

May, 2023

ENVIRONMENTAL IMPACT ASSESSMENT

Syama Prasad Mookerjee Port (erstwhile Kolkata Port Trust)

For

Development of an extended Port Gate System

At

Village & PO - Balagarh, District - Hooghly,
PIN - 712501, West Bengal



Envirotech East Pvt. Limited

An ISO 9001:2015, ISO 14001:2015 & ISO 45001:2018 Certified Company
Inhouse Laboratory Recognised by Ministry of Environment, Forest & Climate
Change, Govt. of India Accredited by NABET, Quality Council of India as an EIA
Consultant

NABET Certificate No.: NABET/EIA/2225/RA 0279

Baseline Monitoring Period: 1st January, 2023 – 31st March, 2022

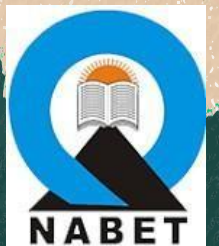
Corporate Office: 100 Kalikapur, Madurdaha, Kolkata- 700107, West Bengal

Phone: 033-24438127/28, Fax: 033-24438128

Email: eeplkol@gmail.com, eeplkol2@gmail.com,

md.eeplkol@gmail.com

Website: www.envirotecheast.com



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An ISO 9001:2015, ISO 14001:2015 & ISO 45001:2018 Certified Company

- Laboratory Recognized by MoEF&CC, Govt. of India
- Laboratory Recognized by West Bengal Pollution Control Board
- Accredited EIA Consultant by QCI-NABET



100, Kalikapur, Madurdaha, Kolkata – 700 107, West Bengal, India

☎ – + 91 33 2443 8127/8128 ; Fax – + 91 33 2443 8128; email: eeplkol@gmail.com, eeplkol2@gmail.com

CIN NO : U74210WB1989PTC047403

Date: 19th May, 2023

TO WHOM IT MAY CONCERN

Subject: Development of an extended Port Gate System at Balagarh, Dist. Hooghly, West Bengal by Syama Prasad Mookerjee Port (erstwhile Kolkata Port Trust)

**Refer: File No. 444/EN/T-II-I/169/2021
Proposal No. SIA / WB / NCP / 69947 / 2021**

We do hereby declared that we, M/s Envirotech East Pvt. Ltd. have undertaken the Environmental Impact Assessment Study for the subject job, as per the EIA Notification, 2006 and in compliance with the finalized Terms of Reference, issued by State Level Environment Impact Assessment Authority (SEIAA), West Bengal vide its letter (Ref. File No. 444/EN/T-II-I/169/2021) dated 15th March, 2022. The prescribed TORs have been complied with and that the data submitted is factually correct.

For Envirotech East Pvt. Ltd.



(Asoke Kumar Banerjee)
Director



श्यामा प्रसाद मुखर्जी पोर्ट, कोलकाता
Syama Prasad Mookerjee Port, Kolkata
सिविल इंजीनियरिंग विभाग/ Civil Engineering Department
मुख्य अभियंता कोलकाता का कार्यालय / Office of the Chief Engineer, Kolkata
15, स्ट्रैंड रोड, कोलकाता – 700 001/ 15, Strand Road, Kolkata – 700 001
दूरभाष/ Phone: 2230-0413, E-mail: ce@kolkataporttrust.gov.in

No. CIV/ 1936/539

Dated: 24 .05.2023

TO WHOM IT MAY CONCERN

Subject: Development of an extended Port Gate System at Balagarh, Dist. Hooghly, West Bengal by Syama Prasad Mookerjee Port, Kolkata (erstwhile Kolkata Port Trust)

Refer: File No. 444/EN/T-II-I/169/2021

Proposal No. SIA / WB / NCP / 69947 / 2021

This is to certify that we, **M/s Syama Prasad Mookerjee Port, Kolkata** (erstwhile Kolkata Port Trust) have gone through the entire Environmental Impact Assessment report, prepared by M/s Envirotech East Pvt. Ltd., Kolkata as per the EIA Notification, 2006 and in compliance with the finalized Terms of Reference, issued by State Level Environment Impact Assessment Authority (SEIAA), West Bengal vide its letter (Ref. File No. 444/EN/T-II-I/169/2021) dated 15th March, 2022, for the above-mentioned project. The Information/data as given in the EIA report has been checked at our end and is found to be correct to the best of our knowledge in all respect.


मुख्य अभियन्ता/Chief Engineer

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	PAGE - 1
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DECLARATION

Declaration by Experts contributing to the EIA report for Development of an Extended Port Gate System at Village & PO - Balagarh, District - Hooghly, Pin - 712501, West Bengal by M/s Syama Prasad Mookerjee Port (erstwhile Kolkata Port Trust)

This project falls under Sl. No. 7(e), [i.e., (Ports/Harbours; <5 million TPA of Cargo handling capacity)] of Category “B” of the list of the projects of the schedule shall require prior Environmental Clearance from Ministry of Environment, Forest & Climate Change (MoEF&CC), Govt. of India.

