Commercial
Noise Level Measurement Result during Monsoon											
ANL1	56.6	66.9	42.2	39.8	44.9	31	60	50	70	70	Mixed Area/Commercial
ANL2	53.1	71.9	44.8	41.9	60.9	31.1	60	50	70	70	Mixed Area/Commercial
ANL3	60.8	74	42.7	41.8	59.6	31	70	60	70	70	Commercial
ANL4	52.7	63.7	43.1	43.5	60.9	31	50	40	55	45	Silent/Institutional
ANL5	55.8	70.7	46.1	42.1	60.9	30.5	55	45	55	45	Residential
ANL6	59.8	76.1	46.6	42.3	56	31.3	75	70	70	70	Industrial
ANL-7	54.1	71.7	45.7	43.2	60.9	31.1	75	70	70	70	Industrial
ANL-8	52.3	63.5	38.7	38.6	60.9	31.4	60	50	70	70	Mixed
ANL-9	53	69.3	40.4	40.3	60.2	31	70	60	70	70	Commercial

Source: Field Data collection by BCL Associates Limited, August, 2025

Results analysis

156. The daytime highest noise level has been captured in Ichakhali Sluice gate Bazar, (ANL3, Commercial area) at 67.4 dB(A) and the lowest noise was captured in Charsarat village (ANL5, Residential area) at 38.5 dB(A). The daytime noise levels at all the locations ranged between 38.5 dB(A) to 67.4 dB(A) for winter season

[23] A-weighted decibel, abbreviated dB(A), is an expression of the relative loudness of sounds in air as perceived by the human ear. In the A-weighted system, the decibel values of sounds at low frequencies are reduced, as the ear is less sensitive to low audio frequencies, especially below 1000 Hz, than to high audio frequencies.

[24] Ministry of Environment, Forest, and Climate Change. (2006). Noise Pollution (Control) Rules, 2006 (S.R.O. No. 212-Law/2006). The People's Republic of Bangladesh.

[25] Guidelines values are for noise levels measured out of doors. Source: Guidelines for Community Noise, World Health Organization (WHO), 1999

and 38.5 dB(A) to 67.4 dB(A) during Monsoon season. All the observed values were within the Noise Pollution (Control) Rules 2006 day-time standards as well as IFC standards set for the respective zone, except winter season {ANL4, 62.4 dB(A)} and Monsoon {ANL5, 55.8 dB(A)}.

157. The night-time noise levels ranged between 34.9 dB(A) to 50.5 dB(A) for winter season and 38.6 dB(A) to 43.5 dB(A) for monsoon season. The maximum value of 50.5 dB(A) was recorded in the BR Powergen, NSEZ (ANL6, Industrial zone), and the minimum value of 34.9 dB(A) was recorded in the winter season. All measured values were within the Noise Pollution (Control) Rules 2006 at night-time standards as well as IFC standards set for the respective zone, except winter season {ANL4, 42.5 dB(A)} and Monsoon {ANL4, 43.5 dB(A)}.

4.1.2 Meteorology

158. The sub-project of NSEZ is located Mirsharai Upazila of the Chattogram district in south-eastern part of Bangladesh, which is situated in the central part of the Asiatic monsoon region, characterized by a tropical climate. Like other parts of Bangladesh, the study area experiences the significant temporal variations of climatic condition due to the influence of moisture-laden monsoon winds from the southwest in summer and drier, colder northwestern winds in winter.

4.1.2.1 Rainfall

159. Like other coastal regions of the country, the monsoon season is very important in this region. The nearest weather station (BMD) to the site is Sitakunda, which is app. 25.0 km from the EZ site in the SW direction. June, July, and August are the months of maximum rainfall in the project area. Average monthly rainfall varies from 5.6 to 867.2 mm. The highest rainfall was recorded in the coastal areas of Chittagong district, Sitakunda Area, and the lowest rainfall was observed in the western and northern parts of the country. The maximum rainfall in 2019 was 1589.0 mm in July. The average monthly rainfall data (obtained from BMD) is given in **Annex-3.**

4.1.2.2 Temperature

160. The average minimum and maximum temperatures in Sitakunda station is 12.13°C & 34.26 °C, respectively. In the Mirsharai area, temperatures vary from 9-25.8°C in winters and 26.6-39.7°C in summers. Details Temperature of the Sitakunda area is recorded from the Sitakunda Meteorological station, which is the closest station to the study area. The data from one station has been considered for establishing the temperature profile of the project area. The average minimum temperature varies between 12.13 to 25.58 °C, whereas the maximum temperature ranges from 27.92 to 34.26 °C. Monthly minimum and maximum temperatures and average minimum and maximum temperatures for the period 2015-2024 for Sitakunda Station are given in **Annex-3.**

4.1.2.3 Relative Humidity

161. Humidity in the Chattogram district varies from 59% during the day in February to 87% in July and August. The spatial and temporal variation of relative humidity is very low in Bangladesh throughout the year. Data from Sitakunda station have been considered to determine the moisture content of the project area. Monthly average normal relative humidity in the project area varies between 64.3% in February (Sitakunda) and 81% in Aug (Sitakunda). The data show that monthly average normal humidity does not vary much with seasonal changes and is relatively high. Monthly average normal humidity data for the Sitakunda areas are given in **Annex-4**.

4.1.2.4 Evaporation

162. Evaporation in the project area reaches its maximum during April-May when temperature, sunshine and wind are at or near their maximum levels for the year. Evapotranspiration peaks in April.

163. The Project area is characterized by southerly wind from the Bay of Bengal during monsoon and north-westerly wind from Himalaya during winter, very similar to the national pattern. The windiest months are April – July mostly. The highest wind speed was observed at Sitakunda station since this station is located at the nearest seashore.

4.1.2.5 Wind Rose

164. The Project area is characterized by southerly wind from the Bay of Bengal during monsoon and north-westerly wind from the Himalaya during winter, very similar to the national pattern. The windiest months are April, July. The highest wind speed was observed at Sitakunda station since this station is located at the nearest seashore. The monthly Normal Wind speeds for the past ten years (2015-2024) and Wind rose diagram are shown in **Annex-4**. The Project area experiences natural calamities such as cyclones, tornadoes, and surges caused by the coastal wind and high-risk zones of cyclones.

4.1.2.6 Sunshine Hours

165. The monthly average sunshine hours in Sitakunda vary from 4 to 9 hours/day. Maximum sunshine hours are recorded in April, May, and June. In general, April, May and June have a maximum of 12 hours of sunlight per day.

4.1.3 Physiography

166. Bangladesh is the world's largest deltaic region with most of its parts located at low altitudes. It is a riverine country crossed by numerous rivers, streams, and their tributaries. It is divided into five physical regions – the Ganges Delta proper to the southwest, the Paradelta to the northeast and the Chittagong region in the southeast as shown as in Error! Reference source not found.. The total flood plain of the Ganges has a low ridge a nd a basin relief crossed by many tidal rivers and creeks. EZ sites are generally flat, low-lying, and poorly drained. The land use of the project site is 'wetland'. The Ichakhali Canal and the tributaries of the Ichakhali Canal are located here, which are flooded during monsoons and high tides. Site development work is underway and most of the land has already been developed. The average elevation of the site at present is about 7m MSL. According to the physiography of Bangladesh, the proposed sub-project area falls under the physiographic unit “Delta (Tidal), Coastal plain”. Chittagong Coastal Plain is exposed to cyclones and low-lying coastal areas are subject to saline storm surges. According to the UNDP and FAO (1988), young tidal floodplains occupy a narrow strip along the study area. It comprises of saline mud flats and marshes exposed at low tide. The landscape is almost level and is crisscrossed by numerous tidal creeks. Heavy silts and clay predominate. Many soils are actually or potentially extremely acid in reaction due to the presence of acid sulphate conditions, but acid sulphate layers inland have generally been buried by 50 cm or more of less Acid River or piedmont alluvium. Seasonal flooding is found in the higher parts and in embanked areas is mainly caused by rainwater. On lower land and near the coast, the land is tidally flooded with saline water.

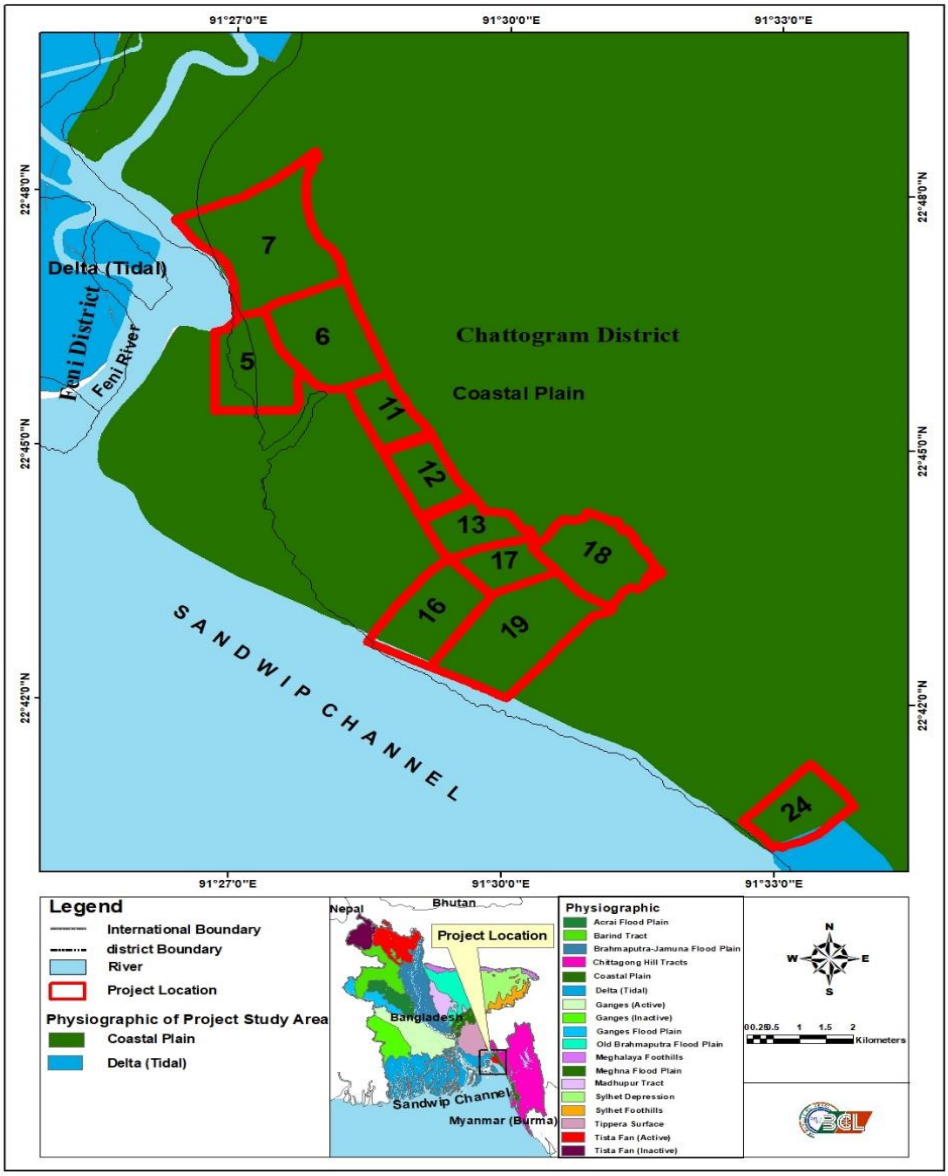


Figure 4-2: Physiographic map of the study areas

4.1.4 Geology

167. The geology of the project area can generally be classified as sedimentary with limestone including metamorphic rocks such as travertine. Occurs as any of the following: quartzite, graphitic schist, chlorite, amphibole, mica and kyalite schist, hornblende, biotite and garnet, gneiss, acid gneiss, granular or charconite. The site is close to the sea and Feni River and covered with clay and sand deposits. According to the Geological Map of Bangladesh, the site is covered by beach and dune sand and water and is classified as low and intertidal plains according to the geomorphic map of Chattogram. The geological map shows the sub-project area in Figure 4-3

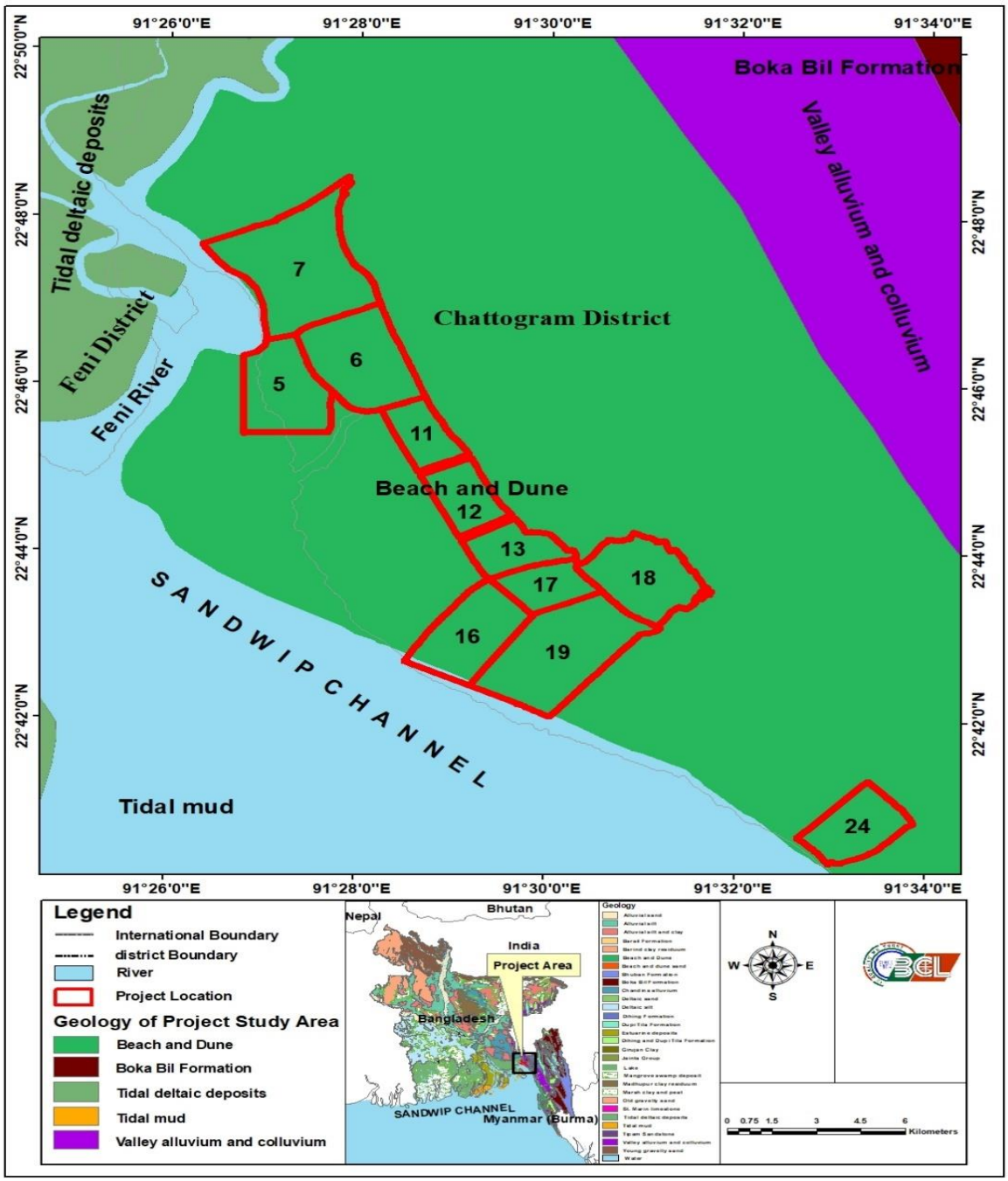


Figure 4-3: Geological Map of the study areas

Table 4-9: Geomorphology unit within NSEZ26

Sl. No.	Geomorphology Unit	Area		
		sq km	Acres	%
1	Coastal Plains	124.06	30654.93	99.91
2	Deltaic Plains	0.11	28.35	0.09

4.1.5 Land Resources

168. In the study area, the major share of the land is under water bodies, which encompasses approximately **188,929.07 acres**, accounting for **37.21%** of the total land cover. This substantial presence of water bodies

[26] F.H. Khan., 1991: Geology of Bangladesh,

plays a vital role in the local ecosystem and influences various socio-economic activities. Agricultural land occupies **140,105.62 acres**, representing **27.59%** of the total area. This land is essential for food production and supports the livelihoods of many residents in the region. The remaining land uses are as follows[27]:

- Mudflat: Covers 15.04% of the total study area;
- Settlement with Homestead Vegetation: Accounts for 13.89% of the total area;
- Mangrove Plantation: Covers 3.03% (or 15,402.09 acres);
- Aquaculture: Represents 1.76% (or 8,952.48 acres);
- Developed Land: Accounts for 0.70% (or 3,534.19 acres);
- Built-up Area: Covers 0.40% (or 2,048.77 acres);
- Mixed Hill Forest: Represents 0.30% (or 1,503.99 acres);
- Railway Area: Accounts for 0.07% (or 378.50 acres).

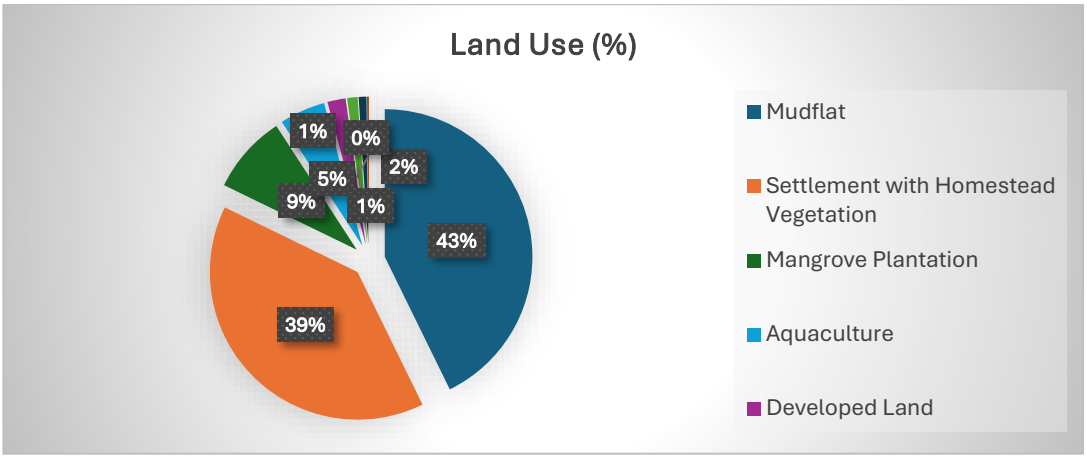


Figure 4-4: Land Use Types in the study areas

4.1.5.1 Land Use

169. The complete graphical representation of land use of the area is shown through the Land use Map in Figure 4-5 and detail land use given in Error! Reference source not found..

Table 4-10: Detail Land Use of the project area

Sl. No.	Land Type	Area(acres)
1	Agriculture Area	893.44
2	Vegetation Area	2246.37
3	Building Structure	373.46
4	CP	10.77
5	Low Land	2087.39
6	Open Land	968.85
7	Road Site Land	24.43
8	Road	325.76
9	Pond	0.12
10	Canal	165.88
11	Waterbodies	118.30
Total Area		**7214.77**

[27] RESA Report, BEZA, 2023

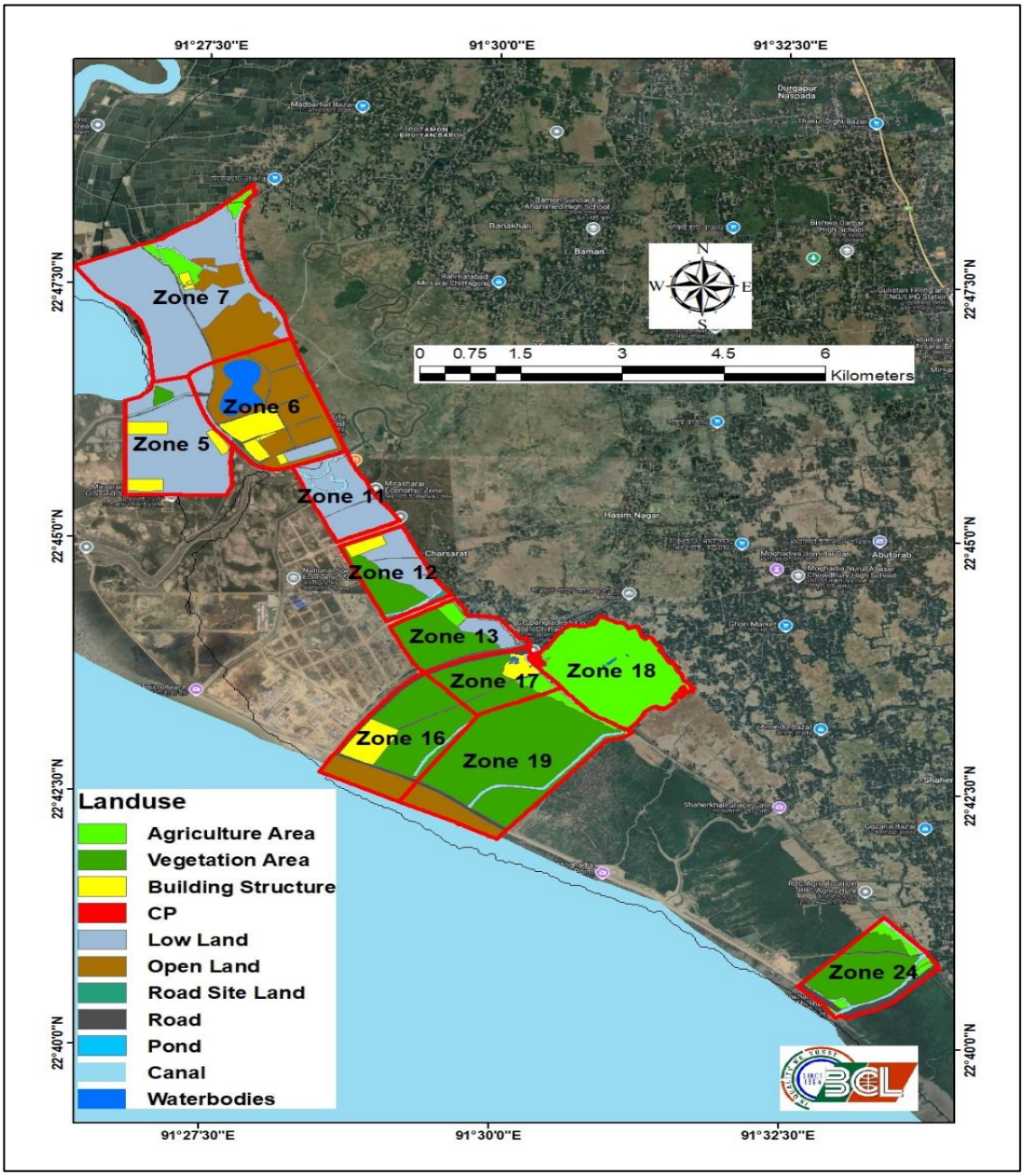


Figure 4-5: Land Use Map of the study areas

4.1.6 Soil Map

170. The soil characteristics in the proposed project areas are mainly calcareous alluvium and grey piedmont soils. The entire country has been divided into 39 sub-soil zones. The project area subsoil characteristics is given in as a map.

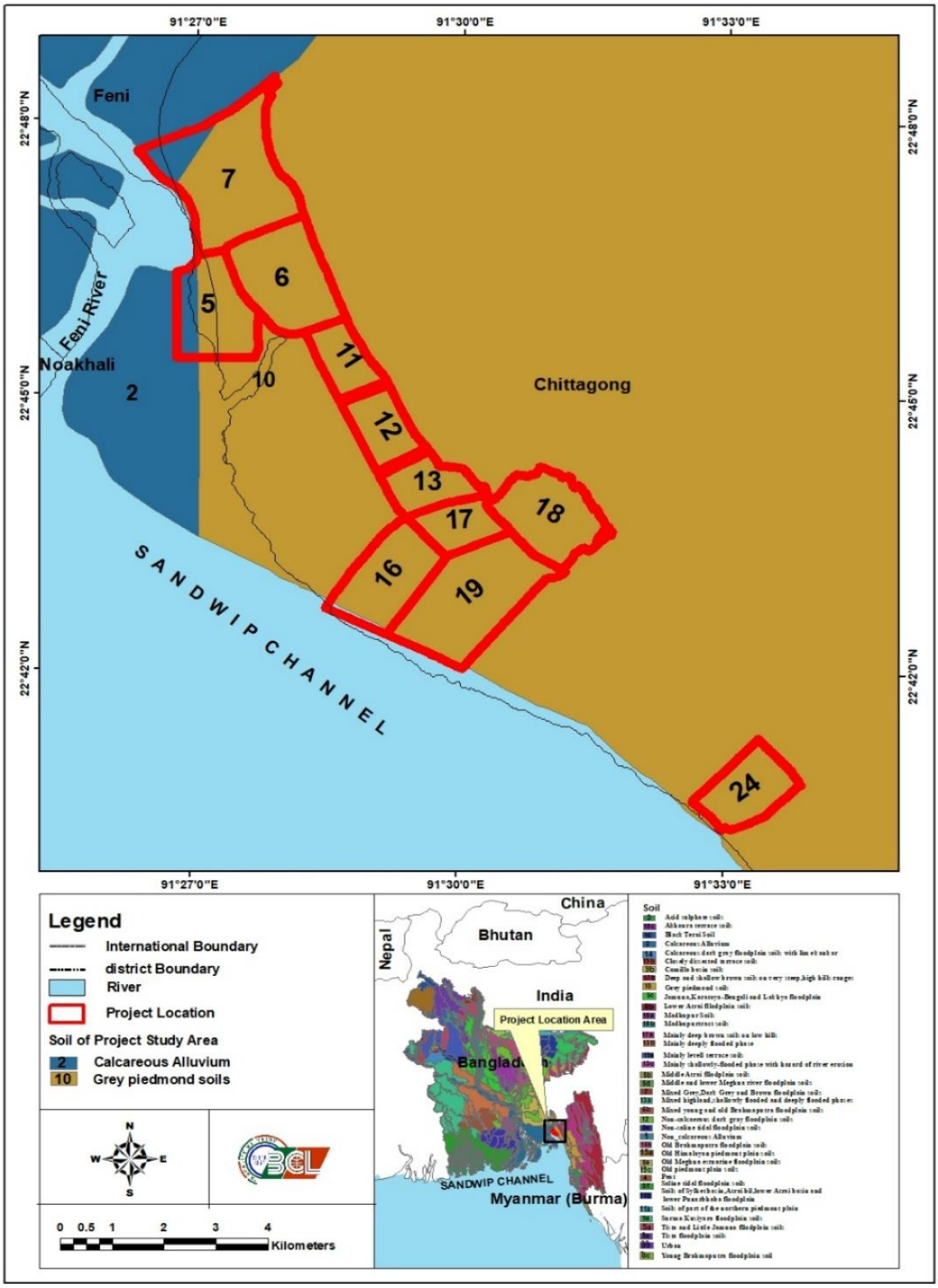


Figure 4-6: Soil Map in the study areas

4.1.7 General Hydrological

171. The project area can be generally classified as a low river flooding area with regards to hydrology. The area has been represented in the hydrology map in Figure 4-7.

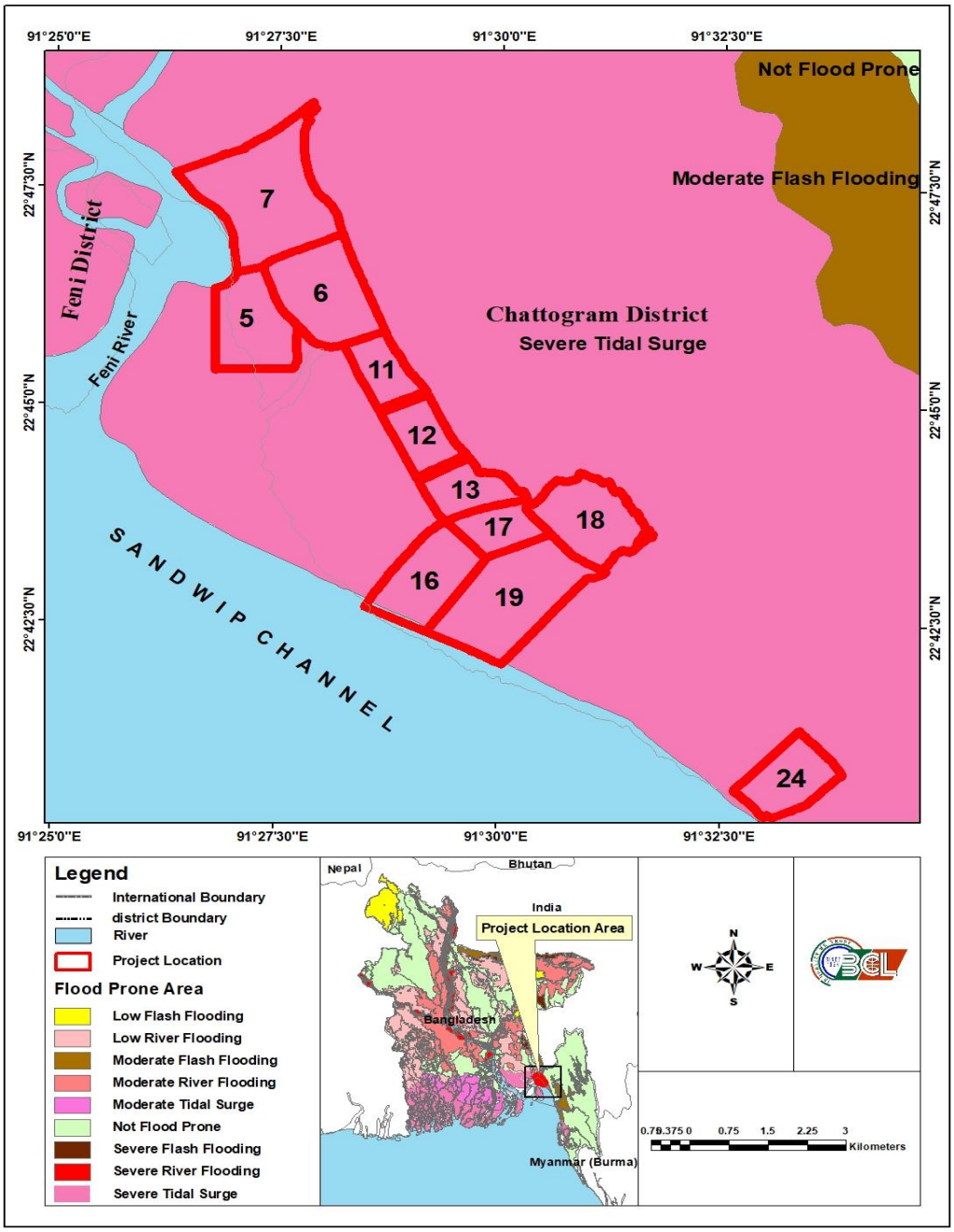


Figure 4-7: Hydrological Map of the project areas.

4.1.7.1 Water Bodies

172. There are a few water bodies around the project area, particularly to the west and south. To the west exists the Feni River and to the south is the Sandwip Channel. The waterbody network is presented in Figure 4-9.

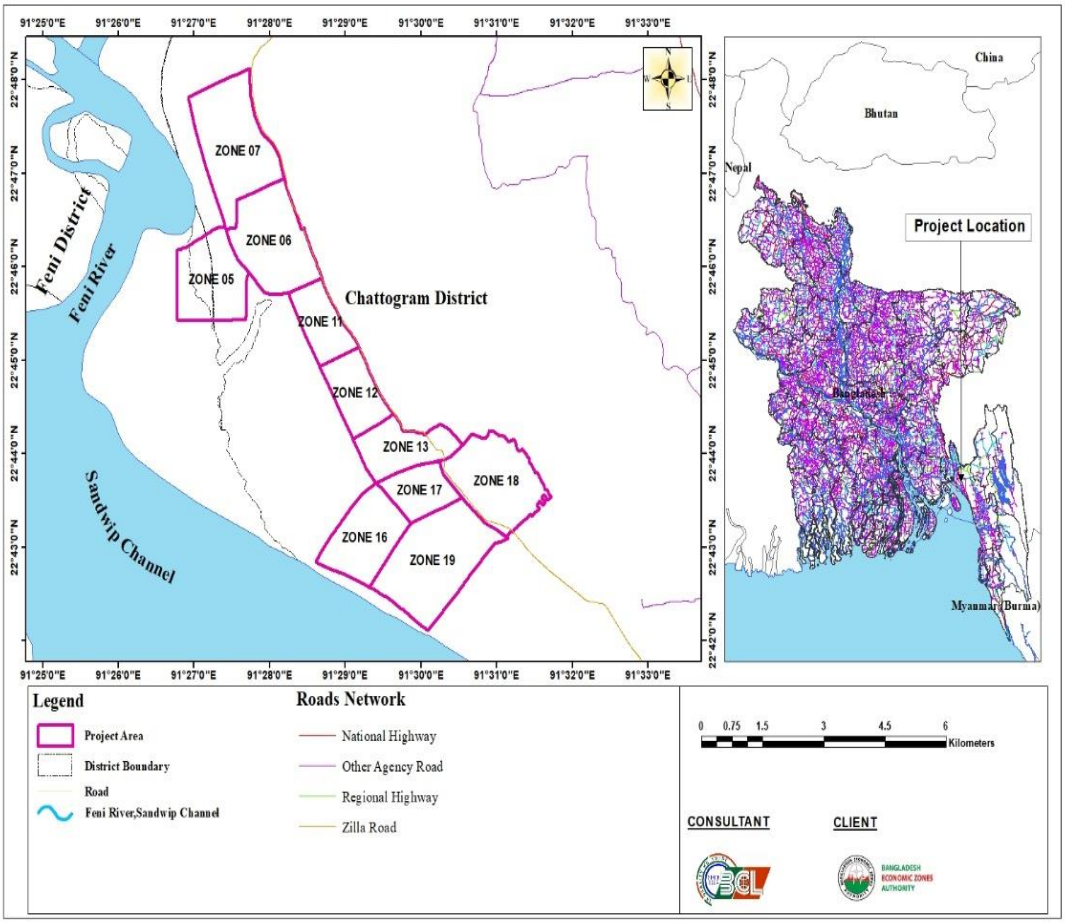


Figure 4-8: Water Bodies network in the study areas

4.1.8 Cyclone

173. Bangladesh can be divided into 3 major cyclone regions: High Wind Area, Risk Area and High-Risk Area. The project area falls within the High-Risk Zone as shown in the map in Figure 4-9.

4.1.9 Flood

174. Bangladesh can be divided into 4 classes of areas according to flood-risk: Coastal Tidal Surge Prone Area, Flash Flood Area, Flood Free Area and River/Monsoon Flood Area. The project area falls within the Coastal Tidal Surge Prone Area as depicted in the map in Figure 4-10

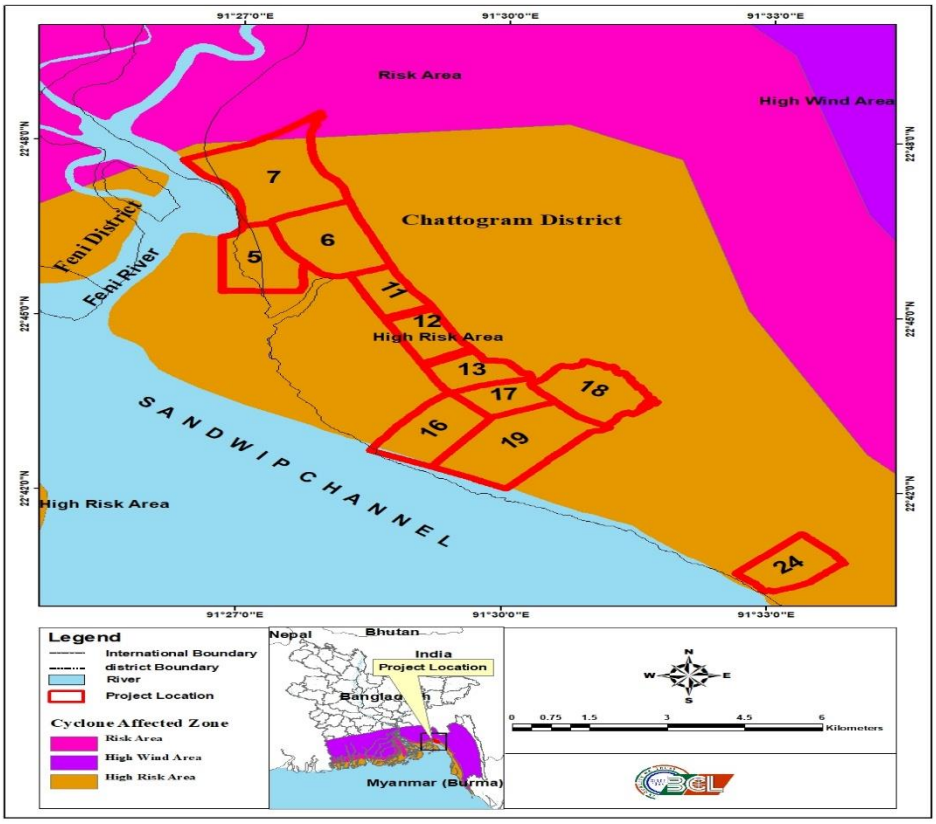


Figure 4-9: Cyclone Map in the study areas

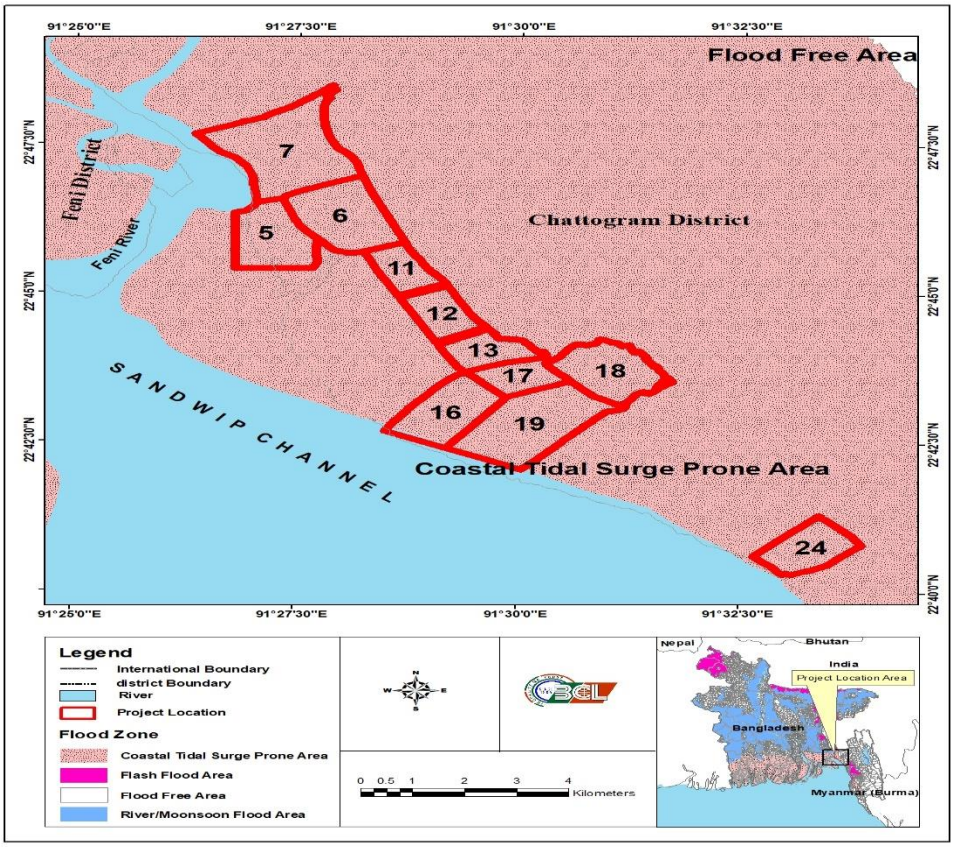


Figure 4-10: Flood Map of the project areas

4.2 BIOLOGICAL ENVIRONMENT

175. The Ecological component of the study focused on flora, (terrestrials and aquatic), fauna/ wildlife (amphibians, reptiles, mammals, and birds) and fishes (fresh and saline water), as well as the surrounding ecosystems. The IUCN, The World Conservation Union, has divided Bangladesh into 25 Bio-ecological Zones (Nishat et al, 2002) in the context of physiographic and biological diversity. The study area has fallen under two bio-ecological zones of coastal floodplain and coastal marine water. The area (both directly and indirectly impacted area) occupies terrestrial as well as aquatic ecosystems. Each of the bio-ecological zones represents the overall ecological situation of an area of the country. A map of the Bio-ecological zone is presented in the Annex 3**,** which indicates that sub-project area mostly saline tidal floodplain and coastal plain. Additionally, the study area's bio-ecological zoning was done using the Bio-Ecological Zone (BEZ) categorization of Bangladesh by IUCN-Bangladesh (2002). Details of the baseline study given in Annex-3.

176. Most of the fieldwork within the project has been addressed with these groups although each group had different approaches and methodologies. The study area (10 km buffer area from the project site) occupied various types of ecosystems such as rural settlements, roadside vegetation, croplands, woodland vegetation, and wetlands. The study of ecosystems of the study area included primary and secondary data collection on local habitats, habitation areas, plantations, ecological critical areas, protected areas, game reserves, Hilsha breeding grounds, transit routes, and sensitive settings. The ecological study was conducted through surveys, direct observations and interviews with local people.

4.2.1 Bio-ecological Zones

177. The country has been considered into 24 different bio-ecological zones however the project areas consist of bio-ecological zones as follows **(Figure 4-13)**:

- Zone-8a: Coastal Plains
- Zone-8d: Meghna Estuarial Flood Plains
- Zone-9a: Chittagong Hills and CHT
- Zone-11: Major Rivers

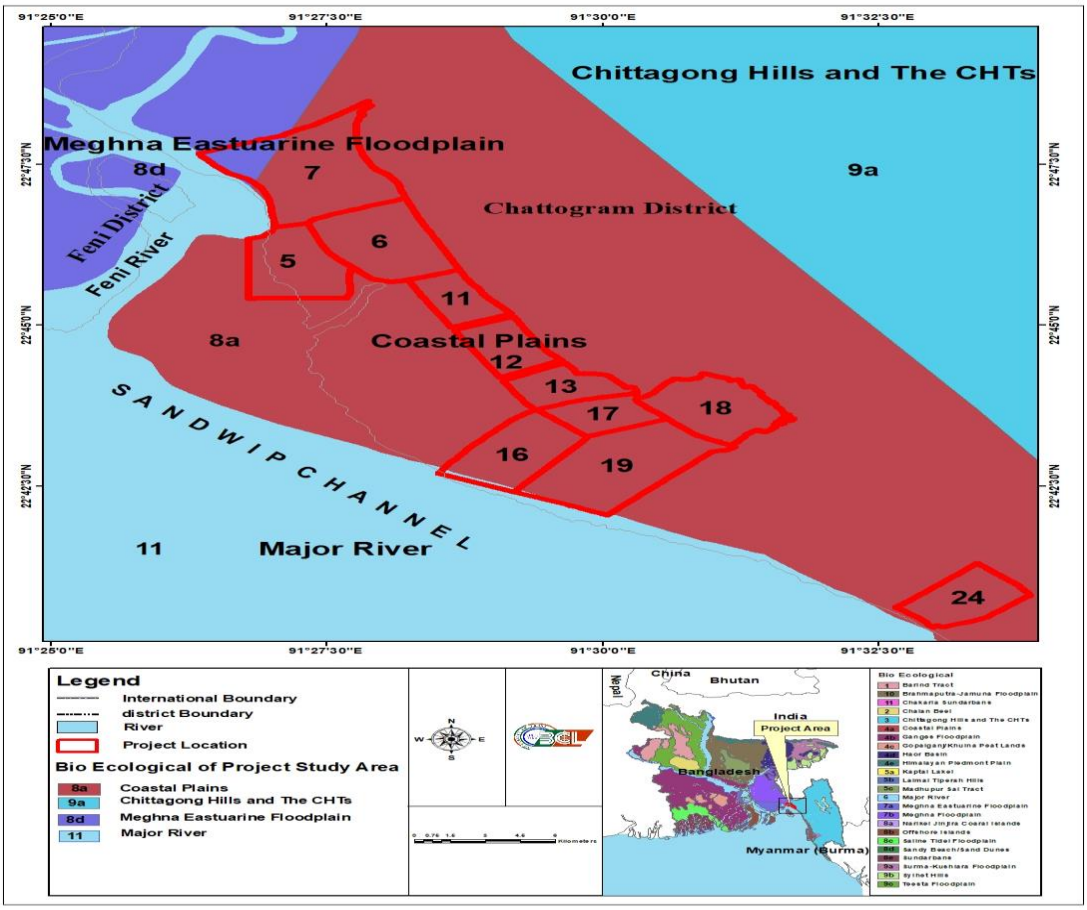


Figure 4-11: Project Area Bio-ecological Zone Map of Bangladesh

4.2.1.1 Ecological Resources

178. The ecological resources in the study areas are mainly Pond, Grazing Land, Roadside Mangrove, Homestead vegetation, Water body, Mangrove Forest, Coastal belt areas, Bamonsundar khal, Daborkhali Khal, and Ichakhali Khal, the Sandwip Channel, a biodiversity rich area. Summary of ecological resources in the terrestrials and marine ecology.

4.2.2 Terrestrial Flora and Fauna

179. Terrestrial flora (terrestrial plants) has been investigated using Random Meander method (Cropper, 1993) and or Quadrat method random basis in the AoI to determine the status of floral presence in the study area. Conducted study on habitat wise by using quadrat (100ftX100ft, 30ftX30ft, and 10ftX10ft) dated 8-12 December 2023, in this method the Consultant explored plant data and information throughout the study through opportunistic basis. Different habitats (roadsides, homesteads, canal, ponds, mangrove, and cultivated lands) are investigated to find out diversity of terrestrial plants. Special efforts were also given to record species of conservation importance according to IUCN Red List of Threatened Species (Online Version 2021-3)' (IUCN, 2021), Wildlife Security Act, 2012 and CITES. Local people have been in the Mangrove Area, interviewed during the investigation. For gathering present conservation and distribution status recorded plants compare with IUCN-Global status. Local people have been interviewed during the investigation. Maximum plant species have been identified at field, however, for confusion in identification, close photographs of flowers, leaves and stems and/or fertile specimens of leaves, stems and roots were collected.

Figure 4-12: Samplings of Quadrat at Charsarat Mangrove Areas

Table 4-11: List of sampling no, habitat, location, latitude, longitude as quadrat

S/N	Sampling no	Habitat	Locations	Latitude, E	Longitude, N
1	Quadrat 1: 10ft X 10ft	Pond	CP mor	22° 43' 52"	91° 30' 17"
2	Quadrat 2: 10ft X 10ft	Mangrove	2B	22° 45'46"	91° 27' 41"
3	Quadrat 3: 10ft X 10ft	Grazing Land	2A zone	22° 45' 46"	91° 27' 44"
4	Quadrat 4: 10ft X 10ft	Roadside	Ichakhali, Sluicegate Road	22° 46' 40"	91° 28' 35"
5	Quadrat 5: 10ft X 10ft	Road site	Charsarat	22° 44'10"	91° 30'40"
6	Quadrat 6: 10ft X 10ft	Mangrove	Charsoroti	22° 44' 20"	91° 29' 90"
7	Quadrat 7: 10ft X 10ft	Homestead	Sorchorot and Mogadia	22° 44' 44"	91° 29' 02"
8	Quadrat 8: 10ft X 10ft	Water body	Office pond, South Mogadia, Super dyke site	22° 45' 40"	91° 28' 12"
9	Quadrat 9: 10ft X 10ft	Mangrove	South Mogadia Super dyke site	22° 42' 39"	91° 29' 15"
10	Quadrat 10: 10ft X 10ft	Coastal belt	Bashundhara Jetty	22° 42' 49"	91° 28' 45"

S/N	Sampling no	Habitat	Locations	Latitude, E	Longitude, N
11	Quadrat 11: 10ft X 10ft	Bamon Sundar Canal	Bamon Sundar Khal, 3 No sluice gate	22° 44' 44"	91° 29' 02"
12	Quadrat 12: 10ft X 10ft	Daborkhali Khal	Daborkhali Khal	22° 43' 50"	91° 27' 55"
13	Quadrat 13: 10ft X 10ft	Ichakhali Khal	Charsoroti, Mogadia 6 no. Union Ichakhali	22.737364	91.496899

Source: Field survey, 2023

180. **Findings:** A total of 123 species of important terrestrial plants under the general of 116 family 61 have been recorded in the project area in **Annex 4**. Among them 44% are trees, 41% are herbs and the rest are shrubs. However, no one is threatened according to red data book on Vascular plants of Bangladesh (Bangladesh National Herbarium). Important terrestrial and aquatic plants observed and noted. Out of 123 species of terrestrial plants mostly use as medicinal and which is 56 in number and use as timber 27, fruit bearing 28, ornament 08 and fuel 04. 23 species of aquatic plants have also been identified. IUCN-Global status of terrestrial plans is DD=03, Least Concern=41, Unknown76 and near threatened=03. The global status of aquatic plants is Least Concern=10 and Unknown=13. Some Important timber trees are Acacia Nilotica, Albizia lebbeck, Albizia procera, Ficus benghalensis, Ficus hispida, Ficus racemose, Ficus religiosa, Eucalyptus camaldulensis, Syzygium cumini, Neolamarckia cadamba, Swietenia mahagoni, Samaneae saman and Acacia auriculiformis.

181. Important Fruit bearing trees are Elaeocarpus robustus, Psidium guajava, Musa paradisiaca, Citrus grandis, Mangifera indica, Spondias piñata, Annona reticulate, Annona squamosal, Cococs nucifera, Areca catechu, Avarrhoa carambola, Moringa olefera, Phyllanthus emblica, Punica granatum, Angle marmelos, Citrus aurantifolia, Limonia acidissima, Litchi chinensis, Manilkara sapota, Phoenix sylvestris, Dillenia indica, etc. Important Medicinal plants are Achyrenthes aspera, Centella asiatica, Vinca rosea, Enhydra fluctuans, Eupatorium odoratum, Mikania scandens, Diplazium esculantum, Heliotropium indicum, Chenopodium album, Commelia benghalensis, Eclipta alba, Tridax procumbens, Coccinia cordifolia, Acalypha indica, Croton bonplandinus, Euphorba hirta, Jatropha gossipifolia, Ocimum sanctum, Aloe vera, Marsilea quadrifolia, Mimosa pudica, Argemone Mexicana, Cynodon dactylon, Spilenthes acmela, Persicaria hydropiper, Scoparia dulcis, Smilax macrophylla, Datura metel, Datura stramonium, Physalis minima, Solanum nigram, Solanum xanthocarpum, Clerodendrum viscosum, Lippia geminate, Vitex negundo, Amiranthus viridis, Carica papaya, and etc,.

- No threatened species identified from the project area.
- Relative abundance of the identified plants area Common=51, Very Common-36, Rare=31 and Few=05.

Table 4-12: Terrestrial Resources within Studied area

Terrestrial Ecology	Number of Species
Terrestrial Ecology	
Terrestrial plants	123
Terrestrial Wildlife:	
-Amphibians	10
-Reptiles	08
-Mammals	10
-Aves	70
Total	**153**

182. Initially, the area was densely populated with mangrove vegetation, which plays a crucial role in coastal ecosystems. However, the initiation of the project has led to the significant removal of these forests. The current status indicates that there are no remaining mangrove forests, ecological sensitive areas, or protected zones within the project boundaries. Consequently, this study concludes that no significant impacts are anticipated on the biological resources of the project site.

4.2.2.1 Endemic/ Threatened/ Endangered Species

183. A total of 123 species of important terrestrial plants under the genera of 116 of family 61 have been recorded in the project area. Among them 44% are trees, 41% herb and the rest are shrubs. However, no one is threatened according to red data book on Vascular plants of Bangladesh (Bangladesh National Herbarium).

Important terrestrial and aquatic plants observed and noted. Out of 123 species of terrestrial plants mostly use as medicinal and which is 56 in number and use as timber 27, fruit bearing 28, ornament 08 and fuel 04. 23 species of aquatic plants have also been identified. IUCN-Global status of terrestrial plans is DD=03, Least Concern=41, Unknown76 and near threatened=03. The global status of aquatic plants is Least Concern=10 and Unknown=13. Some Important timber trees are Acacia Nilotica, Albizia lebbeck, Albizia procera, Ficus benghalensis, Ficus hispida, Ficus racemose, Ficus religiosa, Eucalyptus camaldulensis, Syzygium cumini, Neolamarckia cadamba, Swietenia mahagoni, Samaneae saman and Acacia auriculiformis etc.

184. No threatened species identified from the project area. Relative abundance of the identified plants area Common=51, Very Common-36, Rare=31 and Few=05.

4.2.3 Aquatic Eco-system (Flora and Fauna)

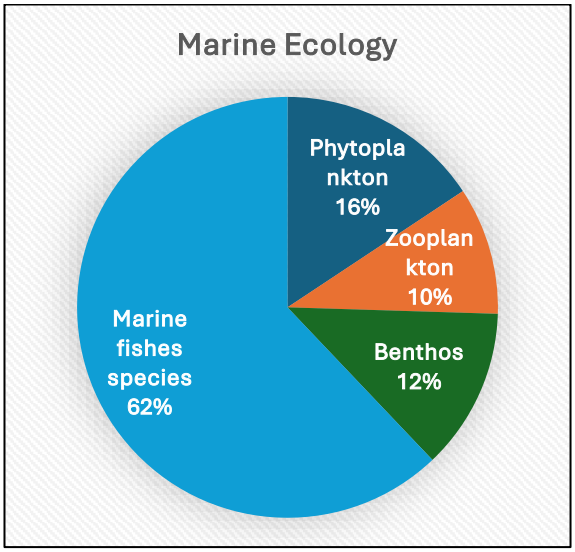
185. Aquatic plants have been investigated using the Random Meander method (Cropper,1993) using quadrat method. Local people were interviewed during the survey. Aquatic habitats in the project area are ponds, canals, and wetlands. The aquatic flora is mainly named in Bangla Mushak Dana, Malanchai, Brahmisak, Kanaidoga, Kachuripana, Topapana, Helencha, Arail, Khudipana, Kalmishak, Dholkolmi, Keshordam, Sushnishak, Pani Biskhatali, etc.

186. The Sitakunda and Mirsharai areas are rich in water bodies, including rivers, ponds, coasts and wetlands, which provide habitats for numerous aquatic species. Biodiversity in these regions is influenced by various factors, including water quality, vegetation, and human activities. The common aquatic faunal species in the study areas are fish, amphibians, Crustaceans, Mollusks etc. are in Annex 3.

187. **Aquatic Plants:** In total 23 species of aquatic plants have also been identified. Aquatic Plants have been investigated using Random Meander method (Cropper,1993). Aquatic habitats in the project area are ponds, canals, and wetlands. The aquatic flora is mainly named in Bangla Mushak Dana, Malanchai, Brahmisak, Kanaidoga, Kachuripana, Topapana, Helencha, Arali, Khudipana, Kalmishak, Dholkolmi, Keshordam, Sushnishak, Pani Biskhatali, etc. List of aquatic plants with detail information are in Annex-3

Table 4-13: Aquatic flora and fauna within the studied area

Aquatic Ecology /	Number
Aquatic Plants	23
Freshwater fish	59
Total	**303**
Marine ecology	
Phytoplankton	24
Zooplankton	15
Benthos	19
Marine fish species	95
Total	**153**



4.2.4 Nearest Reserved/ Sensitive/ Critical Habitat

188. Ecologically Critical Area (ECA) is an environmental protection zone, defined by the Government of Bangladesh under the Bangladesh Environment Conservation Act, 1995, where ecosystem is threatened to reach a critical state. According to Wildlife (Conservation and Security) Act, 2012, protected areas and environmentally controlled areas of Bangladesh are declared as national park, wildlife sanctuary, botanic garden, eco-park, safari park, kunjoban etc. Besides them, Ecologically Critical Area (ECA) of Bangladesh are notified under the Bangladesh Environmental Conservation Act, 1995.

189. **Ecologically Sensitive Areas (ESA):** Ecological sensitive sites which are very important for the flora and fauna (Wildlife). The following map shows the locations of ecological sensitive sites with distance. However, the project areas don't cover any ecologically sensitive areas and distances are more than 10km from the project sites (details in Figure 4-15). The common ESAs in the Chittagong districts are mainly Mohamaya Lake Khoiyachora Waterfall (19.90 km from the project site), Napittachora Waterfall (13.90 km from the project site), Horinmara Hatuvanga Trail (17.10 km from the project site), Komoldoho Waterfall at Sitakundo, Chattagram (17.60 km from the project site), Chandranath Hill (19.90 km from the project site), Guliakhali Sea Beach (24.20 km from the project site), Sahosrodhara Waterfall (27.90 km from the project site), Suptadhara Waterfall (23.05 km from the project site), and Horinmara Hatuvanga Trail (17.10 km from the project site). The details are given in Figure 4-13.

190. There are no marine protected areas within a 10 km radius area of EZ site. No sensitive aquatic species like dolphins are also reported in the Sandwip Channel within 10 kms radius of the EZ site. (*Ref. Addendum EIA report on PSDSP of BEZA*). Protected ecological areas, designated protected areas such as Baroiyadhala National Park: IUCN Category II national park, Ramgarh Sitakunda Reserved Forest, and ecologically sensitive areas for example Mohamaya Lake, Khoiyachora Waterfall**,** Napittachora Waterfall, Komoldoho Waterfall at Sitakundo, Chattogram, Chandranath Hill, Guliakhali sea beach, Sohosrodhara Waterfall, *Suptadhara waterfall,* Horinmara Hatuvanga Trail etc.

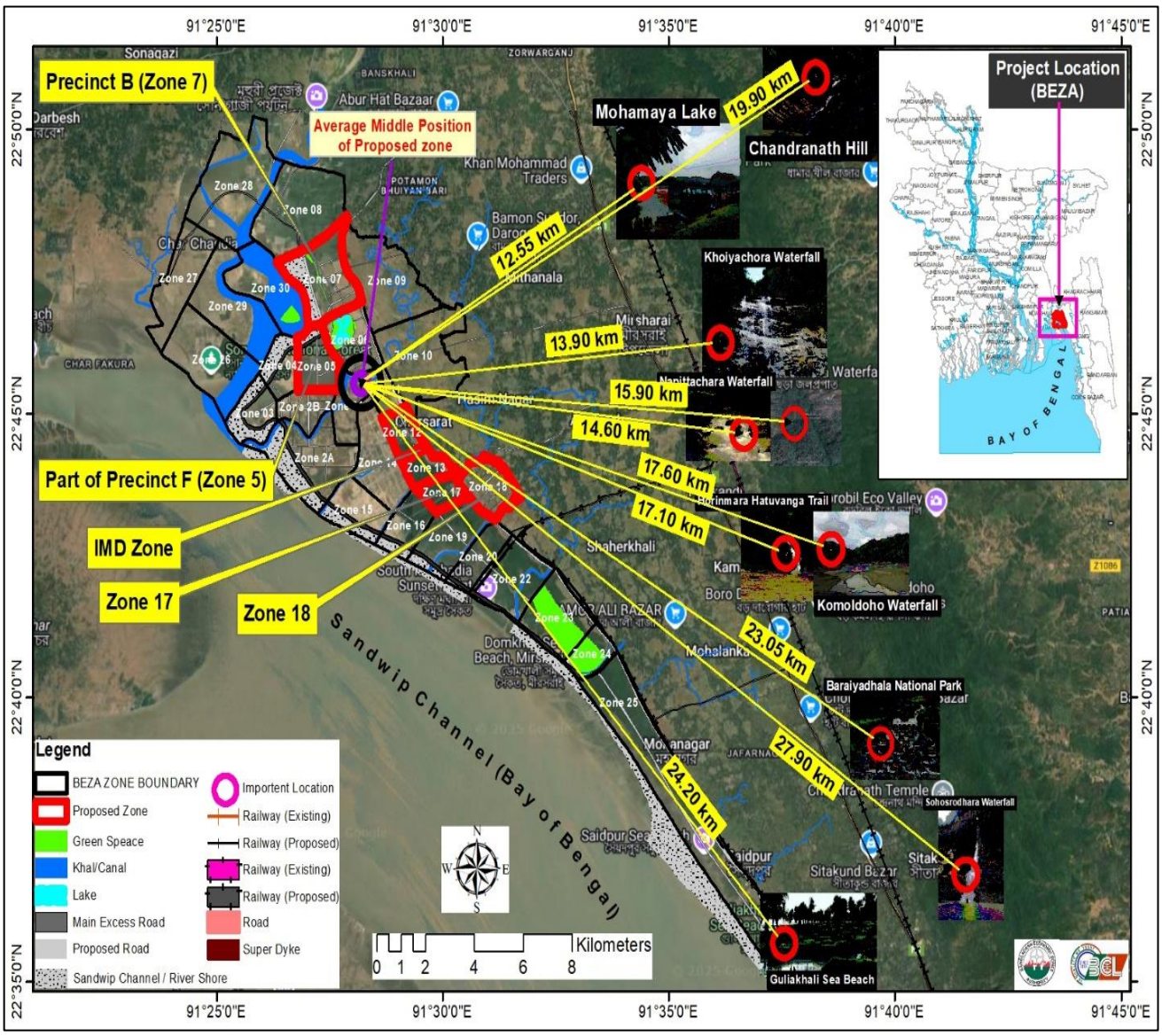


Figure 4-13: Distances between Ecologically Sensitive Areas and Project Areas

191. **Baroiyadhala National Park:** IUCN Category II national park and nature reserve in Bangladesh. The park is located at Sitakunda Upazila, Chattogram District, in the eastern part of the Dhaka-Chattogram Highway. It provides important wildlife corridors for the disappearing flora and fauna of Bangladesh. Khoiyachora Waterfall is located inside the Baroiyadhala National Park. The park was officially declared as a national park by the government of Bangladesh on 6 April 2010. It covers an area of 2933.61 hectares. Fauna of this park includes mainland serow, barking deer, marbled cat, Assamese macaque, Chinese pangolin, kalij pheasant, and various other animals.

192. **Ramgarh Sitakunda Reserved Forest:** The latitude of Ramgarh Sitakunda Reserved Forest is 22.70528, and the longitude is 91.64972 with the GPS coordinates of 22° 42′ 19.00″ N and 91° 38′ 58.99″ E. Ramgarh Sitakunda Reserve Forest is the largest forest in Bangladesh, covering an area of 72 square kilometers. It is located in the Chattogram Division of Bangladesh, near the city of Chattogram. The forest is home to 25 species of mammals, 123 species of birds, eight species of reptiles, and 25 species of trees. The forest is also home to the Baroiadhala National Forest and the Hazarikhil Wildlife Sanctuary.

Waterfall in Mirsharai

Mirsharai-fall-3-Ecotourism at Sitakunda and Mirsharai in BD

Baridhara National Park under Sitakunda Upazila

Ramgarh Sitakunda Reserved Forest

193. Hwever, the project areas don't cover any ECA (Ecologically Critical Area), even no ECA areas declared in Chittagong district.

194. No sensitive aquatic species like dolphins, are also reported within a 10 km radius of the EZ site. (Ref. Addendum EIA report on PSDSP of BEZA). The team observed deteriorated environments for spotted deer within coastal mangroves in the project location. Critical habitat for spotted deer was identified by Anonymous (2018), which is located far from the project location, in the southern part. Among the locations indicated in only Muhuri Dam is near to the project location, while the forested or hilly habitats of Mirsharai Upazila are far away from the channel. Thus, no impact on terrestrial animals could occur in those locations due the project implementation.

4.2.5 Fisheries Resources

195. Both natural and aquaculture fisheries exist in the study area. The some khals that drainout into the Sandwip Channel have limited species diversity. Species diversity is higher in the estuarine mouth compared to that of its upstream direction. For fish species investigation teams visited some fish market like Abu Torab Bazar, Jolodas para, Sarker para, Ichakhali Bazar, Bamon Sundar Dorgar Hat and other markets and landing center also. Consultation was carried with the fishermen in study area to gain knowledge about the fish species in Feni River, khals, beels, ponds etc. Fish species in canals and catches by fishermen are: Golda chingri, Bagda chingri, Chiring, Pangash fish, Coral fish, Promphet fish, South Asian carp/Catla, Ruhi, Hilsa,Bata fish, Gulla, Pua, Riksha/Taposhi, Lorka, Senuwa, Loitta, Nylotika, Mud Crabs, Holona, Mrigal, Silver Carp, Gras Carp, Karpo, Barbs (Putis), Chitol, Folai, catfish (Tengra, Singi, Magur, Boal, Pungus), Snakehead (Shol,Taki), Bele etc.). There are 37 fishponds in the NSEZ project area, community people fish cultures for commercial and own consumption. Mainly white fish culture like Pabda, Poa, Chringri, Telapia, Rui, Tengra, Katla, Mrigel, Carp, Pangus etc. in **Annex 4.**

4.2.5.1 Problems and Issues

196. The fishing industry is a vital part of the local economy and community livelihood, yet it is increasingly threatened by environmental, economic, and social factors. Understanding these problems is crucial for developing sustainable solutions to preserve fish resources and support the communities that depend on them.

197. The major problems and issues of fish resources in the study areas are as follows:

Overfishing	One of the most pressing issues in Mirsharai and Sitakund is overfishing. Unsustainable fishing practices have led to a significant decline in fish populations. Local fishermen often catch fish beyond sustainable limits, driven by economic necessity and the demand for fish in local and regional markets. This overexploitation threatens the long-term viability of fish stocks and disrupts the ecological balance of aquatic ecosystems.
Pollution:	Pollution from industrial activities, agricultural runoff, and urban waste significantly impacts water quality in the rivers and coastal areas of Mirsharai and Sitakund. Contaminants such as heavy metals, pesticides, and plastics not only harm fish populations but also pose health risks to local communities that rely on these water bodies for their livelihoods. The degradation of water quality can lead to fish kills and a decline in biodiversity.
Habitats destructions:	The destruction of natural habitats due to urbanization, industrial development, and land reclamation is another critical issue. Mangroves, wetlands, and other vital ecosystems that serve as breeding and feeding grounds for fish are being lost at an alarming rate. This habitat loss not only reduces fish populations but also affects the overall health of the marine environment.
Climate Change	Climate change poses a significant threat to fish resources in the region. Rising sea temperatures, ocean acidification, and changing weather patterns can alter fish migration patterns and breeding cycles. Additionally, increased frequency and intensity of natural disasters, such as cyclones and flooding, can further disrupt fishing activities and damage local infrastructure.
Socioeconomic Factors	Local communities face various socioeconomic challenges that impact fish resources. Poverty, lack of access to education, and limited alternative livelihoods force many individuals to rely heavily on fishing for their income. This dependence can lead to unsustainable practices as fishermen prioritize immediate economic needs over long-term sustainability.

3.4.1.1 Habitat Description

- **Fresh water fishes:** Fish survey is based on direct observation and interview with local people, especially fishers. A pictorial data collection format used for identification of fishes at field by the local people. IUCN Red List of Threatened Species (Online Version 2020-1) (IUCN, 2020) will also review for determination of globally threatened categories of fishes.
- A total of 59 species of freshwater and brackish water fishes were identified within the impact sites. Fisheries resources of the study area are rich and diversified. Fish habitats of the study area are creeks, Khal, rivers, aquaculture ponds, and natural ponds. Water in these bodies varies from fresh to brackish. Both natural and aquaculture fisheries exist in the study area. The khals that drain into the Sandwip Channel have moderate species diversity. Species diversity is higher in the estuarine mouth compared to that of its upstream direction.
- Consultation was carried with the fishermen in study area to gain knowledge about the fish species in canals, River Feni and ponds etc. For fish species investigation visited some fish markets like Abu Torab Bazar, Jolodas para, Sarker para, Ichakhali Bazar, Bamon Sundar Dorgar Hat and other markets and landing center. Fishermen fishing at the Ichakhali, Shaherkhali and Bamansundar Khal, and fish farms.
- Fisheries resources of the study area are rich and diversified. Fish habitats of the study area are creeks, khal, rivers, aquaculture ponds, and natural ponds. Both natural and aquaculture fisheries exist in the study area Whereas the proposed Gas line network crosses the Ichakhali, Daborkhali and Bamansundar khals. Presently no fish resource exits there.

Fish Production

198. The fish production volumes in Sitakunda and Mirshari have shown significant growth over the years. According to recent data:

- **Sitakunda Upazila**:
    - Total fish production in 2022 was approximately 5,000 metric tons;
    - The predominant species produced were Rohu and Catla, contributing to over 60% of the total production.

- **Mirshari Upazila**:
    - Total fish production in 2022 reached around 3,500 metric tons;
    - Tilapia and Pangasius were the leading species, accounting for nearly 70% of the output.

4.2.5.2 Fish Migration

199. Fish migration in the study areas can be categorized into two main types: seasonal migration and diadromous migration. Seasonal migration typically occurs in response to changes in water temperature and food availability, while diadromous migration involves species that move between freshwater and saltwater environments for breeding purposes.

200. **Seasonal Migration:** During certain times of the year, fish species such as hilsa (Tenualosa ilisha) migrate to spawn in the rivers and estuaries of the project areas. This seasonal movement is often triggered by monsoon rains, which increase river flow and create favorable conditions for spawning. The migration patterns of these fish are closely linked to the lunar cycle, with peaks in movement occurring during specific phases of the moon.

201. **Diadromous Migration:** Diadromous fish species, such as the Indian shad, migrate between freshwater and marine environments. In Chattogram, these fish typically spawn in freshwater rivers and then migrate to the sea as juveniles. This migration is vital for their life cycle and contributes to the overall health of both freshwater and marine ecosystems.

202. Causes of Migration of Fish: Several factors drive fish migration in the coastal areas of Chattogram:

- **Environmental Changes:** Variations in water temperature, salinity, and oxygen levels can prompt fish to migrate in search of more suitable habitats;
- **Food Availability:** The abundance of prey species influences the movement of predatory fish, leading them to migrate to areas with higher food concentrations;
- **Reproductive Needs:** Many fish species migrate to specific spawning grounds to ensure the survival of their offspring.

203. Migration of fish in the project areas has significant implications for local fisheries and biodiversity. Sustainable management practices are essential to ensure that fish populations remain healthy and that the livelihoods of local fishing communities are supported. Overfishing, habitat degradation, and climate change pose threats to migratory fish species, making it crucial to implement conservation measures.

4.2.5.3 Fish Species Composition and Biodiversity

Table 4-14: Status of some common fish species and their composition

Sl, No.	Fish Species (Local name)	Fish Species (Scientific name)	Composition (%)
1	Lotia	*Harpodon nehereus*	6.95
2	Lal chewa	*Trypauchen vagina*	5.65
3	Poa, Kala poa	*Johnius dussumieri*	4.50
4	Bata mach	*Mugil corsula*	3.07
5	Tailla	*Eleutheronema tetradactylum*	0.98
6	Koral	*Lates calcarifer*	6.37
7	Churi	*Lepturacanthus savala*	4.67
8	Hundra	Sillago domina	5.34
9	Ilisha	Tenualosa ilisha	10.68
10	Tapshi, Rishsha	Polynemus paradiseus	3.07
11	Futki datina	Pomadasys hasta	2.5
12	Foli chanda	Pampus argenteus	0.01
13	Kakra	Crab spp	2.95
14	Loilla echa	Metapenaeus brevicornis	2.44
15	Sila kakra	Scylla spp	3.08
16	Gura echa	Acetes indicus	5.61
17	Kukr jib	Cynoglossus cynoglossus	3.29
18	Phaisya, Pati	Thryssa dussumieri	2.41
19	Kata mach	Arius spp	1.89

Sl, No.	Fish Species (Local name)	Fish Species (Scientific name)	Composition (%)
20	Nuna-tengra, Guilla	Mystus guilo	4.98
21	Chapda chingri,	Penaeus indicus	3.94
22	Bagda chingri	Penaeus monodon	2.57
23	Harina chingri	Metapenaeus monoceros	2.30
24	Maittya	Scomberomorus guttatus	3.67
25	Karati alua	Coilia dussumieri	0.95
26	Pangas	Pangasius pangasius	1.38
27	Baila mach, Bela	Glossogobius giuris	1.89
28	Golda chingri	Macrobrachium rosenbergii	2.09

4.2.5.4 Fisheries Management

204. To promote sustainable fisheries in the study areas, it is important to:

- Monitor fish populations and migration patterns.
- Implement seasonal fishing bans during peak spawning periods according to Notifications 2014(DoF).
- Protect critical habitats such as estuaries and mangroves.

205. **Conservation Efforts:** Conservation initiatives should focus on:

- Raising awareness among local communities about the importance of fish migration.
- Collaborating with stakeholders to develop and enforce regulations that protect migratory fish species.
- Conducting research to better understand the ecological dynamics of fish migration in the region.
- Project industrial effluents should not be runoff into the fish prone areas etc.

4.2.6 Marine Ecology

206. Saline water of Sandwip channel entrance into the canals that control by the regulators, Due to lack of proper maintenance the sea water entrenches into the canals and mix with fresh water. As a results, the water in these canals varies from fresh to brackish. The tested results show the salinity of the Bamansundar , Daborkhali, and Ichakhali were 2.1 ppt, 1.4ppt, and less than 0.1 ppt, respectively (**Table 5-3** & **Annex 4**). Even the salinity concentration of the pond water was 0.2 ppt. The khals that drain-out into the Sandwip Channel have moderate species diversity. Fish species diversity is higher in the estuarine mouth compared to that of its upstream direction, while the freshwater fish resources are limited, particularly in the Ichakhali, Daborkhali and Bamansundar khals no fish available, since surface water in these canals' changes from fresh to brackish.

207. The baseline survey of flora and fauna conducted under this study aimed to conduct and an inventory of the existing flora and fauna, including plankton (phytoplankton and zooplankton) and benthos composition. Four locations within the Sandwip Channel, the plankton and benthos composition were analysis. In addition, identifying endangered species of both plants and animals and ecosystems and wildlife habitats within the area. This survey study aims to identify potential threats to wild plants, animals, critical habitats, and ecosystems arising from project activities. Major floral species are generally absent from the sandy beaches along the coast. Ipomoea pescaprae, often known as beach morning glory, is the main type of native vegetation on these sandy beaches. It was also noted that some beach agriculture was being done in small spots.

208. **Mangrove Plantation:** The Chattogram Coastal Forest Division began planting mangroves on this area. *Avicennia officinalis* and *Avicennia marina* are the species most frequently applied

4.2.6.1 Phytoplankton

209. The survey encountered 24 phytoplankton genera belonging to Chlorophyta (green algae), cyanobacteria (blue-green algae) and Bacillarophyta (diatoms) at the four survey locations or survey station (St) in the Sandwip channel . The average density of phytoplankton was 951.6±538.0 cell/L. Two genera of diatoms, *Coscinodiscus* sp. and *Cyclotella* sp. were in all the sampling stations. Among these phyla, diatom was the most dominant group, where *Coscinodiscus* sp., *Odontella* sp. and *Melosira* sp. were most dominant. On the other hand, the Dinoflagelate, *Ceratium* sp. were found nearly at all sites and were abundant. Phytoplankton belonging to Chlorophyta were only recorded in riverine side. The phytoplankton density varied from 279-1659 cells L^{-1} with the highest count observed in the Sandwip channel. Abundance of Phytoplankton Genus at Various sites in the Sandwip Channel are given below

Table 4-15:Abundance of Phytoplankton Genus at Various

Family	Genus	St 5	St 7	St 8	St 9
Bacillariophyta	Bascillaria	37	0	0	0
	Chateceros	55	146	19	0
	Coscinodiscus	236	400	128	291
	Cyclotella	37	73	55	19
	Cylindrotheca	73	0	0	0
	Ditylum	37	146	37	0
	Enromoneis	55	0	0	0
	Flagillaria	0	0	19	37
	Gyrosigma	0	0	0	19
	Hyalodiscus	37	0	0	0
	Melosira	0	55	345	291
	Nitzschia	55	55	37	0
	Odontella	182	182	91	273
	Pleurosigma	0	0	19	0
	Rhizosolenia	0	0	19	0
	skeletonema	19	73	37	37
	Surirella	19	0	0	0
	Thalassionema	37	91	182	73
	Thalassioosira	0	37	19	0
	Triceratium	37	37	37	19
Chlorophyta	Pediastrum	0	0	0	0
Cyanobacteria	Anabaena	19	0	0	0
Dinoflagellata	Ceratium	73	345	182	128
	Peridinium	0	19	0	0
Total		**1008**	**1659**	**1226**	**1187**

4.2.6.2 Zooplankton

210. The study team encountered 15 zooplankton genera and their 3 larval stages. The average density of zooplankton was 278.6±187.2 cell/L**.** Expectedly, copepods followed by the Cladocera were the two most dominant groups as it is common in similar regions. All sites in the Sandwip channel side had similar species composition. The zooplankton density almost followed the spatial pattern of phytoplankton. Even at the riverine side, did not find any rotifer species which could be due to high salinity of all sites (>15ppt). The notable finding in this study is that the density of small size zooplankton was very low. It could be due to low productivity as suggested by phytoplankton, or due to unfavorable condition created by high Suspended Particulate Matter (SPM) resulting from dredging or other activities. Abundance of Zooplankto Genus in different location are given in Table 4-16.

Table 4-16:Abundance of Zooplankton Genus at Various Locations in the Sandwip Channel

Group	Sub grup	Genus	St 5	St 7	St 8
Cladocera	Daphnidae	Dafnia	0	0	8
	Moidae	Moina	0	8	8
Copepoda	Calanoida	Candacia	0	8	4
		Bosmina	0	0	12
		Calanoid nauphius	148	84	100
		Paracalanus	0	8	0
	Copepoda	Copepod nauphlii	0	72	0
		Cyclop larvae	4	0	0
	Cyclopoida	Acartia	4	0	8
		Cyclops	0	8	52
		Eucyclops	12	0	0
		Macrocyclops	4	8	4
		Mesocyclops	24	20	24

Group	Sub grup	Genus	St 5	St 7	St 8
		Microcyclops	0	4	4
		Paracyclops	0	0	4
		Thermocyclops	0	4	0
Oligotrichea	Ostracoda	Favella	0	0	0
Protozoa	Choreotrichida	Tintinopsis	140	232	180
Total			336	456	408

4.2.6.3 Benthos

211. **A total of 19 taxa (families) of soft-bottom macrobenthos were recorded of which 14** families were identified over the six sampling sites. The mean abundance (individual/m2) was 707.8±210.2. St 9 had the lowest density of macrobenthos, followed by St14. The other sites demonstrated similar density but were >1.5 times higher abundance than that of L-09 and 14. The macrobenthos abundance at all sites were dominated by the polychaetas followed by crustacean which is typical of any estuary or coastal ecosystem of similar region (Matin et al., 2018; Hossain et al., 2018). Abundance of Macroinvertebrates collected from the Subtidal Zone of the Sandwip Channel are given below and detail are annex-4

Table 4-17: Abundance of Benthic Macroinvertebrates in the Subtidal Zone of the Sandwip Channel

Class	Family	Abundance (individual/m2)			
		St 5	St 7	St 8	St 9
Polychaeta	Capitellidae	178	134	45	89
	Syllidae	45	45	45	0
	Lumbrinereidae	0	0	89	45
	Nereidae	178	134	223	45
	Goniadidae	45	0	0	45
	Cossuridae	0	0	134	0
	Glyceridae	45	223	45	0
Crustacea	Mysidae	134	134	89	45
	Gammaridae	89	45	45	134
	Portunidae	0	45	89	0
	Ocypode	0	0	0	0
Gastropoda	Gastropoda sp.	0	45	45	0
Bivalve	Bivalve	45	0	45	0
Insect	Insecta	0	0	0	0
	Unidentified	45	0	45	0
Total		804	805	939	403
Shannon-Wiener index		2.01	1.89	2.3	1.67

212. **Marine fishes:** A total of 95 species of marine fishes were recorded from the marine habitat adjacent to the proposed Zone while 51 species from Muhuri reservoir in Bangladesh near sampling points 14, 15, and 16. For marine species identification, our result showed that the majority of the species identified belonged to the Perciformes order, comprising almost one-third (35.79%, n=34) of the total identified species (**Annex 4)**.

4.2.7 Ecosystem Services and Functions

- The ecosystem of the study area is mainly terrestrial and aquatic. Ecosystem services and functions help local people and vice versa. Major benefits of the ecosystem services of the study area are given below:

- Ecosystem services have tremendous benefits to Agricultural activities for food production, economic growth and environmental benefits for sustainable agricultural practices can enhance soil fertility, biodiversity, and water conservation, contributing to overall environmental health,
- Fisheries provide a crucial source of protein and essential nutrients for many populations, especially in coastal communities to support enhance the livelihood options and maintain marine biodiversity to strengthen the ecosystem health, supporting by sustainable fishing practices,
- Forests are habitats for a vast array of plant and animal species, contributing to global biodiversity, mitigating the climate change impacts by absorbing CO2 and releasing O2.
- Tidal actions can help mitigate coastal erosion by distributing sediments and influencing shoreline stability, supporting diverse ecosystems, including mangroves, salt marshes, and estuaries, which are critical habitats for many species as well as tidal movements facilitate nutrient exchange between marine and terrestrial ecosystems
- Photosynthetic processes remove carbon dioxide in the air and supply oxygen to the environment.

213. Trees serve as sources of timber for housing construction etc.

- Animals supply the protein needs of humans, serve as pets or animal skin for making shoes, bags, and other derivatives;
- The watershed provides fresh, clean water for human consumption;
- Trees serve as a buffer against storms preventing the destruction of houses by strong winds;
- Some species of plants can cure human ailments;
- Humus from the decomposition of organic matter serves as a natural fertilizer in areas cleared for agriculture;
- Fisheries resources were once all canals enriched. But due to development activities in this area scarcity occurred;

214. Forest Department started plantation in the super dyke area from 2021, still now around 50 lacs of saplings of mangrove species like Keora, Baen and Geoa planted and in high land planted saplings of Jhau. In around 800 acres of land afforestation are going on by Forest Department of their own fund. Every year replantation has been carried out in around 30%. BWDB funding for mangrove plantation in and around 100 acres of land. Planted saplings size 2-3ft. FD planted sapling of their own nursery.

4.2.8 Agriculture

215. Agriculture, comprising crop cultivation, fisheries, direct farming, sharecropping, agricultural laborers, and so on, is the most common source of employment in the study area, according to the Population and Housing Census (2011). Agriculture employs approximately 2,26,035 males and 11,150 females of the population.

Table 4-18: Upazila wise agricultural employment statistics

Upazila	Male	Female
Mirsharai	16,664	620
Sitakunda	8,648	391
Sona Gazi	10,531	262

Source: Population and Housing Census, BBS 2011

4.2.8.1 Problems and Issues

216. The significant challenges faced by agriculture in the study area focus on factors such as the availability of arable land, crop damage, seasonal flooding, water logging, soil salinity, and the accessibility of high-quality seeds and fertilizers.

217. The limited availability of arable land poses a significant constraint on agricultural activities. As urbanization and industrialization continue to encroach upon agricultural land, farmers are left with diminishing space to cultivate crops, which directly impacts food production.

218. Seasonal flooding is another critical constraint that affects agricultural productivity. The inundation of fields during the monsoon season can lead to prolonged water logging, which adversely affects crop health and yields. Farmers are often left with limited options for crop selection during these periods.

219. Water logging during the monsoon season restricts the types of crops that can be cultivated. The duration of water logging not only hampers crop growth but also increases the risk of diseases and pests, further complicating the agricultural landscape.

220. Soil salinity is a persistent issue that affects crop growth and soil health. High salinity levels can render land unproductive, making it challenging for farmers to maintain healthy crops. This issue is often exacerbated by poor drainage systems and excessive irrigation practices.

221. The accessibility of high-quality seeds and fertilizers is crucial for enhancing crop yields. However, many farmers in the study area struggle to obtain these essential inputs, which limits their ability to improve productivity and adapt to changing agricultural conditions.

4.2.8.2 Farming Practices

222. Most of the people's livelihoods in the NSEZ adjacent areas depend on agricultural farming, fishing, livestock, small businesses, etc. Livestock and poultry, being an essential sector of integrated farming system, play an important role in the economy of the study area. Livestock provides significant draft power for cultivation, threshing and crushing oil seeds. Cow dung is used as a source of manure and fuel. Meat, milk, and eggs are used for human consumption and are a ready source of funds. Most of the household's rear poultry and livestock, a practice that significantly reduces poverty by generating employment and income.

223. During visit the site observed three types of domestic animal grazing surrounding the project area mainly buffalo, cow and sheep. The owners of the livestock population are facing problems in respect of availability of fodder and feeds land development activities are ongoing and as well as infrastructure development in the sub project areas.

4.2.8.3 Cropping Patterns and Intensity

224. The study area experiences three distinct cropping seasons:

- **Kharif-I**: The first phase of the Kharif season, typically associated with the monsoon.
- **Kharif-II**: The second phase, which may include late-maturing crops.
- **Rabi**: The winter cropping season, characterized by cooler temperatures and different varieties.

Table 4-19: Cropping pattern and Intensity in the study areas

Sl. No.	Cropping Season	Major Crops	Months
1	Kharif-I	B. Aus, Jute and vegetables	March to May
2	Kharif-II	T. Aman (HYV & L) and fallow land	June to October
3	Rabi Season	Boro (HYV), vegetables, fruits and pulses	November to February

4.2.8.4 Cropped Area

225. The study of land use indicates a significant portion of the surrounding area is dedicated to agricultural activities and aquaculture.

- Agricultural Land: Comprising a substantial percentage of the area, agricultural land is crucial for food production and local livelihoods;
- Aquaculture Ponds: These areas contribute to the local economy through fish farming and related activities.

226. The land use and land cover within a 10 km radius of the project site. The study reveals that approximately 29.3% of the area is designated for agricultural land and aquaculture ponds. Importantly, it is noted that no agricultural land will be utilized for the development of the Economic Zone (EZ).

4.2.8.5 Crop Damage

227. Crop damage is a prevalent issue highlighted during focused group discussions. This damage is attributed to both excess and scanty rainfall, which disrupts the growth cycle of crops. Farmers often face losses due to unpredictable weather patterns that lead to either flooding or drought conditions.

4.2.8.6 Crop Production

228. Farmers in Chittagong district are engaged in the production of a wide array of agricultural products. The cultivation of food crops serves as the backbone of local sustenance, while cash crops contribute to the economic viability of farming households. Fruits and vegetables are also integral to the agricultural output, providing essential nutrients and contributing to the local economy.

229. In addition to crop production, most households in the district maintain poultry and livestock. This practice not only supports daily consumption needs but also allows families to sell surplus produce in local markets. The integration of livestock and poultry farming into household routines enhances food security and provides additional sources of income.

230. Moreover, the district's farmers are involved in aquaculture, producing fish that supplement their diets and contribute to local food systems. The cultivation of timber and fuel wood is also prevalent, serving both economic and ecological purposes.

4.2.8.7 Input Use

231. The various inputs utilized in agricultural production within the study areas in enhancing productivity, sustainability, and economic viability for local farmers. The most common inputs used, such as seeds, fertilizers, pesticides, and irrigation methods.

Types of Inputs in Agricultural Production

- **Seeds-** The choice of seeds is crucial for successful agricultural production. In the study areas, farmers often select high-yielding varieties (HYVs) that are suited to the local climate and soil conditions. These seeds are typically sourced from local agricultural research institutes or private seed companies, ensuring that they are disease-resistant and have a higher potential for productivity.
- **Fertilizers-**Fertilizers play a vital role in enhancing soil fertility and crop yield. Farmers in these regions commonly use both organic and inorganic fertilizers. Organic fertilizers, such as compost and manure, are preferred for their sustainability and ability to improve soil health. In contrast, chemical fertilizers are used to provide essential nutrients like nitrogen, phosphorus, and potassium, which are critical for crop growth.
- **Pesticides-**The use of pesticides is essential for protecting crops from pests and diseases. Farmers often rely on both chemical and biological pesticides. While chemical pesticides are effective in controlling outbreaks, there is a growing trend towards integrated pest management (IPM) practices that emphasize the use of biological controls and reduced chemical inputs to promote environmental sustainability.
- **Irrigation-**Water management is a key factor in agricultural success, especially in regions prone to drought or irregular rainfall. Farmers in the project areas utilize various irrigation methods, including surface irrigation, drip irrigation, and tube wells. The choice of irrigation system often depends on the crop type, water availability, and economic considerations.
- **Labor-**Labor is another critical input in agricultural production. In these regions, labor is often sourced from local communities, with family members contributing significantly to farming activities. The availability of skilled labor can influence the efficiency of agricultural practices and overall productivity.

4.3 SOCIO-ECONOMIC ENVIRONMENT

232. The EIA study made extensive use of socioeconomic data obtained for determining social baseline condition of the project area through structured questionnaires survey of the sample households (HHs) residing adjacent to the sub-project areas. However, during the survey, some interviews with local residents were held on social conditions as well as gender violence perspective, etc. Details of the existing social environmental condition has given in Annex-3.

233. **Methodology:** The social baseline surveys and investigations entailed both conventional and nonconventional approaches and methods of data collection –such as:

- Following the desk-studies of project documents and available secondary data, the field investigations started with a reconnaissance survey of the project area, taking note of the settlement patterns and the major structures and community properties and public utilities infrastructures (gas, electricity, water supply etc.) located along the proposed alignment;
- Collection and analysis of relevant studies and available secondary data from various national and local sources;
- Sample Surveys carried out to ensure a reasonable representation of all categories of people, the samples have been selected from the Mirsharai area, 'multi-stage sampling' method was followed to have a balanced representation of the project area. A total of 125 HHs were selected from different areas of Mirsharai Upazila covering households, business enterprises, institutions and organizations located along the proposed alignment and outside sub-project site;

- Focus Group Discussions (FGD) and KII and Public Consultation Meetings held with elected representatives of local govt. bodies, NGOs, civil society organizations and public;
- To gain an initial idea of the socio-economic features and key indicators of local poverty situation to confirm the representativeness of the sample plans;
- To gather necessary information on existing socio-economic and cultural conditions in the project area and develop a baseline.

4.3.1 Demography

234. Mirsharai Upazila is in Chattogram district and is bounded by Tripura state of India, Chhagalnaiya and Feni Sadar Upazila on the north, Shaunda Upazila and Bay of Bengal on the south, Fatikchari Upazila on the east, Sona Gazi and Campaniganj (Noakhali) Upazila on the west. Mirsharai Upazila area 482.88 sq km. According to BBS data of 2022, total population 111009; male 472777, female 228303 in Mirsharai Upazila, it has Municipality 2, Union 16, Mouza 109, Village 216, Urban population 31206, Rural population 387510., Population density 826 per sqkm.

Table 4-20: The demographic profile in the project areas of NSEZ

Administrative Unit	Area (Sq.KM)	Total Population	Average HH size	Population Density
Mirsharai Upazila	48.288	397,725	5	826
Sitakunda Upazila	27.97	387,832	5	801
Sona Gazi Upazila	4.97	290,664	4.28	922

Source: HHs census, 2022, BBS.

4.3.2 Economic Activities

235. The distribution of household head by occupation, and it shows that business, day labor and driver category dominate the project area as it accounts for 75.89 percent of the total HH head occupation. No other occupation dominates here. Farming is the main occupation of only 9.82 percent. 6.25 percent of them are service holders as shown in **Table 4-13**.

Table 4-21: Economic Activities in the study areas

Occupations	Primary Occupations of the Household Heads			
	Primary Occupations			
	Male	Female	Total	%
Agricultural farming	11	0	11	9.82
Business	16	0	16	14.29
Service	7	0	7	6.25
Housewife	0	0	0	0
Day laboring	51	0	51	45.54
Expatriate	2	0	2	1.79
Driver	18	0	18	16.07
Electrician	1	0	1	0.89
Old/ Disable	4	0	4	3.57
Fisherman	2	0	2	1.79
Total	**112**	**0**	**112**	**100.00**

Source: Baseline Survey by BCL 2023

4.3.3 Physical Infrastructure and Services

236. The summary of physical infrastructures facilities in the project areas is given below:

Table 4-22: List of Infrastructure facilities in the project areas

Name of the Upazila	Status			
	Kactha	Semi-Pucca	Pucca	Jupri
Mirsharai Upazila, Chattogram	79.2%	9.2%	9.6%	2.1%
Sitakunda Upazila, Chattogram	70.4%	13.5%	13.2%	3.0%
Sonagazi Upazila, Feni	74.64%	13.3%	10.9%	1.35%

Source: Baseline Survey by BCL 2023

237. Services: Safe drinking water crisis is an acute problem experienced by the people in the project areas. Around 1.57% of people received the tap water supply, most of the people in the study areas (92.97%) use the tube well waters and remaining (5.57%) relies on other sources such as pond. During the summer season, the problem gets acute by intrusion of saline water into the groundwater sources and people is forced to use the unsafe drinking water and particularly women and vulnerable people affected mostly.

238. Regarding sanitation access, only 5.36% of the HHs are connected to piped water supply system; while 90.18% depends on hand tube wells and 4.46% HHs collect water from other HH. Only 17.86% HH have sanitary latrine and 82.14% of HH have ring slab/Non-Sanitary Latrine. 84.82% of HHs have electric connections, 1.79% have no electric connection, 4.46% depend on other houses and 8.93% use other sources.

4.3.4 Social and Cultural Amenities

239. No common property resources exist within NSEZ zones, so, due to development of NSEZ projects no CPRs are being affected with the project development.

4.3.5 Public Health

240. Around 69.64% of people of the surveyed area mainly go to the govt. hospitals and 2.6goHs goes to private doctors/clinics for health care services, 99.11% HH goes to village doctor and 40.18% HH goes to pharmacy when any of their members are sick. Whereas 2.67% of HHs reported that the qualified doctor is available.

4.3.6 Poverty

241. Based on poverty rate in Bangladesh the overall economic status of the sampled HHs about 69.64% of total HHs have faced deficit and 14.29% fell deficit at times or medium income family. On the other hand, 16.07% of HHs have surpluses. Among the proposed measures against poverty assistance from Govt. and general demand for industrial establishment; While it is recommended to develop new industries and create employment opportunities to alleviate unemployment and poverty. Those who mentioned unemployment as a problem wanted govt. assistance towards establishing a new factory.

4.3.7 Gender

242. Even though women constitute half of the population, survey findings revealed that women in many aspects fall behind men. The female literacy rate is still a bit high in the survey areas – about 19.82% female compared to 18.92% of male. Around 24.11% of sampled HHs heads do not support women working outside home, 91.96% women members of interviewed HHs reported to have visited any place outside home during a year before interview and 38.46% of total women interviewed reported to have visited any marketplace. About 94.64% of women taking part in deciding about their children's education while 5.36% cannot be able to take any decision. Only 89.29% of women having children of that age group reported full freedom to participation in any decision about their children's marriage, while 5.36% reported possibility of participation in decision making only on limited issues concerning their children's marriage. About their own health, 97.32% of women reported to have absolute freedom of taking decision, while about 2.68% cannot take decision.

4.3.8 Indigenous People

243. No indigenous or small ethnic communities exist in the project areas. So, due to the development of NSEZ, ethnic communities will not be affected.

4.3.9 Communication

244. The shorter, cost-effective and safe road between the NSEZ Economic Zone and the capital Dhaka, as well as the port city Chittagong, the existing road is via the Dhaka-Chittagong National Highway. It is a dedicated route for transporting commodities to and from the economic zone, as well as conveying finished products from this zone to domestic and international markets.

245. In addition to road network, another access to the project site is Waterway, the Sandwip channel located at the western side of the project area. Usually on this route only a few trawlers and fishing boats movement were moving as convenient, no sort of water vessel was plying on Sandwip Channel near the Economic Zone.

4.3.10 Historic, Cultural, Archaeological Resources

246. Archaeological heritage and relics are existing at the Mirsharai Upazila jurisdiction like Dhum Shila Pathar (Shantir Hat), Chhuti Khan Mosque, Paragal Khan Dighi, Nai Duari Mosque, Jagannath Dham (Abu Torab), Kali Mandir (Karerhat), Shantiniketan Vihara, Abhay Charan Vihara. All the archaeological sites are preserved by the Antiquities Act, 1968 (Under Section 12). No site will not be affected by the sub-projects intervention. No archaeological heritage and relics are located within the sub-projects sites in the targeted zones.

5 STAKEHOLDER CONSULTATIONS PLAN

5.1 OVERVIEW

247. Stakeholder communication and engagement is an important process to ensure the effectiveness, accountability and transparency of any development program. Through the process of consultation and participation, people can participate in project activities, raise their voice and give their opinion in project design, planning and implementation.

248. A tentative list of stakeholders for the economic zone is as follows:

- Key Government Agencies: Bangladesh Economic Zones Authority (BEZA), Bangladesh Export Processing Zones Authority (BEPZA), DPHE, DoF, BWDB, BIWTA, RHD, LGED;
- Regulatory Bodies: Department of Environment (DoE);
- Utility service providers: Karnaphuli Gas Distribution Company Limited;
- Local Government Agencies: Mirsharai Upazila Parishad;
- Local community, local elites, local government representatives, schoolteacher, students, women;
- Scientific Agencies (Government): Bangladesh Meteorological Department (BMD);
- Labor forces (farmer, fishermen, business group, entrepreneurs, day labor);
- Non-government organization.

5.2 METHODOLOGY

249. A combination of mixed methods of information disclosure and consultation process was adopted at this stage of EIA preparation. The method selected for consultation was basically designed to keep in mind the profile of the stakeholders, type of information desired and level of engagement required. In each consultation session the consultant introduced themselves, introduced the project and the purpose of engagement with the respective stakeholders. The primary methods followed in the consultation process are:

- Key Informant Interview (KII);
- Focus group discussion (FGD);
- Stakeholder Consultation Meeting (SCM).

5.3 STAKEHOLDER CLASSIFICATION

250. During the preparation of the EIA study, all stakeholders are initially synthesized into two categories which are identified as:

- **Project-affected parties**: those who will be or are likely to be affected by the development of NSEZ are fully occupied by BEZA, but some squatters and people from the outside are grazing their cattle and fishing at Sandwip Channel.
- **Other interested parties**: those who may be interested in the project and who may positively or negatively influence the views of the affected parties or affect the sustainability of the implementation process or project outcomes.

251. Project stakeholders such as local people, landowners, house owners, civil society organizations, locally active NGOs, government officials, farmers, transport owners, women and vulnerable groups, fishermen etc. will be affected directly or indirectly during project construction due to labor flow and project construction activities. The consultation process included conduction KII, FGD and PCM. Details are given in Annex-3

5.4 LIST OF IDENTIFIED STAKEHOLDERS

Table 5-1:List of general identified stakeholders associated with NSEZ

Other interested parties	Interest in the project
International Level	

Other interested parties	Interest in the project
Environmental and societal NGOs (including those working on Labor, Human rights, environment and Gender and GBV matters)	Understanding of the range of problems and opportunitiesassociated with the project(s).
Foreign Investors	The NSEZ has all the potentials to attract FDI as the most attractive destination for investment in Bangladesh.
Multinational or foreign companies	Interested in operating or partnering with companies in the area.
Donor agency	This zone is environmentally and socially sustainable and thelesson and learned may share for international community
Academics and researchers	They may involve with various research work at the project site to provide scientific knowledge of the impacts of the project.
National Level	
Bangladesh Garment Manufacturers and Exporters Association	They have shown interest to establish one garments park atNSEZ complying with required potential environmental and social issues including setting up ETPs
Bangladesh Export Processing Zones Authority	They will establish BEPZA Economic Zone in this city and complying with required potential environmental and social issues including setting up ETPs
59 foreign and local investors	They will establish their industries and complying with required potential environmental and social issues including setting up ETPs
Chattogram Port Authority	Plan to construct a sea port under PPP within NSEZ complying with potential environmental and social issues
Business and workers' organizations	Interest in procurement and supply chain, potential environmentaland social as well as community health and safety, including occupational health and safety of the Labor force
Academic institutions (e.g. universities, think tanks, schools)	There would be a large influx of migrant workers/Managers/staffs with family in the project area. Students from this group would
	Need schooling and healthcare facilities in situ. This demands the establishment of educational institutions within and near the project area. In addition, academic institutions and think thanks would be interested in the project due to its large development impacts (economic growth, social impacts, etc.)
Training service providers	They would be providing the training and skill development programs for workers
Urban Development Department	They are working for preparing a comprehensive Master Plan for influence area of NSEZ and would need help from the local government to implement the plan
Roads and Highways Department	The approach road will play vital role to ensure efficienttransportation links with NSEZ, they may help BEZA and local community through ensuring its proper maintenance
Environmental and societal NGOs	Understanding of the range or problems associated with theproject(s)
Other NGOs (HR, Gender, Labor Issues)	Represents the interests of different interested parties and vulnerable groups
Mass media	They are intermediaries for informing the general public about the planned activities of the project developer(s) and for information disclosure in connection with the proposed project(s)
Business community	Economically interested business entities (conclusion of contracts, economic damage due to competition, etc.); they can be also be potential customers of the project developer

Other interested parties	Interest in the project
Project employees and Project's sub-contractors	Technical understanding of the range or problems associated with the proposed project(s) including Health and Safety issues
Regional and District Level	
Administration of Chattogram Region	Legislative and executive authorities. Functions of supervision and monitoring
Administrations of Chattogram and Feni districts (for WB financed projects)	Legislative and executive authorities. Functions of supervision and monitoring
Local NGOs (HR, Gender, Labor Issues)	Represents interests of different interested parties and vulnerable groups
Mass media	They are intermediaries for informing the general public about the planned activities of the project developer and for information disclosure in connection with the proposed project.
Business community	Economically interested business entities (conclusion of contracts, economic damage due to competition, etc.);
Local communities	Interested parties living in regions of NSEZ that could be indirectly affected by the realization of the projects
Local small business man	Small scale businessmen in the project vicinity would benefit from the project related workers/staff and managers and the raised purchasing power of the local populace getting jobs in the project through selling daily necessities
Mirsharai, Sitakunda and Sonagazi Upazila Administration	The influence area of this city will be busier. The administration of these Upazilas may help to BEZA to control the unplanned development
Union Level	
UP Chairman	Elected Union Porisad Chairman would be interested to have influence over resettlement, compensation and providing jobs to
Ward Members	Represent interests of the affected communities (land users) and vulnerable groups
Local land users and other local population	Potential vulnerable groups, affected communities and other interested parties living in the close proximity of the project area

5.5 CONSULTATION SESSIONS

5.5.1 Key Informant Interviews (KIIs)

252. Total 13 KIIs with the BEZA and NSEZ staffs, KGDCL, Upazila Parishad, Chairman, local elites, worker, labor, fishermen, religious leader, social institutions committee head /representatives of Mosque, Madrasah, School, College, and civil society etc. along the project area were conducted. KIIs have been done for secondary stakeholders such as public administrator, local government representatives (Municipal Mayor, Councilor and UP Chairmen, Members), Local chairman, and influential personalities and other people who have stakes in the project. Two over phone call KII were conducted with Mr. Enamul Haque PD of BEPZA and Mr. Tariqul Islam Sub-Assistant Engineer (SAE). Regarding the land development, and land filling activities at IMD Zones KIIs were conducted with DoF, DoE, BWDB and BIWTA officials.