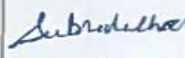
We, hereby, certify that we were part of the EIA team in the following capacity that developed the above EIA.

EIA Co-ordinator : Ports/Harbours; <5 million TPA of Cargo handling capacity

Name : Mr. Subrata Ghosh

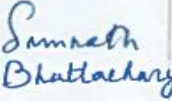
Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	PAGE - 2
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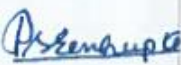
**DECLARATION BY EIA CO-ORDINATORS / FUNCTIONAL AREA EXPERTS
INVOLVED IN THE PREPARATION OF EIA REPORT**

Discipline	Name of Expert	Key Qualifications indicating area of specialization relevant to the respective discipline	Involvement (Period & Task)	Signature
EIA Coordinator : Mr. Subrata Ghosh		Bachelor of Engineering (Electrical)	November, 2021 to till date Assessment & identification of the overall project, co-ordination with respective functional area experts, finalisation of action plans for the overall preparation of EIA/EMP report	
Functional Area Experts involved:				
Air Pollution	Mr. T. Kundu	Bachelor of Technology (Chemical Engineering)	November, 2021 to till date Finalization of monitoring locations for Ambient Air Quality Monitoring, evaluation of Ambient Air Quality results, suggestions & finalization of air pollution control measures, with client and contribution to overall EIA/EMP report preparation.	
Meteorology	Mr. A K. Sinha	P.G. Diploma in Environmental Science and Technology	November, 2021 to till date Identification of air emission sources and their inventorisation, prediction of cumulative impacts on ambient air quality due to all identified point & mobile sources, suggestions & finalization of mitigation measures with project proponent and contribution to overall EIA/EMP report preparation.	

Water Pollution Control	Mr. Asoke Kumar Banerjee	M.Sc. (Chem.)	November, 2021 to till date Finalization of sampling locations for surface water and ground water quality monitoring, evaluation of water quality results, analysis of water balance, identification of sources for wastewater generation and give suggestions on suitable water pollution control, exploring the ways for conservation of water, identification & assessment of impacts, finalization of mitigation measures with project proponent and contribution to overall EIA/EMP report preparation.	<i>Asok Banerjee</i>
Geology Hydrology	Dr. Somenath Bhattacharya	Ph.D in Geology	November, 2021 to till date Assessment of existing Geology and hydrology of the area, Understanding and representing groundwater conditions, finalization of groundwater sampling locations, finalization of survey findings, identification of probable impact due to proposed industrial activity, suggestion of mitigation measures and contribution to overall EIA/EMP report preparation.	<i>Somenath Bhattacharya</i>
Ecology & Bio-diversity	Dr. (Mrs.) Anupam Sinha	Ph.D in Botany	November, 2021 to till date Assessment of the existing Ecology & Bio-diversity with proper emphasis on	<i>Anupam Sinha</i>
	Ms. Puja Ghosh (TM)	M.Sc in Environmental Science	eco-sensitive locations, assessment of possible impacts to the biological	<i>Puja Ghosh</i>

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	PAGE - 4
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			and ecological environment of the area due to the proposed industrial activity and EIA/EMP report preparation.	
Noise & Vibration	Mr. R.K. Dasgupta	Bachelor of Engineering (Mechanical)	November, 2021 to till date Finalization of noise sampling location and analysis of data, identification of impacts, suggestions & finalization of suitable mitigation measures with client and contribution to overall EIA/EMP report preparation.	
Land Use	Dr. Somenath Bhattacharya	Ph.D in Geology	November, 2021 to till date Site visit, supervising development of land use maps of study area using GIS tools, finalization of landuse maps, based on ground truth verification, identification of any probable changes due to the proposed industrial activity and contribution to EIA/EMP report preparation.	
Solid & Hazardous Waste	Mr. Asoke Kumar Banerjee	M.Sc. (Chem.)	November, 2021 to till date Identification of potential solid & hazardous waste generating sources and their inventorisation, finalization of waste management strategies, identification of impacts, finalization of mitigation measures with project proponent and contribution to overall EIA/EMP report preparation.	
Soil Conservation	Mr. Asoke Kumar Banerjee	M.Sc. (Chem.)	November, 2021 to till date	

			Finalization of soil sampling locations, identification of potential sources of impacts due to project, finalization of suitable mitigation measures with project proponent and contribution to overall EIA/EMP report preparation.	
Risk & Hazard	Mr. T. Kundu	Bachelor of Technology (Chemical Engineering)	November, 2021 to till date Identification of major hazards, assessment of risks associated with the proposed project, quantification of the identified risks with the help of the standard software. preparation of on-site and off-site emergency plan and contribution to overall EIA/EMP report preparation.	
Socio-economics	Prof. Pabitra Sengupta	M.Sc. (Economics)	November, 2021 to till date Field survey, assessment of the existing socio-economic scenario of the area, assessment of possible changes to socio-economics of the area due to the proposed project and contribution to overall EIA/EMP report preparation.	