Table 5-2: List of KIIs session

Name	Name	Designation	Location	Date
1	Md. Rashadul Islam	Imam	Ichakhali Central Mosque Ichakhali Union Mirsharai, Chattogram	9.12.2023
2	Abdur Rab	School Teacher	Char Sarat Model High School, Mirsharai, Chattogram	9.12.2023
3	Protap Chandra Roy	Upazila Agriculture Officer	Mirsharai, Chattogram	11.12.2023

4	Md. Motasim Bella (Hafiz)	Farm Manager	Fish Seed Multiplication Farm Mirsharai, Chattogram	11.12.2023
5	Md. Yunus Mia	UP Member,	Ward No-9, Maghadia Union, Mirsharai, Chattogram	11.12.2023
6	Md. Ferdous Wahid	Assistant Engineer (Civil) & Focal Person	National Special Economic Zone (NSEZ) Mirsharai, Chattogram	12.12.2023
7	Md. Shahadat Hossain	Manager	CODEC Abu Turab Branch Abu Turab Bazar, Moghadia Union Mirsharai, Chattogram	12.12.2023
8	Alomgir Hossen	Labor	Nippon Point	04.03.2024
9	.Zohirul Islam	Labor	Nippon Point	04.03.2024
10	Md. Ibrahim Miah	Executive Engineer	NSEZ Development Project, BEZA	02.04.2024
11	.Md. Nazrul Islam	Deputy Project Director	NSEZ Development Project, BEZA	02.04.2024
12	Md. Shahadat Hossain	Jr. Urban Planner (Consultant)	Bangladesh Economic Zones Authority (BEZA)	03.04.2024
13	.Md. Fuad	Deputy Manager	Dhaka Laision Office Karnaphuli Gas Distribution Company Limited (KGDCL)	03.04.2024

5.5.2 Focus Group Discussions (FGDs):

253. Fifteen Focus Group Discussions (FGDs) were carried out to disseminate and disclose the information of the project activities of NSEZ Development Project and to know their opinions about the proposed project.

254. During December 2023 to February 2024, focused group discussions were conducted people with particular emphasize on different groups such as disadvantage/vulnerable people including Daily Laborers group, Farmers group, Fishermen group, Businessmen group women were held at separate locations as shown in Table 5-3

Table 5-3: List of FGDs sessions

Name of Group	Location	Date
Local Community	Shop of Mosharaf Member, Charsarat, Mirsharai	9.12.2023
Local Community	Member's office, dabarkhali poient, Charsarat, Mirsharai	9.12.2023
Business Group	Ichakhali Sluiecegate Bazar, Charsarat, Mirsharai	10.12.2023
Local Community	Shop of Saiful Islam, Dabarkhali poient, Mirsharai	10.12.2023
Farmer Group	Shop of Bellal Hosen, sariatpara, Moghadia, Mirsharai	11,12.2023
Women Group	House of Mafij Saudagor, Bodiullahpara, Mirsharai	11.12.2023
Fishermen Group	House of Shishuram Das, Sarkerpara, Abuturab Bazar, Mirsharai	12.12.2023
Women Group	Besides Eunus Member's house, Sariatpara, Mirsharai	13.01.2024
Students (School Boys) Group	Badiullahpara Primary school Field, Mirsharai	13.01.2024
Labor Group	House of Soleman near about Noyapara Jame Mosque, Mirsharai	23.01.2024
Local Community	House of Shukur Ali near about CP poient, Mirsharai	24.01.2024
Fishermen Group	Misir Ahmed's house near Ahmed Member's house, Badiullahpara, mirsharai	25.01.2024
Students (Schhol Girls) Group	Charsarat Model High School, Mirsharai	25.01.2024
Women Group	Ekramul Haque, Charsarat housing, Mirsharai	14.02.2024
Local Community	House of Tarek, Charsarat, Mirsharai	14.02.2024

5.5.3 Stakeholder Consultation Meeting (SCM):

255. A total of two public consultation meetings were held in the project areas, one was on January 16, 2024, and another was on February 12, 2024, respectively. The details are given below:

Date	Venue	Total participants
January 16, 2024	Moghadiya Union Parishad Hall room	53 out of the total 47 was male and 6
February 12, 2024	Charsarat Model High School	Total: 28; Male: 25 and Female: 3

5.6 SUGGESTIONS FROM CONSULTATION SESSIONS

5.6.1 Summary Of Discussions of KIIs Sessions:

256. Development of NSEZ project area will bring positive impact on society, for example: increase employment opportunities, development of communication system, development of business over all the quality of life will be improved. However, there are some risks for the communities such as the development of Gas Pipeline from Barotakia to Economic Zone, like Gas Pipeline Leakage. The other issues raised by the participants are as follows:

- Local forest drains and irrigation channels may be destroyed. Besides, many cows and buffaloes used to graze in the economic zone which will not be possible anymore;
- After the installation of gas lines, many factories will go into production, because of which there will be a lot of development in this area and the country;
- Must monitor the activities to mitigate the social impact;
- No social forest/drainage system/irrigation channels should be disturbed while installing the gas pipeline;
- There may be conflict between the local community and the laborers coming from outside;
- Crime (theft, robbery, rape) may increase. Addiction and different kinds of diseases can spread;
- Providing compensation if any family is affected. Employment of local people should be arranged on a priority basis;
- The health & safety of all those working on the project must be ensured;
- Gas wastage should be prevented;
- Training and employment of local people should be arranged on a priority basis;
- Due to the economic zone, especially the residents of Moghadiya Union and Ichakhali union are affected from all sides;
- The dredging activities will be at the part of Precinct F (IMD Zone and Housing Facilities) and Precinct B of NSEZ will be installed within the Economic Zone so there is no problem for the local people. However, due to the dredging activity some of the forest, drains and irrigation channels may be affected. Besides, many cows and buffaloes used to graze in the economic zone which will not be possible anymore;
- BEPZA has blocked the Daborkhali khal for their project infrastructure development. Daborkhali Khal is Government recorded Khal and open for all walks of people for different purposes like fishing, crab collection and also aquatic resources collection by community people those are living surrounding area;
- There are still some households living inside the land development within the part of Precinct F (IMD Zone and Housing Facilities) and Precinct B of NSEZ areas they need to be relocated before the dredging activities start;
- The subproject will be specially developed for green and sustainable industries;
- Usually, BIWTA is not authorized to give permission but if the relevant body wants any opinion and sends the dredging related information to BIWTA on that case BIWTA will give their opinion. NOC may be required before starting the dredging;
- Landfilling through sea water salinity intrusion may happen to the ground water through leaching. During construction of the structure, it should be taken into consideration that landfilling sand can contain salt;
- Mr. Shahadat Hossain said there are three sources of water used in the project. Namely: (1) Ground Water (Temporary/construction phase), (2) Water Treatment Plant (WTP)-100 MLD/work in progress (3) Meghna water river etc.

5.6.2 Summary Of Discussions of FGD Sessions:

257. Some issue-specific opinions and recommendations received from the FGD sessions are briefly presented below.

- The community will be greatly benefited due to the economic zone. Because they will get some benefits such as: employment opportunities will increase, business areas will increase, communication system will be better, etc.;
- Communication and development will be improved because of the economic zone. Simultaneously, employment will increase, business will expand, and women will be empowered;
- They have no objection for the dredging from Sandip Channel to the subproject. Because there is no agricultural land, fish culture and roads between the Economic Zone and Sandwip Channel;
- The issue of filling up the canal by BEPZA is going to pose threats to the local farms as the water will have no way to flow and may drown the land;
- The community people were also looking for employment in the BEZA project work, to earn their livelihood during construction phase;
- The safety and security of a female labor is to be ensured at the construction yard during construction phase;

- When people are asked about gender-based violence, they reply that there are very few incidents of violence. It is to be noted that the main reason for such type of violence is non-harmonic relationships with in-laws, dowry, drug addiction, illicit relationships, even teasing etc. Usually, attempts are made to resolve the problem at the family level and if it is beyond their control, they go to law enforcement agencies for justice. However, they requested to take strong initiative to stop the violence against women. It was informed to them that a Grievance Redress Mechanism (GRM) has been developed in the RAP of the project to prevent such incidents and good governance;
- They ask to engage the poor and vulnerable people in the construction work;
- Livelihood restoration issues for the poor and proper have been discussed;
- Skill development training for the poor, rehabilitation, loan facility on easy terms etc.;
- Lot of job opportunity will create here and many people from outside will come to this area to work in the subproject area, so our business will be better;
- Increase employment, development of communication system, development of business over all the quality of life will be improved;
- Many people will come from outside to work at the subproject area, and we may have conflict with them and people who come from outside can spear various types of crime, such as theft, robbery, intoxication etc.;
- Employment of local people should be arranged on a priority basis;
- There will be some positive impact on society, like increasing employment, development of communication system development of business. Overall, the quality of life will be improved at the project site during operation period.

5.6.3 Summary of discussions of Public Consultation Meetings:

258. Discussion at an open forum were arranged where the stakeholders expressed their opinion and views. A few matters and issues related to GBV, and gender equity were discussed with the participants. The participants expressed their views, opinion and perspectives based on their experiences of the said matter gained from inter household and inter households' interactions as well.

Table 5-4: Summary of the Public Consultations at Maghadiya Union Parishad

Public Level Consultation			
Date-16/1/2024		**Demand and Suggestions**	**Response of Authorities/ Consultants**
Maghadiya Union Parishad Hall room	Total: 52 Male: 47 Female: 6 (Annexure 13)	The participants raised their concerns about environmental and social issues such as pollution from construction activities, loss of livelihood, houses, and various diseases etc. Vulnerable PAPs should be considered, such as safety of female workers, new skill trainings for the vulnerable groups etc. Participants raised points on environmental and social risks and impacts on the disadvantaged and marginalized vulnerable groups and Labor Health and Safety (LHS). Steps to be taken by the Client to mitigate environmental degradation such as -to control dust generation during pipeline excavation works -to save the terrestrial flora and fauna and to uphold biodiversity in the locality as much as possible -ensure health safety at the sites -control gender-based violence (GBV) and sexual exploitation abuse and harassment at site and nearby locality -to control drainage of storm water/ rainwater through proper drainage facility provision during construction works	-BEZA will give priority to environmental and social issues -Special support for the disadvantaged/marginalized groups on the site -. The project and its management will incorporate the above-mentioned mitigation measures in the project design and implementation as follows: -Occupational Health and Safety Management Plan and -Labor Management Plan will be prepared for the mitigation of these issues. -Occupational health and safety (OHS) measure will be ensured by providing PPE, first aid box, to the workers

Table 5-5: Summary of Public Consultation Meeting at Charsarat Model High School

Date-12/02/24		Demand and Suggestions	Responses /incorporated in the ESMP
Charsarat Model High School	Total: 28 Male: 25 Female: 3	The participants raised their concerns about environmental and social issues such as pollution from the construction activities.	Proper mitigation measures will be considered during dredging activities. Mitigation measures for controlling the dust generation, noise pollution and surface water pollution from the dredging activities are incorporated in the ESMP.
		The land filing of the canal Daborkhali - has become a major concern for the locals as due to the lack of canal the water may drown the local farmlands. Drainage congestion will occur at the site	The consultant has shared with the Client, this particular issue of landfill of the Daborkhali canal being done by the BEPZA and assured that this concern will be shared with appropriate authority. Consultation with BEPZA, it came to know that this filled up canal will be excavated soon.
		Participants raised points on Labor Health and Safety (LHS), community health and safety.	Occupational Health and Safety Management Plan and Labour Management Plan will be implemented for the mitigation of these issues.
		Other issues include –local level involvement and employment opportunities and their safety issues.	Local labor would be a priority during dredging activities

5.7 FUTURE STAKEHOLDER CONSULTATION PLAN (SEP)

Table 5-6: Stakeholder Consultation Plan (SEP)

Sl. No.	Types of consultation	Participant types	Duration/ Time schedule	Remarks
1	FGDs (Focus Group Discussions)	Local people, workers, and contractor's staff	Quarterly	Meeting minutes should be recorded.
2	KIIs (Key Informant Interviews)	PIU of NSEZ, BEZA officials, local DOE officials, local Fire Service and Civil Defence officials, local forest department officials, local UP members/Chairman and other relevant personnel as required.	Half yearly	Meeting minutes should be recorded.
3	Public Consultation Meetings	PIU of NSEZ, BEZA, contractor's people, local community, local UP members/ chairman, Local administration, local NGOs, Local DOE, Forest Department and Fire Service and Civil Defence officials and others as required.	Yearly	Meeting minutes should be recorded.
4	Face to Face interviews (F2F)	PIU of NSEZ, BEZA, contractor's people, local UP members/ chairman, Local administration etc.	Yearly	Meeting minutes should be recorded.

Note: This is a tentative SEP which can be altered based on ground conditions and project needs as well as following WB's approved SAP for the BEZA[28].

[28] BEZA (February 2020) Stakeholder Engagement Plan (SMP) of Bangladesh Economic Zones, Authority (BEZA), Prime Minister's Office, Government of the People's Republic of Bangladesh

259. Other details are given in Vol-II Annex 15.

6 IMPORTANT ENVIRONMENTAL AND SOCIAL COMPONENTS

260. Analysis of the environmental and social impacts is carried out based on collected primary data and secondary data on physical environment and ecological environment, as well as social issues at project study area. The important environmental and social valued components (IESCS) are screened for this study purpose. The IESCs means specific environmental, ecological, economic, and social attributes that may be potentially impacted by the proposed project activities and that were assessed during the environmental and social assessment. For assessment of important environmental and social components for the project activities followed by a matrix which was developed based on primary and secondary information of the project areas, the matrix is given below Table 6.1.

261. The subprojects are as follows:

Sub-project-1: Construction of arterial and non-arterial roads, footpath and plot entry culvert.

Sub-project-2: Construction of integrated storm water management network

Sub-project-3: Water supply network

Sub-project-4: Construction of Internal Power Distribution Network

Sub-project-5: Construction of a 30 KM Gas Pipeline Network within NSEZ areas

Sub-project-6: Site upgradation-- Land Development of Part of Precinct F (IMD Zone and Housing Facilities) and Precinct B of NSEZ

Sub-project-7: Construction of Treatment, Storage and Disposal Facilities for hazardous waste management of ship recycling industries at Zone 24 of NSEZ areas.

262. The major construction activities for each subproject area will be undertaken as follows:

Table 6-1: List of Major construction activities for each subproject area

Construction Activities	Description
Clearing	The relocation of public utilities within the site of works and for their protection. Clearing should be confined to the areas enclosed by the right of ways limits. Grubbing shall be confined to the areas covered by the works.
Excavation	It includes excavation of side ditches where required, the removal, hauling, and proper utilization or disposal of all excavated materials and shaping of excavation and preparation of exposed surfaces of excavation on the entire length of the roadways.
Trenching/ Borrow pit	Consists of the clearing and stripping of the borrow pits, the excavation and hauling of materials for construction of embankment, backfill, subgrade and shoulders etc.
Backfilling	Backfilling of completed structures shall be conducted with suitable materials and disposal of excavated materials as required.
Concrete works	Necessary concrete work includes preparation of subgrades, construction of earthen shoulders, hard shoulders, subgrade drains, road surface, bituminous surface roads, sub-base, aggregate base, sprinkling, rolling and compaction etc.
Materials management	Coarse minerals aggregates, fine minerals aggregates, bituminous materials, brick pavement, cement, water, admixtures, unsuitable earthen materials disposal etc.
Slope establishment etc.	Necessary slope protection to protect erosion, collapse etc.

263. The assessment matrix for identifying the IESCS in the project area is presented in Table 6-2.

Table 6-2: Assessment matrix for identifying the IESCs in the project areas

Project Activities		Important Physical Environmental Components													Important Social Environmental Component										
		Air Quality	Land Use change	Bad odor/foul odor	Noise Pollution	Surface water Quality	Groundwater Quality	Soil contamination	Waste	Soil Erosion	Slope Stability	Vegetation clearance	Loss of Habitat and Species	Impact on Protected area	Disturbance of agricultural	Disruptions of nearby residents	Impacts on business and	Social Conflict	Social and cultural heritages	Disturbance on local traffic	Community health and safety risks	Occupational Health and Safety	Child Labor	Gender based Violence
Pre-Construction Phase																									
1	Site Clearance																								
2	Heavy vehicle movement																								
3	Labor Influx																								
4	Labor camp establishment																								
5	Stockyard establishment																								
6	Site-office																								
7	Installation of drinking water wells and sanitary toilets																								
Construction Phase																									
8	Storm water drainage development																								
9	Construction of water supply networks																								
10	Site Upgradation-Landfilling at IMD zones and adjacent area																								
11	Gas pipeline network establishment																								
13	Telecommunication network development																								
14	Construction of Internal Road Networks																								
15	TSDF for hazardous waste management of ship recycling																								

Project Activities		Important Physical Environmental Components												Important Social Environmental Component									
		Air Quality	Land Use change	Bad odor/foul odor	Noise Pollution	Surface water Quality	Groundwater Quality	Soil contamination	Waste	Soil Erosion	Slope Stability	Vegetation clearance	Loss of Habitat and Species	Impact on Protected area	Disturbance of agricultural	Disruptions of nearby residents	Impacts on business and	Social Conflict	Social and cultural heritages	Disturbance on local traffic	Community health and safety risks	Occupational Health and Safety	Child Labor	Gender based Violence
Operation and Maintenance Phase																								
1	Road network maintenance works																							
2	Water supply network maintenance works																							
3	Gas pipeline network maintenance works																							
4	Storm water drainage maintenance																							
5	Site Upgradation labelling and industrial set up																							
6	Power network maintenance																							
7	TSDF for hazardous waste management																							

Note:

LEGEND	Magnitude of Impact
	Low magnitude
	High magnitude

6.1 PHYSICAL ENVIRONMENT

264. The important physical environment components that could be potentially impacted due to the project activities is given below in Table 6-3.

Table 6-3: Important Physical Environmental Component of the project

Sl. No.	Project Activities	Parameters	Rationale
1	▪ Construction of arterial and non-arterial roads, footpath and plot entry culvert. ▪ Construction of integrated storm water management network ▪ Construction of Water supply network ▪ Construction of Internal Power Distribution Network ▪ Construction of a 30 KM Gas Pipeline Network within NSEZ areas ▪ Land Development of Part of Precinct F (IMD Zone and Housing Facilities) and Precinct B of NSEZ ▪ Construction of Treatment, Storage and Disposal Facilities for hazardous waste management of ship recycling industries at Zone 24 of NSEZ areas	Air Quality	Establishment of baseline air quality. Release of air pollutants from various emission sources during construction/operation activities, use of equipment and movement of vehicles may occur such as dust and PM10 from construction/operation activities and road traffic.
2		Noise Quality	Establishment baseline noise level because increase in ambient noise levels from construction/operation activities, equipment, and vehicles, pipeline and other construction activities etc. may be occurred during the construction period.
3		Surface Water Quality	Surface water quality may be deteriorated due to wastewater from the labour camp, construction yard discharges into canals and ponds in the study area.
4		Groundwater Quality	Groundwater quality may be deteriorated due to wastewater from the labour camp, construction yard discharges into the ground.
5		Soil contamination	Soil contamination will occur due to construction activities particularly for release of oil, lubricants, grease and other chemicals from using of heavy equipment and vehicles in the construction sites.
6		Waste generation	Different kinds of solid and liquid waste shall be occurred due to the project development activities, mainly, construction waste, kitchen waste and liquid waste from the construction yards and labour camps etc.
7		Soil Erosion	Soil erosion will occur during construction of project activities if proper protection such shoring will not use in the project site.
8		Slope stability	Slope failures may occur during the movement of heavy vehicle, equipment, labour and other construction activities if proper slope protection will not maintain during construction period.
9		Land Use and Land Cover Changes	Change of Land use will occur due to proposed construction and its supporting infrastructure facilities in the project areas

6.2 BIOLOGICAL ENVIRONMENT

265. The biological environment such as vegetation clearance, terrestrial and aquatic flora and fauna and protected areas and ecological disruptions etc., anticipated to be affected due to different kinds of project activities such as construction of arterial and non-arterial roads, footpath and plot entry culvert. integrated storm water management network, water supply network, internal power distribution network development, construction of a 30 KM Gas Pipeline Network within NSEZ areas, Land Development of Part of Precinct F (IMD Zone and Housing Facilities) and Precinct B of NSEZ and construction of Treatment, Storage and Disposal Facilities (TSDF) for hazardous waste management of ship recycling industries at Zone 24 of NSEZ areas. The details are given in Table 6-4.

Table 6-4: Important Biological Environmental Components of the project area

Sl. No.	Parameters	Rationale
1	Vegetation clearance	Due to establishment of water supply, road networks, gas pipeline network, power and telecommunication networks, storm water drainage etc.,

Sl. No.	Parameters	Rationale
		vegetation clearance may occur though most of the sites are free from vegetation however vegetation of surrounding areas may be required to clear that will affect the local species.
2	Terrestrial Flora and Fauna	Due to clearance of vegetation on the site, local terrestrial faunal species and floral species will be affected and may promote to leave the habitat areas for terrestrial faunal species for safe exist.
3	Aquatic flora and faunal species	Due to construction of gas pipeline network in the project areas, will cross some perennial canals that will affect the aquatic flora and faunal species in the project areas.
4	Protected and Ecological Critical Areas	No protected and ecological sensitive areas will be affected by the proposed project activities. Because the project is more than 10 km away of the protected or ecological sensitive areas.

6.3 SOCIAL ENVIRONMENT

266. Due to the proposed project activities, the social environment is anticipated to be affected by disturbance to agricultural land resources, local people access to the construction sites, occupational health and safety, local economy and livelihoods patterns, community safety issues, occurring of child labor, labor influx and gender-based violence etc. The details are given in Table 6-5.

Table 6-5: Important Social Components of the project area

Sl. No.	Parameters	Rationale
1	Disturbance of agricultural land and produce	Existing lands may be affected due to construction works that will limit the local people for agricultural activities.
2	Disruption of local access due to construction materials transportation (pipelines)	Congestion of local roads sometime creates problems for smooth movement of vehicles and pedestrians during development of the project activities in the project areas.
3	Occupational Health Safety	Accident of the Workers and project personnel may occur, as well as to local community. Health and safety are also concern during construction activities. OHS and CHS need to ensure to zero harm during implementation of the project activities
4	Local Economy, Livelihood, Fishing, Buffalow Grazing etc.	Disturbances and limited access to the local people into the project areas including Zones 2A and 2B may create Livelihood disruption who are based on Fishing, Buffalow Grazing etc. in Zone 2A and 2B.
5	Community Health Safety	Movement of heavy vehicles for carrying the construction material may create problem for smooth movement of vehicles and pedestrian in the project areas.
7	Gender Based Violence (GBV)	Gender Based Violence (GBV) will occur in the project areas during construction period if women workers will not receive the equal pay, unequally treated for their physical appearance.
8	Child labor	Child labour may occur in the project areas during construction period due to low payment and force to work for long time.
8	Labor influx	Labor Influx will create negative impacts due to employment of workers/ workforce from different places. Conflict may occur between local workers and far-off workers and the local community. Unhygienic conditions resulting from day-to-day activities of workers during construction stage may spread various diseases and other adverse impacts,

7 IMPACT PREDICTION AND EVALUATION

7.1 IMPACTS AND RISK ANALYSIS:

267. This chapter assessed potential impacts and risks on environmental and social issues, and mitigated them in a sustainable way to avoid, eliminate, or lessen the negative impacts that will occur during the pre-construction, construction, and operation phases. The effects were evaluated based on project activities and existing baseline circumstances, including the natural environment, both physical and biological habitats, as well as the socioeconomic aspects of the project sites. A rapid site-specific environmental assessment was carried out to identify the potential environmental and social impacts specifically identified valued components affected by the project activities. However, the impact matrix has been developed based on the project activities corresponding to anticipated risks and suggested mitigation measures. No scientific equation was applied to scoring the risks, just based on expert judgment (Table 7-1).

7.1.1 Risk Analysis:

268. It is important to consider the likelihood that a change/activity will occur as predicted and also the degree of confidence in the assessment of the impact on environmental components including ecological structure and function. The scale ranges from certain, probable and unlikely to occur, since 5% confidence level is conventionally chosen as the lowest limit for acceptable level of significance. A four-point scale that was used to calculate the significance of impact of the project activities as follows:

- Certain/ near certain: Higher degree of Impact- probability estimated above 56% chance or higher.
- Probable: Substantial Impact-Probability estimated above 30% but below 56% chance
- Likely: Moderate Impact-Probability estimated above 5% but less than 30%
- Extremely unlikely: Lower Impact- Probability estimated at less than 5%

269. This assessment of effects and identification of residual impacts takes account of any incorporated mitigation measures adopted due to any potential impact of proposed project activities will be largely dependent on the extent and duration of change, the number of people or size of resources affected, and their sensitivity to change. Potential impacts can be both negative and positive (beneficial), and the above-mentioned methodology will be applied to define both beneficial and adverse potential impacts.

270. Criteria for determining significance are generally specific for each environmental and social aspect, but generally, the magnitude of each potential impact is defined along with the sensitivity of the receptor. Generic criteria for defining the magnitude and sensitivity used for the project are summarized below.

7.1.2 Impact Magnitude

271. The assessment of magnitude shall be undertaken in two steps: Firstly, the key issues associated with the project are categorized as beneficial or adverse. Secondly, potential impacts shall be categorized as certain, probable, unlikely and extremely unlikely based on consideration of the parameters such as:

- Duration of the potential impact.
- Spatial extent of the potential impact.
- Reversibility.
- Likelihood

Table 7-1: Parameters for Determining the Magnitude of Impacts

Parameter	Extremely Unlikely	Likely	Probable	Certain
Duration	Temporary with no detectable potential impact (0-<1 year)	Within the project lifespan (>1-3 years)	Medium Term Lifespan of the Program (>3 to 5 years)	Long-term (>5 to 10 years)
Reversibility	The potential harm is likely to be minor	The damage can be repaired, the original state can	It considers various types of risks, from environmental	The potential impact is effectively permanent, requiring

Parameter	Extremely Unlikely	Likely	Probable	Certain
	and easily rectified within a year	be restored, or the negative impacts can be significantly reduced by 3 years.	damage to societal disruption, and analyzes the extent to which the consequences of these risks can be mitigated within a period of >3 to 5 years).	considerable intervention to return to baseline conditions which seem to be irreversible.
Spread/Spatial Extend (Considering AOI of 5 km areas)	The impact is not expected to occur, but if it occurs it can be restored within the project areas (0 to 1 km).	The impact is expected to occur within the project areas (>1 to 3 km).	The impact is expected to occur in the project boundary (>3 to 5 km).	Widespread. The impact causes severe and irreversible damage or disruption for more than 5 km areas.
Likelihood	0-1=Unlikely to occur	1(+)-5= Occasional	5(+)-7=Possible (Negative/Positive)	7(+)-10=Certain
Intensity	1-4= Low	4(+)-6= Moderate	6(+)-8= Substantial	8(+)-10= High
Significance of Impact (Likelihood ×Intensity= Significance)	0-4= Low	4(+) - 30= Moderate	30(+)-56= Substantial	56(+)-100= High

Project Activities	Impacts	Duration	Reversible/ Irreversible	Spread	Likelihood of Occurrence (0-10)	Intensity of Impact (0-10)	Significance Value (1-100)	Significance
Pre-Construction Phase and Construction Phase								
(Excavation, trenching, electrical works, backfilling, dredging and dredge materials management, site rehabilitation etc.)	Air Quality	Short term	Reversible	Substantial	5	-7	-35	Substantial
	Noise Level	Short term	Reversible	Substantial	5	-7	-35	Substantial
	Surface Water Quality	Short term	Reversible	Substantial	6	-8	-48	Substantial
	Ground Water Quality	Short term	Reversible	Substantial	6	-7	-42	Substantial
	Terrestrial Ecology	Short term	Reversible	Moderate	5	-7	-35	Substantial
	Aquatic Ecology	Short term	Reversible	Substantial	5	-9	-45	Substantial
	Community Health and Safety	Short term	Reversible	Moderate	5	-6	-30	Moderate
	Social Conflict	Short term	Reversible	Moderate	3	-6	-18	Moderate
	Occupational Health and Safety	Short term	Reversible	Substantial	5	-7	-35	Substantial
	Climate Change Vulnerability	Short term	Reversible	Substantial	5	-7	-35	Substantial
	Labor Influx and Working Conditions	Short term	Reversible	Substantial	6	-8	-48	Substantial
	Soil Erosion and Impact on Soil Quality	Short term	Reversible	Substantial	7	-8	-48	Substantial
	Change of land use and land cover	Long term	Reversible	Moderate	8	-10	-80	High
	GBV/ SEA/SH	Short term	Reversible	Low	5	-6	-30	Moderate
	Child labor/Force labor	Long term	Reversible	Moderate	4	-6	-24	Moderate
	Total weight (sum of significance/total component) = --588/15						-39.2	Moderate Category
Operation Phase								
Operation & Maintenance of the	Air Quality	Long term	Reversible	Substantial	7	-8	-56	Hogh
	Noise Level	Long term	Reversible	Moderate	6	-7	-35	Substantial

Project Activities	Impacts	Duration	Reversible/ Irreversible	Spread	Likelihood of Occurrence (0-10)	Intensity of Impact (0-10)	Significance Value (1-100)	Significance
constructed structures and re-excavated canals	Soil Erosion and Impact on Soil Quality	Long term	Reversible	Moderate	5	-8	-40	Substantial
	Water Quality	Long term	Reversible	High	7	-9	-63	High
	Aquatic Ecology	Long term	Reversible	Moderate	6	-8	-48	Substantial
	Community Health and safety	Long term	Reversible	Moderate	5	-7	-35	Substantial
	Occupational Health and Safety	Long term	Reversible	Moderate	6	-9	-54	Hogh
Total weight (sum of significance/total component) = -331/7							-47.258	Substantial
Overall Rating (Pre & Construction Phase+ Operation Phase) = (-39/20) + (-47.258) =--86.4857/2							-43.2429	Substantial

7.2 PHYSICAL ENVIRONMENT

272. The various ways in which project activities can influence the physical environment, particularly focusing on air, noise, water, and soil during both the construction and operational phases. It provides an assessment of the impacts associated with different subprojects, highlighting the nature and scale of these effects. Understanding these influences is crucial for effective environmental management and mitigation strategies. The subprojects are as follows:

- **Sub-project-1:** Construction of arterial and non-arterial roads, footpath and plot entry culvert.
- **Sub-project-2:** Construction of integrated storm water management network
- **Sub-project-3:** Water supply network
- **Sub-project-4**: Construction of Internal Power Distribution Network
- Sub-project-5: Construction of a 30 KM Gas Pipeline Network within NSEZ areas
- **Sub-project-6:** Site upgradation-- Land Development of Part of Precinct F (IMD Zone and Housing Facilities) and Precinct B of NSEZ
- **Sub-project-7:** Construction of Treatment, Storage and Disposal Facilities for hazardous waste management of ship recycling industries at Zone 24 of NSEZ areas.

273. The importance of addressing site-specific environmental issues and impacts during the preparation of an Environmental Impact Assessment (EIA). While common impacts have been discussed in broader terms, it is crucial to delve into the unique environmental challenges that may arise in particular locations. This approach ensures a comprehensive understanding of the potential effects of a project on the local environment.

7.2.1 Environmental Quality

274. The environmental quality mainly air quality, local noise level, soil quality, surface and groundwater quality, water logging and drainage congestion, disruptions of local canal flows, local land resources of land use pattern and local biodiversity such as ecological resources, fisheries and agriculture etc. will be affected by the proposed project activities mainly during the construction period the anticipated impacts will be significantly occurs. The details are given below:

Table 7-2: Potential Impacts on Environmental Quality Parameters

Environmental Quality	Pre-Construction Period	Potential Impacts (Construction Phase)	Potential Impacts (Operation Phase)
Air Pollution	• Due to clearance of RoW, Utility shifting can cause dust emission and exhaust gas emissions and deteriorate the local air quality. For more air quality modeling has been done (Annex-7)	• The excavation, grading, and movement of heavy machinery can generate significant dust, leading to particulate matter (PM) emissions that can degrade air quality; • Increased traffic from construction vehicles contributes to higher levels of nitrogen oxides (NOx) and volatile organic compounds (VOCs); • The operation of diesel-powered machinery emits pollutants, including carbon monoxide (CO) and particulate matter.	• The completed road and utility networks will lead to increased vehicular traffic, which can elevate air pollution levels due to ongoing emissions; • Facilities connected to the new networks may emit air pollutants, necessitating effective management strategies.
Noise Pollution	• During RoW clearance and utility shifting, heavy equipment such as bulldozers and excavator will use and produce excessive noise that	• The use of excavators, bulldozers, and other heavy equipment generates significant noise, which can disturb nearby communities and wildlife;	• Once operational, the increased volume of vehicles on the new road networks will lead to sustained noise pollution;

Environmental Quality	Pre-Construction Period	Potential Impacts (Construction Phase)	Potential Impacts (Operation Phase)
	could affect the local noise level in the working areas. • For more noise level modeling has been done (Annex-8)	• Increased truck traffic during construction can contribute to elevated noise levels in surrounding areas.	• Facilities utilizing the new infrastructure may also contribute to noise through machinery and operational activities.
Soil Pollution	• During RoW clearance and utility shifting, soil erosion can occur if proper protection is not undertaken at the site.	• Excavation and grading can lead to soil compaction and loss of topsoil, affecting local ecosystems and agriculture; • Spills of fuel, oil, or chemicals during construction can lead to soil contamination, which may require remediation.	• The development of new infrastructure can alter land use patterns, potentially impacting soil health and local flora and fauna; • The construction of a sanitary landfill site and biogas plant must be managed to prevent soil contamination from leachate.

7.2.2 Water Resources:

275. Local water resources both surface and groundwater sources will possibly be contaminated due to carrying out the proposed development activities. Among them, water logging and disruptions of water flow to local canals will be most anticipated impacts also. The details are given in Table 7-3.

Table 7-3: Potential Impacts on Water Resources

Environmental Quality	Pre-Construction Period	Potential Impacts (Construction Phase)	Potential Impacts (Operation Phase)
Surface water Contamination:	• During RoW clearance, the removal of vegetation and soil can lead to the accumulation of excessive earth materials. If these materials are not managed properly, they can become a significant source of surface water pollution; • In monsoon conditions, heavy rainfall can lead to increased surface runoff. This runoff can carry excess earth materials into nearby water bodies, resulting in sedimentation and contamination.	• Construction activities can lead to soil erosion and runoff that may carry sediments and pollutants into nearby water bodies; • Improper management of wastewater from construction sites can lead to contamination of local water sources.	• The stormwater network must be effectively managed to prevent flooding and ensure that water quality is maintained; • Facilities connected to the water supply network may discharge treated or untreated effluents, impacting local water quality.
Groundwater contamination	• Groundwater sources may not be contaminated due to the clearance of RoW and utility shifting.	• Groundwater can be contaminated by sewage & wastewater from labor camp, dumping moist soil for prolonging period and effluent disposal etc.; • Excavation and land clearing can lead to the mobilization of contaminants present in the soil, which may leach into groundwater; • The use of construction materials, such as solvents,	• Factories may release effluents containing heavy metals, chemicals, and other pollutants that can seep into the groundwater; • Leaks from underground storage tanks holding fuels or chemicals can lead to significant

Environmental Quality	Pre-Construction Period	Potential Impacts (Construction Phase)	Potential Impacts (Operation Phase)
		fuels, and lubricants, increases the risk of spills that can infiltrate groundwater; • Improper disposal of construction waste, including hazardous materials, can lead to leachate formation and groundwater pollution.	groundwater contamination.
Water logging and Drainage**:**	• If the materials after clearing from the site will not dispose of in a safe place it will create water logging in the working areas.	• The initial stages of construction often involve land clearing and excavation, which can disrupt existing drainage patterns and lead to temporary water accumulation; • Heavy machinery used during construction can compact the soil, reducing its permeability and increasing the likelihood of water logging; • Rainfall during construction can exacerbate water logging issues, particularly if the site is not adequately prepared to manage stormwater; • Piles of construction materials can obstruct natural drainage paths, contributing to water accumulation in certain areas.	• Least chance to escalate the water logging issues in the project areas. The land development was considered the highest flood level; • If storm water drainage is clogged or improperly design of drainage network will cause water logging in the adjacent areas of NSEZ areas; • If outfall conditions or local canals such as Bamansundar and Ichakhali canal silted up will cause water logging in the localities of NSEZ areas.
Disruption of Canals (khal) water flow	• If any clearance will occur in the canal sides or khal sides it will contaminate the surface water sources and will affect the aquatic resources also.	• Bamansundar and Ichakhali canal water flow may be disrupted temporarily during construction works.	• If outfall conditions or local canals such as Bamansundar and Ichakhali canal silted up will cause water logging in the localities of NSEZ areas.

7.2.3 Land Resources

Change of Land use, topography and land cover:

276. **Pre-Construction and Construction Period:** The existing landscape may suffer degradation due to improper open-cut trenching techniques employed during construction. This can lead to soil erosion, loss of vegetation, and disruption of local wildlife habitats. The visual impact of construction activities can also alter the aesthetic value of the project area, making it less appealing for residents and visitors alike.

277. **Operation Period:** The anticipated impacts during operation period as follows

- The installation of stormwater drainage systems can change the natural hydrology of the project area, potentially leading to increased runoff and changes in groundwater recharge rates;
- Areas that have undergone heavy machinery use may experience soil compaction, which can increase erosion risks;
- The establishment of gas pipelines and other infrastructure can fragment habitats, making it difficult for wildlife to migrate and thrive;
- Operational activities, particularly those associated with landfill sites, can pose risks of soil and water contamination if not managed properly.

7.3 BIOLOGICAL ENVIRONMENT

278. The proposed project site is situated in an area that has already undergone significant development. The elevation of the site has been strategically designed to exceed the highest flood levels, ensuring that the immediate biological setting remains unaffected. Importantly, no trees will be removed, and no water bodies will be filled as part of the construction activities.

279. The local biological setting will not be altered or affected by the construction of the proposed project because the site is already developed, raised elevation considering the highest flood level. No trees or no water bodies will be filled. However, the impact on local ecosystem is anticipated due to construction of 28 km gas pipeline which will cross local water bodies in different areas of the project and landfilling activities in the IMD zones and its adjacent areas. The IMD zone landfilling activities will be carried by dredging of sediments from the sea sides that will cause potential impacts on marine ecology. The details are given below:

7.3.1 Ecological Resources

280. **Pre-Construction Stage:** During the pre-construction stage, it is anticipated that no trees will be required to clearing from the site however some sorts of shrubs and herbs will be affected temporarily and the impact will be short term and reversible.

281. **Construction Phase:** The construction of the 28 km gas pipeline is expected to cross various local water bodies. This aspect of the project raises concerns regarding potential disturbances to aquatic ecosystems. The following impacts are anticipated:

- The pipeline installation may disrupt the habitats of aquatic species, leading to temporary displacement;
- Construction activities could lead to sedimentation and contamination of water bodies, affecting water quality and aquatic life.
- The landfilling activities planned in the IMD zones and adjacent areas will involve dredging sediments from the seaside. This process is likely to have several implications for marine ecology:
- Dredging can displace sediments that are crucial for the habitat of various marine organisms, potentially leading to a decline in biodiversity;
- The process may increase turbidity in the water, which can hinder photosynthesis in aquatic plants and affect the overall health of the marine ecosystem;
- Dredging may also release trapped pollutants into the water column, posing risks to marine life and water quality.

282. **Operation Phase:** During the operation phase, it is projected that the development of the gas pipeline network and landfilling activities will not have any direct adverse impacts. However, the installation of the gas network and subsequent land development in the IMD Zones is expected to stimulate industrial growth. This growth poses a risk of potential impacts on aquatic ecosystems, primarily due to the unauthorized release of industrial effluents, wastewater, and effluence from kitchen and residential areas.

7.3.2 Fisheries

- **Pre-Construction Phase:** The fish species will be affected only if the clearance of RoW and utilities will occur at the surface water sources like canals or khals in the project. The impact is least concern and short term that could be reversible.
- **Construction Phase:** Excavation, filling, storage of raw material, storage of debris, establishment of site for machinery and equipment activities might lead to contamination of rainfall run-off due to mixing with excavated material, debris, raw materials like paints, fuel, rusting of iron etc. site being in close vicinity to channel, khal, river and sea, dredged spoil water and rainfall-runoff water from site will directly enter river & sea might impact the quality of the river & sea water and aquatic life. However, from the other construction activities, the existing aquatic biodiversity will be affected if the surrounding environment is heavily polluted (soil, water, etc.) by the construction activities such as discharge of liquid and solid waste from workers camps and construction yards.
- **Operation Phase:** During the industrial operation, seawater routes will be utilized for the transportation of goods and materials to and from the site, supplementing the existing road network. This method of transportation poses a risk of disturbing marine life, particularly fish populations during their breeding seasons. If appropriate mitigation measures are not implemented, the impact on these fish species could be significant.

283. Moreover, there are perennial canals adjacent to the project site that host local fish species. These canals could be adversely affected if industrial effluents are discharged directly into them without adequate treatment. Such discharges could lead to pollution and disrupt the local aquatic ecosystem, threatening the survival of these fish species.

284. However, it is important to note that the NSEZ has been designed with a strong emphasis on environmental sustainability. The zone aims to minimize any form of pollution that could harm the natural environment. As a result, there is a low likelihood of adverse effects on the local canals during the operational period of the industrial activities. Commitment to environmentally friendly practices within the NSEZ framework is crucial for protecting marine life and ensuring the health of local ecosystems.

7.3.3 Agriculture

285. The potential effects of project activities on agricultural resources, emphasizing that while the designated project areas are devoid of agricultural activities, there remains a risk of contamination to nearby agricultural lands due to improper waste management. The focus is on the implications of construction waste and effluent discharge from labor camps on crop production in adjacent farms.

- **Pre-Construction Phase:** It is assumed that no agricultural land is required or disturbed due to the project activities in the pre-construction stage. The selected site is designated and occupied only for NSEZ development.
- **Construction Phase:** One of the primary concerns is the management of construction waste. If not handled properly, waste materials can be inadvertently released into the environment, particularly affecting nearby agricultural lands. This can lead to soil contamination, which may adversely impact crop health and yield.

286. Another significant risk comes from the influence generated by labor camps associated with the project. If this effluent is discharged into nearby agricultural areas, it can introduce harmful substances into the soil and water systems. This contamination can disrupt the growth of crops and lead to reduced agricultural productivity.

- **Operation Phase:** During the operation period, the agricultural activities of local people will not be affected however, if industrial effluent directly discharge to the open space that will spill out to the agricultural field also and create disturbance and reduce the production of farmers. However, the possibility of this impact is of lower significance because the NSEZ areas are not included in any agricultural field and currently there is no agricultural activity conducted by the local farmers.

7.4 SOCIAL ENVIRONMENT

287. For different kinds of construction works, social environment will be disrupted due to labour influx, increased volume of local traffic and transport that will cause jeopardize of occupational health and safety of workers and other staff and community health and safety of the local people and pedestrians. However, labour influx will cause gender-based violence (GBV) at the construction sites, child labour may occur due to low wages. Waste management will be another challenge that will increase the volume of generation of solid waste at the project sites. The positive site is the project will create the employment generation where local people can get access to work at the site either contractual or daily basis. The details are given below:

7.4.1 Educational status of HHs population

288. The literacy rate average 55.1%; male 57.1%%, female 53.3%. In addition, population aged between 16 and 60 years constitute 62.36% of total population of the sampled HHs - shows that about 76.64% of the total population have certain level education as against 7.17% illiterate. Among the literate ones, nearly 20.09% of male and 19.78% of female have only primary level of education and 1.56% of male and only 0.31% of female received graduation/post-graduation level of education. 25.55% of people received Secondary Education and total 3.12% received Higher Secondary education.

Table 7-4: Educational status in the study areas

Education Type and Level	Male	Female	Total	%
Children	16	28	44	6.85
Primary	129	127	256	39.88
Secondary	87	77	164	25.55
Higher Secondary	14	6	20	3.12
Graduate	4	2	6	0.93

Post graduate	6	0	6	0.93
Literacy course/Self Taught	22	18	40	6.23
Illiterate	26	20	46	7.17
Under age or Child	27	33	60	9.34
Total	331	311	642	100

7.4.2 Occupational status

289. Considering only the population within the age range 15-65 years, who constitute about 66.04% of the total population of the sampled HHs, **Table 7-4** shows the distribution of the 15-65 years aged population by main occupations. It appears that the absolute unemployment rate in the NSEZ influence area is around 3.07%; absolute housewives constitute about 38.91% of the total population of the considered age group. Students aged above 14 years comprise about 10.84% of the population within the same age group. Small and petty business being the single most common occupation for about 5.19% of the total population of the considered age group, service holders constitute 4.25%. Agriculture and day laboring are the main occupation for about 25.95%, agricultural labor is the main source of income.

Table 7-5: Distribution of population Age 15-65 years by main occupation

Occupation	Male	Female	Total	%
Agricultural farming	13	0	13	3.07
Business	22	0	22	5.19
Service	15	3	18	4.25
Housewife	0	165	165	38.91
Day laboring	92	5	97	22.88
Carpenter	2	0	2	0.47
Electrician	1	0	1	0.23
Fishermen	4	0	4	0.94
Expatriate	3	0	3	0.71
Driver	31	0	31	7.31
Old/ Disable	4	5	9	2.12
Student	29	17	46	10.85
Unemployed	11	2	13	3.07
Total	**227**	**197**	**424**	**100**

290. **Table 7-5** shows the distribution of household head by occupation and it shows that business, day labor and driver category dominate the project area as it accounts for 74.67 percent of the total HH head occupation. No other occupation dominates here. Farming is the main occupation of only 733 percent. 7.33 percent of them are service holders.

Table 7-6: Distribution of population by occupation

Occupations	Primary Occupations of the Household Heads			
	Primary Occupations			
	Male	Female	Total	%
Agricultural farming	11	0	11	7.33
Business	19	0	19	12.67
Service	10	1	11	7.33
Housewife	0	3	3	2.00
Day laboring	67	2	69	46.00
Expatriate	2	0	2	1.33
Driver	24	0	24	16.00
Electrician	1	0	1	0.67
Old/ Disable	4	0	4	2.67
Fisherman	2	0	2	1.33
Other	3	1	4	2.67
Total	**143**	**7**	**150**	**100**

7.4.3 Employment Status of HH Population

291. As it is evident from the Table7-6 while children (total 85) aged below 6 combined with students (157) constitute about 37.64% of total population (excluding housewives) of the surveyed HHs. While about 56.80%of total male and 57.05% of female are fully employed, 6.34% of male and 3.52% of female members are absolutely unemployed.

Table 7-7: Distribution of population by employment status

Employment Status	Male		Female		Total	
	Number	Percent	Number	Percent	Number	Percent
Aged blow 6 year	38	11.48	47	15.0641	85	13.2193
Students	83	25.0755	74	23.7179	157	24.4168
Day labor	95	28.7009	5	1.60256	100	15.5521
Agriculture and Fisheries	17	5.13595	0	0	17	2.64386
Driver	7	2.1148	0	0	7	1.08865
Service	44	13.2931	4	1.28205	48	7.46501
Housewife	0	0	166	53.2051	166	25.8165
Unemployed	21	6.34441	11	3.52564	32	4.97667
Business	22	6.64653	0	0	22	3.42146
Old	1	0.30211	2	0.64103	3	0.46656
Other	3	0.90634	3	0.96154	6	0.93313
Total	331	99.9996	312	100	643	100

7.4.4 Accessibility to Health Care Facilities

292. As it is evident from Table 7-7 52% of people of the surveyed area mainly goes to the govt. hospitals and 21.33% HHs go to private doctors/clinics for health care services, 98.67% HH go to the village doctor, and 12.67% HHs go to the pharmacy when any of their members are sick.

293. Whereas 2% of HHs reported having a qualified doctor is available in their locality, 98% of HHs reported having no qualified doctor available in their locality

Table 7-8: Accessibility and frequencies of visit to health care services centers

Types of Health Care	Description	Number	Percent=(n=150)
Human Health Care			
HHs contact first if any family member is sick	Quack/Pharmacy	46	30.67
	Community Health Centre / Village Doctor	148	98.67
	Private Doctor/ Hospital/Clinic	32	21.33
	Govt. Hospital	78	52.00
	Pharmacy	19	12.67
	Kabiraj	11	7.33
A qualified doctor is available in your area	Yes	3	2.00
	No	147	98.00

7.4.5 Vulnerability

294. The community safety and social conflict have been considered as VCs, due to subproject activity. Cultural adjustment, criminal activity, poverty, unemployment, transportation, etc., will lead to social conflict and threaten community safety. Besides, women's safety, GBV and child labor engagement in the subproject also and issues regarding social conflicts.

295. Road construction to be the number one problem by 74.67% of respondents; Unemployment is a common problem reported by 39.33% of respondents. Local conflicts and poverty issues were mentioned by 92% of HHs.

296. Among the proposed measures against poverty, assistance from the government and general demand for industrial establishments, it is recommended to develop new industries and create employment opportunities to alleviate unemployment and poverty. Those who mentioned unemployment as a problem wanted the government. assistance towards establishing a new factory, Table 7-8.

Table 7-9: Major problems and recommended solutions

Type of problems reported	HHs reported the problem (n=150)		Most common recommended solutions
	No.	%	
Conflict with Local People	81	54.00	▪ **Assistance from Government**
Cultural Adjustment	27	18.00	▪ **Assistance from Government and NGO organization**
Non-comparative	12	8.00	▪
Criminal Activity	66	44.00	▪ **Assistance from Government** ▪ **Need social and Law Enforcement Surveillance**
Poverty	57	38.00	▪ **Assistance from Government** ▪ **Need more industries in this area**
Unemployment	59	39.33	▪ **Assistance from Government** ▪ **Need more industries in this area** ▪ **Vocational Training**
Transport	112	74.67	▪ **Repair/improve existing Road**

7.4.6 Labor Influx

- **Pre-Construction Phase:** During the pre-construction stage, the mobilization of migrant laborers to construction sites and labor camps is a critical process. However, this phase can pose significant health risks, particularly concerning the spread of contagious diseases. If the accommodation and facilities provided to these workers are inadequate, the likelihood of disease transmission increases, which can have serious implications for both the laborers and the broader community.
- **Construction Phase:** Due to the labor influx, it will have an impact on the health and safety of the workers, increasing the risk of contracting HIV/AIDS and other transmissible diseases at the labor camps, among other places. Nonetheless, the effects will be temporary, site-specific, and of moderate magnitude.
- **Operation Phase:** During the operation period, numerous industries will be active, employing thousands of local and migrant workers. This influx poses a potential challenge for the spread of infectious diseases within the project areas. However, the project has been designed with environmental considerations in mind, ensuring that residential facilities are available for migrant workers, officials, and staff. These facilities aim to provide a safe and healthy living environment, reducing the risk of disease transmission.

297. To further address health concerns, each industry will have a dedicated EHS department responsible for overseeing health and safety issues on a broader scale. This department will implement strict rules and regulations to manage and mitigate the risks associated with infectious diseases. By adhering to these guidelines, industries can create a safer working environment and minimize the potential for outbreaks.

298. Given the proactive measures in place, the risk of infectious diseases in the project areas is assessed to be moderately significant but manageable. The combination of environmentally friendly designs, adequate residential facilities, and a robust EHS framework will help ensure the health and safety of all individuals involved in the operations.

7.4.7 Occupational health and safety

- **Pre-Construction Phase:** During the pre-construction stage, clearing the site, selection of RoW (right of Way) of pipeline route, storm water drainage, power network, landfilling etc., and working area, base camp, and movement of heavy equipment will be at risk for project's contractor and project personnel, but the impact is low considering the nature of works.
- **Construction Phase:** During the construction period, trenching, excavation, materials transportation and lifting of equipment and pipes, Grading, Stringing, wielding of pipes, coatings and wrapping, potential health hazards are anticipated if proper safety preventive measures are not undertaken properly. Due to wielding, electrical shock may cause serious injuries to health and eyes. Coating and wrapping works, health risks are skin irritation and discomfort for respiratory system will occur.
- **Operation Phase:** The National Special Economic Zones (NSEZ) are designed to promote industrial growth and economic development. However, the rapid industrialization in these zones poses significant health and safety risks to workers. The nature of industrial operations often involves exposure to hazardous materials, machinery, and working conditions that can jeopardize the health and safety of employees. The anticipated OHS impacts are as follows:

- **Exposure to Hazardous Substances**: Workers may be exposed to toxic chemicals, dust, and other harmful substances that can lead to respiratory issues, skin diseases, and long-term health complications;
- **Machinery and Equipment Hazards**: The operation of heavy machinery and equipment presents risks of accidents, injuries, and fatalities if proper safety protocols are not followed;
- **Ergonomic Risks**: Repetitive tasks and poor workstation design can lead to musculoskeletal disorders among workers, affecting their physical health and productivity;
- **Psychosocial Risks**: High-pressure work environments can lead to stress, anxiety, and other mental health issues, further compromising workers' overall well-being.

7.4.8 Child labor

- **Pre-Construction Phase:** During the pre-construction stage, there is minimal likelihood of engaging child labor; however, should any instances arise, they will be strictly prohibited at the site. The organization recognizes the importance of safeguarding children and adhering to legal and ethical standards.
- **Construction Phase:** Child labor frequently occurs in different sectors, including factories, projects, and construction sites. The proposed project is no exception, as there is a significant risk of contractors employing child laborers. Contractors often resort to hiring children due to the lower wages they can pay, exploiting their vulnerability and lack of options. These children are typically forced to work long hours under harsh conditions, which not only jeopardizes their health and safety but also deprives them of their childhood and education.

299. The recruitment of child labor in construction is driven by several factors, including economic pressures, lack of enforcement of labor laws, and the demand for cheap labor. Contractors may prioritize profit over ethical considerations, leading to a cycle of exploitation that is difficult to break. The consequences of child labor extend beyond the immediate harm to the children involved; they also perpetuate a cycle of poverty and hinder societal progress.

300. Addressing the issue of child labor in construction requires a multifaceted approach, including stricter enforcement of labor laws, increased awareness among stakeholders, and the promotion of ethical labor practices.

- **Operation Phase:** During the operation period, instances of child labor can be observed in various factories and industries, either on a daily or contractual basis. However, it is crucial to note that employing any child laborers under the age of 18 at NSEZ sites is strictly prohibited. The Labor Act of 2006 and the Labor Rule of 2015 lay down clear guidelines and regulations to protect children from exploitation in the workforce.

301. If child labor is discovered at NSEZ sites, it constitutes a punishable offense under the existing laws. Authorities are mandated to enforce these regulations rigorously to ensure that children are not subjected to labor that could hinder their development and education. The legal framework aims to create a safe and conducive environment for children, promoting their rights and well-being.

7.4.9 Community health and safety

- **Pre-Construction Phase: C**ommunity health and safety will be jeopardized due to labor influx in the project site and movement of heavy equipment, materials, heavy vehicles etc. The movement of heavy vehicles and equipment can lead to increased traffic congestion and a higher likelihood of accidents. Local roads may not be designed to accommodate heavy roads, leading to potential damage and safety risks for pedestrians and cyclists.
- **Construction Phase:** The construction period introduces additional risks to community health and safety. Activities such as trenching, excavation, and backfilling can create hazards for nearby residents. Heavy equipment movement increases the risk of accidents, while traffic and transport associated with construction can lead to congestion and potential collisions. Furthermore, dust emissions and excessive noise from construction activities can negatively impact the quality of life for those living in proximity to the worksite.
- **Operation Phase:** The community Health and Safety will be affected by pipeline rupturing, equipment failures, spillage accidents etc., during the operation and maintenance period. In addition, gas pipe leakage can cause faulty construction, damage from excavation equipment or corrosion can also affect the community and workers' health and safety in the working areas. Gas leaks can contribute to accumulation of gas that will ignite easily and cause fire accidents or explosions. Trenching, excavation and backfilling, heavy equipment movement, traffic and transport, dust emissions and excessive noise can affect the community health and safety during construction period.

7.4.10 Waste Management

- **Pre-Construction:** During the pre-construction phase, several types of solid waste are typically generated, including:

- **Kitchen Waste**: Labor camps often produce organic waste from food preparation. If not managed properly, this waste can attract pests and contribute to foul odors, impacting the living conditions of workers;
- **Liquid Waste**: Wastewater generated from labor camps, including sewage and other liquid waste, poses a significant risk if it contaminates local water sources or is improperly disposed of, leading to potential health hazards.

- **Construction Phase:** The most common waste-related impacts during the construction period will be as follows:
  - Non-hazardous waste includes excavated material, construction material, municipal Solid Waste, wastewater will generate due to project activities;
  - Hazardous waste may include used oil, empty drums or replaced parts of the construction machinery, battery, chemical for concrete like admixture etc.;
  - potentially a number of risks to human health and the environment that maybe associated with the handling, storage and disposal of waste;
  - Environmental pollution with organic and non- organic waste generated from project activities may occur due to uncontrolled disposal and inadequate management of waste;
  - discharge of untreated wastewater can result in pollution in soil, water bodiesand have adverse effects on human health, flora and fauna and surface and groundwater;
  - accidental release in appropriate disposal of oil from the dredging equipment/ vehicles and disposal of dredging liquid waste etc.

- **Operation Phase:** During the operation period, the following waste will be produced in the NSEZ areas that could potentially damage the natural environment and will require special attention to reduce the anticipated impacts to the local natural and social environment. The waste types are as follows:

Table 7-10: List of waste that could be generated due to the implementation of the project

Project Activities	Types of waste
Power network	**Electrical Waste**: Old transformers, cables, and other electrical components. **Chemical Waste**: Oils and lubricants used in equipment maintenance.
Stormwater Drainage	**Sediment and Debris**: Collected from drainage systems during maintenance. **Pollutants**: Oils, chemicals, and other contaminants washed into the system.
Water Supply Network	**Backwash Waste**: Generated from water treatment processes. **Chemical Residues**: From water treatment chemicals.
Public Amenities	**General Waste**: Litter and refuse generated by users. **Maintenance Waste**: Materials from the upkeep of public facilities.
Solid Waste Management	**Municipal Solid Waste**: Household and commercial waste. **Recyclables**: Paper, plastics, metals, and glass
Sanitary Landfill Site	**Landfill Waste**: Non-recyclable and non-compostable waste. **Leachate**: Liquid that drains or leaches from a landfill

7.4.11 Traffic and Transport

- **Pre-Construction Phase:** During the pre-construction phase, the mobilization of heavy vehicles and equipment to the construction site can significantly impact the surrounding environment. The influx of large machinery not only strains local infrastructure but also poses various health and safety concerns for the community and workers involved in the project.

- **Construction Phase:** During the pre-construction period, it is estimated that around 509 electric poles, 74 light posts and water pipeline are located alongside the edge of the existing road networks within the Zone 2A and zone 2B at different distances. A few of them may be shifted due to construction of gas pipelines, and shifting of utilities like electric poles may require temporary power cut which may disturb the life of common local people. But the impact will be short term. Sometime during shifting underground cable faults may be anticipated which will cause the dangerous situation of the locality. Generally, erection of electric poles may cause inconvenience, block the access to the local residents, shopkeepers, students and children. Occupational and public safety issues of the workers, technicians and residents are a serious concern during shifting of the utilities.

302. Materials carrying vehicles and construction vehicles (Excavator, pay loader, grader, dump-truck etc.) may damage the environment in the construction area and may be a disturbance to the nearby population. Without proper traffic management accidents may also occur.

- **Operation Phase:** Emergency response activities, road closures, and evacuation procedures can lead to significant disruptions in traffic flow, potentially causing delays and congestion. Smoke, flames, or hazardous materials released during an incident received at the sites can reduce visibility on roads, increasing the risk of accidents. Evacuation procedures may lead to increased traffic on evacuation routes, posing challenges in managing a safe and orderly evacuation process. The impact on road safety during gas pipeline incidents can be minimized, ensuring a more effective and safer response.

7.4.12 Employment Opportunity

- **Pre-Construction Phase:** While the pre-construction phase may not offer extensive opportunities for community engagement, the potential for temporary or daily employment can still provide meaningful benefits to local residents. It is essential for project planners to recognize and maximize these opportunities to ensure that the local community feels included and supported during the early stages of the project.
- **Construction Phase:** Employment opportunities will be ensured by direct employment for unskilled labor, indirect employment to the local community, and employment of women workers. Direct employment such as site clearance, excavation, loading and offloading of materials and deliveries, mason and construction works. Further, the construction labor force will be requiring food and other items, which are expected to be supplied by the local eateries, retail shops and the local community. The local community members can take advantage of these opportunities. Employment generation benefits improve the quality of life of the laborers and enhance their productivity and living standards.
- **Operation Phase:** The National Special Economic Zone (NSEZ) project in Bangladesh is a strategic initiative designed to enhance the country's economic landscape. By establishing designated areas with favorable business conditions, the government aims to attract both local and foreign investors. As these zones become operational, they are expected to generate a significant number of employment opportunities across various sectors.

7.4.13 Gender Based Violence (GBV)

- **Construction Phase:** The gender-based violence (GBV) and sexual exploitation and abuse/Sexual Harassment (SH) risks may increase to some extent within local communities when there are large influxes of male workers from outside the area. Gender-based violence (GBV) may occur as a result of recruiting female workers on the job sites and giving poor wages to female and child workers. Physical and sexual harassment will be extremely common in GBV instances. However, this influence is temporary, project-specific, and will have a limited impact.

303. However, the probable impact is expected at site if proper human resource management are not taken in project site such as wage discrimination between men and female, eve teasing and sexual abuse, discouraged to speak and demand equitable benefits in the name of purdah/ dignity of women, etc.

- **Operation Phase:** Alongside the anticipated economic benefits, there have been alarming reports of gender-based violence (GBV) affecting workers and local communities. GBV encompasses a range of harmful behaviors directed at individuals based on their gender, including physical, sexual, and psychological violence. The operation of the NSEZ project has created an environment where such violence can thrive, often exacerbated by socio-economic factors and inadequate protective measures.Other details are given in Vol-II Annexure-2.

7.4.14 Cumulative Impact Assessment

304. The Cumulative Impact Assessment (CIA) was conducted for the development of National Special Economic Zone (NSEZ) follows the International Finance Corporation (IFC) guidelines[29], focusing on a six-step process[30] that evaluates both current and future conditions concerning various valued components (VCs), including physical features, habitats, and wildlife populations, ecosystem services, social conditions, and cultural aspects due to construction of different subproject, specifically landfilling, road and stormwater drainage networks, power network, water supply, gas pipeline, landfill for hazardous waste management of ship

[29] The Good Practice Handbook on Cumulative Impact Assessment and Management: Guidance for the Private Sector in Emerging Markets (IFC, 2013);

[30] Scoping-Phase-I for valued components (VCs), Phase II: environmental drivers, the establishment of Baseline condition, Assessment of current conditions of the site, Prediction of future conditions, Management of cumulative impacts etc.

breaking industries, in the project areas.

305. The CIA has been prepared considering the existing, ongoing, and future development activities within 5 km influence area of the NSEZ areas during the proposed project implementation. Whereas the CIA of Regional Strategic Environmental Assessment (RESA) report has considered the entire study area of NSEZ, the CIA will help the project proponent to avoid or mitigate any significant cumulative impact by zoning/sequencing of the development activities. The CIA would enable the authority to evaluate the thresholds of subproject constructions or any concurrent development that the ecosystem can sustain before any irreversible damage takes place in the sub-project areas. Thus, this CIA should consider a key tool for the justification of the ESIA study.

306. The proposed subprojects development in the economic zone will contribute to environmental impacts on Valued Components (VCs) like land use, air quality, water quality, water resource, mangrove habitat, aquatic ecology, community health and safety, socioeconomics, etc. In the CIA process, the VC screening process was applied, using a logical analytical framework, to determine identified VCs can be reasonably affected by some combination of subprojects constructions and/or external stressors and the multi-projects. The key VCs selected for this CIA are land use, air quality, surface and groundwater resource, drainage, terrestrial, aquatic, and marine ecologies, livelihood (land-based agriculture & fisherman), and social well-being.

307. Cumulative impact is the combination of multiple impacts from ongoing development activities and other projects being implemented by other agencies except BEZA, but development is foregoing to strengthen the NSEZ facilities, the proposed project, and/or anticipated future projects that may result in significant adverse and/or beneficial impacts that would not be expected in the case of standalone projects. In this case, the cumulative impact is the combination of multiple impacts from existing projects that are not part of PRIDE project such as bridge project (length 550 meters) which is being implemented by the Local Government Engineering Department (LGED) and construction of Super Dyke along Sonagazi sites of the NSEZ etc. It is expected that these anticipated projects will be initiated within the next two to three years, supported by other funding agencies (not yet finalized). However, based on available information from secondary sources, there are some industrial construction activities such steel industry, electronics, glassware industries, footwear, pharmaceuticals, paints industry, etc., have started in the NSEZ areas that will also contribute to the CIA[31].

308. **Key VCs for CIA study:** Due to holistic construction approaches in NSEZ and its adjacent areas will affect important VCs of Air quality, water quality, sediment quality, noise level, terrestrial and aquatic ecology and labour influx with employment opportunities in the NSEZ areas.

[31] Regional Strategic Environmental Assessment of NSEZ, BEZA, Vol. II. 2025

Table 7-11: Impacted VCs for the CIA of Subprojects Activities

Important VC	Rationale	Current Status	Contribute to CIA
Air Quality	Dredging for landfilling in IMD zones involves the removal of sediments and debris from the bottom of water bodies, which can release dust and particulate matter into the air. However, the other construction activities can lead to a substantial increase in airborne pollutants. The simultaneous operation of multiple construction projects can lead to a compounded effect on air quality. The combined emissions from dredging and other construction activities such as construction of various industries, bridge and super dyke can result in significantly higher levels of pollutants.	Ambient air quality at all the points is found within the allowable Bangladesh standards. In the land development zones, PM2.5, PM10, SO2, NO2, CO, and O3 values are also within the Bangladesh standard. .	Impacts are expected to be localized, and of moderate duration in the construction phase, and further elevated by other construction of bridge, super dyke and various industry in NSEZ areas. The impact will be of lower significance.
Noise level	Using different equipment, machines, movement of heavy vehicles, and labor force, can generate a significant amount of noise that can exceed the noise standards in the working areas.	Ambient noise level in the study areas remained within national standard of Noise Pollution (Control) Rules 2006. The impacts are currently in Mixed/Commercial Category.	It is expected that during construction activities of NSEZ subprojects and other constructions like bridge construction by LGED and industries will increase the local noise level drastically and the impacts will be moderately significant.
Water Quality	The proposed subprojects activities are likely to have significant implications for local water quality. The discharge of dredging water into nearby canals and ponds poses a direct threat to aquatic ecosystems and the overall health of water bodies in the region. This contamination is not an isolated issue; it is expected to be compounded by other construction activities such as construction of varies industries, bridge and super dyke etc. that may further pollutants into the environment. In addition to the direct effects of the subproject activities, the cumulative impact of other development works in the area cannot be overlooked. bridge construction, factory setups, and super dyke construction can all contribute to increased pollution loads in local water bodies. The interaction between these various sources of contamination can create a compounded effect, leading to more severe water quality issues.	Tested all parameters of DO, TDS, TSS, EC, Turbidity, pH, Salinity, COD, BOD, Hg, Pb, Cd, Oil and Grease, FC, TC of surface water samples. were within the standards of the ECR, 2023, except that TDS in two water samples was slightly above the standards Groundwater tested parameters were TDS, EC, Turbidity, pH, Salinity, Total Hardness as CaCO3, Fe, As, Mn, Odor, FC, and TC. Results showed that only DS and Turbidity in one sample exceeded the national ECR 2023 standard. Fe concentration in all samples slightly exceeds the standard set by ECR 2023. The groundwater samples were collected from 650-700 feet.	Impacts are expected to be localized and further increased by other construction of bridge, super dyke and various industry in NSEZ areas. The impact will be of moderate significance.

Important VC	Rationale	Current Status	Contribute to CIA
Sediment Quality	Dredging operations inevitably disturb and resuspend sediments, leading to a decline in sediment quality both in marine and riverine environments. This disturbance can release contaminants previously bound within the sediment matrix, increasing their bioavailability and potentially impacting aquatic ecosystems. A significant concern arises from the dewatering of dredged materials. This process, while necessary for volume reduction and subsequent disposal or beneficial reuse, can release contaminated water back into nearby surface water sources. The effluent from dewatering operations may contain elevated levels of suspended solids, nutrients, heavy metals, and organic pollutants, further degrading the sediment quality of the receiving water bodies. The problem can be compounded by other construction activities occurring in the vicinity, especially those not supported by the World Bank (WB). For instance, bridge construction often involves pile driving, cofferdam installation, and other activities that can generate sediment plumes and release pollutants. These activities, if not managed properly, can exacerbate the negative impacts of dredging on sediment quality and	The analysis revealed that the textural composition of the sediment samples, characterized by the relative proportions of Sand, Silt, and Clay, aligns with the acceptable ranges outlined in the Australian standards. Similarly, the concentrations of the analyzed heavy metals (Zn, Cu, Hg, Pb, and Cd) were all below the threshold levels specified in both the Australian standards[32] and the Dutch Intervention Values[33]. This indicates that, based on these parameters and compared to these international standards, the sediment quality is within acceptable limits. The absence of specific sediment quality standards in Bangladesh necessitates the adoption of international benchmarks for environmental assessments. While the Australian standards and Dutch Intervention Values provide a valuable framework for evaluating sediment quality, tailored to the local environmental context and potential sources of pollution, it would be beneficial for more accurate and relevant assessments in the future. This would allow for a more nuanced understanding of sediment quality and its	Impacts are expected to be localized and further increased by other construction of bridge, super dyke and other industrial operations. The impacts will be of medium significance.

[32]Reference: https://www.ppsthane.com/blog/soil-sediment-sampling

[32] Recommended toxicant default guideline values for sediment quality, Australian Government Initiative. https://www.waterquality.gov.au/anz-guidelines/guideline-values/default/sediment-quality-toxicants

[33] Guidance Document for Sediment Assessment, Date 4 November 2010, e Dutch Water Act. Ministry of Infrastructure and the Environment - DG Water. December 2009

[33] DGV means Default guideline values.

Important VC	Rationale	Current Status	Contribute to CIA
	overall ecosystem health. The cumulative effect of dredging and non-WB supported construction can lead to a significant and potentially long-lasting decline in sediment quality, requiring careful monitoring and mitigation strategies.	potential impact on the local ecosystem and human health.	
Marine ecology, aquatic life, terrestrial flora and fauna	The population of aquatic organisms' changes in aquatic fauna may consequently alter in food chain and food web at the primary trophic level due to an increase of sedimentation. Increased sedimentation may decrease primary production and create negative cascades by depleting food availability to zooplankton, insects, freshwater mollusks, and fish. A total of 123 species of important terrestrial plants under 116 genera of the family 61 have been recorded in the project area. Among them, 44% are trees, 41% are herbs, and the rest are shrubs. Out of 123 species of terrestrial plants, mostly used as medicinal and which is 56 in number and used as timber 27, fruit-bearing 28, ornamental 08, and fuel 04. 23 species of aquatic plants have also been identified. A total of 10 species of amphibians, 70 species of birds and 10 species of mammals were recorded in the study area.	The baseline conditions suggested that the density of small-sized zooplankton was very low. It could be due to low productivity, as suggested by phytoplankton, or due to unfavorable conditions created by high Suspended Particulate Matter (SPM) resulting from other activities. **Benthos:** A total of 19 taxa (families) of soft-bottom macrobenthos were recorded of which 14 families were identified over the six sampling sites. The mean abundance (individual/m2) was 707.8±210.2. St 9 had the lowest density of macrobenthos, followed by St14. The other sites demonstrated similar density but were >1.5 times higher in abundance than that of L-09 and 14. In addition, the District Fisheries Officer (DFO) in Feni district has confirmed that one Hilsa breeding site is predicted at the confluence of the Sandwip channel and the Feni river (also called as Muhuri River), which is 5 km away from the nearest potential dredging locations (L-09), and the Mayani point is another Hilsa Spawning Ground (91°32.15′E and 22°42.59′N), located in the Shaerkhali canal inside Mirsharai plain land, notified in the Gazette in 2014 by the DoF (Department of Fisheries). But the current condition of this spawning ground in the Shaerkhali canal is	Destructed vegetation cover and habitat can be re-established through afforestation and a habitat improvement program Nursery and plantation techniques vary considerably among the different species and existing conditions; irrespective of the areas under the core zone or buffer zone, considering the inundation level and condition of soil, species would be selected. Such habitat restoration programs are recommended at a block that is inside the impacted area.

Important VC	Rationale	Current Status	Contribute to CIA
		silted up, and the local people have reported that there is no evidence of this Hilsa spawning ground. The study areas are characterized by a common assemblage of terrestrial plants, animals, and Aves species. Detailed surveys confirmed the absence of any species listed as threatened or endangered under relevant conservation legislation. Given the commonality of the observed species and the specific nature of the proposed dredging activities for landfilling, the assessment predicts no potential impacts on the terrestrial ecology of the study areas. Dredging activities are not expected to significantly disrupt habitats or negatively affect the populations of the observed species.	
Social			
Labor Influx/Employment	Included due to the impact the subproject will have on jobs in the area and the potential for labor influx. On a more positive note, the employment variable is expected to have a high positive impact as a result of the new job opportunities created by the development of the economic zone. This influx of employment can significantly benefit the local economy and contribute to the area's overall development.	Local laborers are not receiving job opportunities in the EZ preparatory activities. Influx of laborers for preparatory activities.	Localized and no adverse cumulative impacts are anticipated. Even, the employment generation will be increased due to other construction activities that are not part of the PRIDE project. The impacts will be substantial due to getting access to the employment opportunities by the local people.

309. CIA Quantifications: This CIA is prepared based on the proposed subprojects activities of NSEZ areas however it will not consider the future other projects which will be deemed necessary for acceleration of facilities for NSEZ areas. It is anticipated that all about air quality, noise level, water quality, soil quality and sediment quality, local ecosystems are the important VCs which will be affected by the proposed NSEZ interventions and other construction activities in the NSEZ areas like various industrial set up and super dyke and bridge construction by LGED.

Table 7-12: CIA of Proposed Sub-Projects and Other Activities on Valued Components

Activities	Source of pollutant	Valued Component					Overall Cumulative Impact
		Air Quality	Water Quality	Sediment Quality	Marine ecology, aquatic life, terrestrial flora and fauna	Noise level	
Excavation, Trenching, Backfilling, Dredging, Dredge materials management, Landfilling, Waste and Hazardous waste management etc.	**Project Activity**						
	Dust and exhaust gas emissions						
	Liquid and chemical waste (oil, Mobil, grease, chemicals etc.)						
	Dredging of bottom sediments						
	Landfilling						
	Non-hazardous and hazardous waste						
	Traffic and Transport						
	Compaction of surface						
Other Activities							
Other constructions are being carried out by other agencies except BEZA such as industrial set up, bridge construction by LGED etc.	Construction of an administration building						
	Setting up labor camps						
	Revegetation and establishment of green buffers						

	Categorization of Impact	
	Low (L)	Impacts are localized, of short duration and are expected to have an insignificant effect on the valued component
	Medium (M)	Impacts are more widespread, of moderate duration and are expected to have a limited to moderate effect on the valued component
	High (H)	Impacts are widespread, of longer duration and are expected to have an adverse effect on the valued component

Details are given in Vol-II Annex 6.

8 ENVIRONMENTAL MANAGEMENT PLAN

310. The Environmental Management Plan (EMP) outlines the strategies and measures to manage and mitigate the potential environmental and social impacts associated with the project implementation. The objectives of the EMP are typically designed to ensure responsible and sustainable practices throughout the project lifecycle. The specific objectives are as follows:

- Ensure that the project adheres to all relevant national and International environmental and social regulations and standards;
- Identify and assess potential environmental and social impacts of the project. Develop strategies to mitigate and monitor adverse impacts to an acceptable level;
- Enhancing stakeholder engagement including local communities, indigenous groups, and other relevant parties;
- Establish mechanisms for communication, consultation, and feedback to address concerns and incorporate local knowledge;
- Implement measures to protect and conserve biodiversity, ecosystems, and natural resources affected by the project;
- Promote resource efficiency and sustainable use of natural resources;
- Develop effective waste management plans to minimize environmental pollution;
- Address social issues such as displacement, resettlement, and labor conditions;
- Build the capacity of local communities, project staff, and relevant stakeholders to understand and manage environmental and social issues;
- Develop and implement plans for responding to emergencies, accidents, or unforeseen events that may have environmental or social implications;
- Establish a robust monitoring and reporting system to track the implementation of the EMP and assess its effectiveness;

8.1 PHYSICAL ENVIRONMENT

311. Environmental management plans regarding the physical environment are presented in the following tables

- Table 8-1: EMP for the Managing and Tracking the Environmental Quality Parameters during Pre-Construction, Construction and Operation

Table 8-2: EMP for safeguarding the water resources in the project areas

Land Resources

- Table 8-3: EMP for safeguarding land resources in the project areas

8.2 ECOLOGICAL ENVIRONMENT

312. Environmental management plans under the ecological environment are presented in the as follows;

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- ECOLOGICAL ENVIRONMENT
- Ecological resources
- Table 8-4: EMP for safeguarding ecological resources in the project areas

Fisheries resource

- Table 8-5: EMP for safeguarding the fisheries resources in the project areas
- Table 8-6: EMP for safeguarding the agricultural resources in the project areas

8.3 SOCIAL ENVIRONMENT

313. Environmental management plan of the social environment is presented as follows;

PHYSICAL ENVIRONMENT

Table 8-1: EMP for the Managing and Tracking the Environmental Quality Parameters during Pre-Construction, Construction and Operation Phases

Environmental Quality	Potential Impacts	Proposed Mitigation Measures	Responsible Agency		Associated Cost
			Planning and Execution	Supervision/ Monitoring Agency	
Pre-Construction and Construction Period					
Air Pollution	• The excavation, grading, and movement of heavy machinery can generate significant dust, leading to particulate matter (PM) emissions that can degrade air quality; • Increased traffic from construction vehicles contributes to higher levels of nitrogen oxides (NOx) and volatile organic compounds (VOCs); • The operation of diesel-powered machinery emits pollutants, including carbon monoxide (CO) and particulate matter.	• Ensure that all vehicles and machines comply with technical and environmental safety regulations; • Schedule the operation times for vehicles and machines working in the construction area to reduce air emissions; • The contractor shall maintain an inventory of the number, type and location of all stationary emission sources within the boundary of the construction site during the period of construction; • Before the commencement of any work, the Engineer may require the methods of working and equipment intended to be used on the site to be made available for inspection and approval to ensure that they are suitable for the project; • The Contractor shall ensure that all Plant and Equipment to be used on site are properly maintained in good operating condition and that the Plant and Equipment does not give rise to excessive exhaust smoke emissions; • In the process of material handling, any material which has the potential to create dust shall be treated with water or wetting agent sprays, especially when dusty materials are being loaded or unloaded; • Any vehicle with an open load-carrying area used for moving materials, and having the potential to create dust, shall have properly fitting side and tail boards. Materials having the potential to create	• Contractor(s)	• BEZA	Contract cost

Environmental Quality	Potential Impacts	Proposed Mitigation Measures	Responsible Agency		Associated Cost
			Planning and Execution	Supervision/ Monitoring Agency	
		dust shall not be loaded to a level higher than the side and tail boards and shall be covered by a clean tarpaulin; • The tarpaulin shall be properly secured and shall extend at least 300 mm over the edges of the side and tail boards; • Stockpiles of dusty materials will be covered by polythene or tarpaulin; • The Contractor shall frequently clean and water any public road used by vehicles accessing the site to minimize the fugitive dust emissions; • Regular watering and sprinkling for dust suppression are to be done properly; • The Contractor shall restrict all vehicles on the Site to a maximum speed of 15-20 km/hr. km per hour and confined haulage and delivery vehicles to designated roadways inside the site; • The contractor shall conduct quarterly air quality monitoring of PM10, PM2.5, NO2, SO2, CO and O3 by a third-party organization to verify the air quality standard with the national index of National Air Pollution (Control) Rule 2022.			
Noise Pollution	• The use of excavators, bulldozers, and other heavy equipment generates significant noise, which can disturb nearby communities and wildlife; • Increased truck traffic during construction can contribute to elevated noise levels in surrounding areas.	• To avoid or mitigate this problem, construction activities in daytime and minimize night-time work; • Regulate the speed for traffic in and around the project areas and carry out maintenance and routine inspections on vehicles and construction machinery to ensure the technical standards; • Ensure the construction equipment is with proper silencer and muffler,	• Contractor(s)	• BEZA	• Contract cost

Environmental Quality	Potential Impacts	Proposed Mitigation Measures	Responsible Agency		Associated Cost
			Planning and Execution	Supervision/ Monitoring Agency	
		padding/noise isolator and select the least noisy machine; • The personnel involved in high noise generating activities shall be provided with personal protective devices like ear plugs, earmuffs etc.; • The contractor should conduct noise levels daily by their own arrangement of using standard equipment and recording all the data and information which should be included in the quarterly monitoring report; • In addition, contractor shall conduct quarterly noise level measures (Noise levels in Leq, Leqday, Leqnight and Hourly Leq) by a third party to verify the noise level within the national standard of Noise Pollution (Control) Rule 2006.			
Soil Pollution	• Excavation and grading can lead to soil compaction and loss of topsoil, affecting local ecosystems and agriculture; • Spills of fuel, oil, or chemicals during construction can lead to soil contamination, which may require remediation.	• To reduce or mitigate this problem, construction vehicles will remain on compacted roads; • Fuel, lubricating oil, and used oil storage areas will be in the designated area; • The contractor shall ensure daily collection and disposal of construction waste, debris, oil, fuel spillage, used oil etc.; • To avoid soil compaction along the transportation routes, only identified haul roads would be used for transportation and sandbags can be used to trap sediments more effectively in the trenching and excavated sites.	• Contractor(s)	• BEZA	• Contract cost
Operation Period					
Air Pollution	• The completed road and utility networks will lead to increased vehicular traffic, which can elevate	• To mitigate this problem, implement, implement regular maintenance and inspection schedules, develop and	• BEZA	• BEZA	• Development cost/ operation cost

Environmental Quality	Potential Impacts	Proposed Mitigation Measures	Responsible Agency		Associated Cost
			Planning and Execution	Supervision/ Monitoring Agency	
	air pollution levels due to ongoing emissions; • Facilities connected to the new networks may emit air pollutants, necessitating effective management strategies; • Gas Pipeline leaks during operation period may cause sources of air pollutants in the project areas; • Improper management of biogas plants can cause air pollution through releasing foul gas into the air.	practice emergency response plans at the project site; • Provide personnel with the necessary training on handling pipeline leaks, install fire and explosion detection systems, implement automatic fire suppression systems, create evacuation plans for nearby areas, strengthen coordination with local fire departments for rapid response, and use advanced leak detection systems for early identification and the installation of automatic shut-off valves to minimize gas release in the event of a leak; • For traffic and transport, vehicle speed should be limited to 25/30 km/hr. within the project areas that will reduce dust and gas emission in the project areas; • The biogas plant should be maintained properly and capped all the escape gas within the premises.			
Noise Pollution	• Once operational, the increased volume of vehicles on the new road networks will lead to sustained noise pollution; • Facilities utilizing the new infrastructure may also contribute to noise through machinery and operational activities.	• Noise standards will be strictly enforced for all vehicles, plants, equipment, and construction machinery; • All construction equipment used for an 8-hour shift will conform to a standard of less than 90 dB(A); • Workers in the vicinity of high noise levels will be provided earplugs, to prevent prolonged exposure to noise levels of more than 90dB(A) per 8-hour shift, and; • Vehicle speed should be limited to 25/30 km hr. within the project areas etc.	• BEZA	• BEZA	• Development cost/operation cost
Soil Pollution	• The development of new infrastructure can alter land use	• Biogas plant should be regularly maintained at the site to protect releasing effluent into the open space;	• BEZA	• BEZA	• Development cost/ operation cost

Environmental Quality	Potential Impacts	Proposed Mitigation Measures	Responsible Agency		Associated Cost
			Planning and Execution	Supervision/ Monitoring Agency	
	patterns, potentially impacting soil health and local flora and fauna; • The construction of a sanitary landfill site and biogas plant must be managed to prevent soil contamination from leachate.	• Water supply networks should be checked regularly to protect leaks to avoid soil contamination at the site; • Any kind of effluent shall be managed properly without releasing them to the open space.			

Water Resources

Table 8-2: EMP for safeguarding the water resources in the project areas

Environmental Quality	Potential Impacts	Proposed Mitigation Measures	Responsible Agency		Associated Cost
			Planning and Execution	Supervision/ Monitoring Agency	
Pre-Construction and Construction Period					
Surface water pollution	• Construction activities can lead to soil erosion and runoff that may carry sediments and pollutants into nearby water bodies; • Improper management of wastewater from construction sites can lead to contamination of local water sources.	• To reduce the water pollution, the contractor shall design methods of working to minimize water pollution and necessary training the workers to ensure that these methods are implemented; • The contractor shall provide toilets with septic tanks system or sanitary pits of sufficient capacity for the number of workers on the site; • No overflows from the storage tanks to the surface water drains will be permitted; • Diesel and oil, cement, glues. Painting other toxic chemicals shall be handled properly and cover up all drains to prevent waste from ending up in the water. Minimize land disturbance and leave maximum vegetation cover; • The contract shall conduct quarterly environmental monitoring for	• Contractor(s)	• BEZA	Contract cost

Environmental Quality	Potential Impacts	Proposed Mitigation Measures	Responsible Agency		Associated Cost
			Planning and Execution	Supervision/ Monitoring Agency	
		surface water pollution, the parameters such as pH, DO, TDS, Turbidity, Temperature, TSS, BOD, COD, Lead, Iron, Zinc, Cadmium, Arsenic, Chloride, Oil and Grease etc., monitored by a third-party to cross-check with the national standards (ECR 2023).			
Groundwater pollution	• Groundwater can be contaminated by sewage & wastewater from labor camp, dumping moist soil for prolonging period and effluent disposal etc.; • Excavation and land clearing can lead to the mobilization of contaminants present in the soil, which may leach into groundwater; • The use of construction materials, such as solvents, fuels, and lubricants, increases the risk of spills that can infiltrate groundwater; • Improper disposal of construction waste, including hazardous materials, can lead to leachate formation and groundwater pollution.	• The proposed landfill site shall be 500 m away from the groundwater well or source. • The Biogas plant should be maintained at a minimum distance of 500 meters from the groundwater wells or sources; • Runoff of storm water drainage shall be confirmed without sewerage contamination; • The outfalls of drainage shall be away from the localities, groundwater sources and busy areas such as markets, hat, bazar; • The contractor shall monitor the groundwater quality quarterly by a third-party to check with the national standards (ECR 2023). The parameters such as pH, Turbidity, TDS, Hardness as CaCO3, Cr, Cu, Fe, Mn, Mg, Na, Zn, SS, Temperature, Faecal Coliform, Total Nitrogen, Nitrate, Sulphate etc. shall be monitoring quarterly and test in a government recognized laboratory etc.	• Contractor(s)	• BEZA	• Contract cost

Environmental Quality	Potential Impacts	Proposed Mitigation Measures	Responsible Agency		Associated Cost
			Planning and Execution	Supervision/ Monitoring Agency	
Water logging and Drainage**:**	• The initial stages of construction often involve land clearing and excavation, which can disrupt existing drainage patterns and lead to temporary water accumulation; • Heavy machinery used during construction can compact the soil, reduce its permeability and increasing the likelihood of water logging; • Rainfall during construction can exacerbate water logging issues, particularly if the site is not adequately prepared to manage stormwater; • Piles of construction materials can obstruct natural drainage paths, contributing to water accumulation in certain areas.	• The storm water drainage shall be designed considering the following parameters: • The system must be designed to handle the maximum flows to prevent flooding; • Rainfall intensity is considered in relation to the time of concentration which shall be considered in the design patterns/layout, as this is considered the entire catchment contributes to runoff at the outlet; • Intensity-Duration-Frequency shall be followed based on historical rainfall data, to determine the expected rainfall intensity for a specific duration and return period (e.g., a 10-year storm, a 100-year storm); • The chosen return period depends on the level of flood protection desired for the area; • Assessing the drainage area, land use, soil types, slopes, and impervious surfaces to determine the runoff coefficient and estimate the volume of surface runoff; • While the protection dam provides a significant layer of defense against external flooding, a comprehensive stormwater drainage design is still essential for managing the runoff generated within the project site, and;	• Contractor(s)	• BEZA	• Contract cost

Environmental Quality	Potential Impacts	Proposed Mitigation Measures	Responsible Agency		Associated Cost
			Planning and Execution	Supervision/ Monitoring Agency	
		• Other appropriate mitigation measures shall be applied based on local context.			
Disruption of Canals (khal) water flow	• Bamansundar and Ichakhali canal water flow may be disrupted temporarily during construction works.	• Plan construction activities during dry seasons to minimize water flow disruption; • Implement construction in phases to limit the extent of disruption at any given time; • Install silt fences to prevent sediment from entering the canals, which can affect water quality and flow; • Regular monitoring shall be confirmed by the contractors if any incident or case found it shall be reported to BEZA immediately etc.	• Contractor(s)	• BEZA	• Contract cost
Operation Period					
Surface water pollution	• The stormwater network must be effectively managed to prevent flooding and ensure that water quality is maintained; • Facilities connected to the water supply network may discharge treated or untreated effluents, impacting local water quality.	• Sanitary landfill and biogas plants should be maintained properly to protect any effluent to the surface water sources; • Drainage outfalls shall be maintained, and regular monitoring shall be confirmed during the monsoon season; • Outfall capacity shall be maintained all year round and any kind of wastewater or sewerage effluent shall be strictly prohibited to release into the surface water sources, and ; • Others appropriate mitigation measures shall be applied based on ground condition etc.	• BEZA	• BEZA	• Development cost/ operation cost
Groundwater pollution	• Factories may release effluents containing heavy	• All types of waste, including sewage, wastewater, oil, paint, and	• BEZA	• BEZA	• Development cost/operation cost

Environmental Quality	Potential Impacts	Proposed Mitigation Measures	Responsible Agency		Associated Cost
			Planning and Execution	Supervision/ Monitoring Agency	
	metals, chemicals, and other pollutants that can seep into the groundwater; • Leaks from underground storage tanks holding fuels or chemicals can lead to significant groundwater contamination.	other hazardous materials, must be discharged only at designated fixed locations or sites selected by the Bangladesh Economic Zones Authority (BEZA); • It is imperative to observe the groundwater conditions within the project areas and the immediate surrounding areas. Should any heavy metal contamination be detected, it is mandatory to report the findings to the Water Resources and Planning Organization (WARPO) without delay; • Immediate measures must be taken to address any contamination issues to safeguard the health and wellbeing of the local population. This includes implementing remediation strategies such as alternative sources of drinking water or water supply systems that shall be developed in the affected areas and ensuring that the community is informed of any potential risks associated with groundwater contamination.			
Water logging and Drainage**:**	• Least chance to escalate the water logging issues in the project areas. The land development was considered the highest flood level; • If storm water drainage is clogged or improperly design of drainage	• Establish a routine maintenance schedule for all drainage systems to ensure they remain functional and free of blockages; • Integrate green spaces and permeable surfaces within the NSEZ to enhance water absorption and reduce runoff;	• BEZA	• BEZA	• Development cost/ operation cost

Environmental Quality	Potential Impacts	Proposed Mitigation Measures	Responsible Agency		Associated Cost
			Planning and Execution	Supervision/ Monitoring Agency	
	network will cause water logging in the adjacent areas of NSEZ areas; • If outfall conditions or local canals such as Bamansundar and Ichakhali canal silted up will cause water logging in the localities of NSEZ areas.	• Use sensors and gauges to monitor water levels in drainage systems and surrounding areas; • Conduct training for staff and local stakeholders on best practices for water management and drainage maintenance etc.			
Disruption of Canals (khal) water flow	• If outfall conditions or local canals such as Bamansundar and Ichakhali canal silted up will cause water logging in the localities of NSEZ areas.	• Creating contingency plans for managing water flow disruptions, including temporary diversions or storage solutions; • Implementing drainage systems that redirect excess water without impacting canal flow; • Regular inspections of canals to identify blockages or alterations in flow patterns etc.	•	•	•

Land Resources

Table 8-3: EMP for safeguarding land resources in the project areas

Environmental Quality	Potential Impacts	Proposed Mitigation Measures	Responsible Agency		Associated Cost
			Planning and Execution	Supervision/ Monitoring Agency	
Pre-Construction and Construction Period					
Land Resources	• The existing landscape may suffer degradation due to improper open-cut trenching techniques employed during construction;	• Trenching, excavation, and backfilling shall be carried out based on the approved layout plan and design; • This approach is vital to avoid disruptions of land resources	• Contractor(s)	• BEZA	Contract cost

Environmental Quality	Potential Impacts	Proposed Mitigation Measures	Responsible Agency		Associated Cost
			Planning and Execution	Supervision/ Monitoring Agency	
	• This can lead to soil erosion, loss of vegetation, and disruption of local wildlife habitats; • The visual impact of construction activities can also alter the aesthetic value of the project area, making it less appealing for residents and visitors alike.	and ensure that the natural landscape is preserved as much as possible; • Proper site rehabilitation must be confirmed after the completion of construction works. This includes restoring the land to its original condition or improving it, ensuring that any disturbances caused by the construction activities are adequately addressed; • The illegal dumping of solid and liquid waste is strictly prohibited and shall be considered a punishable offense.			
Operation Period					
Land Resources	• The installation of stormwater drainage systems can change the natural hydrology of the project area, potentially leading to increased runoff and changes in groundwater recharge rates; • Areas that have undergone heavy machinery use may experience soil compaction, which can increase erosion risks; • The establishment of gas pipelines and other infrastructure can fragment habitats, making it difficult for wildlife to migrate and thrive;	• Regular monitoring should be conducted at the outfall areas, local canals, and seaside locations to observe the runoff from the drains; • This monitoring is crucial to identify any potential pollution sources and to assess the impact of runoff on local water quality and ecosystems; • Any kind of disturbance to the local wildlife and flora shall be strictly prohibited. It is imperative to maintain the natural habitats and biodiversity in the area, ensuring that all project	• BEZA	• BEZA	• Development cost/ operation cost

Environmental Quality	Potential Impacts	Proposed Mitigation Measures	Responsible Agency		Associated Cost
			Planning and Execution	Supervision/ Monitoring Agency	
	• Operational activities, particularly those associated with landfill sites, can pose risks of soil and water contamination if not managed properly.	activities are conducted with minimal impact on the surrounding environment; • Landfill sites must be confirmed to ensure they do not contaminate the water sources of the project and its adjacent areas; • Proper assessment and management practices should be implemented to prevent leachate and other contaminants from affecting the local water quality.			

ECOLOGICAL ENVIRONMENT

Ecological resources

Table 8-4: EMP for safeguarding ecological resources in the project areas

Environmental Quality	Potential Impacts	Proposed Mitigation Measures	Responsible Agency		Associated Cost
			Planning and Execution	Supervision/ Monitoring Agency	
Pre-Construction and Construction Period					
Ecological Resources	• The pipeline installation may disrupt the habitats of aquatic species, leading to temporary displacement; • Construction activities could lead to sedimentation and contamination of water bodies, affecting water quality and aquatic life;	• Schedule construction activities during periods when aquatic species are less active or during their non-breeding seasons to minimize disruption; • Establish buffer zones around sensitive habitats to limit construction activities and reduce disturbances; • Develop and implement erosion and sediment	• Contractor(s)	• BEZA	Contract cost

Environmental Quality	Potential Impacts	Proposed Mitigation Measures	Responsible Agency		Associated Cost
			Planning and Execution	Supervision/ Monitoring Agency	
	• The landfilling activities planned in the IMD zones and adjacent areas will involve dredging sediments from the seaside. This process is likely to have several implications for marine ecology: • Dredging can displace sediments that are crucial for the habitat of various marine organisms, potentially leading to a decline in biodiversity; • The process may increase turbidity in the water, which can hinder photosynthesis in aquatic plants and affect the overall health of the marine ecosystem; • Dredging may also release trapped pollutants into the water column, posing risks to marine life and water quality.	control plans that include silt fences, sediment basins, and other best management practices to minimize sediment runoff; • Regularly monitor water quality in nearby water bodies during construction to detect any contamination early and take corrective actions; • Ensure that all construction materials and methods used are environmentally friendly and do not introduce harmful substances into the water; • Provide training for construction personnel on best practices for minimizing environmental impacts and the importance of protecting water quality.			
Operation Period					
Ecological Resources	• During the operation phase, it is projected that the development of the gas pipeline network and landfilling activities will not have any direct adverse impacts. However, the	• Implement a habitat restoration plan post-construction to rehabilitate affected areas and promote the return of displaced species;	• BEZA	• BEZA	• Development cost/ operation cost

Environmental Quality	Potential Impacts	Proposed Mitigation Measures	Responsible Agency		Associated Cost
			Planning and Execution	Supervision/ Monitoring Agency	
	installation of the gas network and subsequent land development in the IMD Zones is expected to stimulate industrial growth. This growth poses a risk of potential impacts on aquatic ecosystems, primarily due to the unauthorized release of industrial effluents, wastewater, and effluence from kitchen and residential areas.	• If any trees are cut or felling down, at least 3 species should be planted against 1 cut following 1:3 equation; • Ensuring that hazardous materials are disposed of in compliance with regulations to prevent contamination; • Conducting audits to assess compliance with environmental standards and to identify areas for improvement;			

Fisheries resource

Table 8-5: EMP for safeguarding the fisheries resources in the project areas

Environmental Quality	Potential Impacts	Proposed Mitigation Measures	Responsible Agency		Associated Cost
			Planning and Execution	Supervision/ Monitoring Agency	
Pre-Construction and Construction Period					
Fisheries Resources	Excavation, filling, storage of raw material, storage of debris, establishment of site for machinery and equipment activities might lead to contamination of rainfall run-off due to mixing with excavated material, debris, raw materials like paints, fuel, rusting of iron etc. site being in close vicinity to channel, khal, river and sea, dredged spoil water enter river & sea might impact the quality of the river & sea water and aquatic life. However, from the other	• Any kind of waste disposal to the open water sources shall be strictly prohibited; • Sea water ways shall be restricted during breeding season; • Implement a robust environmental monitoring program to assess the health of aquatic ecosystems regularly. This should include water quality testing, fish	• Contractor(s)	• BEZA	Contract cost

Environmental Quality	Potential Impacts	Proposed Mitigation Measures	Responsible Agency		Associated Cost
			Planning and Execution	Supervision/ Monitoring Agency	
	construction activities, the existing aquatic biodiversity will be affected if the surrounding environment is heavily polluted (soil, water, etc.) by the construction activities such as discharge of liquid and solid waste from workers camps and construction yards. And rainfall-runoff water from site will directly	population surveys, and habitat assessments; • Involve local stakeholders, including fishermen, and community leaders, to enhance conservation of local fish species.			
Operation Period					
Fisheries Resources	During the industrial operation, seawater routes will be utilized for the transportation of goods and materials to and from the site, supplementing the existing road network. This method of transportation poses a risk of disturbing marine life, particularly fish populations during their breeding seasons. If appropriate mitigation measures are not implemented, the impact on these fish species could be significant. Moreover, there are perennial canals adjacent to the project site that host local fish species. These canals could be adversely affected if industrial effluents are discharged directly into them without adequate treatment. Such discharges could lead to pollution and disrupt the local aquatic ecosystem, threatening the survival of these fish species. However, it is important to note that the NSEZ has been designed with a strong emphasis on	• Implement measures to control stormwater runoff, such as the construction of retention basins and vegetated swales, to prevent sedimentation and contamination of water bodies; • Collaborate with local fishing communities to promote sustainable fishing practices. This may include training programs on responsible fishing techniques and the importance of preserving fish stocks; • Develop and implement emergency response plans to address potential spills or accidents that could adversely affect water quality and fisheries resources.	• BEZA	• BEZA	• Development cost/ operation cost

Environmental Quality	Potential Impacts	Proposed Mitigation Measures	Responsible Agency		Associated Cost
			Planning and Execution	Supervision/ Monitoring Agency	
	environmental sustainability. The zone aims to minimize any form of pollution that could harm the natural environment. As a result, there is a low likelihood of adverse effects on the local canals during the operational period of the industrial activities. Commitment to environmentally friendly practices within the NSEZ framework is crucial for protecting marine life and ensuring the health of local ecosystems.				

Agricultural resources

Table 8-6: EMP for safeguarding the agricultural resources in the project areas

Environmental Quality	Potential Impacts	Proposed Mitigation Measures	Responsible Agency		Associated Cost
			Planning and Execution	Supervision/ Monitoring Agency	
Pre-Construction and Construction Period					
Agricultural Resources	• One of the primary concerns is the management of construction waste. If not handled properly, waste materials can be inadvertently released into the environment, particularly affecting nearby agricultural lands. This can lead to soil contamination, which may adversely impact crop health and yield; • Another significant risk comes from the effluents generated by labor camps associated with the project. If this effluent is discharged into nearby agricultural areas, it can introduce harmful substances into the soil and water systems. This contamination	• : All types of waste must be disposed of exclusively at designated sites. This practice is crucial in preventing contamination of agricultural and open land resources; • Measures must be implemented to protect against leaching from waste disposal sites. This includes using barriers and monitoring systems to ensure that no harmful substances seep into the surrounding land; • Effluent must be managed in accordance with established engineering designs. This ensures that the treatment and	• Contractor(s)	• BEZA	Contract cost

Environmental Quality	Potential Impacts	Proposed Mitigation Measures	Responsible Agency		Associated Cost
			Planning and Execution	Supervision/ Monitoring Agency	
	can disrupt the growth of crops and lead to reduced agricultural productivity.	disposal processes are effective and safe for the environment; • It is imperative that effluent is not released into open land resources. Continuous monitoring and management practices should be implemented to guarantee that agricultural land remains unaffected by any effluent discharge.			
Operation Period					
Agricultural Resources	During the operation period, the agricultural activities of local people will not be affected however if industrial effluent directly discharge to the open space that will spill out to the agricultural field also and create disturbance and reduce the production of farmers. However, the possibility of this impact is of lower significance because the NSEZ areas are not included in any agricultural field and currently there is no agricultural activity conducted by the local farmers.	• Implement a monitoring program to regularly assess the impact on agricultural resources; • Create buffer zones between the NSEZ and adjacent agricultural lands to reduce the risk of contamination from pollutants and to minimize disturbances from noise and light; • Ensure that the NSEZ does not adversely affect local water sources used for irrigation; • Involve local farmers and agricultural stakeholders in decision-making processes related to the NSEZ operations; • Provide support for farmers transitioning to alternative livelihoods or practices affected by the project; • Conduct regular audits of the environmental management plans to ensure compliance and effectiveness.	• BEZA	• BEZA	• Development cost/ operation cost

SOCIAL ENVIRONMENT

Socio-economic resource

Table 8-7: EMP for safeguarding the socio-economic impacts in the project areas

Environmental Quality	Potential Impacts	Proposed Mitigation Measures	Responsible Agency		Associated Cost
			Planning and Execution	Supervision/ Monitoring Agency	
Construction Period					
Labor Influx	• An influx of labor will take place in the project areas due to the lack of appropriate local workers for this specific type of project activity; • The health and safety of the working force are impacted by the possibility of developing HIV/AIDS and other infectious diseases at the labor camps, and construction camps. Nonetheless, the effects will be temporary, site-specific, and manageable	• To reduce or avoid this anticipated risk, workers should be provided with on-the-job training on OHS issues; • Ensure appropriate PPE (Hard boots, life vest, safety goggles, hand gloves etc.) should be available at the site and used by workers. • Sanitary toilets should be made at the sites; separate female toilet is required if female workers involved at the sites; • Drinking water supply should be accessible by each worker at the site (portable drinking water supply is acceptable.) and conducting Toolbox meeting (TBM) at the construction sites etc.	• Contractor(s)	• BEZA	Contract cost
Occupational health and safety	• During the construction period, trenching, excavation, materials transportation and lifting of equipment and pipes, Grading, Stringing, wielding of pipes, coatings and wrapping, potential health hazards are anticipated if proper safety preventive measures are not undertaken properly; • Due to wielding, electrical shock may cause serious injuries to health and eyes; • Coating and wrapping works, health risks are skin irritation and discomfort.	• Standards of Health and Safety for all employees are not less than those laid down by the national standards or statutory regulations; • The Contractor shall provide all appropriate protective clothing and equipment for the work to be done and ensure its proper use. Where required, safety nets, belts, harnesses and lines shall be ensured by the contractors; • The "safety directives for work equipment" and "safety directives for protective gears" shall be prepared and	• Contractor(s)	• BEZA	Contract cost

Environmental Quality	Potential Impacts	Proposed Mitigation Measures	Responsible Agency		Associated Cost
			Planning and Execution	Supervision/ Monitoring Agency	
		disseminated to the workers by the contractor; • Construct sanitary latrine or septic tank system or install portable cabin toilet for workers/ employees; • Heavy Equipment: (Heavy Equipment includes but is not limited to: Backhoes, Bulldozers, Road Graders, Excavators, Scrapers Loaders, Dump Trucks, Earth Movers, Trucks 2 Tons GVW or Greater.) Operators should have license, training, qualifications, certifications and medical fitness Heavy Equipment should be equipped with back-up alarm, horn and seat belt. All Motorized Heavy Equipment should require Rollover Protective Structures (ROPS) with seat restraints. Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas. Inspections Before use. A Traffic Management Plan should be developed for the project/ site to ensure safe interactions between work activities, equipment, people and environment; • Material Handling: Safeguard and Control Measures should be considered for Loading and Unloading Hazards. Use of mechanical lifting equipment e.g., Cranes, Forklifts and etc. Conduct Safe Work zone during loading/ unloading and regular inspection; • Electrical Safety: Insulation - insulate electrical conductors with glass, rubber or plastic;			

Environmental Quality	Potential Impacts	Proposed Mitigation Measures	Responsible Agency		Associated Cost
			Planning and Execution	Supervision/ Monitoring Agency	
		• Electrical protective devices interrupt current flow when they exceed conductor capacity like fuses, circuit breakers & ground fault circuit interrupters (GFCI's). Only competent people who are trained and qualified to work on electrical equipment. PPE for electrical work includes Hard hat, Safety glasses, long sleeve cotton shirt and long non-melting pants. Regularly check electrical equipment. Give instructions to workers to report any electrical faults immediately and stop using the tool or cable as soon as any damage is seen. Where possible, eliminate risks by using battery powered or cordless tools or tools which operate from a 110V supply system.			
Community health and safety	• The local community near the project area will not to be impacted by the proposed onsite construction activities since there is no residence adjacent to the project site; • However, offsite infrastructure such as accesses road permits the movement of construction vehicles for the transportation of construction materials at the project site; • The number of vehicles will increase. This increasing amount of traffic will cause traffic congestion with time. In addition, road accidents may occur due to the movement of vehicles with construction materials and equipment and operation of machinery and equipment; • Especially the school going children are the major victim of accidents on the approach road;	• To reduce this anticipated risk, site security must be maintained, information regarding construction work must be disseminated, and a boundary fence (at least 2 m in height) should be installed around the working area. Safety Signs/ Markings: The contractor will provide safety signs/ markings around the site. The size and locations of signs will be as per the instruction of the engineer.	• Contractor(s)	• BEZA	Contract cost

Environmental Quality	Potential Impacts	Proposed Mitigation Measures	Responsible Agency		Associated Cost
			Planning and Execution	Supervision/ Monitoring Agency	
	• Communicable diseases can spread among the local community from the influx of construction workers due to improper management of construction camps; • The community health and safety will be at risk due to the trenching, excavating, backfilling, pipe installation, wielding, vehicle movement and other types of construction works.				
Waste management	• The Project will generate both solid non-hazardous and hazardous waste throughout the construction phase. The anticipated non-hazardous waste types include excavated material, broken aggregates, solid waste, filling materials, wastewater etc. While hazardous waste may include used oil, empty drums or replaced parts of the construction may include used oil, empty drums or replacement parts of the construction machinery, used battery etc.	• To reduce this anticipated impact, the contractor shall provide sufficient containers for the temporary storage of solid waste including separate containers for hazardous and non-hazardous waste and shall be clearly labelled; • The hazardous waste/e-waste to be collected in bins, steel drums and stored in a segregated roofed area and periodically disposed at approved waste disposal facilitates; • The contractor shall provide appropriate facilities for temporary dumping of all types of waste before final disposal; • The contractor shall not dispose any waste, rubbish or offensive matter in any place not approved by the Engineer or project authority.	• Contractor(s)	• BEZA	Contract cost
Traffic and transport	• No of electrical poles, street light posts and water pipeline and other utilities facilities will be required for shifting during construction period, and shifting of utilities like electric poles may require temporary power cut which may disturb the life of common local people. But the impact will be short term;	• To minimize these anticipated impacts, defensive driving training of drivers and proper maintenance of vehicles is required; • Establishing diversion roads during the construction, traffic sign/cautionary signs to avoid undue traffic congestion, lighting at night-time and movement of	• Contractor(s)	• BEZA	Contract cost

Environmental Quality	Potential Impacts	Proposed Mitigation Measures	Responsible Agency		Associated Cost
			Planning and Execution	Supervision/ Monitoring Agency	
	• Generally, erection of electric poles may cause inconvenience, block the access to the residents, shopkeepers, students and children; • Occupational and public safety issues of the workers, technicians and residents are a serious concern during shifting of the utilities; • Materials carrying vehicles and construction vehicles (Excavator, pay loader, grader, dump-truck etc.) may damage the environment in the construction area and may be a disturbance to the nearby population; • Without proper traffic management, accidents may also occur.	construction vehicles to be planned during off-peak period and; • Flagmen shall be equipped with red and green flags and illuminating vest at night especially near at intersection etc.			
Child labor	• The contractor sometimes hires or recruits the child labor workforce into the project. In keeping with internationally recognized standards, the project will make a distinction between child labor and young workers; • The project will not tolerate child labor under any circumstances.	• To reduce this risk, the Contractor, including its Subcontractors, shall not employ or engage a child under the age of 14 unless the national law specifies a higher age (the minimum age). Should not employ or engage a child between the minimum age and the age of 18 in a manner that is likely to be hazardous, or to interfere with, the child's education, or to be harmful to the child's health or physical, psychological or sexual abuse. mental, spiritual, moral, or social development	• Contractor(s)	• BEZA	Contract cost
Employment opportunity	• Employment opportunities will be created for both skill and unskilled laborers and indirect employment of the local community at the construction sites.	• To mitigate the social unrest, the contractor should recruit a minimum of 30% local labor, especially in the non-skilled jobs and non-discriminated wages as per current Labor Law and Government regulations should also be ensured.	• Contractor(s)	• BEZA	Contract cost

Environmental Quality	Potential Impacts	Proposed Mitigation Measures	Responsible Agency		Associated Cost
			Planning and Execution	Supervision/ Monitoring Agency	
Gender Based Violence (GBV)	• The gender-based violence (GBV) and sexual exploitation and abuse/Sexual Harassment (SH) risks may increase to some extent within local communities when there are large influxes of male workers from outside the area; • Generally, the female employment tends to be more concentrated in low-paid and low-productivity occupations; • Increasing women's labor force participation and improving the quality of female employment will require more significant support for women's access to employment opportunities and high-quality skills development programs.	• Mandatory and repeated training and awareness raising for the workforce about refraining from unacceptable conduct toward local community members, specifically women; • Informing workers about national laws that make sexual harassment and gender-based violence a punishable offence which is prosecuted; • Introducing, and signing of a Worker Code of Conduct by all workers as part of the employment contract, and including sanctions for non-compliance (e.g., termination); • Adopting a policy to cooperate with law enforcement agencies in investigating complaints about gender- based violence; • A grievance mechanism on potential GBV/SEA/SH cases under the guidance of the Project PIU and shall consider in submitting bid the provisions for service provide	• Contractor(s)	• BEZA	Contract cost
Operation Period					
Occupational health and safety	• During the operation period, occupational health and safety will be affected by the gas pipe leakage, fire and explosions	• To avoid this anticipated impact, maintenance like checking, re-testing of gas pipeline, water supply, power and telecommunication networks, biogas plants, drainage network etc., should be carried out regularly and if leakage is found, immediately shut down the networks and repair the line as early as possible etc.; • Regular emergency exercises are required to increase preparedness by ensuring that responders are properly equipped and trained for rescue and	• BEZA	• BEZA	• Development cost/ operation cost

Environmental Quality	Potential Impacts	Proposed Mitigation Measures	Responsible Agency		Associated Cost
			Planning and Execution	Supervision/ Monitoring Agency	
		firefighting duties and that the rescue and evacuation plan is implemented; • To ensure quick action, it is vital to make sure that communication lines are open; • Fire extinguishers and fireballs and other latest technology should be accessible at the site and capacitate the workers to use this equipment during fire events and explosion etc.			
Community health and safety:	• The community Health and Safety (CHS) will be affected by pipeline ruptures, equipment failures, spillage accidents etc., during the operation and maintenance period; • In addition, gas pipe and water pipe leakage can occur caused faulty construction, damage from excavation equipment or corrosion can also affect the community and workers health and safety in the working areas; • Gas leaks can contribute to accumulation of gas that will ignite easily and cause fire accidents or explosions.	• To avoid this anticipated impact, maintenance like checking, re-testing of gas/water pipeline should be carried out regularly and if leakage is found, immediately shut down the gas/water supply and repair the line as early as possible etc.; • Implement stringent safety zones and evacuation procedures; • Provide workers with appropriate personal protective equipment (PPE), including flame-resistant clothing and respiratory protection; • Conduct regular emergency response drills to enhance preparedness etc.	• BEZA	• BEZA	• Development cost/ operation cost
Traffic and transport:	• Emergency response activities, road closures, and evacuation procedures can lead to significant disruptions in traffic flow, potentially causing delays and congestion. • Smoke, flames, or hazardous materials released during a pipeline incident can reduce visibility on roads, increasing the risk of accidents; • Evacuation procedures may lead to increased traffic on evacuation routes, posing challenges in managing a safe and orderly evacuation process;	• Maintain liaison with the local traffic department and share the project traffic management plan for their information; • Develop and implement traffic management plans to divert traffic away from the affected area and ensure the safety of both drivers and emergency responders; • Install or activate advanced warning systems, such as flashing lights or variable message signs, to alert drivers to	• BEZA	• BEZA	• Development cost/ operation cost

Environmental Quality	Potential Impacts	Proposed Mitigation Measures	Responsible Agency		Associated Cost
			Planning and Execution	Supervision/ Monitoring Agency	
	• The impact on road safety during gas pipeline incidents can be minimized, ensuring a more effective and safer response.	reduced visibility conditions and potential hazards; • Foster collaboration between public agencies, private transportation companies, and local businesses to improve overall transportation			

8.4 SPECIFIC ENVIRONMENTAL MANAGEMENT PLAN FOR EACH SUBPROJECT.

314. The anticipated impacts and proposed mitigation measures are described as sub-project specific in the environmental Management Plans as follows:

- Table 8-8: Sub-project specific EMP for construction of gas pipeline networks in project areas.
- Table 8-9: Site specific EMP for the Land Development of IMD zone and housing facilities ii Zone 5 and Zone 18
- Table 8-10: Site Specific EMP for Construction of Power Network within NSEZ Areas
- Table 8-11: Site EMP for Construction of Storm Water Drainage and Road Networks within the NSEZ Areas
- Table 8-12: EMP for TSDF for the Ship Recycling Industries at Zone-24 of NSEZ Areas
- Table 8-13: Site specific EMP for construction of water supply within the NSEZ areas.

Table 8-8: Sub-project specific EMP for construction of gas pipeline networks in project areas.

Project Activities	Types of environmental components	Potential Risks	Mitigation Measures	Responsible Agencies		Associated Cost
				Planning and Execution	Supervision & Monitoring	
Pre-Construction and Construction Phase						
▪ Manpower Engagement ▪ Pipeline Route and Working Area selection ▪ Selection of base camp/ Labor camp ▪ Movement of heavy equipment ▪ Utility Shifting ▪ Vegetation Clearance ▪ Trench excavation & Landfilling ▪ Transporting, Lifting and Placement of pipes in the trench ▪ Grading, Stringing, welding of pipes, coating, and wrapping ▪ Water body, road and railway crossing through open-cut system ▪ Lowering in, tying in, cathodic protection ▪ Commissioning	**Physical Environment**	**Vulnerable to Land Use:** Vulnerable to land use-trenching, excavation, and trench filling after digging the gas pipeline will cause erosion of the slope.	Proper mitigations measures such as using backhoe, ripper or other approved technique, ditch shall provide minimum cover (1.22 meter) from the top of the pipe surface to the original or final ground surface, contractor shall provide additional cover to meet special construction requirements contained in right of way and permit conditions and prior to lowering-in, any loose rock, debris, metal of any kind and hard objects shall be removed from the ditch etc. can help to minimize the impacts to land use pattern in the project areas.	Contractor	KGDCL/ BEZA	Contract cost
	Social Environment	**Labor Influx:** An influx of labor will take place in the project areas due to the lack of appropriate local workers for this specific type of project activity. The health and safety of the working force are impacted with the possibility of developing HIV/AIDS and other infectious diseases at the labor camps, and construction camps. Nonetheless, the effects will be temporary, site-specific, and manageable	To reduce or avoid this anticipated risk, workers should be provided with on-the-job training on OHS issues. Ensure appropriate PPE (Hard boots, life vest, safety goggles, hand gloves etc.) should be available at the site and used by workers. Sanitary toilets should be made at the sites; separate female toilet is required if female workers involved at the sites. Drinking water supply should be accessible by each worker at the site (portable drinking water supply is acceptable.) and conducting Toolbox meeting (TBM) at the construction sites etc.	Contractor	KGDCL/ BEZA	Contract cost

Project Activities	Types of environmental components	Potential Risks	Mitigation Measures	Responsible Agencies		Associated Cost
				Planning and Execution	Supervision & Monitoring	
▪ Metering station and other permanent structures above ground. ▪ Gas pipeline leakage ▪ Valve station and RMS	**Social Environment**	**Employment opportunities:** Employment opportunities will be created for both skill and unskilled labors and indirect employment of the local community at the construction sites.	To mitigate the social unrest, the contractor should recruit a minimum of 30% local labor, especially in the non-skilled jobs and non-discriminated wages as per current Labor Law and Government regulations should also be ensured.	Contractor	KGDCL/ BEZA	Contract cost
		Labor Camp: During establishment of labor camps, local air quality will be disturbed by dust emissions, surface and groundwater sources could be contaminated by toilets and other sanitary works	To mitigate this risk, labor camp should be within close proximity of the site, good accommodation for the labors and keep it clean and hygienic with proper ventilation, sanitation (latrines 1 per 25 persons and separate bathing facility and urinals, male and women). The construction camps should be at least 500 m distance from the human settlements to avoid conflicts and stress over the infrastructure facilities with the local community, and the location for stockyards for construction materials will be identified at least 1 km from water sources. Store houses for hazardous material like diesel should be at a distance from construction labor camps.	Contractor	KGDCL/ BEZA	Contract cost
		Occupational Health and Safety: During the pre-construction stage, clearing the site, selection of RoW (right of Way) of pipeline route and working area, base camp, and movement of heavy	To reduce these anticipated impacts, the suggested mitigation measures should be employed regularly ▪ Standards of Health and Safety for all employees are not less than those laid down by national standards or statutory	Contractor	KGDCL/ BEZA	Contract cost

Project Activities	Types of environmental components	Potential Risks	Mitigation Measures	Responsible Agencies		Associated Cost
				Planning and Execution	Supervision & Monitoring	
		equipment will be at risk for staff and workers, but the impact is moderately significance considering the nature of works. However, during the construction period, trenching, excavation, materials transportation and lifting of equipment and pipes, Grading, Stringing, wielding of pipes, coatings and wrapping, potential health hazards are anticipated if proper safety preventive measures are not undertaken properly. Due to wielding, electrical shock may cause serious injuries to health and eyes. Coating and wrapping works, health risks are skin irritation and discomfort for respiratory system will occur.	regulations. ▪ The Contractor shall provide all appropriate protective clothing and equipment for the work to be done and ensure its proper use. Where required, safety nets, belts, harnesses and lines shall be provided by the contractor. The "safety directives for work equipment" and "safety directives for protective gears" shall be prepared and disseminated to the workers by the contractor. ▪ Construct sanitary latrine or septic tank system or install portable cabin toilet for workers/ employees ▪ Heavy Equipment: (Heavy Equipment includes but is not limited to: Backhoes, Bulldozers, Road Graders, Excavators, Scrapers Loaders, Dump Trucks, Earth Movers, Trucks 2 Tons GVW or Greater.) Operators should have license, training, qualifications, certifications and medical fitness Heavy Equipment should be equipped with back-up alarm, horn and seat belt. All Motorized Heavy Equipment should require Rollover Protective Structures (ROPS) with seat restraints. Ensure the visibility of workers through their use of high visibility vests when working in or walking through heavy equipment operating areas. Inspections Before use. Traffic Management Plan should be developed for the project/ site to ensure			

Project Activities	Types of environmental components	Potential Risks	Mitigation Measures	Responsible Agencies		Associated Cost
				Planning and Execution	Supervision & Monitoring	
			safe interactions between work activities, equipment, people and environment. ▪ Material Handling: Safeguard and Control Measures should be considered for Loading and Unloading Hazards. Use of mechanical lifting equipment e.g., Cranes, Forklifts and etc. Conduct Safe Work zone during loading/ unloading and regular inspection. ▪ Electrical Safety: Insulation - insulate electrical conductors with glass, rubber or plastic. Electrical protective devices - interrupts current flow when it exceeds conductor capacity like fuses, circuit breakers & ground fault circuit interrupters (GFCI's). Only competent people who are trained and qualified to work on electrical equipment. PPE for electrical work includes Hard hat, Safety glasses, long sleeve cotton shirt and long non-melting pants. Regularly check electrical equipment. Give instructions to workers to report any electrical faults immediately and stop using the tool or cable as soon as any damage is seen. Where possible, eliminate risks by using battery powered or cordless tools or tools which operate from a 110V supply system.			

Project Activities	Types of environmental components	Potential Risks	Mitigation Measures	Responsible Agencies		Associated Cost
				Planning and Execution	Supervision & Monitoring	
		Social conflict: During the pre-construction period, utility shifting can enhance the social conflict if proper consultation is not held with the local community. However, during the construction period,	▪ Stakeholder consultations are important for the local community such as focus group discussions (FGD), interviews, meetings etc., before and during utilities shifting. ▪ After construction, utilities should be installed appropriately at the disrupted sites by project cost. ▪ To reduce this impact, necessary information should be given to the surrounding neighbors, information should include (construction time, and construction natures etc.) ▪ To carry out regular stakeholder consultation with the local community. ▪ To make strong correlations with local people's representatives, religious leaders, social leaders, and others to avoid any kind of social conflict in the project areas. ▪ Any other necessary steps should be taken based on situations like meetings, workshops etc.	Contractor	KGDCL/ BEZA	Contract cost
		Gender Based Violence (GBV): The gender-based violence (GBV) and sexual exploitation and abuse/Sexual Harassment (SH) risks may increase to some extent within local communities when there are large influxes of male workers from outside the area.	▪ Mandatory and repeated training and awareness raising for the workforce about refraining from unacceptable conduct toward local community members, specifically women. Informing workers about national laws that make sexual harassment and gender- based violence a punishable offence which is prosecuted. Introducing, and signing of a Worker Code of Conduct by all workers as part	Contractor	KGDCL/ BEZA	Contract cost

Project Activities	Types of environmental components	Potential Risks	Mitigation Measures	Responsible Agencies		Associated Cost
				Planning and Execution	Supervision & Monitoring	
		Generally, the female employment tends to be more concentrated in low-paid and low-productivity occupations. Increasing women's labor force participation and improving the quality of female employment will require more significant support for women's access to employment opportunities and high-quality skills development programs.	of the employment contract, and including sanctions for non-compliance (e.g., termination). Adopting a policy to cooperate with law enforcement agencies in investigating complaints about gender-based violence. a grievance mechanism on potential GBV/SEA/SH cases under the guidance of the Project PIU and shall take into account in submitting bid the provisions for service providers in case of potential GBV victims/cases.			
		Child Labor: The contractor sometimes hires or recruits the child labor workforce into the project. In keeping with internationally recognized standards, the project will make a distinction between child labor and young workers. The project will not tolerate child labor under any circumstances.	To reduce this risk, the Contractor, including its Subcontractors, shall not employ or engage a child under the age of 14 unless the national law specifies a higher age (the minimum age). Shall not employ or engage a child between the minimum age and the age of 18 in a manner that is likely to be hazardous, or to interfere with, the child's education, or to be harmful to the child's health or physical, mental, spiritual, moral, or social development.	Contractor	KGDCL/ BEZA	Contract cost
		Force Labor: It will occur during the construction period e.g., excavation, trenching, transporting materials, and	To reduce this anticipated risk, the Contractor, including its Subcontractors, shall not employ or engage forced labor. Forced labor consists of any work or service, not voluntarily performed, that is	Contractor	KGDCL/ BEZA	Contract cost

Project Activities	Types of environmental components	Potential Risks	Mitigation Measures	Responsible Agencies		Associated Cost
				Planning and Execution	Supervision & Monitoring	
		others, however, force is not allowed at the construction sites. The following measures shall be implemented to reduce this anticipated risk.	exacted from an individual under threat of force or penalty, and includes any kind of involuntary or compulsory labor, such as indentured labor, bonded labor or similar labor-contracting arrangements. No people shall be employed or engaged who have been subject to trafficking. Trafficking in persons is defined as the recruitment, transportation, transfer, harboring or receipt of persons by means of the threat or use of force or other forms of coercion, abduction, fraud, deception, abuse of power, or of a position of vulnerability, or of the giving or receiving of payments or benefits to achieve the consent of a person having control over another person for the purposes of exploitation.			
	Physical Environment (Environmental Quality)	**Air pollution:** **Air pollution** will occur due to site preparation, construction works, earth filling, stack yards and labour shed construction, grading and movement of vehicles etc.	Ensure that all vehicles and machines comply with technical and environmental safety regulation. Schedule the operation times for vehicles, machines working in the construction area to reduce air emissions. The contractor shall maintain an inventory of the number, type and location of all stationary emission sources within the boundary of the construction site during the period of construction. Before the commencement of any work, the Engineer may require the methods of working and equipment intended to be used on the site to be made available for inspection and approval to ensure that they are suitable for	BEZA	KGDCL/ BEZA	Contract cost

Project Activities	Types of environmental components	Potential Risks	Mitigation Measures	Responsible Agencies		Associated Cost
				Planning and Execution	Supervision & Monitoring	
			the project. The Contractor shall ensure that all Plant and Equipment to be used on site are properly maintained in good operating condition and that the Plant and Equipment does not give rise to excessive exhaust smoke emissions. In the process of material handling, any material which has the potential to create dust shall be treated with water or wetting agent sprays, especially when dusty materials are being loaded or unloaded. Any vehicle with an open load-carrying area used for moving materials, and having the potential to create dust, shall have properly fitting side and tail boards. Materials having the potential to create dust shall not be loaded to a level higher than the side and tail boards and shall be covered by a clean tarpaulin. The tarpaulin shall be properly secured and shall extend at least 300 mm over the edges of the side and tail boards. Stockpiles of dusty materials will be covered by polythene or tarpaulin. The Contractor shall frequently clean and water the any public road used by vehicles accessing the site to minimize the fugitive dust emissions. Regular watering and sprinkling for dust suppression are to be done properly. Compaction of prepared site to re-strain the fugitive emissions. The			

Project Activities	Types of environmental components	Potential Risks	Mitigation Measures	Responsible Agencies		Associated Cost
				Planning and Execution	Supervision & Monitoring	
			Contractor shall restrict all vehicles on the Site to a maximum speed of 15-20 km/hr. km per hour and confine haulage and delivery vehicles to designated roadways inside the site.			
		Noise Pollution: Noise pollution may occur because of: Operation of vehicles and equipment during the site preparation, earth work, stack yards and labour shed construction, transportation of construction materials etc.	To avoid or mitigated this problem, construction activities in day time and minimize night time working. Regulate the speed for traffic in and around the project areas and carry out maintenance and routine inspections on vehicles and construction machineries to ensure the technical standards. Ensure the construction equipment are with proper silencer and muffler, padding/noise isolator and select the least noisy machine. The personnel involved in high noise generating activities shall be provided with personal protective devices like ear plug, earmuffs etc.	BEZA	KGDCL/ BEZA	Contract cost
		Water Pollution: Surface and groundwater can be contaminated by sewage & wastewater from labour camp, dumping of moist soil for prolong period and effluent disposal etc.	To reduce the water polltuion, the contractor shall design methods of working to minimize water pollution and necessary trainings to the workers to ensure that these methods are implemented. The contractor shall provide toilets with septic tanks system or sanitary pits of sufficient capacity for the number of workers on the site. No overflows from the storage tanks to the surface water drains will be permitted. Diesel and oil, cement, glues. Paint, other	BEZA	KGDCL/ BEZA	Contract cost

Project Activities	Types of environmental components	Potential Risks	Mitigation Measures	Responsible Agencies		Associated Cost
				Planning and Execution	Supervision & Monitoring	
			toxic chemicals etc., shall be handled properly and cover up all drains to prevent waste from ending up in the water. Minimize land disturbance and leave maximum vegetation cover.			
		Soil Pollution: Project site soil and sediment can be polluted due to disposal of solid and liquid waste of diversified construction works, operation of heavy equipment, oil spillage of construction vehicles etc.	To reduce or mitigate this problem, construction vehicles will remain on compacted roads. Fuel, lubricating oil, and used oil storage areas will be in the designated area. Contractor shall ensure daily collection and disposal of construction waste, debris, oil, fuel spillage, used oil etc. To avoid soil compaction along the transportation routes, only identified haul roads would be used for transportation and sand bags can be used to trap sediments more effectively in the trenching and execavated sites.	BEZA	KGDCL/ BEZA	Contract cost
	Social Environment	**Community health and safety:** The local community near the project area will not to be impacted by the proposed onsite construction activities since there is no residence adjacent to the project site. However, offsite infrastructure such as accesses road is permitting movement of construction vehicles for the transportation of construction materials at	To reduce this anticipated risk, site security must be maintained, information regarding construction work must be disseminated, and a boundary fence (at least 2 m in height) should be installed around the working area. Safety Signs/ Markings**:** The contractor will provide safety signs/ markings around the site. Size and locations of signs will be as per the instruction of the engineer.	BEZA	KGDCL/ BEZA	Contract cost

Project Activities	Types of environmental components	Potential Risks	Mitigation Measures	Responsible Agencies		Associated Cost
				Planning and Execution	Supervision & Monitoring	
		the project site. The number of vehicles will increase. This increasing number of traffic will occur traffic congestion with time. In addition, road accidents may occur due to the movement of vehicles with construction materials and equipment and operation of machinery and equipment. Specially the school going children are the major victims of accidents in the approach road. Communicable diseases can spread among the local community from the influx of construction workers due to improper management of construction camps. The community health and safety will be at risk due to the trenching, excavating, backfilling, pipe installation, wielding, vehicle movement and other types of construction works.				
	Social Environment	**Traffic and transport**: No of electrical poles, street light posts and water pipeline and other utilities facilities will be required for shifting during construction period, and shifting of utilities like	To minimize these anticipated impacts, defensive driving training of drivers and proper maintenance of vehicles is required. Establishing diversion roads during the construction, traffic sign/cautionary sign to avoid undue traffic congestion, lighting at night-times and movement of construction vehicles to be planned during off-peak	BEZA	KGDCL/ BEZA	Contract cost

Project Activities	Types of environmental components	Potential Risks	Mitigation Measures	Responsible Agencies		Associated Cost
				Planning and Execution	Supervision & Monitoring	
		electric poles may require temporary power cut which may disturb the life of common local people. But the impact will be of short term. Generally, erection of electric poles may cause inconvenience, block the access to the local residents, shopkeepers, students and children. Occupational and public safety issues of the workers, technicians and residents are a serious concern during shifting of the utilities. Materials carrying vehicles and construction vehicles (Excavator, pay loader, grader, dump-truck etc.) may damage the environment in the construction area and may be a disturbance to nearby population. Without proper traffic management, accidents may also occur.	period and flagmen shall be equipped with red and green flags and illuminating vest at night especially near at intersection etc.			
		Hazardous and Non-hazardous Waste: The Project will generate both solid non-hazardous and hazardous wastes throughout the construction phase. The anticipated non-hazardous waste types include excavated	To reduce this anticipated impact, the contractor shall provide sufficient containers for the temporary storage of solid waste including separate containers for hazardous and non-hazardous wastes and shall be clearly labeled. The hazardous waste/e-waste to be collected in bins, steel drums and stored in a segregated roofed	BEZA	KGDCL/ BEZA	Contract cost

Project Activities	Types of environmental components	Potential Risks	Mitigation Measures	Responsible Agencies		Associated Cost
				Planning and Execution	Supervision & Monitoring	
		material, broken aggregates, solid waste, filling materials, wastewater etc. While hazardous waste may include used oil, empty drums or replaced parts of the construction machinery, used battery etc.	area and periodically disposed at approved waste disposal facilitates. The contractor shall provide appropriate facilities for temporary dumping of all types of waste before final disposal. The contractor shall not dispose of any waste, rubbish or offensive matter in any place not approved by the Engineer or project authority			
	Biological Environment	**Terrestrial and Aquatic ecology:** The proposed project sites will not cover any protected areas, or ecologically sensitive areas. No trees will be affected by the construction activities except for some bush types of vegetation. The project has limited impacts to aquatic biodiversity during crossing the canal and ditches and low-lying areas etc.	to lessen the effects on biodiversity, bubble curtains or creation of agitation in water should be carried out prior carrying out the construction to provide avoidance time and let the species move away from crossing point and to prevent any injury/mortality. Contractors should submit SOPs and action time charts with risk management plan prior to any construction work.	BEZA	KGDCL/ BEZA	Contract cost
		Stakeholder consultation will be regularly held with the project affected people, workers and local community to avoid social conflict and strengthening the environmentally friendly project implementation.	It should be regularly held with the project affected people, workers and local community to avoid social conflict and strengthen the environmentally friendly project implementation.	BEZA	KGDCL/ BEZA	Contract cost
Operation & Maintenance Period						

Project Activities	Types of environmental components	Potential Risks	Mitigation Measures	Responsible Agencies		Associated Cost
				Planning and Execution	Supervision & Monitoring	
▪ Pipeline Operation and Maintenance ▪ Station Operation the DRS	**Social Environment**	**Occupational health and safety** During the operation period, occupational health and safety will be affected by the gas pipe leakage, fire and explosions	To avoid this anticipated impact, maintenance like checking, re-testing of gas pipeline should be carried out regularly and if leakage found, immediately shut down the gas supply and repairing the line as early as possible etc. Regular emergency exercises are required to increase preparedness by ensuring that responders are properly equipped and trained for rescue and firefighting duties and that the rescue and evacuation plan is implemented. To ensure quick action, it is vital to make sure that communication lines are open. Fire extinguishers and fireballs and other latest technology should be accessible at the site and capacitate the workers to use this equipment during fire events and explosion etc.	BEZA	KGDCL/ BEZA	Operation cost
	Environmental Quality	**Noise and Vibration:** The valve stations, and others pipeline facilities can produce excessive noise, affecting the local terrestrial ecosystem and human health.	Noise standards will be strictly enforced for all vehicles, plants, equipment, and construction machinery. All construction equipment used for an 8-hour shift will conform to a standard of less than 90 dB(A). Workers in the vicinity of high noise levels will be provided earplugs, to prevent prolonged exposure to noise levels of more than 90dB(A) per 8-hour shift.	BEZA	BEZA	Operation cost
	Environmental Quality	**Air Pollution:** Air pollutants such as VOCs, NOx, PM may be released from the gas pipeline operation, RMS operation and maintenance such as pipeline	To mitigate this problem, implement regular maintenance and inspection schedules, develop and practice emergency response plans, provide personnel with the necessary training on handling pipeline leaks, install fire and explosion detection	BEZA	BEZA	Operation cost

Project Activities	Types of environmental components	Potential Risks	Mitigation Measures	Responsible Agencies		Associated Cost
				Planning and Execution	Supervision & Monitoring	
		pigging, fire and explosions, gas pipeline leaks etc. These pollutants can significantly contribute to deteriorating the local air quality and affecting human health and natural environments.	systems, implement automatic fire suppression systems, create evacuation plans for nearby areas, strengthen coordination with local fire departments for rapid response, and use advanced leak detection systems for early identification and the installation of automatic shut-off valves to minimize gas release in the event of a leak.			
	Social Environment	**Community health and safety:** The community and workers Health and Safety (OHS) will be affected by pipeline ruptures, equipment failures, spillage accidents etc., during the operation and maintenance period. In addition, gas pipe leakage can occur caused faulty construction, damage from excavation equipment or corrosion can also affect the community and workers health and safety in the working areas. Gas leaks can contribute to accumulation of gas that will ignite easily and cause fire accidents or explosions.	▪ To avoid this anticipated impact, maintenance like checking, re-testing of gas pipeline should be carried out regularly and if leakage found, immediately shut down the gas supply and repair the line as early as possible etc. ▪ Implement stringent safety zones and evacuation procedures. Provide workers with appropriate personal protective equipment (PPE), including flame-resistant clothing and respiratory protection. ▪ Conduct regular emergency response drills to enhance preparedness. ▪ Ensure responders have proper training and equipment for firefighting and rescue operations. ▪ Develop and practice well-defined evacuation and rescue plans. ▪ Ensure clear communication channels for rapid response. ▪ Offer psychological support services and counseling for affected individuals.	BEZA	BEZA	Operation cost

Project Activities	Types of environmental components	Potential Risks	Mitigation Measures	Responsible Agencies		Associated Cost
				Planning and Execution	Supervision & Monitoring	
			▪ Fire extinguishers and fireballs and other latest technology should be accessible at the site and capacitate the workers to use this equipment during fire events and explosion etc.			
	Social Environment	**Traffic and transport:** Emergency response activities, road closures, and evacuation procedures can lead to significant disruptions in traffic flow, potentially causing delays and congestion. Smoke, flames, or hazardous materials released during a pipeline incident can reduce visibility on roads, increasing the risk of accidents. Evacuation procedures may lead to increased traffic on evacuation routes, posing challenges in managing a safe and orderly evacuation process. The impact on road safety during gas pipeline incidents can be minimized, ensuring a more effective and safer response.	▪ Maintain liaison with local traffic department and share the project traffic management plan for their information. ▪ Develop and implement traffic management plans to divert traffic away from the affected area and ensure the safety of both drivers and emergency responders. Install or activate advanced warning systems, such as flashing lights or variable message signs, to alert drivers to reduced visibility conditions and potential hazards. ▪ Foster collaboration between public agencies, private transportation companies, and local businesses to improve overall transportation resilience during emergencies.	BEZA	BEZA	Operation cost

Table 8-9: Site specific EMP for the Land Development of IMD zone and housing facilities ii Zone 5 and Zone 18

Sub-project Activities	Anticipated Impacts/Risks	Suggested Mitigation Measures	Responsible Parties		Associated Cost
			Implementing Agency	Monitoring & Supervision	
Construction Phase (Pipe installation, Dredging, and land development stage)					
Pipe Installation	Noise level	• To reduce the noise level, it is necessary to plan the pipe route to minimize proximity to sensitive receptors. • Selecting low noise generating equipment • Maintain construction-related noise-generating vehicles, equipment, machinery, and generators on a regular interval • Restrict the speed limit of construction vehicles to a maximum of 30 km • Workers should be provided with earplugs and encouraged by their use ensure good and low-noise-producing engines • Limit construction-related activities to 6 am to 6 pm • Conduct noise level and vibration level monitoring a regular interval	Contractor	DSC & PIU	Contract cost
	Local Ecosystems	• To minimize the ecological impacts, delivery pipelines should be chosen in consideration of the less vegetative areas. • Implement noise reduction measures, such as using quieter equipment or installing noise barriers, and • Work should be limited to only daytime from 6 am to 6 pm • Avoiding the breeding season to conduct installation work etc.	Contractor	DSC & PIU	Contract cost
	Occupational Health and Safety	• To minimize the risk, it is necessary to utilize cranes, forklifts, pipe layers, and other mechanical lifting devices to minimize manual handling. • Ensure that all equipment is properly maintained and operated by trained personnel • Implement lockout/tagout procedures to prevent unexpected events. • Necessary PPE should be accessible by the workers, such as earplugs or earmuffs, hand gloves, respirators, and eye protection • The contractors should follow the Occupational Health and Safety plan during construction work (shown in **Annex- 11,**	Contractor	DSC & PIU	Contract cost

Sub-project Activities	Anticipated Impacts/Risks	Suggested Mitigation Measures	Responsible Parties		Associated Cost
			Implementing Agency	Monitoring & Supervision	
		Vol. II. . • The contractor should implement the Emergency Response and Disaster Management Plan (as shown in **Annex-10, Vol. II.** at the site for workers to combat natural disasters like cyclones, surges, thunder, etc. and immediately save lives			
	Community Health and Safety	• To mitigate this problem, it is suggested to avoid pipe routes alongside villages and busy areas with alternative routes and access points for local people, • Work should be conducted only in the daytime from 06 am to 06 pm • Avoid damaging property of local people as much as possible • Addressing any kind of complaints promptly and respectfully.	Contractor	DSC & PIU	Contract cost
Dredging	Air Quality	• Provide face masks for the workers, laborers and staff at all time • Conduct air quality monitoring as per the national standard • Ensure good quality engines are used at the site • Adjusting dredging operations to minimize air pollution • Conduct regular inspection to meet the compliance requirements and • Other mitigation measures as appropriate should be adopted based on the local conditions.	Contractor	DSC & PIU	Contract cost
	Noise level	• Using low noise generating equipment and dredging techniques such as slow dredging speeds and optimized cutter head designs • Regularly monitoring noise levels at the working areas etc. • Ensuring appropriate PPE is accessible by all etc. • Workers should be provided with earplugs and encourage their use • Limit the dredging -related activities to 6 am to 6 pm • Conduct noise level and vibration level monitoring a regular interval etc.	Contractor	DSC & PIU	Contract cost

Sub-project Activities	Anticipated Impacts/Risks	Suggested Mitigation Measures	Responsible Parties		Associated Cost
			Implementing Agency	Monitoring & Supervision	
	Surface Water Quality	• To mitigate the impact, selecting dredging methods that minimize sediment resuspension, such as hydraulic dredging with cutter suction heads is the best solution • Avoiding dredging during spawning or breeding seasons of aquatic animals • Periodically conduct the sea water quality with an accredited laboratory and • Regular monitoring of water quality is essential also etc.	Contractor	DSC & PIU	Contract cost
	Aquatic ecology	• To lessen the impact, it is necessary to select dredging sites that minimize impacts on sensitive habitats and avoid dredging during spawning or breeding periods. • Employing hydraulic dredger or cutter suction dredgers to prevent excessive turbidity and monitoring of water quality is essential etc.	Contractor	DSC & PIU	Contract cost
	Climate change vulnerability	• Selecting dredging techniques is important to minimize sediment disturbance and reduce the release of contaminants. • Integrate climate change adaptation strategies into dredging operations to ensure climate resilient dredging operation etc. • Monitoring the exhaust gas emission from the dredgers and other equipment regularly • The contractor should implement the Emergency Response and Disaster Management Plan at site to	Contractor	DSC & PIU	Contract cost
	Occupational Health and Safety	• To protect workers' health and safety, it is necessary to take preventive measures such as strict fall protection measures (e.g., safety harnesses, guardrails), vessel stability, life jackets, lockout/tagout procedures, clean and dry working areas, adequate lighting, using non-slip surface and good housekeeping and monitoring weather conditions are crucial. • The contractors should follow the Occupational Health and Safety plan during construction work (shown in annex 11, **Vol. II.**)	Contractor	DSC & PIU	Contract cost

Sub-project Activities	Anticipated Impacts/Risks	Suggested Mitigation Measures	Responsible Parties		Associated Cost
			Implementing Agency	Monitoring & Supervision	
		• The contractor should implement the Emergency Response and Disaster Management Plan (as shown in **Annex- 10, Vol. II.** at the site for dredging activities during the natural disasters like cyclones, surges, thunder, etc., and immediately save lives			
	Community Health and Safety	• To minimize this impact, clear communications with the community people should be ensured and local people should be informed about the dredging schedule. • Implementing safety measures, such as marking dredging areas with buoys and providing warnings to boaters, can prevent accidents etc.	Contractor	DSC & PIU	Contract cost
	Movement of Water Vessels	• It is advised to select the route carefully route planning can minimize vessel traffic in sensitive areas and reduce the risk of collisions or groundings. • Reducing vessel speeds can decrease sediment resuspension, noise pollution, and the risk of accidents, and • Implementing safety measures, such as marking dredging areas with buoys and providing warnings to boaters, vessels etc., can prevent accidents etc.	Contractor	DSC & PIU	Contract cost
Landfilling	Air Quality	• Provide face masks for the workers, laborers and staff at all time • Conduct air quality monitoring as per the national standard • Ensure good good-quality engines are used at the site • Adjusting infilling operations to minimize air pollution • Conduct regular inspection to meet the compliance requirements • Other mitigation measures as appropriate, should be adopted based on the local conditions.	Contractor	DSC & PIU	Contract cost
	Noise level	• Using low noise generating equipment for levelling, grading etc. • Regularly monitoring noise levels at the working areas etc. • Ensuring appropriate PPE is accessible by all etc. • Workers should be provided with earplugs and encourage	Contractor	DSC & PIU	Contract cost

Sub-project Activities	Anticipated Impacts/Risks	Suggested Mitigation Measures	Responsible Parties		Associated Cost
			Implementing Agency	Monitoring & Supervision	
		their use • Limit the dredging -related activities to 6 am to 6 pm • Conduct noise level and vibration level monitoring a regular interval etc.			
	Surface Water Quality	• To prevent the piling up of excavated soil, raw material, and construction debris at the site by proper management and disposal • Minimize run-off by using sprays for curing • Maintaining an appropriate flow of water sprinklers at the site • Construction of stormwater drains along with sedimentation tanks with sandbags as partitions and barriers for direct flow of runoff to canals. • Construction of an adequate number of toilets and a proper sanitation system to prevent open defecation along the riverbanks/water supply lines • Construction of soak pits/septic tanks to dispose of the domestic wastewater generated from labor camps to prevent disposal of sewage in surface water bodies • Proper collection, management, and disposal of construction and municipal waste from the site to prevent mixing of the waste in run-off and entering the water bodies • No debris/construction material should enter the aquaculture ponds and other water bodies in the area • Surface water should be collected and examined in the laboratory	Contractor	DSC & PIU	Contract cost
	Groundwater Quality	• No sewage or wastewater will be allowed to accumulate in any unlined structure and timely disposal of the construction/chemical/hazardous waste so as to prevent leaching of any pollutant to the ground helped in preserving groundwater. • Pumping groundwater should be from deep aquifers of more than 300 m to supply water free from contamination (e.g.,	Contractor	DSC & PIU	Contract cost

Sub-project Activities	Anticipated Impacts/Risks	Suggested Mitigation Measures	Responsible Parties		Associated Cost
			Implementing Agency	Monitoring & Supervision	
		arsenic). Safe and sustainable discharges are to be ascertained before the selection of pumps. • Tube wells will be installed with due regard for the surface environment, protection of groundwater from surface contaminants, and protection of aquifer cross-contamination. • All tube wells, test holes, and monitoring wells that are no longer in use or needed shall be properly decommissioned. • Install monitoring wells in both upstream and downstream areas near construction yards and construction camps to regularly monitor the water quality and water levels. • Protect groundwater supplies of adjacent lands.			
	Soil Erosion and Impact on soil quality	• Establish a local drainage line with an appropriate spoil/silt collector • Rehabilitate road drainage structures to reduce soil erosion	Contractor	DSC & PIU	Contract cost
	Waterlogging and drainage	• Establish a drainage line with an appropriate silt collector and silt screen for rainwater or wastewater connecting to the existing drainage lines already there • Rehabilitate road drainage structures immediately if damaged by contractors' road transport. • Build new drainage lines as appropriate and required wastewater from construction yards connecting to the available recipient water bodies. • Ensure wastewater quality conforms to the relevant standards provided by DoE, before it is discharged into the recipient water bodies. • Ensure the internal roads/hard surfaces in the construction yards'/construction camps that generate storm water drainage to accommodate high runoff during downpours and that there is no stagnant water in the area at the end of the downpours. • Construct wide drains instead of deep drains to avoid sand deposition in the drains that require frequent cleaning. • Provide appropriate silt collector and silt screen at the inlet	Contractor	DSC & PIU	Contract cost

Sub-project Activities	Anticipated Impacts/Risks	Suggested Mitigation Measures	Responsible Parties		Associated Cost
			Implementing Agency	Monitoring & Supervision	
		and manholes and periodically clean the drainage system to avoid drainage congestion. • Protect natural slopes of drainage channels to ensure adequate storm water drains. • Regularly inspect and maintain all drainage channels to assess and alleviate any drainage congestion problems. • Reduce infiltration of contaminated drainage through stormwater management design. • The contractors should follow the Drainage Management Plan (indicative DMP) is documented in **Annex -16, Vol. II.**)			
	Waste Generation	• Establish a waste management system at the project area • Train workers and staff to manage waste properly • Provide waste collection bins (hazardous, organic, and solid) at labor camps, administrative buildings, and construction sites • Maintain waste inventory, and conduct an MOU with the waste collector as per the waste management plan • The contractors should follow the Waste Management Plan (indicative WMP) is documented in **Annex -14, Vol. II.**)	Contractor	DSC & PIU	Contract cost
	Energy Consumption:	**Energy Consumption:** • Utilize maximum energy-efficient technologies, • Install energy-saving lighting, machines, and VFDS • Calculate/track GHG emissions • Set up a target to minimize GHG emissions • Ensure oil (diesel, octane) is stored in a safe place with secondary containment • Contractors should utilize every possible way to reduce GHG emissions • Utilize solar system, rainwater harvesting in the camps • Control the burning of fossil fuels • Use clean energy for cooking • Overhauling machinery, vehicles on routine maintenance	Contractor	DSC & PIU	Contract cost

Sub-project Activities	Anticipated Impacts/Risks	Suggested Mitigation Measures	Responsible Parties		Associated Cost
			Implementing Agency	Monitoring & Supervision	
		• Contractors should manage waste properly and should not burn solid waste • Control of GHG emissions by energy use efficiency, process modification, selection of fuels • Control GHG emissions by updating processes that may result in fewer emissions			
	Utility and machinery:	• Ensure that safe and updated machinery is used in the subproject • Hauling and calibrating machinery on a regular interval • All machinery is stored in a safe place • Maintain a lockout and tagout while working with the electrical connection • Maintain proper switching, wiring, and cables to reduce short circuits. • Power supply generators and substations should be enclosed with security barriers • Provide enough awareness signage	Contractor	DSC & PIU	Contract cost
	Terrestrial Ecology	• To reduce the anticipated impacts, strict monitoring is required during dredging activities. • Dreading should be carried out in a planned way. The planned dredging has less impact on the existing bank vegetation and animals, causing temporary harm to herbs and shrubs in the project area. Faunal groups, including amphibians, reptiles, birds, and mammals, may experience temporary disturbance. • Conduct onsite water testing by testing kits (e.g., turbidity, pH, BOD, etc.) Regularly. • If there are any negative impacts, or dead bodies of fish or other sea creatures, it should be reported immediately • Any kind of killing, trapping, and hunting of aquatic birds and other animals should be prohibited at the site, and it will be a punishable offense. • Workers should be sensitized in this regard. • Strict monitoring is required at the sites, etc.	Contractor	DSC & PIU	Contract cost

Sub-project Activities	Anticipated Impacts/Risks	Suggested Mitigation Measures	Responsible Parties		Associated Cost
			Implementing Agency	Monitoring & Supervision	
		• Replantation of the felled tree, about 2529 following the r Enhancement Measures and Green Plan as documented in Annex 19**, Vol-II**			
	Aquatic Ecology	• It is required to minimize contamination of rainfall run-off to minimize impact on water quality & aquatic life supported by the water bodies. • No solid or liquid waste shall be discharged in khal, sea, and any other water body • Septic tanks/soak pits should be provided at the construction site & labor camp to treat sewage to be generated from labor camps and prevent its disposal in the water body • Toilets should be provided at construction sites & labor camps to prevent contamination of water due to open defecation in nearby areas. • Vehicle washing/equipment cleaning should not be allowed near water bodies • Wastewater from the washing area should be collected and should be used for curing purposes or wheel washing purposes and should not be allowed to enter the water bodies • Excavation and filling should be carried out in phased manner to minimize exposure of loose earth for longer duration • A temporary storm water drainage system should be developed at site to channelize the storm water away from excavation/filling area, debris storage area and raw material storage area • All the raw material and debris should be stored in covered sheds on paved surfaces to minimize the contamination of rainfall run-off • Contractors should follow the gob restriction on fishing during hilsa spawning period and stop the dredging activities for safety purposes, if necessary	Contractor	DSC & PIU	Contract cost
	Occupational Health and Safety	• Workers should be provided with on-the-job training on OHS issues. • Ensure appropriate PPE (Hard boots, life vest, safety goggles, hand gloves etc.) should be available at the site and used by workers.	Contractor	DSC & PIU	Contract cost

Sub-project Activities	Anticipated Impacts/Risks	Suggested Mitigation Measures	Responsible Parties		Associated Cost
			Implementing Agency	Monitoring & Supervision	
		• Sanitary toilets should be made at the sites; a separate female toilet is required if female workers are involved at the sites. • Drinking water supply should be accessible to each worker at the site (portable drinking water supply is acceptable). • A toolbox meeting (TBM) should be carried out on OHS issues before starting to work at the site • Ensure implementation of Occupational Health and Safety Management Plan (indicative OHSP is documented in **Annex 11**, **Vol-II)**			
	Child labor	• Contractor and PIU, PRIDE or BEZA shall include provisions for the prohibition of child labor • The contractor, PIU of the PRIDE project, and BEZA shall regularly monitor sub-project sites to guide contractors and third-party monitoring/ related firm to discourage child labor	Contractor	DSC & PIU	Contract cost
	Labor Influx and Working Conditions	• Provide skill enhancement training to locals • Contract with different agencies to undertake civil works • Accommodation for the skilled and unskilled laborers will be provided at the workforce camps • Ensure the Labor Management Plan (LMP) needs to be executed by the Contractor (following the LMP of the PRIDE project, BEZA)	Contractor	DSC & PIU	Contract cost
	Community Health and Safety and GBV/SA/SH	• Ensure the dust-suppressing vehicle sprays water • Conduct free, prior, and informed community consultation • Provide traffic management personnel to control traffic • Disseminate leaflets, awareness signage, and posters regarding HIV/AIDS and awareness training on, these transmitted diseases and social conflict • Conduct toolbox talks daily basis and cover these issues • Maintain GBV GRM at PIU and Contractor level, aware of workers about GVB/SA/SH	Contractor	DSC & PIU	Contract cost
	Employment generation	• The subproject would require skilled manpower. • The contractor will hire a sufficient number of skilled manpower. • PIU/BEZA will monitor the overall performance of the contractor independently in complying with the provisions of the ESMP for satisfactory environmental management of the proposed subproject, including compliance with the DoE conditions and social compliances.	Contractor	DSC & PIU	Contract cost

Sub-project Activities	Anticipated Impacts/Risks	Suggested Mitigation Measures	Responsible Parties		Associated Cost
			Implementing Agency	Monitoring & Supervision	
		• Local community members will get preference for employment (daily basis or contractual) at the site. • Capacity building and training on EHS, OHS, WASH, housekeeping, and other relevant topics			
	GBV/ SEA/SH	• The project has been screened for GBV risks and it has been rated as "substantial". • The GBV Action Plan that will be prepared by BEZA will include appropriate mitigation measures • Conduct training on GBV/SEA/SH by the social and gender councilor	Contractor	DSC & PIU	Contract cost
	Social Conflict	• Contractors should execute free, prior, and informed consultation with the local people • Distribute leaflets, awareness signage, and posters regarding HIV/AIDS • conduct awareness training on social conflict, transmitted diseases such as HIV/AIDS • Conduct toolbox talks daily basis and cover these issues • Gender-based violence should be strictly monitored at the site etc. • Leaning land filing areas may affect vegetation and agricultural patterns. Engaged people in vegetation, agriculture or farming are employed in the land-development activity. • Contractors should support local people to move alternative ways. • Consultation with the local community about the alternative options (for economic development as well as transportation);	Contractor	DSC & PIU	
	Traffic movement and disruption	• The dredgers and other equipment are mobilized via road and waterways networks during daytime, • Ensure traffic is lights for assisting vehicles particularly during the evening • Allocate traffic management personnel with proper PPE, flags, signal lights etc. • Ensure speed of vehicles (maximum limit 25 km/hr.) • Provide training to the drivers, operators and signal man • Ensure Traffic Management Plan implemented properly by the contractor (as indicated by the TMP is documented in **Annex -13, Vol-II)**	Contractor	DSC & PIU	Contract cost

Sub-project Activities	Anticipated Impacts/Risks	Suggested Mitigation Measures	Responsible Parties		Associated Cost
			Implementing Agency	Monitoring & Supervision	
	Traffic and Transport	• The dredgers and other equipment are mobilized via road networks during the daytime, • Ensure traffic is light for assist vehicles, particularly during the evening • allocate traffic management personnel with proper PPE, flags, signal lights etc. • Ensure speed of vehicles (maximum limit 25 to 30 km/hr.) • Provide training to the drivers, operators, and signalman • Ensure Traffic Management Plan implemented properly by the contractor (Annex -13, Vol-II)	Contractor	DSC & PIU	Contract cost

Table 8-10: Site Specific EMP for Construction of Power Network within NSEZ Areas

Affected components	Environmental and Social Issues	Mitigation Measures	Parameters to be monitored	Locations	Measurements	Monitoring Frequency	Responsible Agency for Supervision and Monitoring	
							Implementation agency	Supervision Agency
Control of Air Pollution (Dust control)	Air pollution will occur due to site preparation, site development, earth filling, stackyard, labor shed construction, grading and movement of vehicles etc.	• Ensure that all vehicles and machines comply with technical and environmental safety regulations. • Schedule the operation times for vehicles and machines working at the construction sites. • Maintain an inventory of numbers, types and locations of all stationary emissions sources within the boundary of construction sites. • Maintaining and carrying out proper and efficient measures wherever necessary to reduce dust nuisance.	$PM_{2.5}$, PM^{10}, SPM, CO, NO_X, SO_X	At four locations (Site boundary of substations, underground cables as above, and other locations selected by PIU of NSEZ.)	24 hrs	Quarterly including the baseline conditions (before, during and after the construction period)	Contractor	NSEZ/ BEZA
			General air quality visibility	Project site	Visual inspection	Daily	Contractor	NSEZ/ BEZA

Affected components	Environmental and Social Issues	Mitigation Measures	Parameters to be monitored	Locations	Measurements	Monitoring Frequency	Responsible Agency for Supervision and Monitoring	
							Implementation agency	Supervision Agency
		• Prevent dust which originates from the construction activities and operation at the worksites, campsites and site offices. • Sprinkling water on the sites at least 3 times a day or more depending on the atmospheric conditions. • Keeping necessary covering/protection on stockpiled fine aggregates to reduce dust nuisance during natural air blowing etc.						
Control of Noise Pollution	Increase in ambient noise level due to operation of vehicles and equipment during site preparation, earth works, stackyards, labor shed construction, and transportation of construction materials.	• Detailed design for substation works to ensure operational noise will be limited to 45 dB(A) in low noise areas, 50 dB(A) in medium noise areas and 60 dB(A) in high noise at site boundary. • Transformers and other noise generating equipment to be installed appropriately within the substation areas. • Air compressors (if use during the construction period) which sound should be reduced properly, lined and sealed acoustic cover and being operated within cover. • All pneumatically operated tools should be fitted with properly maintained mufflers or silencers of	Noise levels in leq, Leq $_{days}$, Leq$_{nights,}$ and hour Leq	Undertake at least 5 locations including site boundary of substations, in protected areas, cables as above, and other locations selected by PIU of NSEZ.	24 hours	Monthly including baseline including pile works, peak movement of traffic at substation sites and underground cables as above.	Contractor	NSEZ/ BEZA

Affected components	Environmental and Social Issues	Mitigation Measures	Parameters to be monitored	Locations	Measurements	Monitoring Frequency	Responsible Agency for Supervision and Monitoring	
							Implementation agency	Supervision Agency
		the type recommended by manufacturers. • All machinery which will be used intermittently should be shut off in periods of non-use. • Construction activities should be carried out in day times and minimize night-time workings. • Regulate the speed of traffic in and around the project areas. • Regularly carrying out maintenance and routine inspection on vehicles and machinery to ensure the technical standards. • Ensure the construction equipment is with proper silencer and muffler, padding/noise isolator and select the lease noise generating equipment and machinery • The personnel involved with high noise generating activities shall be provided with personal protective devices such as ear plugs, ear mufflers etc.						
Control of water pollution	Surface and groundwater quality can be contaminated by sewage and wastewater from labor camps,	▪ Providing necessary arrangements to prevent entrance or accidental spillage, solid matters, contaminants, debris, garbage, cement, concrete, sanitary waste, oil, grease, pollutants and wastewater from aggregate processing, concrete batching, or	**Surface water quality** pH, DO, TDS, Turbidity, Temperature, TSS, BOD,	**Surface water locations:** Nearby water bodies or canals including	Standard analytical methods	Quarterly for water quality testing (4 locations*5 times both surface and	Contractor(s)	NSEZ/ BEZA

Affected components	Environmental and Social Issues	Mitigation Measures	Parameters to be monitored	Locations	Measurements	Monitoring Frequency	Responsible Agency for Supervision and Monitoring	
							Implementation agency	Supervision Agency
	dumping moist soil for a longer period and effluent disposal etc.	other construction operations into nearby streams, lakes, water courses, and underground water sources. ▪ Ensure water quality as per requirement: ▪ The contractor shall design methods of working to minimize water pollution and to meet the appropriate environmental standards following the ECR 2023. ▪ The contractor should provide toilets with septic tanks or sanitary pits of sufficient capacity for the numbers of workers working at the sites. ▪ No overflows from the storage tanks to the surface water drains will be permitted. ▪ Keeping materials such sand, cement and others in a secure place where there is not a risk of washout them into water ways or drains. ▪ Monitor and improve management and disposal of site waste. ▪ Cover up all the drains to prevent waste from ending up in water. ▪ Minimize land disturbance and leave maximum vegetation cover.	COD, Pb, Fe, Zn, Cd, As, Cl-, oil and grease etc. **Groundwater quality** pH, Turbidity, TDS, Hardness, Total Cr, Cu, Fe, Mn, Mg, Na, Zn, SS, Temperature, Total Coliform, Faecal Coliform, Total N, Nitrate, Sulphate etc.	Ichakhali canal within 50m of substations and within the ROW of power networks. **Groundwater monitoring locations:** Construction site-1, labor camp-1, substation-2,		groundwater)		

Affected components	Environmental and Social Issues	Mitigation Measures	Parameters to be monitored	Locations	Measurements	Monitoring Frequency	Responsible Agency for Supervision and Monitoring	
							Implementation agency	Supervision Agency
		▪ Properly collect and treat any wastewater ▪ Ichakhali canal at the site shall be retained and no waste is disposed of in the canal ▪ Silts are removed periodically from these silt traps to avoid choking and overflow etc.						
Control of soil pollution	Project site soil and sediment can be contaminated due to disposal of solid and liquid waste from construction works, operation of heavy equipment, oil spillage of construction vehicles etc.	▪ Clearing vegetation will be limited and rootstock to be left in-situ if possible. ▪ Construction vehicles will remain on compacted roads. ▪ Fuel, lubricant oils and used oil storage areas will be in the designated areas. ▪ Contractors ensure daily collection, and disposal of construction waste, debris, oil, fuel, spillage, used oil etc. ▪ To avoid soil compaction along the transportation routes, only identified haul roads would be used for transportation. ▪ Avoid damage to the important topographic features identified along the route by controlling access to these areas by providing temporary fencing.	pH, Total Sulphur (T-S), NH4+, (T-N), (T-P), (T-Hg), Cd, CN, Cr, Pb, As, PCB, Cu, Zn, Oil and grease, salinity etc.	Stackyard along the boundary of substation, within the ROW of the transmission line.	Standard Analytical Method	Baseline once during construction/ installation and after installation of power networks.	Contractor	NSEZ/ BEZA

Affected components	Environmental and Social Issues	Mitigation Measures	Parameters to be monitored	Locations	Measurements	Monitoring Frequency	Responsible Agency for Supervision and Monitoring	
							Implementation agency	Supervision Agency
Waste Management	The project will generate both hazardous and non-hazardous waste throughout the construction phase. Non-hazardous waste such as excavated materials, broken aggregates, solid waste, filling materials, wastewater etc., and Hazardous waste mainly PCB used in transformers, CFCs, SF6 gas used in GIS, empty paints, used oils, empty drums, used batteries, and construction machinery etc.	▪ Providing, installing and maintaining at least 3 nos. waste collection bins ▪ One for organic waste, one for construction waste and one for hazardous waste with minimum capacity of 30 liters each. ▪ Bins will be kept in a safe, easily accessible place that will be easy to use, and no adverse impact will generate on the surrounding environment etc. ▪ PCB will not be used in any new transformers or equipment installed by the project. ▪ Use of CFCs including halons is prohibited. ▪ Separate containers shall be provided for hazardous and non-hazardous waste applicable which will be clearly labelled. ▪ The hazardous e-waste shall be collected in steel drums and stored in segregated roofed areas and periodically disposed to the approve sites. ▪ The contractor shall construct sanitary latrines or septic tank systems or install portable cabin toilets for workers.	Record all construction materials used and removed by land clearance or generated by construction works.	Substation and transmission lines, construction sites, storage areas and temporary workers camps etc.	Visual Inspection	Monthly	Contractor(s)	NSEZ/BEZA

Affected components	Environmental and Social Issues	Mitigation Measures	Parameters to be monitored	Locations	Measurements	Monitoring Frequency	Responsible Agency for Supervision and Monitoring	
							Implementation agency	Supervision Agency
		▪ The contractor shall provide appropriate facilities for temporary dumping before final disposal etc.						
Occupational Health and safety	Accidents/ Incidents	▪ The contractor shall provide appropriate PPE to the workers where required safety nets, belts, harness and lines etc. ▪ Safety directives for work equipment and protective gears shall be prepared and disseminated for workers. ▪ The contractor should provide first aid box, medical supplies and other related facilities. ▪ Appropriate safety and health signs should be ensured at the site. ▪ Fire prevention and firefighting provisions should be confirmed at the site to reduce fire risks. ▪ Any kind of accident, incident, injury and near miss should be recorded properly at the site etc. ▪ Any other appropriate measures should be undertaken if it requires.	Zero lost times/fatalities, near miss, incident, occupational diseases, dangerous occurrence, any relevant grievances received, addressed and resolved etc.	Project activities areas and construction workers camps.	Record all incidents and response taken (including date, time and details of incident, treatment given and the outcome	Monthly	Contractor(s)	NSEZ/ BEZA
Infectious disease	Risks of HIV/AIDS/COVID-19	▪	Ensure that contractor personnel and local community	Project sites	Consultation with workers and communities.	Daily	Contractor(s)	NSEZ/ BEZA

Affected components	Environmental and Social Issues	Mitigation Measures	Parameters to be monitored	Locations	Measurements	Monitoring Frequency	Responsible Agency for Supervision and Monitoring	
							Implementation agency	Supervision Agency
			understand HIV/AIDS/ COVID-19 awareness campaign.					
Community Health and Safety	Community disturbance and potential safety hazard due to road traffic	▪ The contractor should ensure site security appropriately. ▪ Dissemination of information relating to the construction works should be carried out among the community people. ▪ Installation of boundary fence is required at the site. ▪ Safety signs and markings should be installed in visible locations where local people can see it easily. ▪ Employ flag men to control traffic in the working areas ▪ Consultation with the local people is required and should be ensured etc.	Accidents, incidents and complaints and traffic related issues: Speed control of construction vehicles. Timing/schedule of construction vehicles Traffic control Site attention sign/ flag men any relevant grievances received, addressed and resolved etc.	Approach road	Incidents, accidents and community complaints	Daily	Contractor(s)	NSEZ/ BEZA

Affected components	Environmental and Social Issues	Mitigation Measures	Parameters to be monitored	Locations	Measurements	Monitoring Frequency	Responsible Agency for Supervision and Monitoring	
							Implementation agency	Supervision Agency
Drinking water facilities	Worker's health and safety, diseases, injury etc.	▪ Providing continuously adequate drinking water supply at construction camps, worksites and site offices. ▪ Installing necessary tubewells as required. ▪ Providing essential storage facilities of drinking water by supplying portable best quality water tank.	Drinking water supply facilities Tube-well installation	Construction camp/site office	Visual Inspection	Monthly	Contractor(s)	NSEZ/ BEZA
Temporary sanitation facilities	Worker's health and safety, diseases, injury etc.	▪ Providing at least two portable toilet facilities ▪ Construction of temporary semi-pucca toilets with two pits and soak well latrines one for female and another for male workers. ▪ Ensure worker accommodation in a safe location that no adverse impact will generate on the surrounding environment.	Sanitary Toilets/ septic tank facilities	Labor camps, construction sites, site office.	Visual Inspection	Monthly	Contractor(s)	NSEZ/ BEZA
Storm water drainage system and sedimentation tank	Wastewater management	▪ To get rid of the surface runoff during the monsoon season. ▪ Avoid waterlogging and drainage congestion during the monsoon season	Nos/length of temporary drains facilities provided by the contractor	Construction sites, labor camps and storage site.	Visual Inspection	Quarterly	Contractor(s)	NSEZ/ BEZA

Affected components	Environmental and Social Issues	Mitigation Measures	Parameters to be monitored	Locations	Measurements	Monitoring Frequency	Responsible Agency for Supervision and Monitoring	
							Implementation agency	Supervision Agency
Traffic Management	Accident/ Incident and public disturbance	▪ Maintaining traffic management at worksite from time of commencement of construction works to time of completion works. ▪ Ensuring that road is safe for users ▪ Providing a safe working environment for those involved in work on the trafficked network and minimizing any disturbance to smooth flow of traffic. ▪ Providing necessary barricades, warning signs, lights, guide signs, flagmen, maintaining diversion roads by cutting, filling, construction etc. ▪ Keeping provision for existing traffic and pedestrian movement in such a way that to ensure that a single lane at least 3.00 meters wide is available for public traffic. ▪ Removal of all temporary construction on completion of the activities.	Approach route and transportation sites.	Project site and approach road sites	Visual Inspection	Monthly	Contractor(s)	NSEZ/ BEZA
Construction Camp Management	Health and safety, and security	▪ Providing necessary furniture, sanitary facilities with hand washing facilities, septic tanks/soak pits firefighting, electrical supply, safe drinking water supply, cooking arrangement, setting of waste bins	Neat and cleanliness and housekeeping.	Camp site	Visual Inspection	Monthly	Contractor(s)	NSEZ/ BEZA

Affected components	Environmental and Social Issues	Mitigation Measures	Parameters to be monitored	Locations	Measurements	Monitoring Frequency	Responsible Agency for Supervision and Monitoring	
							Implementation agency	Supervision Agency
		and sufficient ventilation facilities etc. ▪ Removal of structures and restoration of the site on completion of the works including removal of all materials, equipment, plant and furniture from the dismantle the camps and removing access road ▪ Maintaining the facilities in good condition throughout the construction periods.						
First Aid Box	Health and safety	▪ Supplying, equipping, and maintaining adequate first aid boxes at construction sites, site office and labor campsites. ▪ Erect conspicuous notice boards directing where these are situated ▪ Providing all requisite medical first aid kits including necessary medicines and other items as required. ▪ Provide, equip and maintain necessary dressing kits throughout the working periods for attending minor injuries.	Nos of first aid boxes with necessary medicines.	Site office, labor camps, construction sites etc.	Visual Inspection	Monthly	Contractor(s)	NSEZ/ BEZA
Personnel Protective Equipment (PPE)	Occupational Health and Safety	▪ Providing and maintaining appropriate (safe design, fit and comfort) PPE for each worker ▪ Ensure the highest possible protection for each employee in	Nos of PPE and accessibility by all workers	Construction sites	Visual Inspection	Monthly	Contractor(s)	NSEZ/ BEZA

Affected components	Environmental and Social Issues	Mitigation Measures	Parameters to be monitored	Locations	Measurements	Monitoring Frequency	Responsible Agency for Supervision and Monitoring	
							Implementation agency	Supervision Agency
		establishing and maintaining a safe and healthy working environment. ▪ Providing training or demonstrating proper understanding and developing skills in the use of PPE. ▪ Supplying the best quality of safety jackets, suitable hand protection gloves-flexible, durable and excellent puncture resistance, appropriate foot protection shoes having impact resistance, toes and heat-resistant soles, best quality safety helmet- tough, light weight and durable; suitable eye protection goggles to protect against specific workplace hazards, fit properly and comfortable to wear.						
Site preparation, protective fencing and safety measures with warning signs.	Safety and security	▪ Erecting and maintaining temporary fencing and gate if possible. ▪ Ensuring using best practices to protect local flora and fauna species and confining it within defined working areas. ▪ Utilizing appropriate techniques to minimize soil erosion including filling and cutting slopes ▪ Using suitable light equipment and confining the effects of vegetation clearance and soil disturbance within	Fencing and safety measurements	Project site	Visual Inspection	Monthly	Contractor(s)	NSEZ/ BEZA

Affected components	Environmental and Social Issues	Mitigation Measures	Parameters to be monitored	Locations	Measurements	Monitoring Frequency	Responsible Agency for Supervision and Monitoring	
							Implementation agency	Supervision Agency
		the allocated land boundaries including avoiding environmentally sensitive areas, protected areas, archaeological sites and areas adjacent to the surface water sources etc. ▪ Providing necessary protective fencing with warning signboard etc.						
Site cleaning, Removal and Disposal Activities	Neat and cleanliness, health and safety	▪ Ensure cleaning and maintaining is always carried out at the construction sites ▪ Keeping the construction areas, and storage areas are free from accumulation of waste materials or rubbish with necessary arrangement for collecting at a central disposal area daily ▪ Wastewater and sewage from office, and labor camps shall be piped to soak pits or other approved disposal areas. ▪ All used fuels, oils, other plants or vehicle fuels, old tires, tubes, other solid waste from households, office, workshop, construction materials etc., to be kept at a safe place. ▪ Any spillage shall be cleaned up by either burning them at the central disposal areas, including removing all waste, debris, rubbish, unused materials, concrete forms,	Disposal and clearing activities	Project site	Visual Inspection	Monthly	Contractor(s)	NSEZ/ BEZA

Affected components	Environmental and Social Issues	Mitigation Measures	Parameters to be monitored	Locations	Measurements	Monitoring Frequency	Responsible Agency for Supervision and Monitoring	
							Implementation agency	Supervision Agency
		equipment, machinery, surplus or unwanted materials buried or cleaned up in an approved way.						
Grievance Redress Mechanism	▪	▪ Establishment of communication channels such phone, SMS and emails ▪ Make GRM Boxes available at the construction sites, site offices and labor camp sites. ▪ Design posters, billboards, handouts, miking for posting GRM related information including GBV/SEA/SH risks and mitigation measures. ▪ Dissemination of information to the adjacent communities through brochures/leaflets, and community consultation at a regular interval ▪ Provision for receiving daily grievances, proper registration/record keeping, and resolution of grievances ▪ For GBV, SEA/SH grievances-maintenance of confidentiality and report on age, sex and summary of grievances only when consent is given.	Grievances/ complaints	Project site, labor camp, site office and construction camps etc.	Recording of nos. of grievance received, addressed and resolved a	Monthly	Contractor(s)	NSEZ/ BEZA
Labor Influx Management	▪	▪ Supply, commissioning, operation and maintenance of occupational health and safety, safety inspection,	Employment of local labors	Project site	Labor register	Monthly	Contractor(s)	NSEZ/ BEZA

Affected components	Environmental and Social Issues	Mitigation Measures	Parameters to be monitored	Locations	Measurements	Monitoring Frequency	Responsible Agency for Supervision and Monitoring	
							Implementation agency	Supervision Agency
		toolbox talk, warning sign including COVID-19 issues. ▪ Emergency medical transport and hospitalization/ treatment ▪ Conduct awareness training or sessions at the construction sites at a regular interval ▪ Enhance capacity building, and awareness training and monitoring program regularly including code of conduct, SEA/SH, OHS, accidental and incidental reporting etc.	and migrant labors					

Table 8-11: Site EMP for Construction of Storm Water Drainage and Road Networks within the NSEZ Areas

Issues	Project Activity	Possible Impacts	Suggested Mitigation Measures	Implementing Agency	
				Planning & Execution	Monitoring & Supervision Agency
Air quality	Site preparation, construction vehicles, material storage, and different types of construction works.	Air pollution will occur due to site preparation, stackyard and labor shed construction, hauling of equipment and dust generation from earth works such as levelling, grading, excavation works and movement of vehicles across unpaved roads, especially during windy conditions etc.	• Ensure that all vehicles, trucks, and electrical devices used in the project site will comply with technical, environmental and safety standards with regulations. • Schedule the operation times for vehicles and machines working in the construction areas to reduce air pollution. • Regular watering and sprinkling for dust suppression are to be done properly. • Stockpiles of dusty materials will be covered up by hard polythene or tarpaulin to reduce dust emission.	Contractor	**PIU Of NSEZ/ CSC**

Issues	Project Activity	Possible Impacts	Suggested Mitigation Measures	Implementing Agency	
				Planning & Execution	Monitoring & Supervision Agency
			• No stockpile will be maintained outside, and maximum possible distance between stockpile and nearest receptors. • The access road should be kept clean and free from mud and slurry. • Materials transportation will be covered up with impervious sheeting. • Speed of vehicles both on site and at intersections should be limited to 25-30 km/hr. • All diesel power equipment should be maintained regularly to minimize emission. • Solid waste burning in the sub-project site will be strictly prohibited etc.		
Water resources (surface and groundwater) and Quality	Construction of labor camps, refueling of vehicles, washing of equipment, and vehicles at safe distances from water sources.	Surface and groundwater can be contaminated by sewage and wastewater from labor camps and effluent disposal from washing of construction vehicles as well as due to improper housekeeping of hazardous waste etc.	• Labor camps should be constructed at a safer distance (30m) from the water body. • Arrangement of mobile toilets may be set at worksites. • Waste disposal is strictly prohibited to water body and proper disposal mechanisms should be adopted. • Proper sanitation facilities should be made available. • Channelize water from labor camps and worksites to nearby drains. • Campsite sewage disposal should be stored in a septic tank and soak wells. • Periodical training should be provided for the workers and staff for best utilization of water. • Recycle and reusing the waste as maximal extent. • Fuel, oil and used oil storage should be contained on a concrete floor. • Refueling will be carried out in designated areas with a strong protocol. • Construction vehicles and equipment should be serviced regularly at offsite locations.	Contractor	**PIU Of NSEZ/ CSC**

Issues	Project Activity	Possible Impacts	Suggested Mitigation Measures	Implementing Agency	
				Planning & Execution	Monitoring & Supervision Agency
			• Oil leakage and storage should be contained and cleaned up immediately. • Waste oil should be collected and stored for recycling or disposal etc.		
Soil & sediment pollution	Different activities such as handling construction materials (stone, bricks, sand, gravel, slurry, fuel, lubricants and paints) and disposal of solid waste and sewage from labor camps and construction yards etc.	Soil and sediment can be polluted due to handling of construction materials and disposal of solid and liquid waste from the construction sites. However, due to operating of heavy equipment may impact on soil texture and sediment can be contaminated by oil spill, and waste debris etc.	• Soil conservation measures will be undertaken during stockpiling, preservation of topsoil and gravel for remediation of disturbed areas. • Construction vehicles will remain on designated and prepare compacted gravel road. • Fuel, lubricating oil and used oil should be stored in drums and stored in the designated areas with concrete floors. • Onsite sanitation facilities should be adapted for latrines and sewage treatment. • Spill containment and clean up kit will be available at the site and to be cleaned regularly. • Construction vehicles and equipment will be serviced regularly. • Any kind of waste such as construction waste, liquid waste, used oil, fuel etc., shall be collected regularly, and • Ensure adequate drainage facilities are available at the construction sites etc.	Contractor	PIU of BEZA/ CSC
Noise pollution	Operation of various construction vehicles and diesel based machineries for constructing different types of civil infrastructures.	Noise pollution may occur due to operation of vehicles, equipment during the site preparation, stackyard, and labor shed construction, hauling of equipment, transportation of materials, plant materials, machineries, personnel, operation of DG sets, operation of batching plants for concrete and asphalts etc.	• Working schedule should be limited only to daytime and minimizing nighttime work as much as possible. • Regulate the speed of traffic in the project site. • Regularly carrying out maintenance and inspection on vehicles and construction equipment's to control noise generation. • The contractor shall ensure the construction equipment is within proper silencer and muffler. • The contractor should ensure low noise generating equipment is being used at the site. • Mobile noise sources such as cranes and earth moving equipment shall be routed in considering minimum disturbance to receptors (birds and animals around).	Contractor	**PIU Of NSEZ/ CSC**

Issues	Project Activity	Possible Impacts	Suggested Mitigation Measures	Implementing Agency	
				Planning & Execution	Monitoring & Supervision Agency
			• Restrict the nighttime vehicle movement at the access road. • Temporary noise barrier shall be used around the high noise generating construction equipment, and • Other measures as appropriate shall be applied etc.		
Ecosystem and Biodiversity	Operation of different noisy equipment, machineries for executing the construction works.	Negative impacts on ecosystem and biodiversity both flora and fauna may occur because of oil spillage, disposal of solid and liquid waste from onsite development activities. Project construction vehicles and equipment and vehicles will disturb the habitat of fishes Construction works and its associated machineries and vehicles can adversely affect the biodiversity of adjacent manmade forest in the subproject areas.	• Ensure proper disposal of construction waste. • No waste should be dumped into water bodies. • Wastewater from labor camps and construction yards should not be disposed of water bodies. • Site should be neat and clean and ensure no waste dump into the water bodies. • Storage of materials should not be kept in near water bodies. • Noise generating activities should be carried out only in the daytime. • Limiting the construction work at nighttime. • Damage to the natural topography and landscape should be minimized as much as possible. • Any kind of haunting, trapping and killing of wild animals should be strictly prohibited at the construction sites. • A minimum distance of 30m shall be kept from the canal, rivers and ponds if mud crab habitat found and as well as migratory birds are not affected.	Contractor	**PIU Of NSEZ/ CSC**
Labor management and social conflict management	Labor management including labor influx	During construction period, some workers from outside the project areas may be deployed that will cause conflict among them and local people. Sexual abusing female workers by the male workers may occur at the camp sites. Discrimination of wages, lack of adequate OHS, aggressive behavior by the migrant workers	• Local people should be deployed at the sites as much as possible. • Ensure the construction of labor shed and stockyard at the designated site avoiding the water bodies and local community vicinity. • Labor Management Plan should be executed properly. • Providing proper training and capacity building of workers & contractors. • Identifying the factors that might create conflict between workers and local people and avoiding it as much as possible. • Equal wage should be ensured both for male and female workers. • Providing appropriate PPE to all workers and staff etc.	Contractor	**PIU Of NSEZ/ CSC**

Issues	Project Activity	Possible Impacts	Suggested Mitigation Measures	Implementing Agency	
				Planning & Execution	Monitoring & Supervision Agency
		and managers may create labor unrest in the project areas.			
Gender Based Violence (GBV)	Engagement of different types of women labors in the construction sites.	Wages discrimination between male and female workers may occur. Women friendly sitting arrangement and drinking water supply may not be provided. Women may be victim of sexual abasement and eve teasing at the working sites.	• Engage competent women ward members speaking for women and working for them to participate in the implementation of the project. • Impart awareness training for both elected representatives and employees. • Activate GRC regarding hearing complaints and resolving them. • Ensure representation of women member in the GRC. • Ensure women friendly sitting arrangements and safe drinking water supply in women designated areas. • Workers should sign the code of conduct and adequate training in GBV is required.	Contractor	**PIU Of NSEZ/ CSC**
Occupational Health and Safety Hazard	Handling and disposal of hazardous and non-hazardous during construction period.	Constructed related health hazards e.g., incidental events (accident, injury, near miss) may occur during work at the sites. Handling and disposal of hazardous and non-hazardous during construction period. Improper traffic management can cause accidental cases in the project areas.	• Proper training should be provided for workers and contractors on OHS issues. • Cleanliness at the site premises and working places, living places and at the labor sheds should be confirmed. • Arrangement of proper ventilation and temperature at the labor shed. • Ensure proper disposal of solid and liquid waste • Provisions of adequate toilets and separate toilets for female workers and staff. • Provide sufficient dustbins to manage the solid waste at the sites, labor camps and construction yards. • Ensure appropriate PPE is accessible by each worker (e.g., safety boots, gloves, visible jackets, hard helmets, goggles, masks, eye shield for electrical works, earplugs and others).	Contractor	**PIU Of NSEZ/ CSC**
Social conflict	Management of labor influx	Due to engagement of large number of migrant workers in the project site, extra pressure may impose on the local resources like housing and water resources.	• Orientation and training should be provided to the workers, contractors and supervisors on health, safety and environment, including sexual diseases. • Health and safety training on communicable diseases should be provided for the workers.	Contractor	**PIU Of NSEZ/ CSC**

Issues	Project Activity	Possible Impacts	Suggested Mitigation Measures	Implementing Agency	
				Planning & Execution	Monitoring & Supervision Agency
		In addition, influx of workers to the community may pose risk for community health and safety, especially an increase in prevalence of diseases. Subsequently, the main anxiety for the community is food and water borne diseases, fecal elements contaminated to the water sources etc.	• Liaison with the community should be maintained throughout the construction period. • Grievance redress mechanism should be established at the project site before commencing construction works. • No child and force labor will be employed by the contractors. • Contractors will recruit local people either daily basis, or contractually to increase local engagement. • Available treatment of vector borne diseases by the contractors and • Regular monitoring shall be confirmed by the contractors etc.		
Traffic and Transport	Movement of construction vehicles for transportation of materials, personnel and equipment to the site.	Materials carrying vehicles and construction vehicles (pay loader, excavator, dump truck etc.) may damage environment in the construction areas and may create disturbance to nearby physical and social institutes. Without proper traffic management, accidents may also occur etc.	• Inform local people about the subproject activities. • Inspire local people to use connecting and diversion roads during the construction period. • Temporary roads should be developed for carrying materials in place of use of community road. • If village roads are used, please avoid peak hours and ensure regular maintenance is carried out. • Increased traffic should follow the traffic schedule to avoid traffic congestion. • Place traffic sign/cautionary signs to avoid undue traffic congestion and associated traffic measures to limit the traffic congestion in the working areas. • Lighting should be ensured on the passage roads during nighttime. • For regulation of traffic, flag men should be used of red and green flag especially near at intersection. • For notification of construction activities at least two signs shall be put up on each road and close to the point of intersection. • Traffic safety is to be ensured as per traffic management plan etc.	Contractor	**PIU Of NSEZ/ CSC**

Issues	Project Activity	Possible Impacts	Suggested Mitigation Measures	Implementing Agency	
				Planning & Execution	Monitoring & Supervision Agency
Community health and safety	Carrying construction materials into the project site by motorized vehicles.	Community health and safety can hamper due to different construction works and traffic management.	• Prior to starting the construction activities, contractor shall inform the local community. • Instruct the driver and limit the vehicle speed (25-30 km/hr.) near the settlement areas especially in the bazar areas. • Ban the use of mobile phones and talking while driving in the approach road. • Regular health checkups of the workers and awareness training on communicable diseases shall be carried out. • Ensure proper lighting at the project site during nighttime. • Avoid unnecessary noise pollution • Water shall be sprayed to the dry surface to control dust emission. • Contractors should develop traffic management plan. • Awareness creation on STDs, HIV/AIDs, GBV, SEA can bring positive results to limit the risk, and • Other mitigation measures as appropriate etc.	Contractor	**PIU Of NSEZ/ CSC**
Hazardous and non-hazardous waste	Adding admixture of cocreating works of civil structures, fueling and maintenance of construction vehicles and equipment.	The project will generate both solid non-hazardous waste and hazardous waste throughout the construction period. The anticipated non-hazardous waste mainly construction materials, excavated materials, municipal solid waste, wastewater while hazardous waste may include used oil, paints, chemicals, empty drums, replaced parts of construction vehicles and equipment, used battery and concrete admixtures etc. Local environment and human health will be jeopardized during	• The hazardous waste to be generated at the campsites should be collected in steel drums and stored in segregated roofed areas and periodically disposed of in a designated site selected by BEZA. • The campsite shall have compost pits for treating organic waste and separate bins for collecting inorganic waste which shall be disposed of in a selected disposal site. • Waste management and minimizing potential impacts during construction will be ensured by appropriate procedures, protocols and monitoring etc.,	Contractor	**PIU Of NSEZ/ CSC**

Issues	Project Activity	Possible Impacts	Suggested Mitigation Measures	Implementing Agency	
				Planning & Execution	Monitoring & Supervision Agency
		handling, storage and disposal of waste both on and offsite etc.			
Air Quality	Due to maintenance and operational works to road and storm water drainage, local air quality will be deteriorated.	During operation period, maintenance works shall be carried out periodically along the storm water drainage and road networks that will cause deterioration of local air quality due to dust generation from the construction sites.	• To mitigate this impact, watering and sprinkling shall be conducted twice a day during maintenance period. • Dust arrester can be used to arrest dust emission from the site. • Ensure good equipment and engines are used during repairing and maintenance work, and • Other appropriate mitigation measures shall be ensured etc.	**PIU Of NSEZ**	BEZA
Surface water Quality	Due to maintenance and operational works to road and storm water drainage, local surface water quality will deteriorate by releasing stagnant water in the drains.	Due to maintenance works, surface runoff will occur and pollute the outfalls' locations that will cause water logging in the subproject areas.	• To manage this problem, pushing and jetting methods can help to reduce the surface water pollution and minimize the water logging problems also.	**PIU Of NSEZ**	BEZA

Table 8-12: EMP for TSDF for the Ship Recycling Industries at Zone-24 of NSEZ Areas

Issues	Potential Impacts	Mitigation Measures	Responsible Agency		Cost
			Implementing Agency	Supervision and Monitoring Agency	
Physical Environment					
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 daytime	Contractor	PIU Of NSEZ/CSC	Contract cost
Noise level	Noise from construction, and increased vehicles	• Maximum allowable noise level • regulation shall be maintained	Contractor	PIU Of NSEZ/CSC	Contract cost

Issues	Potential Impacts	Mitigation Measures	Responsible Agency		Cost
			Implementing Agency	Supervision and Monitoring Agency	
	movements	• for areas near mosque, school, • residences and other sensitive locations • Construction works near residential areas should be done during the daytime only, • Measures shall be taken to lower noise from equipment			
Surface water Quality	Pollution of water channels from solid and liquid waste from construction Filling up of local small waterbodies like ponds	• Rainfall run-off from the construction site needs to be captured to prevent deposal into natural waterbodies • Wastewater shall be collected, re-used and/or disposed of offsite after oil/grease removal and settlement of suspended solids.	Contractor	PIU Of NSEZ/CSC	Contract cost
Groundwater Quality	Oil leakage, Sewage leakage	• Extraction of groundwater shall be from optimum location to minimize impact on local tubewells • Areas of oil and liquid waste shall be made impermeable to prevent leakage • Pollution prevention plans will be prepared and followed to prevent groundwater from contamination and protection of aquifer cross contamination.	Contractor	PIU Of NSEZ/CSC	Contract cost
Soil Pollution	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.	Contractor	PIU Of NSEZ/CSC	Contract cost
Biological Environment					
Flora	Trees in the locality may be affected by dust, emissions	• Tree plantation should be implemented in the project areas and its adjacent areas.	Contractor	PIU Of NSEZ/CSC	Contract cost
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).	Contractor	PIU Of NSEZ/CSC	Contract cost

Issues	Potential Impacts	Mitigation Measures	Responsible Agency		Cost
			Implementing Agency	Supervision and Monitoring Agency	
		• Minimize the release of oil, oil waste 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			
Biodiversity, Natural Habitat	Disturbance to aquatic and amphibian habitats from noise, pollution, increased movements.	• Limit the construction works within the designated sites allocated to the contractors.	Contractor	PIU Of NSEZ/CSC	Contract cost
Social Environment:					
Economy & livelihood	Work opportunities & Business opportunities will be created both for the local and outsiders.	• Allocate some work to the local poor and affected people during recruitment. • Gender equity and equal wage must be ensured. • Provision shall be kept for economic opportunities to be accessed by local people	Contractor	PIU Of NSEZ/CSC	Contract cost
Education	Disturbance to nearby academic institutions may be affected due to the construction activities.	• Minimize construction activity during daytime • Limit construction activity within designated areas	Contractor	PIU Of NSEZ/CSC	Contract cost
Labor Influx	Social conflict between local people and contractor(s), outside laborers will occur during the construction periods.	• 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	Contractor	PIU Of NSEZ/CSC	Contract cost
Pollution induced social issues	Pollution of soil may affect agriculture	• Keep an option for people to submit any complaints	Contractor	PIU Of NSEZ/CSC	Contract cost

Issues	Potential Impacts	Mitigation Measures	Responsible Agency		Cost
			Implementing Agency	Supervision and Monitoring Agency	
	Pollution of rivers may affect fisheries Dust, emission, and increased traffic may affect livestock	• Compensation for any damage caused by facility activity			
Operation & Maintenance Period					
Physical Environment					
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 be done during in daytime only, • Measures should be taken to lower noise from equipment • Ships movement shall be limited to 10 PM	PIU of NSEZ	BEZA	Development budget
Air Quality	Dust generation from industrial works including harmful particles like paint, rust Air quality degradation from spreading of toxic and hazardous materials. Fumes from waste oil 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	PIU of NSEZ	BEZA	Development budget
Surface water Quality	Pollution from movement of Ships Pollution from leakage of solid and untreated liquid waste 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.	PIU of NSEZ	BEZA	Development budget

Issues	Potential Impacts	Mitigation Measures	Responsible Agency		Cost
			Implementing Agency	Supervision and Monitoring Agency	
		• Monitoring of Water Quality			
Ground Water Quality	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 water quality.	PIU of NSEZ	BEZA	Development budget
Soil Pollution	Contamination from Oil leakage, sewage leakage, heavy metals Pollution from solid and liquid wastes including toxic/ hazardous waste Degradation from disposal of industrial/chemical wastes, affecting agriculture Salinity intrusion from embankment /breach	• Oil use or extraction areas shall be impermeable concrete-floor. • Harmful waste shall be contained at all stages. • Metal scraps shall not be stored directly on the ground but with some barriers	PIU of NSEZ	BEZA	Development budget
Biological Environment					
Flora	Scenic beauty shall be ensured once completing the construction period.	• Nos of trees shall be implemented in the landfill sites to create green barriers around the disposal sites.	PIU of NSEZ	BEZA	Development budget
Fauna	Habitation of some aquatic species including fish, dolphins and 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.	PIU of NSEZ	BEZA	Development budget
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.	PIU of NSEZ	BEZA	Development budget

Issues	Potential Impacts	Mitigation Measures	Responsible Agency		Cost
			Implementing Agency	Supervision and Monitoring Agency	
		• Provide adequate knowledge to the workers regarding protection of flora and fauna, and relevant government regulations and punishments for illegal poaching.			
Social Environment					
Employment opportunity	Employment opportunities will be created for the local people.	• Local people will get hired to work on the subproject sites that could improve the livelihood and economy in the local people.	PIU of NSEZ	BEZA	Development budget
Social Unrest	Social unrest may occur due to generations of offensive odors from the landfill site.	• Odor management plan should be implemented properly. • Site boundary with sufficient height will decrease the odor dissemination in the local areas. • Ensure regular monitoring is conducted at the site properly etc.	PIU of NSEZ	BEZA	Development budget

Table 8-13: Site specific EMP for construction of water supply within the NSEZ areas.

Issues	Project Activity	Possible Impacts	Suggested Mitigation Measures	Implementing Agency		Cost
				Planning & Execution	Monitoring & Supervision Agency	
Pre-construction & Construction Period:						
Physical Environment (Environmental Quality, and Land Resources)						
Air quality	Site preparation, construction vehicles, material storage, and different types of construction works.	Air pollution will occur due to site preparation, stackyard and labor shed construction, hauling of equipment and dust generation from earth works such as levelling, grading, excavation works and movement of vehicles across unpaved roads, especially during windy conditions etc.	• Ensure that all vehicles, trucks, and electrical devices used in the project site will comply with technical, environmental and safety standards with regulations. • Schedule the operation times for vehicles and machines working in the construction areas to reduce air pollution.	Contractor	**PIU Of NSEZ/ CSC**	Contract cost

Issues	Project Activity	Possible Impacts	Suggested Mitigation Measures	Implementing Agency		Cost
				Planning & Execution	Monitoring & Supervision Agency	
			• Regular watering and sprinkling for dust suppression are to be done properly. • Stockpiles of dusty materials will be covered up by hard polythene or tarpaulin to reduce dust emission. • No stockpile will be maintained outside, and maximum possible distance between stockpile and nearest receptors. • The access road should be kept clean and free from mud and slurry. • Materials transportation will be covered up with impervious sheeting. • Speed of vehicles both on site and at intersection should be limited to 25/30 km/hr. • All diesel power equipment should be maintained regularly to minimize emission. • Solid waste burning in the project site will be strictly prohibited etc.			
Water resources (surface and groundwater) and Quality	Construction of labor camps, refueling of vehicles, washing of equipment, and vehicles at safe distances from water sources.	Surface and groundwater can be contaminated by sewage and wastewater from labor camps and effluent disposal from washing of construction vehicles as well as due to improper housekeeping of hazardous waste etc.	• Labor camps should be constructed at a safer distance (30m) from the water body. • Arrangement of mobile toilets may be set at worksites. • Waste disposal is strictly prohibited to water body and proper disposal mechanisms should be adopted. • Proper sanitation facilities should be made available. • Channelize water from labor camps and worksites to nearby drains.	Contractor	**PIU Of NSEZ/ CSC**	Contract cost

Issues	Project Activity	Possible Impacts	Suggested Mitigation Measures	Implementing Agency		Cost
				Planning & Execution	Monitoring & Supervision Agency	
			• Campsite sewage disposal should be stored in a septic tank and soak wells. • Periodical training should be provided to the workers and staff for best utilization of water. • Recycle and reusing the waste as maximal extent. • Fuel, oil and used oil storage should be contained on a concrete floor. • Refueling will be carried out in designated areas with a strong protocol. • Construction vehicles and equipment should be serviced regularly at offsite locations. • Oil leakage and storage should be contained and cleaned up immediately. • Waste oil should be collected and stored for recycling or disposal etc.			
Soil & sediment pollution	Different activities such as handling construction materials (stone, bricks, sand, gravel, slurry, fuel, lubricants and paints) and disposal of solid waste and sewage from labor camps and construction yards etc.	Soil and sediment can be polluted due to handling of construction materials and disposal of solid and liquid waste from the construction sites. However, due to operating of heavy equipment may impact on soil texture and sediment can be contaminated by oil spill, and waste debris etc.	• Soil conservation measures will be undertaken during stockpiling, preservation of topsoil and gravel for remediation of disturbed areas. • Construction vehicles will remain on designated and prepare compacted gravel road. • Fuel, lubricating oil and used oil should be stored in drums and stored in the designated areas with concrete floors. • Onsite sanitation facilities should be adapted for latrines and sewage treatment.	Contractor	PIU of BEZA/ CSC	Contract cost

Issues	Project Activity	Possible Impacts	Suggested Mitigation Measures	Implementing Agency		Cost
				Planning & Execution	Monitoring & Supervision Agency	
			• Spill containment and clean up kit will be available at the site and to be cleaned regularly. • Construction vehicles and equipment will be serviced regularly. • Any kind of waste such as construction waste, liquid waste, used oil, field etc., shall be collected regularly, and • Ensure adequate drainage facilities are available at the construction sites etc.			
Noise pollution	Operation of various construction vehicles and diesel based machineries for constructing different types of civil infrastructures.	Noise pollution may occur due to operation of vehicles, equipment during the site preparation, stackyard, and labor shed construction, hauling of equipment, transportation of materials, plant materials, machineries, personnel, operation of DG sets, operation of batching plants for concrete and asphalts etc.	• Working schedule should be limited only to daytime and minimizing nighttime work as much as possible. • Regulate the speed of traffic in the project site. • Regularly carrying out maintenance and inspection on vehicles and construction equipment's to control noise generation. • The contractor shall ensure the construction equipment is within proper silencer and muffler. • The contractor should ensure low noise generating equipment is being used at the site. • Mobile noise sources such as cranes, earth moving equipment shall be routed in considering minimum disturbance to receptors (birds and animals around). • Restrict the nighttime vehicle movement at the access road. • Temporary noise barrier shall be used around the high noise generating construction equipment, and	Contractor	**PIU Of NSEZ/ CSC**	Contract cost

Issues	Project Activity	Possible Impacts	Suggested Mitigation Measures	Implementing Agency		Cost
				Planning & Execution	Monitoring & Supervision Agency	
			• Other measures as appropriate shall be applied etc.			
Biological Environment (Ecological Resources, Fisheries and Agriculture)						
Ecosystem and Biodiversity	Operation of different noisy equipment, machineries for executing the construction works.	Negative impacts on ecosystem and biodiversity both flora and fauna may occur because of oil spillage, disposal of solid and liquid waste from onsite development activities. Project construction vehicles and equipment and vehicles will disturb the habitat of fishes Construction works and its associated machineries and vehicles can adversely affect the biodiversity of adjacent manmade forest in the subproject areas.	• Ensure proper disposal of construction waste. • No waste should be dumped into water bodies. • Wastewater from labor camps and construction yards should not be disposed of water bodies. • Site should be neat and clean and ensure no waste dump into the water bodies. • Storage of materials should not be kept in near water bodies. • Noise generating activities should be carried out only in the daytime. • Limiting the construction work at nighttime. • Damage to the natural topography and landscape should be minimized as much as possible. • Any kind of haunting, trapping and killing of wild animals should be strictly prohibited at the construction sites. • A minimum distance of 30m shall be kept from the canal, rivers and ponds if mud crab habitat found and as well as migratory birds are not affected.	Contractor	**PIU Of NSEZ/CSC**	Contract cost
Social Environment:						
Labor management and social conflict management	Labor management including labor influx	During construction period, some workers from outside the project areas may be deployed that will	• Local people should be deployed at the sites as much as possible. • Ensure the construction of labor shed and stockyard at the designated site	Contractor	**PIU Of NSEZ/ CSC**	Contract cost

Issues	Project Activity	Possible Impacts	Suggested Mitigation Measures	Implementing Agency		Cost
				Planning & Execution	Monitoring & Supervision Agency	
		cause conflict among them and local people. Sexual abusing female workers by the male workers may occur at the camp sites. Discrimination of wages, lack of adequate OHS, aggressive behavior by the migrant workers and managers may create labor unrest in the project areas.	avoiding the water bodies and local community vicinity. • Labor Management Plan should be executed properly. • Providing proper training and capacity building of workers & contractors. • Identifying the factors that might create conflict between workers and local people and avoiding it as much as possible. • Equal wage should be ensured both for male and female workers. • Providing appropriate PPE to all workers and staff etc.			
Gender Based Violence (GBV)	Engagement of different types of women labors in the construction sites.	Wages discrimination between male and female workers may occur. Women friendly sitting arrangement and drinking water supply may not be provided. Women may be victim of sexual abasement and eve teasing at the working sites.	• Engage competent women ward members speaking for women and working for them to participate in the implementation of the project. • Impart awareness training for both elected representatives and employees. • Activate GRC regarding hearing complaints and resolving them. • Ensure representation of women member in the GRC. • Ensure women friendly sitting arrangements and safe drinking water supply in women designated areas. • Workers should sign the code of conduct and adequate training in GBV is required.	Contractor	**PIU Of NSEZ/ CSC**	Contract cost
Occupational Health and Safety Hazard	Handling and disposal of hazardous and non-hazardous during construction period.	Constructed related health hazards e.g., incidental events (accident, injury, near miss) may occur during work at the sites.	• Proper training should be provided for workers and contractors on OHS issues.	Contractor	**PIU Of NSEZ/ CSC**	Contract cost

Issues	Project Activity	Possible Impacts	Suggested Mitigation Measures	Implementing Agency		Cost
				Planning & Execution	Monitoring & Supervision Agency	
		Handling and disposal of hazardous and non-hazardous during construction period. Improper traffic management can cause accidental cases in the project areas.	• Cleanliness at the site premises and working places, living places and at the labor sheds should be confirmed. • Arrangement of proper ventilation and temperature at the labor shed. • Ensure proper disposal of solid and liquid waste • Provisions of adequate toilets and separate toilets for female workers and staff. • Provide sufficient dustbins to manage the solid waste at the sites, labor camps and construction yards. • Ensure appropriate PPE is accessible by each worker (e.g., safety boots, gloves, visible jackets, hard helmets, goggles, masks, eye shield for electrical works, earplugs and others).			
Social conflict	Management of labor influx	Due to engagement of large number of migrant workers in the project site, extra pressure may impose on the local resources like housing and water resources. In addition, influx of workers to the community may pose risk for community health and safety, especially an increase in prevalence of diseases. Subsequently, the main anxiety for the community is food and water borne diseases, fecal elements contaminated to the water sources etc.	• Orientation and training should be provided to the workers, contractors and supervisors on health, safety and environment, including sexual diseases. • Health and safety training on communicable diseases should be provided for the workers. • Liaison with the community should be maintained throughout the construction period. • Grievance redress mechanism should be established at the project site before commencing construction works. • No child and force labor will be employed by the contractors.	Contractor	**PIU Of NSEZ/ CSC**	Contract cost

Issues	Project Activity	Possible Impacts	Suggested Mitigation Measures	Implementing Agency		Cost
				Planning & Execution	Monitoring & Supervision Agency	
			• Contractors will recruit local people either daily basis, or contractually to increase local engagement. • Available treatment on vector borne diseases by the contractors and • Regular monitoring shall be confirmed by the contractors etc.			
Traffic and Transport	Movement of construction vehicles for transportation of materials, personnel and equipment to the site.	Materials carrying vehicles and construction vehicles (pay loader, excavator, dump truck etc.) may damage environment in the construction areas and may create disturbance to nearby physical and social institutes. Without proper traffic management, accidents may also occur etc.	• Inform local people about the subproject activities. • Inspire local people to use connecting and diversion roads during the construction period. • Temporary roads should be developed for carrying materials in place of use of community road. • If village roads are used, please avoid peak hours and ensure regular maintenance is carried out. • Increased traffic should follow the traffic schedule to avoid traffic congestion. • Place traffic sign/cautionary signs to avoid undue traffic congestion and associated traffic measures to limit the traffic congestion in the working areas. • Lighting should be ensured on the passage roads during nighttime. • For regulation of traffic, flag men should be used of red and green flag especially near at intersection. • For notification of construction activities at least two signs shall be put up at each road and close to the point of intersection.	Contractor	**PIU Of NSEZ/ CSC**	Contract cost

Issues	Project Activity	Possible Impacts	Suggested Mitigation Measures	Implementing Agency		Cost
				Planning & Execution	Monitoring & Supervision Agency	
			• Traffic safety is to be ensured as per traffic management plan etc.			
Community health and safety	Carrying construction materials into the project site by motorized vehicles.	Community health and safety can hamper due to different construction works and traffic management.	• Prior to starting the construction activities, contractor shall inform the local community. • Instruct the driver and limit the vehicle speed (25-30 km/hr.) near the settlement areas especially in the bazar areas. • Ban the use of mobile phones and talking while driving in the approach road. • Regular health checkups of the workers and awareness training on communicable diseases shall be carried out. • Ensure proper lighting at the project site during nighttime. • Avoid unnecessary noise pollution • Water shall be sprayed to the dry surface to control dust emission. • Contractors should develop traffic management plan. • Awareness creation on STDs, HIV/AIDs, GBV, SEA can bring positive results to limit the risk, and • Other mitigation measures as appropriate etc.	Contractor	**PIU Of NSEZ/ CSC**	Contract cost
Hazardous and non-hazardous waste	Adding admixture of cocreating works of civil structures, fueling and maintenance of construction vehicles and equipment.	The project will generate both solid non-hazardous waste and hazardous waste throughout the construction period. The anticipated non-hazardous waste mainly construction materials, excavated materials,	• The hazardous waste to be generated at the campsites should be collected in steel drums and stored in segregated roofed areas and periodically disposed of in a designated site selected by BEZA.	Contractor	**PIU Of NSEZ/ CSC**	Contract cost

Issues	Project Activity	Possible Impacts	Suggested Mitigation Measures	Implementing Agency		Cost
				Planning & Execution	Monitoring & Supervision Agency	
		municipal solid waste, wastewater while hazardous waste may include used oil, paints, chemicals, empty drums, replaced parts of construction vehicles and equipment, used battery and concrete admixtures etc. Local environment and human health will be jeopardized during handling, storage and disposal of waste both on and offsite etc.	• The campsite shall have compost pits for treating organic waste and separate bins for collecting inorganic waste which shall be disposed of in a selected disposal site. • Waste management and minimizing potential impacts during construction will be ensured by appropriate procedures, protocols and monitoring etc.,			
Operation Period:						
Physical Environment (Environmental quality and land resources)						
Air Quality	Due to maintenance and operational works to road and storm water drainage, local air quality will be deteriorated.	During operation period, maintenance works shall be carried out periodically along the storm water drainage and road networks that will cause deterioration of local air quality due to dust generation from the construction sites.	• To mitigate this impact, watering and sprinkling shall be conducted twice a day during maintenance period. • Dust arrester can be used to arrest dust emission from the site. • Ensure good equipment and engines are used during repairing and maintenance work, and • Other appropriate mitigation measures shall be ensured etc.	**PIU Of NSEZ**	BEZA	Development budget
Surface water Quality	Due to maintenance and operational works to water line, local surface water quality will deteriorate by releasing stagnant water in the outfall.	Due to maintenance works, surface runoff will occur and pollute the outfalls' locations that will cause water logging in the subproject areas.	• To manage this problem, pushing and jetting methods can help to reduce the surface water pollution and minimize the water logging problems also.	**PIU Of NSEZ**	BEZA	Development budget

8.4 RELEVANT ENVIRONMENTAL MANAGEMENT PLANS

315. During the project life cycle, the contractor should follow the different management plans. Indicative management plans should be outlined for the contractor in the BID documents as included in the Annexure in Volume II. These are as follows

- Emergency Response and Disaster Management Plan, Annex-10
- Occupational Health and Safety Plan, Annex-11
- Labor Management Plan, Annex-12
- Traffic Management plan, Annex-13
- Waste Management Plan, Annex-14,
- Stakeholder Engagement Plan, Annes 15
- Drainage Management Plan, Annex-16
- Dredging Management/Land Development Plan, Annex-17
- Environmental and Social Code of Practices, Annex-18
- Environmental Enhancement Measures and Greenery Plan, Annex-19

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9 ENVIRONMENTAL MONITORING PROGRAM

9.1 PHYSICAL ENVIRONMENT

9.1.1 Environmental Quality

316. Monitoring of environmental quality parameters is crucial for assessing the impact of construction and operational activities on the surrounding environment. The total estimated budget of 5,031,000 BDT for monitoring environmental quality parameters during both the construction and operation periods reflects a commitment to maintaining environmental standards and ensuring the sustainability of the project. This budget will facilitate ongoing assessments and necessary adjustments to minimize environmental impacts throughout the project lifecycle.

317. The Environmental Quality Monitoring parameters, method and frequency at the construction sites is presented in Table 9.1, Land resources EMP in Table 9.2.

9.2 BIOLOGICAL ENVIRONMENT

318. The environmental monitoring program for the ecological resource is presented in Table 9-3. The EMPs for the fisheries and agriculture are presented in Table 9-4 and Table 9-5, respectively.,

9.3 SOCIAL ENVIRONMENT

319. The EMoP for safeguarding social environment in the project areas is presented in Table 9-6.

Table 9-1: Environmental Quality Monitoring at the Construction Sites

Environmental Criterion	Monitoring Parameters	Methods	Frequency	Responsible Parties
Construction Period:				
Air Quality	PM10, PM2.5, NOx, SOx and CO	Standard Analytical Method following National Air Pollution (Control) Rules 2022	Quarterly	Contractor
Noise level	Leq Day and Leq Night	Standard Analytical Method following National Noise Pollution (Control) Rules 2006	Quarterly	Contractor
Surface water Quality	Temperature, TSS, EC, Turbidity, pH, Salinity, COD, (BOD), Hg, Cd, Zn, Cr, Total Coliform (TC) etc.	Standard Analytical Method following National Air Pollution (Control) Rules 2022	Quarterly	Contractor
Groundwater Quality	Temperature, TDS, EC, Turbidity, pH, Salinity, Total Hardness as CaCO3, Fe, As, Mn, FC, TC, Odor etc.	Standard Analytical Method following National Air Pollution (Control) Rules 2022	Quarterly	Contractor
Sediment Quality	Zinc (Zn), Copper (Cu), Mercury (Hg), Lead (Pb), Cadmium (Cd) etc.	International Standards	Quarterly	Contractor
Soil Quality	pH, Total Sulphur, NH4+, Total Nitrogen, Total Phosphorus, Total Mercury, Cd, Total Cyanides (CN), Cr & Cr+6), Pb, As, Polychlorinated biphenyl, (PCB), Cu, Zn, Oil & Grease and Salinity.	International Standards	Baseline, Once during Construction / Installation and after installing pipeline networks.	Contractor

Table 9-2: EMoP for safeguarding the Land Resources in the project areas

Environmental Criterion	Method, Location, Parameters	Responsibility & Frequency
Construction Phase		
Land Resources	**Method:** Physical Inspection; **Location:** outfall areas, local canals, and seaside locations to observe the runoff from the drains; **Parameters:** approved layout plan and design, natural landscape preserving, traffic and transport, waste management, site rehabilitation, solid waste management at the construction sites.	Contractor Once a month
Operation Phase		
Land Resources	**Method:** Physical Inspection; **Location:** Construction site perimeters nearest to residences; by side of main roads. Mainly Trenching, excavation, and backfilling sites; **Parameters:** Status of wildlife, plants, water quality, outfall conditions, effluent and leachate management, traffic and transport, soil erosion etc.	BEZA Once a month.

Aquatic ecosystem	**Method:** Interview with local people, and physical inspection; **Location:** At perimeter of canal sites nearest to residences; **Parameters:** Measurement.	BEZA Quarterly

Table 9-3: EMoP for safeguarding the Ecological Resources in the project areas

Environmental Criterion	Method, Location, Parameters	Responsibility & Frequency
Construction Phase		
Surface water pollution	**Method**: Visual inspection; interview with workers as needed; **Location**: Construction site; **Parameters**: Adequacy of workers' behaviors in spill and leak prevention; measures, including storage of chemicals, fuels, lubricants.	Contractor Daily
Surface water Pollution	**Method:** Measurement; **Location**: Construction site; **Parameters:** Surface water quality (e.g., pH, temperature, BOD-5, TDS, COD, DO, Pb, total coliform, Hg, NO3-N, NH4-N, PO4-P and Cr; CBP: As, pH, TSS, COD, total coliform, fecal coliform, Cr, DO, Pb, Hg, NO3-N, oil and grease).	Contractor Quarterly
Waste	**Method:** Visual inspection and records; **Location:** Construction site, Site Office (or Contractor's Office); **Parameters:** Number of recyclable wastes collected on site, and documentation of transfers to identified service provider available.	Contractor Once a month
Loss of local habitats	**Method:** Visual inspection and records and interviews; **Location:** Construction site perimeters nearest to residences; by side of main roads; **Parameters:** Status record of terrestrial plants and animals, water quality parameters.	Contractor Quarterly
Operation Phase		
Surface water quality	**Method:** Measurement; **Location: perimeters** nearest to the canal sides; **Parameters:** Surface water quality (e.g. (e.g., pH, temperature, BOD-5, TDS, COD, DO, Pb, total coliform, Hg, NO3-N, NH4-N, PO4-P and Cr; CBP: As, pH, TSS, COD, total coliform, fecal coliform, Cr, DO, Pb, Hg, NO3-N, oil and grease).	BEZA Quarterly
Aquatic ecosystem	**Method:** Interview with local people, and physical inspection; **Location:** At perimeter of canal sites nearest to residences; **Parameters:** Measurement.	BEZA Quarterly

Table 9-4: EMoP for safeguarding the Fisheries Resources in the project areas

Environmental Criterion	Method, Location, Parameters	Responsibility & Frequency
Construction Phase		
Surface water pollution	**Method**: Visual inspection; interview with workers as needed; **Location**: Construction site;	Contractor Daily

	Parameters: Adequacy of workers' behaviors in spill and leak prevention; measures, including storage of chemicals, fuels, lubricants.	
Surface water Pollution	**Method:** Measurement; **Location**: Construction site; **Parameters:** Surface water quality (e.g., pH, temperature, BOD-5, TDS, COD, DO, Pb, total coliform, Hg, NO3-N, NH4-N, PO4-P and Cr; CBP: As, pH, TSS, COD, total coliform, fecal coliform, Cr, DO, Pb, Hg, NO3-N, oil and grease).	Contractor Quarterly
Loss of local fish habitats	**Method:** Visual inspection and records and interviews; **Location:** Near surface water sources e.g. Canals, Khals, Ponds, and sea sides; **Parameters:** Status record of fish population, and water quality.	Contractor Quarterly
Operation Phase		
Surface water quality	**Method:** Measurement; **Location: perimeters** nearest to the canal sides; **Parameters:** Surface water quality (e.g. (e.g., pH, temperature, BOD-5, TDS, COD, DO, Pb, total coliform, Hg, NO3-N, NH4-N, PO4-P and Cr; CBP: As, pH, TSS, COD, total coliform, fecal coliform, Cr, DO, Pb, Hg, NO3-N, oil and grease).	BEZA Quarterly
Aquatic ecosystem	**Method:** Interview with local people, and physical inspection **Location:** At perimeter of canal sites nearest to residences Parameters: Measurement	BEZA Quarterly

Table 9-5 EMoP for safeguarding the Agricultural Resources in the project areas

Environmental Criterion	Method, Location, Parameters	Responsibility & Frequency
Construction Phase		
Agricultural resources	**Method**: Visual inspection; interview with farmers, and record of crop production; **Location**: Construction site and its adjacent agricultural land; **Parameters**: Adequacy of preventing spill and leak prevention; measures, including storage of chemicals, fuels, lubricants, effluents, and liquid waste etc.	Contractor Daily
Operation Phase		
Agricultural resources	**Method:** Physical inspection, interviews and records of crop production etc.; **Location: perimeters** nearest to the crop lands; **Parameters:** crop intensity, crop types, record of crop production etc.	BEZA Quarterly

Table 9-6: EMoP for safeguarding the Social Environment in the project areas

Environmental Criterion	Method, Location, Parameters	Responsibility & Frequency
Pre-Construction Phase		
Land Acquisition	**Method:** Interviews with affected people; **Location:** At perimeter of canal sites nearest to residences; **Parameters:** Records of affected livelihoods, Number of complaints from the local communities, Number of grievances and reconciliations, Minutes of consultation meeting with local communities.	Contractors Once a month

Construction Phase		
Waste	**Method:** Visual inspection and records; **Location:** Construction site, Site Office (or Contractor's Office); **Parameters:** Number of recyclable wastes collected on site, and documentation of transfers to identified service provider available.	Contractor Once a month
Community Health and Safety	**Method:** Inspection, Interviews with site manager; **Location:** Site Office (or Contractor's Office); **Parameters:** Minutes of consultation meeting with local communities, Number of diseases among local people and their details (only those likely caused by / relevant to construction work).	Contractor Once a month
	Method: Interviews with local communities; **Location:** Residences nearby, Site Office (or Contractor's Office); **Parameters:** Number of complaints from the local communities, Number of grievances and reconciliations.	Contractor Daily (ad-hoc)
Local Traffic and accidents (public safety)	**Method**: Observation, Inspection, Interviews with site manager, nearby residents, and local police; **Location:** Construction site perimeters nearest to residences; by side of main roads, Site Office (or Contractor's Office); **Parameters:** Daily Log sheet of vehicle movement, Number of awareness training for workers, copy of driving licenses, Driver ID card, Adequacy of construction site signage, fencing and security presence, Record of accidents (number, affected people, date and time, actions, etc.).	Contractor Daily
Occupational health and safety	**Method:** Inspection; and interviews with workers; **Location:** Site Office (or Contractor's Office); **Parameters:** Records of toolbox meetings, Number of labor accidents and their details, Number of diseases among workers and their details, Number of awareness training for workers, Daily Log sheet of vehicle movement, Checking record books of medical checkups etc.	Contractor Daily
Labor condition (including child labor, forced labor and gender-based violence)	**Method:** Inspection, Interviews with site manager; **Location:** Site Office (or Contractor's Office); **Parameters:** Daily workers' attendance sheet, employment record.	Contractor Quarterly
Operation Phase		
Employment Opportunity	**Method:** Measurement; **Location:** Project sites are mainly industry; **Parameters:** daily, contractual or permanent employment status.	BEZA Quarterly
Accident/Incident Record	**Method:** Interview with local people, and physical inspection, and Records; **Location:** At perimeter of the project site; **Parameters:** No of accident/incident and no of injury etc.	BEZA Monthly

9.4 SUBPROJECT SPECIFIC ENVIRONMENTAL MONITORING PROGRAM

320. The sub-project specific EMoP is presented in the following tables.

- EMoP for the Site Upgradation- Land Development of Part of Precinct F (IMD Zone and Housing Facilities) under NSEZ[34] in Table 9-7
- EMoP for the construction of gas pipeline networks within NSEZ areas[35] in Table 9-8
- : EMoP for the construction of Power network within NSEZ areas in Table 9-9
- :EMoP for the construction of TSDF for hazardous waste management of ship recycling industries within NSEZ areas in Table 9-10
- EMoP for the construction of water supply networks within NSEZ areas in Table 9-11
- EMoP for the construction of storm water drainage and road networks within NSEZ areas in Table 9-12

[34] Source: Environmental and Social Impact Assessment (ESIA) Report for Land Development of Part of Precinct F (IMD Zone and Housing Facilities), NSEZ, BEZA.

[35] Source: Environmental and Social Impact Assessment (ESIA) Report for Construction of Gas Pipeline Networks within NSEZ areas, BEZA. https://nsez.gov.bd/?p=1300

Table 9-7: EMoP for Site Upgradation- Land Development of Part of Precinct F (IMD Zone and Housing Facilities) under NSEZ[36]

SL.	Monitoring Component	Monitoring Parameter	Monitoring standard	Monitoring Method	Monitoring frequency	Monitoring Agency		Monitoring Locations
						Execution by	Supervision	
A. Physical Environment (Environmental Quality, Land Resources)								
01	Ambient Air Quality	PM10, PM2.5, NO2, SO2, CO Dust suppression	Air Pollution (Control) Rules 2022, ESS-3, ESS-4, ESS-2	▶ Sampling and Lab test	Quarterly	Contractors	PIU, PRIDE	Dredging Location Landfill sites, and Vehicle movement route
02	Ambient Noise Quality and Vibration Level	Noise level in Leq Vibration Level (mm/s)	Noise Pollution (Control) Rules 2006, ESS-3 ESS-4, ESS-2	▶ Sampling and Lab test ▶ Sampling in Day and Night time	Weekly	Contractors	PIU, PRIDE	Dredging Location Landfill sites, and Vehicle movement route
03	Surface water Quality	Temperature, TSS, EC, Turbidity, pH, Salinity, COD, (BOD), Hg, Cd, Zn, Cr, Total Coliform (TC) etc.	ECR 2023 ESS-3	▶ Sampling and Lab test	Quarterly	Contractors	PIU, PRIDE	Nearest waterbody/ canals around the landfill site Sandwip Channel (L-5, L-7, L-8, L-9)
04	Ground Water Quality and drinking water	Temperature, TDS, EC, Turbidity, pH, Salinity, Total Hardness as CaCO3, Fe, As, Mn, FC, TC, Odor etc.	ECR 2023 ESS-3	▶ Sampling and Lab test	Monthly	Contractors	PIU, PRIDE	Sample one (1) from the inside the land filling area, sample one (1) from BEZA office, sample three (3) from the labor camps = 5

[36] Source: Environmental and Social Impact Assessment (ESIA) Report for Land Development of Part of Precinct F (IMD Zone and Housing Facilities), NSEZ, BEZA.

SL.	Monitoring Component	Monitoring Parameter	Monitoring standard	Monitoring Method	Monitoring frequency	Monitoring Agency		Monitoring Locations
						Execution by	Supervision	
05	Sediment Quality	Zinc (Zn), Copper (Cu), Mercury (Hg), Lead (Pb), Cadmium (Cd) etc.	ECR 2023 ESS-1	▶ Sampling and Lab test	Quarterly	Contractors	PIU, PRIDE	Sandwip Channel (L-5, L-7, L-8, L-9)
06	Soil Erosion	Bank of the Sandwip Channel at the dredging sites	ESS-3	▶ Physical observations	Daily	Contractors	PIU, PRIDE	Along the delivery pipeline, shoreline, coast, and landfill site.
07	Land Use changes	Soil erosion, clearing vegetation and record of oil, Mobil, or grease changes from engine etc.	ESS-1	▶ Site observation	Daily	Contractors	PIU, PRIDE	Along the delivery pipeline, shoreline, coast, and landfill site.
08	Solid & Hazardous Waste Management	Food waste, HHs waste, Liquid waste, and medical wastes etc.	Solid waste management Rules 2021 ESS-2, ESS-4	▶ Visual inspection ▶ Record keeping of waste ▶ Training	Quarterly	Contractors	PIU, PRIDE	Labor camps, dredging locations, Landfill sites etc.
09	Movement of traffic	Traffic counting, movement, maintenance records, accident record	ESS4	▶ Visual inspection ▶ Record keeping ▶ Maintenance record	Quarterly	Contractors	PIU, PRIDE	Camps and sites
10	GHG Emission tracking	GHG Tracking tools, emission calculation, fuel consumption	ESS1 ESS 3	▶ Record keeping on fuel consumption (oil, diesel, octane, petrol consumption)	Quarterly	Contractors	PIU, PRIDE	
B	**Biological Environment (Ecological Resources, Fisheries and Agriculture)**							
11	Biodiversity: Terrestrial and Aquatic Flora, Fauna etc.	Nos of trees felled, Nos of accidental deaths, disturbances, rescues and rehabilitation of	Biodiversity (Conservation) Act 2017 ESS-6	▶ Interviews with workers, local people, and site managers and ▶ Visual inspection ▶ Ecological Survey	Before, During, and After dredging	Contractors & Environmental consultant	PIU, PRIDE	Along the delivery pipeline, shoreline, coast, and landfill site.

SL.	Monitoring Component	Monitoring Parameter	Monitoring standard	Monitoring Method	Monitoring frequency	Monitoring Agency		Monitoring Locations
						Execution by	Supervision	
		local wild species. Monitoring of death/ disturbance of aquatic flora and faunal species						
12	Habitat (Wildlife)	Sensitive habitats in Project influence area Within 10km Program impact area, within 2 km around the activity sites.	Biodiversity (Conservation) Act 2017 ESS-6	▶ Awareness raising of workers, employees and general public, Include information on wildlife protection ▶ A public education program Number of sighting of key wild species ▶ Daily monitoring ▶ of indicator wildlife species and other species quantitatively ▶ A public education program should be implemented to avoid poaching of wildlife ▶ Keeping away ▶ Keeping away from sensitive habitats such as water channels & *khals*	Before and throughout the construction phase	Contractors & Environmental consultant	PIU, PRIDE	Along the delivery pipeline, shoreline, coast, and landfill site.
13	Habitat (Aquatic Flora and Fauna including Benthos)	Evidence of initiation of monitoring plan		▶ Visual inspection Ecological Survey ▶ Inspection of channel morphology and monitoring of benthic biota.	Quarterly at 4 locations for 2 years	Contractors & Environmental consultant	PIU, PRIDE	Along the delivery pipeline, shoreline, coast, and landfill site.

SL.	Monitoring Component	Monitoring Parameter	Monitoring standard	Monitoring Method	Monitoring frequency	Monitoring Agency		Monitoring Locations
						Execution by	Supervision	
14	Aquatic Fauna	Number of reports of sightings of key species Evidence of initiation of the monitoring plan		▶ Visual inspection Ecological Survey ▶ Inspection of aquatic habitats, channel morphology and quantitative monitoring of faunal species (fish, dolphin).	Quarterly at 4 locations for 3 years	Contractors & Environmental consultant	PIU, PRIDE	Sandwip Channel
	Fisheries	• Disturbance of fish and damage of aquatic vegetation.		▶ No mitigation is required as operation will not be long lasting and due to dynamic nature of riverbed the system will regain soon. ▶ Ensure measures to prevent bagda larva collection and killing other species by traditional fishers. ▶ Enhance culture and capture fishery in planned manner.	Consultations with local community	Contractor of Dredging	PIU, PRIDE	Sandwip Channel and khals
15	Impacts on aquatic habitat and migratory birds	• Presence of Study report, Implementation of recommended impact • Avoidance and mitigation measures	Within 2-3 km of construction sites	▶ Visual inspection Ecological Survey ▶ A detailed study on aquatic habitat and migratory birds will be carried out with appropriate impact avoidance and mitigation	Before construction is commenced and midway through dredging activities, and after completion of dredging	Contractors & Environmental consultant	PIU, PRIDE	Sandwip Channel
B. Social Environment								

SL.	Monitoring Component	Monitoring Parameter	Monitoring standard	Monitoring Method	Monitoring frequency	Monitoring Agency		Monitoring Locations
						Execution by	Supervision	
16	Occupational Health and Safety	PPE, access to safe drinking water, and sanitary toilets, good housekeeping, first-aid medical facility etc. Detail Plan given in **Annex-10**	Project's Occupational health and safety plan ESS-2	▶ Records of accident/ incident. ▶ Physical observations ▶ Records of toolbox meeting etc.	Daily	Contractors	PIU, PRIDE	Dredging sites, Landfill sites, and delivery pipeline etc.
17	Daily Labor Influx	PPE, attendance, accidents and injuries Grievance	LMP ESS2	▶ Records of attendance, injury, attendance	Daily	Contractor	PIU, PRIDE	Dredging sites, Landfill sites, and delivery pipeline etc.
18	Community Health and Safety	Information dissemination, hard barricade installation, deployment of flag man, danger sign posting, traffic management plan etc.	Project's Occupational health and safety plan ESS-4	▶ Physical observations. ▶ Consultation schedule and records. ▶ GRM records etc.	Daily	Contractors	PIU, PRIDE	Dredging sites, roadsides, Landfill sites, and delivery pipeline etc.
19	Women Worker, disadvantageous and vulnerable people	GBV (gender-based violence)	Project document (gender action plan) ESS-1	▶ Physical observations. ▶ Records of wages ▶ Consultation schedule and records. ▶ GRM records etc.	Daily	Contractors	PIU, PRIDE	Dredging locations and landfill sites.
20	Infectious Diseases	Medical Testing of workers	Project's Occupational health and safety plan ESS-2, ESS-4	▶ Records of accident/ incident. ▶ Physical observation ▶ Records of toolbox meeting etc.	Daily	Contractors	PIU, PRIDE	Dredging sites, Landfill sites, and delivery pipeline etc.
21	Grievance Redress	Record of grievances and	ESS-5	▶ Nos of grievances recording and remedial actions.	Monthly	Contractors	PIU, PRIDE	Entire subproject study area

SL.	Monitoring Component	Monitoring Parameter	Monitoring standard	Monitoring Method	Monitoring frequency	Monitoring Agency		Monitoring Locations
						Execution by	Supervision	
	Mechanism (GRM	settlement of the issues.						
22	Capacity Building	No training, meeting, Toolbox meeting, workshop, and informal discussion.	ESS-1	▶ Number of training sessions conducted, and participants reached. ▶ Improvement in the understanding and awareness of environmental and social issues among project staff and local communities.	Quarterly	Contractors	PIU, PRIDE	Entire subproject study area
23	Emergency Preparedness and Response	Emergency history and records. Detail given in Annex-9: Emergency response and Disaster Management Plan	ESS-2	▶ Effectiveness of emergency response plans assessed through drills and simulations. ▶ Time taken to respond to and resolve emergencies or accidents. The indicative formats of Emergency preparedness and response such as fire, security, medical etc. given in Annex-4	Quarterly	Contractors	PIU, PRIDE	Entire subproject study area
24	Compliance with Regulations	Site Clearance/ Environmental Clearance from the DOE and BWDB, WB Clearance or approval of ESIA and recommendations Quarterly/Semi-annual Environmental &Social	ESS-1	▶ Evaluation of implementation status for ESMP in line with National Laws and WB Environmental and Social Standards.	Annually	Contractors	PIU, PRIDE	Entire subproject study area

SL.	Monitoring Component	Monitoring Parameter	Monitoring standard	Monitoring Method	Monitoring frequency	Monitoring Agency		Monitoring Locations
						Execution by	Supervision	
		Safeguards Monitoring Report.						
25	Incident and Non-Compliance Reports	Periodically checking the Accident/ Incident Record Form	ESS-2	▶ Number and nature of incidents or instances of non-compliance with environmental and social requirements.	Monthly	Contractors	PIU, PRIDE	Entire subproject study area
26	Stakeholder Engagement	Checking of stakeholder engagement records (e.g., meeting, workshop, FGD, IDI, KII, PCM etc.) Survey results etc.	ESS-10	▶ Level of satisfaction among stakeholders through surveys or feedback mechanisms. ▶ Number and quality of consultations should be held with local communities, indigenous groups, and other stakeholders.	Monthly	Contractors	PIU, PRIDE	Entire subproject study area

Table 9-8: EMoP for construction of the gas pipeline networks within NSEZ areas[37]

Affected Component	Environmental Issue	Parameters to be Monitored	Location	Measurements	Frequency	Responsibility	Supervision and Monitoring
Water quality	Surface water quality	Temperature, Total Dissolved Solid (TDS), Salinity, Turbidity, Total Suspended Solids (TSS), pH, Dissolved oxygen (DO), Biochemical Oxygen Demand (BOD5), Chemical Oxygen Demand (COD)	Ichakhali canal, Daborkhali canal and Bamansundar canal	As per National/International Standard	Before, during and after construction from each canal	Contractor	KGDCL/ PIU-BEZA
	Ground water quality	Drinking water quality parameters notably pH, Manganese, Iron, Arsenic, TC, FC, pH, DO, TDS, Turbidity, Chloride	Labor camp	Standard	Quarterly	Contractor	KGDCL/ PIU-BEZA

[37] Source: Environmental and Social Impact Assessment (ESIA) Report for Construction of Gas Pipeline Networks within NSEZ areas, BEZA. https://nsez.gov.bd/?p=1300

Ambient Air Quality	Dust generation	SPM, PM $_{2.5}$, PM_{10}, CO, SO_2, NOx.	At 04 Locations (At project site, nearest settlement/Important Sensitive Receptors: as directed by engineer)	As per the requirement of Standard method	Quarterly including the baseline condition, (before) and during construction as per the instruction of engineer	Contractor	KGDCL/ PIU-BEZA
		General air quality (visibility)	Project site	Visual Inspection	Daily	Contractor	KGDCL/ PIU-BEZA
Noise	Increase in ambient noise levels	Noise levels in Leq, Leq_{day}, Leq_{night} and hourly Leq	At 04 Locations (At project site, nearest settlement/Important Sensitive Receptors: as directed by engineer)	At least -2 hrs.	Quarterly	Contractor	KGDCL/ PIU-BEZA
Soil Quality	Quality of Soil	pH, Total Sulphur, NH4+, Total Nitrogen, Total Phosphorus, Total Mercury, Cd, Total Cyanides (CN), Cr & Cr+6), Pb, As, Polychlorinated biphenyl, (PCB), Cu, Zn, Oil & Grease and Salinity.	Construction Area	Standard, Analytical methods	Baseline, Once during Construction / Installation and after installing pipeline networks.	Contractor	KGDCL/ PIU-BEZA
Occupational Health and Safety and	Accidents or incidents	Near misses, incidents, occupational diseases, dangerous occurrences	Project activity areas and construction workers camp	Incidents/ accidents	Daily	Contractor	KGDCL/ PIU-BEZA
Infectious Diseases	Risk of HIV/AIDS	Ensuring that the contractor's personnel and local community understand HIV-AIDS awareness campaign	Project site	Consultation with workers & community	Daily	Contractor	KGDCL/ PIU-BEZA

Community Health and safety	Community disturbance and potential safety hazard due to road traffic	Accidents, incidents and complaints and traffic related issues: --Speed control of construction vehicles, -Timing/scheduling of construction vehicles, Traffic control, -Site attention sign/traffic flag man etc.	Approach Road	Incidents,	Daily	Contractor	KGDCL/ PIU-BEZA
Operation and Maintenance Period (Defect Liability Phase)							
Water Quality	Gas pipeline leakage and spill can contaminate the nearby water resources	Visibility	Accident/ Incident sites	Visual Inspection	Daily during incidental/ accidental events)	PIU-BEZA	KGDCL/ PIU-BEZA
Air Quality	Air pollutants will be released from the gas pipeline operation and maintenance such as pipeline pigging.	VOCs, NOx, PM	Accident or incident areas	As per National/International Standard	Once a year	PIU-BEZA	KGDCL/ PIU-BEZA
Noise Level	The valve stations, and others pipeline facilities can produce excessive noise.	Noise levels in Leq, Leq_{day}, Leq_{night} and hourly Leq	Valve station sites.	At least 2 hrs.	Quarterly	PIU-BEZA	KGDCL/ PIU-BEZA
Occupational Health & Safety	Accidents or incidents. Checklists are given in Annex-4	Near-misses, incidents, occupational diseases, dangerous	Sub-project activity areas	Incidents/ accidents	Daily (during incidental/	PIU-BEZA	KGDCL/ PIU-BEZA
Community Health & Safety	Accidents or incidents	Occurrences	Sub-project activity areas	Incidents/ accidents	accidental events)	PIU-BEZA	KGDCL/ PIU-BEZA
Terrestrial Ecology	Re-vegetation	Replace the dead trees	Designated sites where plantation will occur.	Visual Inspection	Quarterly	PIU-BEZA	KGDCL/ PIU-BEZA

Table 9-9: EMoP for construction of the Power network within NSEZ areas

Affected components	Environmental and Social Issues	Parameters to be monitored	Locations	Measurements	Monitoring Frequency	Responsible Agency for Supervision and Monitoring		Implementation Cost (BDT)
						Implementation agency	Supervision Agency	
Control of Air Pollution (Dust control)	Air pollution will occur due to site preparation, site development, earth filling, stackyard, labor shed construction, grading and movement of vehicles etc.	PM2.5, PM10, SPM, CO, NOX, SOX	At four locations (Site boundary of substations, underground cables as above, and other locations selected by PIU of NSEZ.)	24 hours	Quarterly including the baseline conditions (before, during and after the construction period)	Contractor	NSEZ/BEZA	Contract cost
		General air quality visibility	Project site	Visual inspection	Daily	Contractor	NSEZ/BEZA	Contract cost
Control of Noise Pollution	Increase in ambient noise level due to operation of vehicles and equipment during site preparation, earth works, stackyards, labor shed construction, and transportation of construction materials.	Noise levels in leq, Leq $_{days}$, Leq$_{nights}$, and hour Leq	Undertake at least 5 locations including site boundary of substations, in protected areas, cables as above, and other locations selected by PIU of NSEZ.	24 hours	Monthly including baseline including pile works, peak movement of traffic at substation sites and underground cables as above.	Contractor	NSEZ/BEZA	Contract cost
Control of water pollution	Surface and groundwater quality can be contaminated by sewage and wastewater from labor camps, dumping moist soil for a longer period	**Surface water quality** pH, DO, TDS, Turbidity, Temperature, TSS, BOD, COD, Pb, Fe, Zn, Cd, As, Cl-, oil and grease etc.	**Surface water locations:** Nearby water bodies or canals including Ichakhali canal within	Standard analytical methods	Quarterly for water quality testing (4 locations*5 times both surface and groundwater)	Contractor(s)	NSEZ/BEZA	Contract cost

Affected components	Environmental and Social Issues	Parameters to be monitored	Locations	Measurements	Monitoring Frequency	Responsible Agency for Supervision and Monitoring		Implementation Cost (BDT)
						Implementation agency	Supervision Agency	
	and effluent disposal etc.	**Groundwater quality** pH, Turbidity, TDS, Hardness, Total Cr, Cu, Fe, Mn, Mg, Na, Zn, SS, Temperature, Total Coliform, Faecal Coliform, Total N, Nitrate, Sulphate etc.	50m of substations and within the ROW of power networks. **Groundwater monitoring locations:** Construction site-1, labor camp-1, substation-2,					
Control of soil pollution	Project site soil and sediment can be contaminated due to disposal of solid and liquid waste from construction works, operation of heavy equipment, oil spillage of construction vehicles etc.	pH, Total Sulphur (T-S), NH4+, (T-N), (T-P), (T-Hg), Cd, CN, Cr, Pb, As, PCB, Cu, Zn, Oil and grease, salinity etc.	Stackyard along the boundary of substation, within the ROW of the transmission line.	Standard Analytical Method	Baseline once during construction/ installation and after installation of power networks.	Contractor	NSEZ/BEZA	Contract cost
Waste Management	The project will generate both hazardous and non-hazardous waste throughout the construction phase. Non-hazardous waste such as excavated materials, broken aggregates, solid waste, filling	Record all construction materials used and removed by land clearance or generated by construction works.	Substation and transmission lines, construction sites, storage areas and temporary workers camps etc.	Visual Inspection	Monthly	Contractor(s)	NSEZ/BEZA	Contract cost

Affected components	Environmental and Social Issues	Parameters to be monitored	Locations	Measurements	Monitoring Frequency	Responsible Agency for Supervision and Monitoring		Implementation Cost (BDT)
						Implementation agency	Supervision Agency	
	materials, wastewater etc., and Hazardous waste mainly PCB used in transformers, CFCs, SF6 gas used in GIS, empty paints, used oils, empty drums, used batteries, and construction machinery etc.							
Occupational Health and safety	Accidents/ Incidents	Zero lost times/fatalities, near miss, incident, occupational diseases, dangerous occurrence, any relevant grievances received, addressed and resolved etc.	Project activities areas and construction workers camps.	Record all incidents and response taken (including date, time and details of incident, treatment given and the outcome. Checklists are given in Annex-4	Monthly	Contractor(s)	NSEZ/BEZA	Contract cost
Infectious disease	Risks of HIV/AIDS/ COVID-19	Ensure that contractor personnel and local community understand HIV/AIDS/ COVID-19 awareness campaign.	Project sites	Consultation with workers and communities.	Daily	Contractor(s)	NSEZ/BEZA	Contract cost
Community Health and Safety	Community disturbance and potential safety	Accidents, incidents and complaints and	Approach road	Incidents, accidents and	Daily	Contractor(s)	NSEZ/BEZA	Contract cost

Affected components	Environmental and Social Issues	Parameters to be monitored	Locations	Measurements	Monitoring Frequency	Responsible Agency for Supervision and Monitoring		Implementation Cost (BDT)
						Implementation agency	Supervision Agency	
	hazard due to road traffic	traffic related issues: Speed control of construction vehicles. Timing/schedule of construction vehicles Traffic control Site attention sign/ flag men any relevant grievances received, addressed and resolved etc.		community complaints				
Drinking water facilities	Worker's health and safety, diseases, injury etc.	Drinking water supply facilities Tube-well installation	Construction camp/site office	Visual Inspection	Monthly	Contractor(s)	NSEZ/BEZA	Contract cost
Temporary sanitation facilities	Worker's health and safety, diseases, injury etc.	Sanitary Toilets/ septic tank facilities	Labor camps, construction sites, site office.	Visual Inspection	Monthly	Contractor(s)	NSEZ/BEZA	Contract cost
Storm water drainage system and sedimentation tank	Wastewater management	Nos/length of temporary drains facilities provided by the contractor	Construction sites, labor camps and storage site.	Visual Inspection	Quarterly	Contractor(s)	NSEZ/BEZA	Contract cost
Traffic Management	Accident/ Incident and public disturbance	Approach route and transportation sites.	Project site and approach road sites	Visual Inspection	Monthly	Contractor(s)	NSEZ/BEZA	Contract cost
Construction Camp Management	Health and safety, and security	Neat and cleanliness and housekeeping.	Camp site	Visual Inspection	Monthly	Contractor(s)	NSEZ/BEZA	Contract cost

Affected components	Environmental and Social Issues	Parameters to be monitored	Locations	Measurements	Monitoring Frequency	Responsible Agency for Supervision and Monitoring		Implementation Cost (BDT)
						Implementation agency	Supervision Agency	
First Aid Box	Health and safety	Nos of first aid boxes with necessary medicines.	Site office, Labor camps, construction sites etc.	Visual Inspection	Monthly	Contractor(s)	NSEZ/BEZA	Contract cost
Personnel Protective Equipment (PPE)	Occupational Health and Safety	Nos of PPE and accessibility by all workers	Construction sites	Visual Inspection	Monthly	Contractor(s)	NSEZ/BEZA	Contract cost
Site preparation, protective fencing and safety measures with warning signs.	Safety and security	Fencing and safety measurements	Project site	Visual Inspection	Monthly	Contractor(s)	NSEZ/BEZA	Contract cost
Site cleaning, Removal and Disposal Activities	Neat and cleanliness, health and safety	Disposal and clearing activities	Project site	Visual Inspection	Monthly	Contractor(s)	NSEZ/BEZA	Contract cost
Grievance Redress Mechanism	▪	Grievances/ complaints	Project site, labor camp, site office and construction camps etc.	Recording of nos. of grievance received, addressed and resolved a	Monthly	Contractor(s)	NSEZ/BEZA	Contract cost
Labor Influx Management	▪	Employment of local laborers and migrant labors	Project site	Labor register	Monthly	Contractor(s)	NSEZ/BEZA	Contract cost

Table 9-10: EMoP for construction of the TSDF for hazardous waste management of ship recycling industries within NSEZ areas

Environmental Items:	Location	Parameters	Monitoring Frequency	Method	Responsible Parties		Cost
					Implementing Agency	Supervision	
Construction Period (Environmental Quality and Water Resources)							
Preparation and updating the CESMP	-		-		Contractor	NSEZ/BEZA	Contract cost

Environmental Items:	Location	Parameters	Monitoring Frequency	Method	Responsible Parties		Cost
					Implementing Agency	Supervision	
Conduct Air Quality Monitoring (at least 4 locations):	Construction site-1, labor camp-1, adjacent areas-2	PM2.5, PM10, SPM, CO, NOX, SOX	Quarterly	24 hrs.	Contractor	NSEZ/BEZA	Contract cost
Noise sampling, testing and Monitoring: at least 5 locations.	Construction site-1, labor camp-1, adjacent areas-2	Leq	Quarterly	24 hrs.	Contractor	NSEZ/BEZA	Contract cost
Surface water quality sampling and testing: at least 4 locations of nearby water bodies	Nearby water bodies or canals including Ichakhali Canal	pH, DO, TDS, Turbidity, Temperature, TSS, BOD, COD, Pb, Fe, Zn, Cd, As, Cl-, oil and grease etc.	Quarterly	Standard analytical methods	Contractor	NSEZ/BEZA	Contract cost
Drinking water quality sampling and testing: at least 4 locations	Construction site-1, labor camp-1, adjacent areas-2	pH, Turbidity, TDS, Hardness, Total Cr, Cu, Fe, Mn, Mg, Na, Zn, SS, Temperature, Total Coliform, Faecal Coliform, Total N, Nitrate, Sulphate etc.	Quarterly	Standard analytical methods	Contractor	NSEZ/BEZA	Contract cost
Social Environment							
Solid and liquid waste	Project site	Solid and liquid waste generated from the construction activities	Quarterly	Visual Inspection	Contractor	NSEZ/BEZA	Contract cost
Traffic Management	Approach Road	Accidents, Incidents, near-miss, injuries etc.	Daily	Visual Inspection	Contractor	NSEZ/BEZA	Contract cost
Occupational Health and Safety	Project site, Labor camp, construction areas, approach road	Accidents, Incidents, near-miss, injuries etc.	Daily	Visual Inspection	Contractor	NSEZ/BEZA	Contract cost
Community Health and Safety	Approach Roads and construction sites	Public disturbance, Accidents, Incidents, near-miss, injuries etc.	Daily	Visual Inspection	Contractor	NSEZ/BEZA	Contract cost

Environmental Items:	Location	Parameters	Monitoring Frequency	Method	Responsible Parties		Cost
					Implementing Agency	Supervision	
First Aid Box	Site office, Labor camps, construction sites etc.	Nos of first aid boxes with necessary medicines.	Monthly	Visual Inspection	Contractor	NSEZ/BEZA	Contractor(s)
Personnel Protective Equipment (PPE)	Construction sites	Nos of PPE and accessibility by all workers	Monthly	Visual Inspection	Contractor	NSEZ/BEZA	Contractor(s)
Operation Period:							
Water Quality	Landfill site	pH, DO, TDS, Turbidity, Temperature, TSS, BOD, COD, Pb, Fe, Zn, Cd, As, Cl-, oil and grease etc.	Quarterly	Standard analytical methods	NSEZ/BEZA	NSEZ/BEZA	Operation budget
Air Quality	Landfill site	PM2.5, PM10, SPM, CO, NOX, SOX	Quarterly	Standard analytical methods	NSEZ/BEZA	NSEZ/BEZA	Operation budget
Noise Level	Project site	Noise levels in Leq, Leq_{day}, Leq_{night} and hourly Leq	Quarterly	Standard analytical methods	NSEZ/BEZA	NSEZ/BEZA	Operation budget
Occupational Health & Safety	Project site	Near-misses, incidents, occupational diseases, dangerous	Daily	Visual Inspection	NSEZ/BEZA	NSEZ/BEZA	Operation budget
Community Health & Safety	Project site	Public disturbance, offensive odor, diseases etc.	Monthly	Visual Inspections	NSEZ/BEZA	NSEZ/BEZA	Operation budget

Table 9-11: EMoP for construction of the water supply networks within NSEZ areas

Issues	Location	Parameters	Frequency	Method	Responsible Parties		Cost
					Implementation Agency	Supervision	
Construction Period							
Physical Environment (Environmental Quality and Land Resources)							
Air quality	Project site	Baseline and regular data for particulate matters 10 and 2.5 (PM10, PM2.5), sulfur dioxides (SO2), nitrogen dioxide (NO2), CO etc.	Quarterly	Standard analytical methods	Contractor	PIU of NSEZ/ CSC	Contract cost
Noise Level	Construction site-1, labor camp-1, adjacent areas-2	Baseline & regular monitoring of noise level in dB(A) Leq	Monthly	dB meter recording	Contractor	PIU of NSEZ/ CSC	Contract cost
Water Quality	Construction site, & Labor camp	baseline and regular monitoring of pH, Iron, Arsenic, Manganese, Chloride, Total Coliform (ground water) pH, turbidity, Dissolved Oxygen, Biochemical oxygen demand, (BOD5), Chemical oxygen demand, (COD), Total Suspended Solids, Total Coliform (surface water)	Quarterly	Standard analytical methods	Contractor	PIU of NSEZ/ CSC	Contract cost
Soil erosion	Excavation, pipelying and backfilling sites	Soil erosion management measures	Daily	Visual Inspection	Contractor	PIU of NSEZ/ CSC	Contract cost
Storm water	Excavation, pipelying and backfilling sites	Soil erosion management measures	Daily	Visual Inspection	Contractor	PIU of NSEZ/ CSC	Contract cost
Biological Environment							
Conservation of Natural Resources	Project site	Number of scheduled trees Vegetation conditions	Daily	Visual Inspection Nos of tree plantation	Contractor	PIU of NSEZ/ CSC	Contract cost
Social Environment							
Materials management	Stackyard, construction sites	Qualitative characteristics Preventive measures of EMP	Daily	Visual Inspection Nos of tree plantation	Contractor	PIU of NSEZ/ CSC	Contract cost

Issues	Location	Parameters	Frequency	Method	Responsible Parties		Cost
					Implementation Agency	Supervision	
Waste management	Project site, labor camp, stackyard and construction areas	Qualitative characteristics Disposal manifests Waste Management Plan (WMP)	Daily	Visual Inspection Nos of tree plantation	Contractor	PIU of NSEZ/ CSC	Contract cost
Stakeholder engagement	Project site	Public Consultations, Information Disclosure, Communication	Monthly	Meeting, workshops, awareness session etc.	Contractor	PIU of NSEZ/ CSC	Contract cost
Post-Construction Period							
Construction camp	Project site (construction camp)	Pre-existing conditions	subproject completion	One time	Contractor	PIU of NSEZ/ CSC	Contract cost
Replantation	Project site	Pre-existing conditions		Tree-cutting Permit and EMP	Contractor	PIU of NSEZ/ CSC	Contract cost
Land rehabilitation	Project site	Pre-existing conditions	subproject completion	EMP measurements	Contractor	PIU of NSEZ/ CSC	Contract cost
Materials and infrastructure	Project site	Pre-existing conditions	subproject completion	EMP measurements	Contractor	PIU of NSEZ/ CSC	Contract cost

Table 9-12: EMoP for construction of the storm water drainage and road networks within NSEZ areas

Issues	Location	Parameters	Frequency	Method	Responsible Parties		Cost
					Implementation Agency	Supervision	
Construction Period							
Physical Environment (Environmental Quality and Land Resources)							
Air quality	Project site and labor camps: 2 samples at project site (one at 2A and another one at 2B)	Dust generation PM10, PM2.5, sulfur dioxides (SO2), nitrogen dioxide (NO2), CO etc.	Quarterly (24 hrs measurement)	Standard analytical methods following NAPCR 2022	Contractor	PIU of NSEZ/ CSC	Contract cost
Noise Level	06 locations at project site at high noise location and adjacent	Baseline & regular monitoring of noise level in dB(A) Leq Day and Leq Night	Quarterly (24 hrs measurement)	Standard analytical methods following NPCR 2006	Contractor	PIU of NSEZ/ CSC	Contract cost
Water Quality	Surface water- 2 samples from canal	Turbidity, pH, DO, TDS, BOD5, NH3, COD and Oil & Grease	Quarterly	Standard analytical methods of surface	Contractor	PIU of NSEZ/ CSC	Contract cost

Issues	Location	Parameters	Frequency	Method	Responsible Parties		Cost
					Implementation Agency	Supervision	
				water quality as per ECR 2023			
	Groundwater- 2 samples from project site and closest borehole of the project site	pH, Alkalinity, Cl-, As, Fe, TSS, Salinity, Pb etc.	Quarterly	Standard analytical methods of Groundwater quality as per ECR 2023	Contractor	PIU of NSEZ/ CSC	Contract cost
Topsoil	Project site	Check liquid waste, and care and proper handling of oil and other hazardous waste	Daily	Visual Inspection	Contractor	PIU of NSEZ/ CSC	Contract cost
Sediment of Khal	Project site	Heavy metal	Quarterly	Visual Inspection	Contractor	PIU of NSEZ/ CSC	Contract cost
Biological Environment:							
Ecology (Terrestrial and Aquatic Ecology)	Canals and forest areas	Tree and aquatic species	Once for tree prior to starting construction and yearly aquatic monitoring	Visual Inspection	Contractor	PIU of NSEZ/ CSC	Contract cost
Social Environment							
Employment (engaging local labor)	Project site	Associated project workers	Weekly	Consultation with local laborers	Contractor	PIU of NSEZ/ CSC	Contract cost
Women worker	Camp site and working sites	Wage, increment and working hours etc.	Weekly	Consultation with female laborers	Contractor	PIU of NSEZ/ CSC	Contract cost
Social conflict and labor unrest	Project site	GRM	Weekly	Complaints box/register and discussion with local people and laborers.	Contractor	PIU of NSEZ/ CSC	Contract cost
Waste (liquid and solid waste)	Project site	Check storage, transportation, disposal and handling of hazardous waste	Daily	Visual Inspection	Contractor	PIU of NSEZ/ CSC	Contract cost
Occupational Health and Safety	Construction camps and construction areas	Check quality of food, accommodation at labor camps, access to sanitary	Daily	Visual Inspection	Contractor	PIU of NSEZ/ CSC	Contract cost

Issues	Location	Parameters	Frequency	Method	Responsible Parties		Cost
					Implementation Agency	Supervision	
		toilets, and safe drinking water supply etc.					
Community Health and Safety	Approach road	Accidents, Incidents and compliance	Based on occurrence	Record of accidents, incidents and community complaints	Contractor	PIU of NSEZ/ CSC	Contract cost
Drainage congestion	Project site	Water logging, suspension of community life, ecological impacts, design and layout plan etc.	Weekly	Visual Inspection	Contractor	PIU of NSEZ/ CSC	Contract cost
Tree Plantation	Project site	Implementation of tree plantation plan	During plantation period	Visual Inspection and record of tree species, numbers and plantation date	Contractor	PIU of NSEZ/ CSC	Contract cost

9.5 SUBPROJECT SPECIFIC ENVIRONMENTAL MONITORING BUDGET

321. The Estimated Budget for the site specific Environmental Monitoring Programs are presented in the following tables.

- Site Upgradation--- Land Development of Part of Precinct F (IMD Zone and Housing Facilities) and Precinct B of NSEZ[38] presented in **Table 9-13**.
- Estimated Environmental Monitoring Budget for construction of gas pipeline networks within NSEZ areas39 in Table 9-14.
- Estimated Environmental Monitoring Budget for construction of internal power networks within NSEZ areas40 in **Table 9-15**.
- Estimated Environmental Monitoring Budget for construction of road networks and storm water drainage within NSEZ areas41 in Table.
- Estimated Environmental Monitoring Budget for construction of water supply networks within NSEZ areas in Table 9-17.
- Estimated Environmental Monitoring Budget for Treatment, Storage and Disposal Facilities (TSDF) of ship recycling industries at Zone-24 of NSEZ area in Table 9-18.

[38] Source: Environmental and Social Impact Assessment (ESIA) Report for Land Development of Part of Precinct F (IMD Zone and Housing Facilities) and Precinct B of NSEZ, NSEZ, BEZA.

[39] Source: Environmental and Social Impact Assessment (ESIA) Report for Construction of Gas Pipeline Networks within NSEZ areas, BEZA. https://nsez.gov.bd/?p=1300

[40] Bidding Document for Power Network, Package No.: WD-4A-NSEZ-BEZA (Part-1). https://nsez.gov.bd/?page_id=686

[41] Bidding Document for Road & Storm Water Network for Mirsarai-2B EZ, package no WD-2-NSEZ-BEZA. https://nsez.gov.bd/?page_id=686

Table 9-13: Estimated Environmental Monitoring Budget for Site Upgradation--- Land Development of Part of Precinct F (IMD Zone and Housing Facilities) and Precinct B of NSEZ[42]

Sl. No.	Monitoring Issues	Description	Monitoring Locations/ Sites	No. of Samples	Monitoring Frequency (Time)	Unit Rate (BDT)	Cost / Year (BDT)	Total Cost (Considering 2 Yr. Construction period)
Environmental Quality								
A	**Construction Period**							
1	Air Quality	PM10, PM2.5, NO2, SO2, CO and O3	• Dredging Location, • Landfill Site • Road Surface	11	Quarterly	45,000	19,80,000	39,60,000
2	Noise and Vibration Level	Noise levels in L_{eq}, Leq_{day}, Leq_{night} and Hourly L_{eq}	• Dredging Location, • Landfill Site • Road Surface	8	Quarterly	6,000	1,92,000	3,84,000
3	Soil Quality	pH, Total Sulphur, NH4+, Total Nitrogen, Total Phosphorus, Total Mercury, Cd, Total Cyanides (CN), Cr & Cr+6), Pb, As, Polychlorinated biphenyl, (PCB), Cu, Zn, Oil & Grease and Salinity.	Construction areas	3 (baseline, construction and after construction)	One time	25000	75000	75000
Sub-Total (A)								4,419,000
B	Operation Period							

[42] Source: Environmental and Social Impact Assessment (ESIA) Report for Land Development of Part of Precinct F (IMD Zone and Housing Facilities) and Precinct B of NSEZ, NSEZ, BEZA.

1	Air Quality	PM10, PM2.5, NO2, SO2, CO and O3	• Road sites • Biogas plant sites • Sanitary landfill sites	06	Bi-yearly	45,000	270,000	540,000
2	Noise and Vibration Level	Noise levels in L_{eq}, Leq_{day}, Leq_{night} and Hourly L_{eq}	• Road sites • Valve station sites. • Sanitary landfill sites	06	Bi-yearly	6,000	36000	72,000
Sub-Total (B)								612,000
Total (A+B)								5,031,000
Water Resources								
A	**Construction Period**							
1	Surface water Quality	pH, DO, TDS, Turbidity, Temperature, TSS, BOD, COD, Lead, Iron, Zinc, Cadmium, Arsenic, Chloride, Oil and Grease etc.	• Dredging Location, • Landfill Site • Drainage sites	3	Quarterly	45000	540,000	1,080,000
2	Groundwater Quality	pH, Turbidity, TDS, Hardness as CaCO3, Cr, Cu, Fe, Mn, Mg, Na, Zn, SS, Temperature, Faecal Coliform, Total Nitrogen, Nitrate, Sulphate etc.	• Landfill Site, • BEZA Office, • Labor Camps	3	Quarterly	40000	480,000	960,000
3	Dredging Sediment Quality	pH, Heavy Metals As, Cd, Cr, Cu, Hg, Pb, Zn	Dredging Locations	2	Quarterly	45000	360,000	720,000
Sub-Total (C)								2,760,000
B	Operation Period							
1	Surface water Quality	pH, Turbidity, TDS, Hardness as CaCO3, Cr, Cu, Fe, Mn, Mg, Na, Zn, SS, Temperature, Faecal Coliform, Total	• Samples Two (2) from land fill locations	02	Quarterly	45000	360,000	720,000

		Nitrogen, Nitrate, Sulphate etc..						
2	Groundwater Quality	pH, DO, Total Dissolve Solid (TDS), Turbidity, Temperature, TSS, BOD, COD, Lead, Iron, zinc, Cadmium, arsenic, chloride, Oil and Grease	• Samples Two (2) from land fill locations	06	Quarterly	45000	360,000	720,000
Sub-Total (D)								1,440,000
Total (C+D)								4,200,000
Grand Total (A+B+C+D)								92,31,000

Table 9-14: Estimated Environmental Monitoring Budget for construction of gas pipeline networks within NSEZ areas43

. Sl. No.	Monitoring Issues	Description	Monitoring Locations/ Sites	Monitoring Frequency/ Unit	Unit Rate (BDT)	Cost in (BDT)
A	**Construction Phase (30 Months)**					
A.1	**Environmental Pollution Monitoring (Environmental Physical and Biological Environment and Social Environment)**					
1	Surface water Quality	Temperature, TDS, Salinity, Turbidity, TSS, pH, DO, BOD, COD	Three (3) samples from Ichakhali canal, Daborkhali canal and Bamansundar canal	Before, during and after construction (a total of 9 samples from 3 locations)	45,000	405,000
2	Ground Water Quality and drinking water	pH, Manganese, Iron, As, TC, FC, pH, DO, TDS, Turbidity, Chloride,	Labor and Construction Camp (2 locations)	Once before construction and quarterly during construction (a total of 21 samples)	30,000	630,000
3	Air Quality	PM10, PM2.5, NO_2, SO_2, CO and O_3	04 Locations (at project site, nearest Important Sensitive Receptors: as directed by engineer)	Pre-construction once and quarterly during construction (a total of 41samples)	45,000	1,845,000

[43] Source: Environmental and Social Impact Assessment (ESIA) Report for Construction of Gas Pipeline Networks within NSEZ areas, BEZA. https://nsez.gov.bd/?p=1300

. Sl. No.	Monitoring Issues	Description	Monitoring Locations/ Sites	Monitoring Frequency/ Unit	Unit Rate (BDT)	Cost in (BDT)
4	Noise Level	Noise levels in Leq, Leqday, Leqnight and hourly Leq	04 Locations (at project site, nearest settlement /Important receptors	Pre-construction once and quarterly during construction (a total of 41 samples)	8,000	328,000
5	Soil Quality	pH, Total Mercury, Cd, Cr & Pb, Cu, Zn, Salinity.	Construction Area (2 Samples)	Two samples during construction	50,000	100,000
	Sub total					**3,208,000**
A-2	**Environmental Mitigation Measures**					
1	Dust suppressing by water sprayer	Suppressing quantity	Road surface			Civil work
2	Providing sewage tank/soak well in construction camps and yards;	Installation of sufficient and good quality toilets and sewage tank	Labor camps, administrative office and working sites			Civil work
3	Installation of Tube well and safe drinking water supply at labor camps and working site	Installation of sufficient numbers of tube wells and ensure the safe drinking water supply	Labor camps, administrative office and working sites			Civil work
4	Providing solid waste management facility in construction camps (Waste bins)	Sufficient solid waste management provided	Labor camps, administrative office and working sites	Monthly	20,000	240,000
5	Disposal of construction debris and other waste materials and transportation	Labor camps, administrative office and working sites	Labor camps, administrative office and working sites	Monthly	20,000	240,000
6	Implementation of TMP	Roads Networks in NSEZ	**Project areas**	Daily	LS	400,000
7	Occupational Health and Safety and	PPE cost (safety jacket/ life jacket, high visibility vest, helmets, hand protection gloves, protective shoes, safety helmets, eye protection goggles, Face mask/KN95, Hand Sanitizer)	Labor camp and working sites.	Monthly	20,000	240,000
8	Implementation of Environmental Enhancement Measures Greenery Plan	Approximately 12000 sapling plantations alongside the road networks in Zone 2A and 2B	Roadside	LS	700	8,400,000
		Plantation of Vetivar / Nepiar / Barmuda grasses	Road shoulder and slops	LS	LS	1,200,000
9	Informatory Signage for safety near sensitive locations and built-up sections				LS	150,000
	Sub total					**10,870,000**

. Sl. No.	Monitoring Issues	Description	Monitoring Locations/ Sites	Monitoring Frequency/ Unit	Unit Rate (BDT)	Cost in (BDT)
A-3	**Training for Workers and Institutional Strengthening, and implementation of SEP**					
1	Capacity Building	Training of the workers & project professional	Working sites	LS		1,800,000
2	Implementation of SEP			LS		**375,700**
	Sub Total					**2175700**
1	Water Quality	Gas pipeline leakage and spill can contaminate the nearby water resources	Working sites	LS		**150,000**
2	Air Quality	Air pollutants will be released from the gas pipeline operation and maintenance such as pipeline pigging.	Working sites	LS		**360,000**
3	Noise Level	The valve stations, and others pipeline facilities can produce excessive noise.	Working sites	LS		**64,000**
4	Water Quality	Gas pipeline leakage and spill can contaminate the nearby water resources	Working sites	LS		**200,000**
5	Occupational Health and Safety	Accidents or incidents	Working sites			**100,000**
6	Terrestrial Ecology	Re-vegetation	Roadsides			**500,000**
	Sub total					**1,374,000**
	Total (A+B)					**17,627,700**
	Contingency 10%					1762700
	Grand Total (BDT)					**19,390,470**
	Total Cost (Million BDT)					**19.39**
	Total Cost (Million USD) Note: (1 USD = BDT 119.52 Nov 02, 2024				**0.162**	

Table 9-15: Estimated Environmental Monitoring Budget for construction of internal power networks within NSEZ areas44

Environmental Items:	Location	Parameters	Monitoring Frequency:	Quantity (Yearly);	Unit/sample (BDT)	Budget (Yearly) BDT	Total Cost (BDT) for 2 Yrs.
Construction Period (Environmental Quality and Water Resources)							

[44] Bidding Document for Power Network, Package No.: WD-4A-NSEZ-BEZA (Part-1). https://nsez.gov.bd/?page_id=686

Preparation and updating the CESMP	-		-	01			-
Conduct Air Quality Monitoring (at least 4 locations):	substations, in protected areas, cables as above, and other locations	PM2.5, PM10, SPM, CO, NOX, SOX	Quarterly (baseline+1 time/quarter)	4+4 ×4= 20	45000	900000	1800000
Noise sampling, testing and Monitoring: at least 5 locations.	site boundary of substations, in protected areas, cables as above, and other locations	Leq	Monthly (baseline+1/month)	5+5 × 12 = 65	8000	520000	1040000
Surface water quality sampling and testing: at least 4 locations of nearby water bodies	Nearby water bodies or canals including Ichakhali Canal	pH, DO, TDS, Turbidity, Temperature, TSS, BOD, COD, Pb, Fe, Zn, Cd, As, Cl-, oil and grease etc.	Quarterly (4 locations*5 times)	4+4 ×5= 24	45000	1080000	2160000
Drinking water quality sampling and testing: at least 4 locations	Construction site-1, labor camp-1, substation-2,	pH, Turbidity, TDS, Hardness, Total Cr, Cu, Fe, Mn, Mg, Na, Zn, SS, Temperature, Total Coliform, Faecal Coliform, Total N, Nitrate, Sulphate etc.	Quarterly (4 locations*5 times)	4+4 ×5= 24	45000	1080000	2160000
Grand Total (BDT)						3580000	7160000

Table 9-16: Estimated Environmental Monitoring Budget for Construction of Road Networks and Storm Water Drainage within NSEZ areas[45].

Environmental Items:	Location	Parameters	Monitoring Frequency:	Quantity (Yearly);	Unit/sample (BDT)	Total Cost (BDT) for 2 Yrs.
Construction Period (Environmental Quality and Water Resources and Biological Resources)						
Preparation and updating the CESMP	-		-	01		-
Conduct Air Quality Monitoring (at least 4 locations):	2 samples at project sites	PM2.5, PM10, SPM, CO, NOX, SOX	Quarterly	60	45000	2700000
Noise sampling, testing and Monitoring: at least 5 locations.	6 locations at project site (high noise generating sites and adjacent sensitive receptors)	Leq	Quarterly	180	8000	144000

[45] Bidding Document for Road & Storm Water Network for Mirsarai-2B EZ, package no WD-2-NSEZ-BEZA. https://nsez.gov.bd/?page_id=686

Environmental Items:	Location	Parameters	Monitoring Frequency:	Quantity (Yearly);	Unit/sample (BDT)	Total Cost (BDT) for 2 Yrs.
Surface water quality sampling and testing: at least 4 locations of nearby water bodies	Two samples from nearest canals	pH, DO, Turbidity, TDS, BOD, COD, NH3, oil and grease etc.	Quarterly	36	45000	216000
Drinking water quality sampling and testing: at least 4 locations	2 locations at project sites and closest borehole of the project site	pH, Alkalinity, Cl-, Fe, As, TSS, Salinity and Pb etc.	Quarterly	12	45000	216000
Tree Plantation Plan	The project site	Different kinds of tree species		7000	200	140000
Grand Total (BDT)						7700000

Table 9-17: Estimated Environmental Monitoring Budget for Construction of Water Supply Networks within NSEZ Areas

Environmental Items:	Location	Parameters	Monitoring Frequency:	Quantity (Yearly);	Unit/sample (BDT)	Budget (Yearly) BDT	Total Cost (BDT) for 2 Yrs.
Construction Period (Environmental Quality and Water Resources)							
Preparation and updating the CESMP	-		-	01			-
Conduct Air Quality Monitoring (at least 4 locations):	substations, in protected areas, cables as above, and other locations	PM2.5, PM10, SPM, CO, NOX, SOX	Quarterly	20	45000	900000	1800000
Noise sampling, testing and Monitoring: at least 5 locations.	site boundary of substations, in protected areas, cables as above, and other locations	Leq	Quarterly	65	8000	520000	1040000
Surface water quality sampling and testing: at least 4 locations of nearby water bodies	Nearby water bodies or canals including Ichakhali Canal	pH, DO, TDS, Turbidity, Temperature, TSS, BOD, COD, Pb, Fe, Zn, Cd, As, Cl-, oil and grease etc.	Quarterly	24	45000	1080000	2160000
Drinking water quality sampling and testing: at least 4 locations	Construction site-1, labor camp-1, substation-2,	pH, Turbidity, TDS, Hardness, Total Cr, Cu, Fe, Mn, Mg, Na, Zn, SS, Temperature, Total Coliform, Faecal Coliform, Total N, Nitrate, Sulphate etc.	Quarterly	24	45000	1080000	2160000
Grand Total (BDT)						3580000	7160000

(Budget made based on assumption which can be changed based on the project needs)

Table 9-18: Estimated Environmental Monitoring Budget for TSDF of Ship Recycling Industries at Zone-24 of NSEZ Areas

Environmental Items:	Location	Parameters	Monitoring Frequency:	Quantity (Yearly);	Unit/sample (BDT)	Budget (Yearly) BDT	Total Cost (BDT) for 2 Yrs.
Construction Period (Environmental Quality and Water Resources)							

Preparation and updating the CESMP	-		-	01			-
Conduct Air Quality Monitoring (at least 4 locations):	substations, in protected areas, cables as above, and other locations	PM2.5, PM10, SPM, CO, NOX, SOX	Quarterly	20	45000	900000	1800000
Noise sampling, testing and Monitoring: at least 5 locations.	site boundary of substations, in protected areas, cables as above, and other locations	Leq	Quarterly	40	8000	320000	640000
Surface water quality sampling and testing: at least 4 locations of nearby water bodies	Nearby water bodies or canals including Ichakhali Canal	pH, DO, TDS, Turbidity, Temperature, TSS, BOD, COD, Pb, Fe, Zn, Cd, As, Cl-, oil and grease etc.	Quarterly	20	45000	900000	1800000
Drinking water quality sampling and testing: at least 4 locations	Construction site-1, labor camp-1, substation-2,	pH, Turbidity, TDS, Hardness, Total Cr, Cu, Fe, Mn, Mg, Na, Zn, SS, Temperature, Total Coliform, Faecal Coliform, Total N, Nitrate, Sulphate etc.	Quarterly	20	45000	900000	1800000
Grand Total (BDT)						3020000	6040000

(Budget made based on assumption which can be changed based on the project requirements)

9.6 INSTITUTIONAL SETTING AND IMPLEMENTATION ARRANGEMENTS

322. The implementation of the Environmental and Social Management Plan (ESMP) requires the organization's support structure in the form of organizational requirements, training, mechanisms to implement, and an information management system.

323. The NSEZ of the BEZA under the Chief Advisor's Office of the GoB is the Executing Agency (EA) for this subproject. In the institutional arrangement procedure, the Project Director will be directly involved in the implementation of the ESMP. For preparing the bid document, specification of the contract document, float bid document, as well as supervision and monitoring of the Project Implementation Unit (PIU) or Project Management Unit (PMU) of the PRIDE project would require skilled manpower. Since the Part of Precinct F (IMD Zone and Housing Facilities) of NSEZ would be developed by the contractor, the contractor will hire a sufficient number of skilled manpower.

324. The Environmental and Social Management Plan (ESMP) will be carried out under the direct supervision of the PIU/PMU of NSEZ. The PIU will be in charge of overall coordination between various government agencies such as the DOE and the World Bank to implement the ESMP to the project sites during the Construction period by the World Bank Environmental and Social Standards (ESS-1 to 10, except ESS-9) and ECR 2023) as well as other applicable national laws and regulations.

325. The PMU of NSEZ will hire contractors to construct dredging pipelines and other infrastructure in compliance with ESMP. The organizational flowchart for the implementation of the ESMP for this sub-project is shown in Error! Reference source not found..

Figure 9-1: Organizational Flow Chart for the ESMP Implementation

9.6.1 Roles and responsibilities for ESMP implementation

326. The description of the key specific responsibilities of various agencies and parties for implementing environmental and social safeguards is provided below;

1. Project Implementing Unit

327. The Project Implementing Unit (PIU) of NSEZ will be responsible for ensuring that all components of the ESMP comply with the local and World Bank ESF (Environmental and Social Framework) during the implementation of the project. Under the EA, the PIU will manage individual contract Packages under the subproject. The PIU is headed by a Project Director, responsible for ensuring the implementation of the social and environmental safeguards for the subproject in consistent with WB-ESF and GoB's environmental rules and regulations. The organizational setup of the PIU is presented in

328. . The PD and DPDs, and APDs would be supported by an Environmental and Social Specialist. The PIU will take responsibility for implementing the environmental and social requirements following the approved ESIA report at the field level. The PIU and the field offices will conduct the field visit regularly (at least bi-monthly), site visits, and ensure that the project meets the compliance requirements by the contractor and DSC.

Table 9-19 : Personnel under the PIU of the NSEZ -BEZA

Name of Posts	No. of Post	Mode of Recruitment	Pay Grade
Project Director (PD)	1	Deputation	3
Deputy Project Director (DPD)	3	Deputation	4
Executive Engineer (Xen)	2	Deputation	5
Assistant Project Director (APD)	3		
Social Specialist	1	Deputation	5
Environmental Specialist	1	Deputation	6
Monitoring and Evaluation Consultant	12	Deputation	6
Social Counselor	4	Contractual agreement	
Environmental Counselor	2	Contractual agreement	

Note: The PIU set up is prepared based on the scope of the subproject.

329. The PIU will submit the monthly, quarterly, semiannually, and annually on the environment and social monitoring (prepared by DSC and contractors) to the World Bank for review and disclosure on the World Bank's websites. However, the details of the scope of PIU for monitoring the environmental and social progress at the site are specified below.

- The Safeguard specialist(s) of PIU will ensure that the C-ESMP is made part of the contract documents.
- Review all sub-plans identified in the CESMP to be prepared by the Contractor to include camp layout, waste/debris management plan, traffic management plan etc., as per requirements of the contract document.
- Review monthly/quarterly/annual environmental monitoring reports prepared by the Contractor's
- Conduct monthly or bi-monthly site and follow-up inspections to ensure the veracity of the submitted monitoring reports and enforce the ESMP and EMoP;
- Ensure that DSC, while carrying out work at the site, follows the environmental and social standards, guidelines, and manual of BEZA-PRIDE
- Ensure that the ESMP and relevant environmental clauses are included in the contractor's bidding documents
- Conduct spot checks on-site to monitor the contractor's compliance with the ESMP
- If there are any non-compliance issues or unanticipated environmental impacts, ensure that necessary corrective actions are taken and the ESIA and/or ESMP are updated as necessary
- Ensure that all grievances and complaints received are addressed promptly and properly documented
- Carry out all other activities on environmental and social safeguards on behalf of the PIU as needed.

2. Design and Supervision Consultant

330. The NSEZ shall utilize the consultancy services of the DSC for the overall management and supervision of construction work on behalf of the EA. In addition to supervising the construction work of the contractor, their role will be to check on conformity with the relevant clauses in construction contracts and national legislation. Since the project area is close to the habitat of the marine ecosystem and other important aquatic faunal species, there will be an additional provision of an ecological expert in the DSC team. The roles and responsibilities of DSC's Environmentalist and Ecologists are shown in **Table 9-20**.

Table 9-20. Roles and Responsibilities of PIC's Environment and Ecological Experts

CSC Environment Specialist	DSC Ecological Expert
• Review ESIA to acquaint him/herself with the project and environmental safeguard requirements. • Identify statutory/regulatory requirements (clearances/permits/NOC for the project and ensure all are secured or at least applied for. • In case it is applied for, assist the PIU by follow-ups. Provide technical input if required. • Prepare and provide a checklist/format to the contractor for periodic pollution monitoring and OHS reporting in line with EMP and EMoP. • Review the method of construction technology, especially dredging to minimize noise and vibration from dredging pipeline installation. • Review the adequacy of existing onsite facilities (waste management, storm water drainage, oil spillage prevention, fire-fighting, emergency preparedness, and other OHS requirements) before the start of construction. • Review and approve the C-ESMP submitted by the contractor and check whether it is in line with the ESMP of ESIA and present site conditions. • Conduct workshops/training for contractors and PIU staff before and periodically during construction. • Conduct regular site inspections to examine environmental compliance and suggest corrective actions; • In times of emergencies, as stated above, where necessary, coordinate with the relevant government agencies. • Assess the practicality of the proposed GRC and modify as per local conditions, and maintain proper records of all grievances received and addressed under the project • Prepare Semi and Annual Monitoring Plan • Provide necessary support to the PMU to ensure proper disclosure of project-related information to stakeholders • Coordinate and work closely with the ecologists of the contractor and the NSEZ.	• Review ESIA to acquaint him/herself with the project and the ecological component of environmental safeguard requirements. • Review the baseline condition of Dolphin and other aquatic and benthic fauna. • Review the proposed design and activities of the contractor that may have potentially significant adverse impacts on local biodiversity • Modify, if required, the construction schedule to avoid any adverse impact on aquatic fauna • Apprise the contractor about construction protocols and legal compliances (act/rule/) during the Hilsha breeding period and other wildlife migrations. • Review and approve the C-ESMP submitted by the contractor and check whether it is in line with the ESMP of ESIA and present site conditions. • Prepare forms/formats and a checklist for monitoring to be conducted by the contractor related to marine, other aquatic fauna and Hilsha fish. • Ensure that monitoring is being conducted as per project requirements and EMoP. • Supervise the implementation of activities proposed for the Hilsha breeding ground mitigation/conservation. • Conduct an awareness program for Dolphin conservation among all stakeholders • Prepare semi-annual monitoring reports on monitoring /biodiversity-related activities. • Prepare semi-annual monitoring reports on the monitoring of biodiversity-related activities • Coordinate and work closely with the expert of the contractor's ecologist and the PIU. • Provide necessary checklists, forms, and formats to continue monitoring of Hilsha spawning period and other aquatic fauna during the dredging activities of the subproject • Prepare the Semi-Annual Monitoring Plan

3. Contractor/ Sub-contractors

331. The Contractor/sub-contractor is legally mandated to implement the ESMP and EMoP and obtain all environment-related permits and clearances required for construction. Hence, the selected contractor must have a testimonial to be compliant to the Environmental Management System,) and related Occupational Health and Safety (OHS). The Contractor will provide an experienced environmental and occupational health and safety specialist. The contractor will implement the environmental and social mitigation measures as per the ESMP as E&S compliance during the Construction Period. Contractors should prepare a site-specific Construction Environmental and Social Management Plan (C-ESMP) based on the ESIA report, including ESMP's recommendations and World Bank guidelines. To implement the C-ESMP, contractors will recruit an Environmental and Social Management Officer (ESMO) and an Occupational Health and Safety Officer (OHSO) for monitoring Environmental and Social compliance during contractor activities.

The overall responsibility includes as following

- ❖ Review ESIA, especially ESMP and EMoP in detail and identify clearances required during the construction stage.
- ❖ Prepare site-specific C-ESMP of the subproject. The C-ESMP should be included the labor management plan, waste management plan, traffic management plan, occupational health and safety plan, spill management plan, drainage management plan, tree planation plan and greenery plan etc. as well as environmental and social code of practices **((Annexures, Volume-II),** and to be implemented during

construction stage in compliance of the ESMP of the project.

- ❖ Ensure that the regulatory permissions secured for construction equipment, vehicles, and machinery are obtained timely manner and are valid at all times during the execution
- ❖ Prepare all sub-plans such as the traffic management plan, emergency response and disaster management plan, construction material and storage handling plan, waste management plan, occupational health and safety plan, camp layout plan, and any other plans specified in tender specifications and deemed necessary for environmental safeguard.
- ❖ Fill up the environmental and safety-related compliances as per daily/weekly, fortnightly, monthly, quarterly, semi-annual checklists in the ESMP.
- ❖ Implement the ESMP and ensure the construction works comply with it and conditions of all environmental clearances and permits issued by respective statutory bodies;
- ❖ Ensure that construction activities are carried out in a manner that avoids, mitigates, and minimizes adverse impacts on biodiversity as given in the ESIA report and ESMP
- ❖ Identify locations for siting construction camps and other plants, machinery, vehicles, and equipment, as well as locations for storage and disposal of wastes, both from the construction camps and from the site, and obtain approval for the same from the PIC
- ❖ Detail out site-specific environmental mitigation and enhancement measures and obtain approval of the DSC for the same.
- ❖ Ensure that the safety of the workers and other site users is not compromised.
- ❖ Preparing registers for material sources, labour, pollution monitoring results, public complaints, and as may be directed by the DSC;
- ❖ Undertake enhancement measures as outlined in ESIA, including ESMP;
- ❖ .Preparing and submitting monthly/quarterly/semi and annual Safeguard reports as per ESMP/EMoP to DSC on the status of implementation of environmental safeguard measures.

4. Third Party Monitoring

332. A third-party monitoring (TPM) is required to track the progress of environmental and social management at the dredging sites and landfilling sites following the World Bank Environmental and Social Framework. Particularly for collecting the environmental quality parameters, e.g., air quality, noise level, surface water quality and groundwater quality, and soil quality, following the parameters mentioned in the Environmental and Social Monitoring Plan of the ESIA report and analysis in the government-accredited laboratory periodically. The TPM entity should be impartial, technically competent, and have no vested interest in the subproject's success. The key functions of TPM include:

- **Verification of Compliance:** Assessing whether the project is adhering to the requirements of the ESMP, permits, and relevant regulations.
- **Independent Data Collection and Analysis:** Gathering data on environmental and social indicators to assess this subproject's impacts.
- **Stakeholder Engagement:** Consulting with affected communities and other stakeholders to gather feedback and address concerns.
- **Reporting and Recommendations:** Providing regular reports to the project proponent, highlighting areas of compliance and non-compliance, and recommending corrective actions.

5. Department of Environment

333. As a Safeguards regulatory organization of the Bangladesh DOE is responsible for overseeing environmental safeguards during the construction of the subproject. Their crucial role includes issuing environmental clearances, monitoring of construction impacts, and ensuring compliance with environmental regulations as necessary, according to ECR 2023. Also review the quarterly environmental monitoring report with providing feedback on the implementation of environmental safeguards, and providing technical guidance to the EA

9.7 GRIEVANCE REDRESS MECHANISMS

334. To receive complaints, grievances, and remedies over the issues concerned, a grievance redress mechanism (GRM) shall be established likely adhering to the World Bank's Environmental and Social Standards, particularly, ESS-10 focuses on information disclosure and stakeholder engagement, which aligns

with the need for a GRM. The establishment of a Grievance Redress Mechanism (GRM) is crucial in ensuring accountability and addressing concerns raised by stakeholders. The environmental and social consultant team (E&S team) will oversee the GRM system over the project implementation period and has a strong relationship with PMU of BSMSN indicating that both entities work closely together. The PMU is likely responsible for project implementation, and collaboration between project management and grievance redress activities.

335. The GRM is designed to be straightforward and consistent, ensuring that the process of making a complaint is easily understandable for everyone, regardless of their background or affiliations. The GRM is inclusive, considering factors such as education, social standing, and political affiliation. This emphasizes equal access to the grievance process for all stakeholders involved in the project. Acknowledging the importance of gender responsiveness, the GRM ensures that female complainants have the option to have their grievances heard and responded to by a woman or women. This is crucial for creating a supportive and comfortable environment for all stakeholders.

336. BEZA will ensure that the public, particularly those directly affected by the project components will have the chance to express their legitimate grievance or to file a complaint about the project by setting up a mechanism to address the issues raised. A two-tier bottom up GRC system will be established in this Project. First, there will be GRCs at the local level, hereafter called Local GRC (union/municipality level); and second, GRC at the project level to give room for grievances to be reviewed. The APs will be informed through public consultation that they have a right to have their grievances redressed by the local committees as well as by the project management.

i) Development of Procedures for Grievance Mechanism

337. To provide a more structured local level GRM, project-level grievance redress mechanism, a grievance redress committee (GRC) will be formed as soon as the funding of the project becomes effective and will continue until project completion. The PD will act as the convener and members of the GRC will be representatives from the NGO, chair of the union where the project is located, a witness for the AP, and a representative from a local group (i.e. religious, teacher, etc.). There will be two entry points in filing a complaint(s) as follows:

First level – affected persons (APs) will be informed in writing to the conveyor of local level GRC of their losses and entitlements. If APs agree with the conditions of entitlements, they can claim for the payments from the EA. GRCs at the union/municipality level (community level) will be formed with representatives from Project site manager (BEZA), local elected representatives from the Local Government Institutions (LGI), representatives of the affected persons (preferably women representative in case of women AP's), and RAP implementing NGO. There will be one GRC at local (union/municipality) level by the project to make it accessible to affected people both in terms of distance and time.

Second level – if the APs disagree, he/she can be approached to PMU for clarifications. The PMU will respond to queries within two weeks. Grievances raised will be documented providing details on the person, concern(s) raised, and the action taken by the PMU. If the AP(s) is satisfied, compensation can be claimed from the PMU. The Project-Level GRC will review all unresolved cases forwarded to by Local GRCs. It will be headed by the Project Director (PD). The Project-level GRC with representation of senior elected official and civil society members will further establish fairness and transparency in the resolution of disputes or grievances. In specific cases, Project-level GRC may seek legal advice from the Legal Advisor, if required.

338. The GRC will meet once a month to deliberate on the complaint(s), if any, and will keep a record of the grievances. The record will include the contact details of the complainant, date the complaint was received and the nature of the complaint, agreement on corrective actions and the date it was enforced, and the outcome. Complaints received, with appropriate documentation, will become part of the environmental and social monitoring reports submitted to WB. PMU will ensure that the grievance redress mechanism maintains a transparent process that is gender and special needs-responsive, culturally appropriate, and easily accessible to all project affected people at no costs and without retribution. The proposed mechanism does not impede access to the country's judicial or administrative remedies.

ii) Implementation Arrangements

339. BEZA has developed this Resettlement Policy Framework to guide the land acquisition and resettlement activities under the PRIDE project. A set of professionals including Resettlement Specialist have been working in the BEZA. The institutional arrangement of BEZA is aligned as per this framework. BEZA will appoint Consulting Firm/NGO as a RAP implementing agency (IA) for preparation and or implementation of the land acquisition and RAP. BEZA will supervise and monitor the activities of RAP IA.

340. In the institutional arrangement procedure, Project Director, and Team Leader/Deputy Team Leader will be directly involved. The PD and DPD would be supported by Environmental and Social Specialists. Under PMU, there will be relevant officials and consultants to support the PD.

341. The E&S unit and PMU will submit monthly and quarterly progress reports on Environmental and Social Compliances to GM (P&D). After reviewing it will be sent to the World Bank. Institutional setting and implementation arrangement of BEZA for environmental and social issues is shown in Figure-9.1.

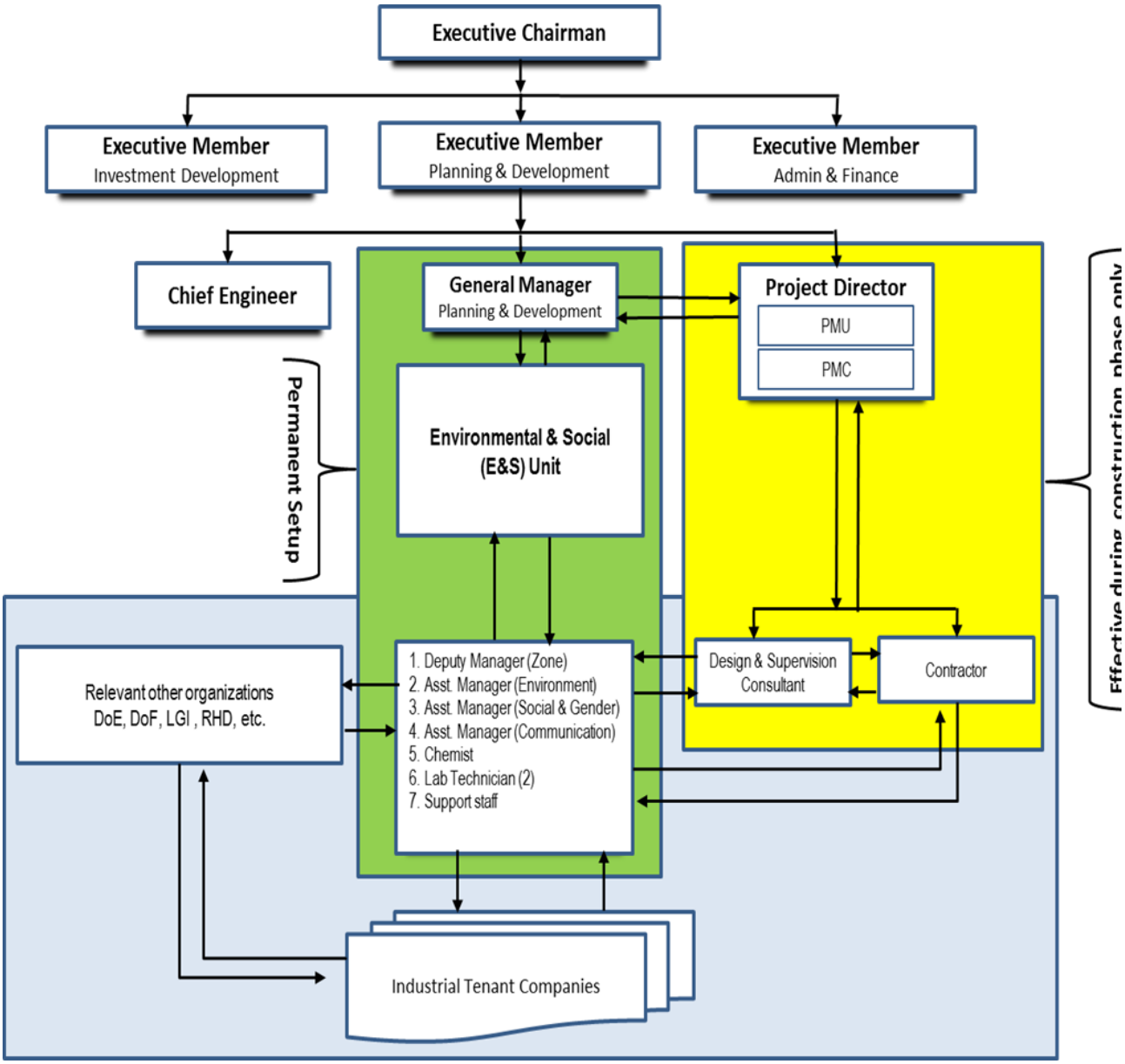

Figure 9-2: Institutional Arrangements for Grievance Redressal Mechanism

iii) Grievance Redress Committee

342. A member committee will be formed at each level. Tier-1 level, the committee will lead by Asst. Project Director, or Deputy Manager (Zone) with the representatives from contractors, DSM consultants, local people and Higher-level committee will be formed by Project Director, with the members of the Deputy Project

Director as member secretary, Deputy Manager (Zone), DSM consultant and one local elected member from the project site.

iv) Publicize the Grievance Mechanism

343. The disclosure of the Grievance Redress Mechanism (GRM) is a critical aspect of ensuring transparency and accessibility for stakeholders. The disclosure should be comprehensive, providing clear information on how individuals or groups can submit grievances, the process that will be followed, and the expected timelines for resolution.

Disclosures Step:	Way forward
Public Accessibility:	GRM information is easily accessible to all stakeholders. This could include publishing it on project websites, community noticeboards, or distributing printed materials in local languages.
Clear Communication:	Clearly explain the purpose and procedures of the GRM in a language that is easily understood by all stakeholders. Avoid technical jargon that might be confusing.
Submission Channels:	Specify the various channels through which grievances can be submitted. This could include in-person submissions to designated focal points, written submissions, or even anonymous channels if appropriate.
Contact Information:	Provide contact details for the individuals or offices responsible for receiving grievances at both Tier 1 and Tier 2 levels. Include names, phone numbers, and email addresses.
Timelines for Resolution:	Clearly outline the expected timelines for each stage of the grievance process. This helps manage expectations and demonstrates commitment to timely resolution.
Appeal Process:	Describe the process for appealing a decision, including the designated authority or office to which appeals should be submitted.
Confidentiality and Privacy:	Assure stakeholders that their grievances will be handled confidentially and with respect for their privacy, especially if the nature of the grievance involves sensitive information.
Feedback and Follow-up:	Explain how feedback on the grievance process will be collected and used for continuous improvement. Also, inform stakeholders about the possibility of follow-up after a grievance has been resolved.
Cultural and Gender Sensitivity:	Emphasize the cultural and gender responsiveness of GRM, reiterating that the process is designed to be inclusive and respectful of diversity.
Regular Updates:	Shall provide regular updates on the status of grievances and any improvements or changes to the GRM system. By effectively disclosing the GRM, empower stakeholders to engage with the process, fostering trust and accountability in the project's environmental and social practices.

344. GRM Box should be accessible at the project sites for enhancing practicability of a physical Grievance Redress Mechanism (GRM) to facilitate the submission of grievances from local communities, workers, and other stakeholders. Placing the GRM Box in a prominent and easily accessible location at the construction site, ensuring it is visible to all stakeholders, and providing clear and simple signage on and around the GRM Box, explaining its purpose, how to use it, and the types of grievances that can be submitted.

v) Develop Resolution Options and Response

345. The GRM is designed to be accessible to all, accepting verbal complaints in the same manner as written complaints. This accommodates individuals with limited literacy skills, ensuring that the complaint process is inclusive and reachable by a diverse range of stakeholders. Setting timelines for responses is an essential aspect of the GRM. This ensures that complaints are addressed promptly, demonstrating a commitment to timely and efficient resolution.

346. Implementing a two-tier Grievance Redress Mechanism (GRM) system is a strategic approach to ensure that grievances are addressed efficiently and at the appropriate level. The detail is given below:

Tier 1: Local Resolution

347. The Project Manager/designated person by PMU shall be the contact person for verbal or written filing of grievances at the first tier. Response and attempted resolution of complaints will be done within 7 working days. Investigation of grievances will involve site visits and consultations with the complainant, other affected people, contractors, and other relevant parties such as local NGO representatives, as appropriate to the complaint. If the complainant is a woman, arrangements should be made for a female mediator to be involved in the interaction. If the complainant cannot communicate in Bengali, arrangements should be made for an interpreter.

GRM steps	Functionality of GRM system
Submission of Grievance:	Stakeholders submit their grievances to a local or project-level GRM focal point. This could be a designated person or officer by PMU of BSMSN within the project area.
Initial Assessment:	The local GRM focal point conducts an initial assessment of the grievance to determine its nature, validity, and complexity. This step ensures that straightforward grievances are resolved at the local level.
Resolution Attempts:	The local GRM focal point makes efforts to resolve the grievance through dialogue, mediation, or other appropriate means. This could involve engaging relevant project stakeholders and addressing concerns in a timely manner.
Documentation:	All communications, actions taken, and resolutions attempted at this stage are documented. This documentation is crucial for transparency, accountability, and future reference.
Communication of Resolution:	Once a resolution is achieved, the local GRM focal point communicates the outcome to the complainant and other relevant stakeholders. If the complainant finds the resolution acceptable, the grievance is considered closed at this tier.

Tier 2: Escalation to Project Management Unit (PMU)

348. This structured two-tier GRM system aims to balance local responsiveness with higher-level oversight, ensuring that grievances are resolved efficiently and at the appropriate level of competency and authority.

349. Unresolved grievances escalated to Level 2 will be processed by the Project Director. Other members of the GRC will include (i) BEZA field officials from BSMSN, (ii) a representative of the relevant local ward member office, (iii) a representative of the relevant female ward member's office, (iv) a representative from the contractor(s), (v) a representative from the local people, and (vi) one or more representatives from any relevant locally active NGOs or civil advocacy groups.

GRM steps	Functionality of GRM system
Appeal Process	If the complaint with the resolution at Tier 1, they have the option to appeal. The appeal is submitted to the Project Management Unit (PMU) or a higher-level authority within the project.
Review by PMU:	The PMU conducts a thorough review of the grievance, considering the actions taken at Tier 1 and evaluating whether the resolution aligns with project policies and Environmental and Social Standards.
Decision and Final Resolution:	The PMU makes a final decision on the grievance, considering the findings from the review. If necessary, additional measures may be taken to address the concerns raised. The decision is communicated to the complainant and other relevant stakeholders.

GRM steps	Functionality of GRM system
Documentation and Learning:	The entire process, including the appeal and the final decision, is documented. Lessons learned from the grievance are noted, contributing to continuous improvement in the GRM system.
Key Principles for Both Tiers:	Timeliness: Clearly defined timelines for each step of the process to ensure prompt resolution. Transparency: All communications, decisions, and actions are transparent, allowing stakeholders to understand the process and outcomes. Feedback Mechanism: Throughout both tiers, there should be opportunities for feedback from complainants to enhance the effectiveness of the GRM system. Training and Capacity Building: Training for staff involved in the GRM system to ensure they have the necessary skills and knowledge to handle grievances effectively. Regular Review: Periodic reviews of the GRM system to assess its effectiveness and make improvements based on feedback and lessons learned.

v) Recording of Grievances

350. A simple grievance record form will be used to record any kind of grievance as follows in Table 9-1.

Table 9-21: Grievances Record form

Name of complainant	Date	Description of grievances	Person in Charge	Response/ action taken	Status

vi) Appeal and Register a Complaint

351. Any type of grievance, whether formal or informal, should be recorded first and then sent to the appeal procedure or GRC committees at the first field level. GRC will review the complaints, follow the appeal process appropriately, and attempt to resolve the issues; if required, the hearing process will be used. For the ultimate decision, the appeal will be sent to the project authority for additional review with recommendations, and the project authority will make the final decision and settle any concerns that are not resolved at the field level. Figure 9-3 depicts the appeals process in detail.

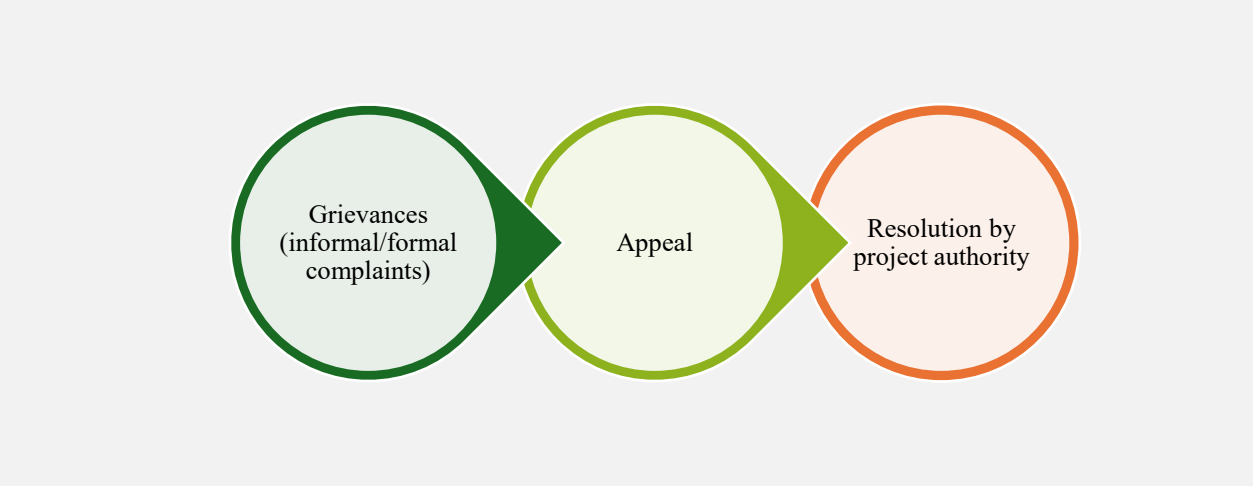

Figure 9-3: Different Steps/ Procedures in the complaints management process.

vii) Resolve and Follow Up

352. The policy should be kept transparent and up to date, as well as made available to the local community, workers, employees, and other interested parties. GRM procedures should provide clear paths for filing and managing grievances, both formal and informal complaints. The follow-up process and processes are explained below.

Step-1: Responding to a grievance record or letter: Employees, workers, the local community, and other groups expressed their concerns in both formal and informal methods throughout this stage. It has explained the nature of the grievances and provided any relevant evidence. The response should affirm that it will be explored and provide recommendations for the next actions, including timelines.

Step-2: Investigation: To resolve the issue, the project authority should conduct an unbiased investigation. The investigation shall be conducted by local level GRC members appointed by the GRC at level 1. It's vital to remember that the investigation is a fact-finding exercise before the grievance hearing.

Step-3: Hearing: To determine the outcome of the grievance, all relevant information, evidence, and statements should be considered. It should be kept confidential without interruption by any party. Notes should be taken during hearings.

Step-4: Grievance Outcomes: The project authority shall evaluate what is fair and reasonable based on their investigation(s), hearing, and previous rulings in similar cases. If a grievance is upheld, more actions may be necessary to remedy the complaint (GRC at level 2).

Monitoring and Reporting[46]

353. Monitoring system:

- Tracking forms and procedures to collect information from complainants.
- Assigned staff to update the database routinely.
- identify systemic causes, enhance transparency, publicize complaint handling, and evaluate overall effectiveness.
- Processes for alerting stakeholders about the progress of a case (such as written status reports).
- Procedures to retrieve data for reporting purposes.

Reporting system:

- Assign a single person to oversee each grievance, from receipt to implementation.
- Promote prompt resolution.

[46] https://documents1.worldbank.org/curated/pt/598641478092542645/pdf/108864-WP-CAO-ENGLISH-Implementing-Grievance-mechanisms-PUBLIC.pdf

- Keep all parties involved (complainant and employee) updated on case status and progress toward resolution.
- Document the response and outcome(s) to ensure fairness and consistency.
- Document stakeholders' responses and whether more study or consultation is required.
- Maintain a record of settlements and establish standards for future resolutions.
- Ensure that the implementation of any settlement is timely and comprehensive.
- All grievances should be included in the quarterly environmental safeguards monitoring report to World Bank with remedial actions.

Training/ Workshops on Grievance Redress Mechanism

- Develop clear and visually appealing brochures that explain grievance management procedures and potential outcomes.
- Increase awareness of project activities by providing materials in local languages, mostly Bengali, to facilitate communication with the community.
- Conduct interactive and informative seminars, workshops, meetings, and stakeholder consultations in the local community to promote project activities.
- Facilitate formal training sessions (quarterly or semi-annually) for grievance redressal committee members and local residents on grievance recording, interactive engagement, investigations, hearings, and final outcomes.

354. Increase capacity to arrange monthly GRC meetings at the field level to assess grievances and resolution procedures etc.

9.8 TRAINING REQUIREMENT AND INSTITUTIONAL STRENGTHENING

355. The Implementation Agency, Monitoring and Supervision Agency (PMU of NSEZ), contractors, and others relevant personnel will be trained in EMP, EMoP, mitigation strategies, occupational and community health and safety management, waste management, emergency response, traffic management, biodiversity management, stakeholder engagement, and the use of grievance redress mechanisms, among other things**. Table 9-22** summarizes the subjects, techniques, and anticipated cost of training. The Environmental and Social Consultant of the DSC will prepare a training session plan after consulting with the PMU of the NSEZ, following World Bank recommendations.

Table 9-22: Training Program and Implementation Cost

Training Topics	Target Audiences	Duration	Frequency of Training	Responsible	Supervision Agency	Estimated Cost (BDT)/ for Ist yr.	Estimated Cost (BDT)/ for 2 yrs.
ESMP Implementation: Roles and Responsibilities, Monitoring, Supervision and Reporting Procedures.	Contractor's representatives, PMU of NSEZ representatives,	Before construction (2 days)	Before the commencement of construction works	DSC	NSEZ-BEZA	300,000	300,000
		Refresher training each year up to the construction period (2 days duration)	Annually	DSC	NSEZ-BEZA	200,000	400,000
Grievance Redress Mechanism: Roles and Responsibilities, Procedures, Occupational and Community Health and Safety, Emergency Preparedness and Response, Pollution Control and Environmental Monitoring, construction waste management, Inspection and Reporting, Public Consultation, Contractor Engagement and Management, including ESMP enforcement,	Contractor's representatives, PMU of NSEZ representatives,	Refresher training each year up to the construction period (2 days)	Annually	DSC	NSEZ-BEZA	300,000	600,000
		Refresher training in each year up to the construction period (2-day period)	Annually	DSC	NSEZ-BEZA	200,000	400,000
Labor and Working Conditions: Terms and conditions of employment according to national working laws and regulations. Contractor and sub-contractor codes of conduct, Worker's organizations, Child labor and minimum age employment Rules etc.	Contractor's representatives, PMU of NSEZ representatives,	Before construction (1 day)	Before the commencement of construction works	DSC	NSEZ-BEZA	300,000	300,000
		Refresher training in each year up to the construction period (1 day)	Annually	DSC	NSEZ-BEZA	200,000	400,000
GBV Risk: Raising awareness and measures to prevent and mitigate GBV risks. The topics, activities, and targeted groups will be developed in the GBV Action Plan, including GBV-specific GRM	Contractor's representatives, PMU of NSEZ representatives,	Prior to construction (1 day)	Before the commencement of construction works	DSC	NSEZ-BEZA	200,000	200,000
		Refresher training in each year up to the construction period (1 day)	Annually	DSC	NSEZ-BEZA	100,000	200,000
Total Cost (BDT): Eighteen Lakh Taka only.						**1,800,000**	**2,800,000**

10 CONCLUSION AND RECOMMENDATIONS

10.1 CONCLUSION

356. The NSEZ project involves extensive construction activities that will significantly alter the landscape and environmental conditions of the area. While the initial assessment indicates a lack of major pollution, the upcoming construction efforts necessitate careful consideration of environmental management practices to mitigate any adverse effects.

357. Due to the development of NSEZ project, the construction activities will mainly involve excavation, trenching, installation, wielding, brick and concrete works, etc., that will pollute the natural environment such as local air quality, excessive noise, water quality, soil quality, affect the local biodiversity, and significantly affect the social environmental components also. However, these anticipated negative consequences can be easily mitigated because most of them are temporary and reversible. The most negative impacts are deteriorating the local air quality due to dust and exhaust gas emissions, excessive noise will be generated by using different equipment, vehicles, and other logistics support, surface water quality will be affected along the water resources, local biodiversity, both floral and faunal species will be affected or migrated to a safe distance, increased road traffic, and other factors will jeopardize occupational and community health and safety.

358. Medium term and significant impacts are mainly causing removal of trees from the project sites, but it is to be mitigated by taking a replantation plan (1:3) immediately after completion of construction. During operation and maintenance period, fire accidents will be escalated by gas leakage from the pipeline that would be the significant impacts to the natural and social environment if quality of works are not ensured during construction. All the possible impacts are identified and suggested mitigation measures are outlined in this EIA report. If appropriate precautions are not taken, occupational and community health and safety will be in danger. Strict oversight and appropriate implementation of EMP are necessary to reduce these hazards.

359. The baseline environmental monitoring of certain environmental attributes viz. meteorology, ambient air quality, and ambient noise quality was studied for the future development of industrial infrastructures of the NSEZ, and it is likely impacts are insignificant in context of implementation of project development through adopting the mitigation and monitoring measures as highlighted in the EMP and EMoP in this EIA study.

360. A key feature of the project is the creation of green spaces aimed at restoring native plant species in the project areas. This initiative not only enhances biodiversity but also contributes to the overall health of the ecosystem, providing habitats for wildlife and improving air quality.

10.2 RECOMMENDATIONS

361. The key recommendations are as follows:

- Abatement of pollution is required to be maintained during construction and operation periods following the mitigation strategies of this EIA;
- EMP should be implemented properly and Integrate findings and suggestions into the project planning process, design, and incorporate into Bid Document and implementation;
- Prioritizing Occupational Health and Safety plans can lower workplace risks for workers;
- Provide Community health and safety plans to mitigate project related impacts to the local community;
- Regular stakeholder consultation is essential for reducing social conflict and engaging the community effectively during implementation;
- Local people should access work on the site either daily basis or contractual basis;
- Child labor, force labor and Gender Based Violence (GBV) are strictly prohibited at the site;
- Separate and site specific EIAs are required for the construction of water supply networks, establishment of Central Effluent Treatment Plan (CETP), development of sanitary land fill for solid waste management and biogas plants etc., following the ECR 2023 and other national rules and regulations such as Solid Waste Management Rules 2021;
- Any kind of effluent generated from the construction activities is not allowed to discharge to the open water sources;
- Rigorous monitoring should be carried out at the TSDF site considering the community health and safety issues

- Necessary capacity building activities such as training, workshops, meetings, etc., shall be carried out on a regular basis to implement the environmental and social safeguards accurately during the project implementation period etc.