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	CONT. - 1
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CONTENT

CHAPTER	DESCRIPTION
CHAPTER-1.0: INTRODUCTION	
1.1	Purpose Of The Report
1.2	Identification Of The Project
1.3	Project Proponent
1.4	Traffic Forecast
1.5	Brief Description of the Project
1.6	Legal Brief & Legal Framework For EIA Study
1.7	Scope Of Study- Details Of Regulatory Scoping Carried Out As Per Terms Of Reference
CHAPTER-2.0: PROJECT DESCRIPTION	
2.1	The Project
2.2	Location For New Berth & Allocation Of Cargo
2.3	Project Surveys & Studies
2.4	Project Engineering
2.5	Cargo handling Equipment
2.6	Water Supply, Sewrage & Drainage
2.7	Fire Fighting System
2.8	Manpower Planning
2.9	Solid Waste Management
2.10	Control off Fugitive Emissions at various Auxiliary Facilities inside the Plant
2.11	Wastewater Management
2.12	Rain Water Harvesting
2.13	Storm Water Drainage System
2.14	Project Cost
CHAPTER-3.0: DESCRIPTION OF THE ENVIRONMENT	
3.1	Introduction
3.2	Physiographic Details
3.3	Geology & Geo Hydrology
3.4	Ground Water Table
3.5	Major Industries Within 10 Km Radius Study Area
3.6	Land Use
3.6.1	Methodology
3.6.2	Data Source & Analysis
3.6.3	Other Secondary Data
3.6.4	Digital Image Processing
3.6.5	Landuse & Landcover Pattern

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	CONT. - 2
---	--	------------------

CHAPTER	DESCRIPTION
3.6.6	Land Utilization Pattern
3.7	Soil
3.7.1	Physical Characteristics
3.7.2	Chemical Characteristics
3.8	Air Quality
3.8.1	Selection of Monitoring Stations
3.8.2	Parameters & Frequency of Monitoring
3.8.3	Results & Discussions
3.9	Meteorology
3.9.1	Location
3.9.2	Past Records of IMD, Durgapur
3.9.3	On-Site Meteorological Observatory
3.10	Water Environment
3.10.1	Present Water Use
3.10.2	Water Quality
3.11	Noise
3.11.1	Major Sources of Noise in the Study Area
3.11.2	Ambient Noise Monitoring
3.11.3	Noise Levels in the Study Area
3.12	Ecology
3.12.1	Study Methodology
3.12.2	Description of the Study Area
3.13	Demography & Socio-Economic Status
3.13.1	Brief Outline of the Study Area
3.13.2	Demographic Aspects of the Study Area
3.13.3	Social structure
3.13.4	Literacy levels
3.13.5	Occupational Structure
3.13.6	Infrastructural Facilities
CHAPTER-4.0: ANTICIPATED ENVIRONMENTAL IMPACTS & MITIGATION MEASURES	
4.1	Prediction of Impacts
4.2	Impacts during Construction Phase
4.3	Impacts during Operational Phase
CHAPTER-5.0: ANALYSIS OF ALTERNATIVES	
5.1	Analysis of Alternatives
CHAPTER-6.0: ENVIRONMENTAL MONITORING PROGRAM	
6.1	Environmental Monitoring Program
CHAPTER-7.0: ADDITIONAL STUDIES	
7.1	Introduction
7.2	Risk Assessment

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	CONT. - 3
---	--	------------------

CHAPTER	DESCRIPTION
7.3	Risk Anysis
7.4	Oil Spills Contingency Plan
7.5	Risk Assessment for handling Dry Cargo
7.6	Risk Assessment due to Coal Storage
7.7	On Site Disaster Management Plan
7.8	Evacuation Plan
7.9	Cargo Operations
7.10	Marine Operations
7.11	Medical Services
7.12	P&E Services
7.13	Civil Engineering Services
7.14	Financial Services
7.15	Administrative Services
7.16	On-site Action plan for Major Disaster
7.17	Education of Public
7.18	Rehabilitation & Resettlement
7.19	Social Impact Assessment Sttudy
7.20	Public Consultation
7.21	Conclusion
CHAPTER-8.0:PROJECT BENEFITS	
CHAPTER-9.0: ENVIRONMENTAL COST BENEFIT ANALYSIS	
CHAPTER-10.0: ENVIRONMENTAL MANAGEMENT PLAN	
10.1	Environmental Management Plan
10.2	Construction Phase
10.3	Operational Phase
10.4	Fire & Safety Management
10.5	Environmental Awareness Campaign
10.6	Legal and Statutory Compliance
10.7	Documentation
10.8	Information Dissemination and Public Relations
10.9	Occupational Health and Safety
10.10	Energy Conservation Plan
CHAPTER-11.0: DISCLOSURE OF CONSULTANTS ENGAGED	

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	CONT. - 4
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■ ANNEXURES

ANNEXURE	DESCRIPTION
I	Standard TOR from SEIAA, Govt. of West Bengal
II	Relevant Indian Standards
III	Ambient Air Quality Data
IV	Plantation Plan

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C1 - 1
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CHAPTER-1.0 INTRODUCTION

1.1 PURPOSE OF THE REPORT

Port of Kolkata, the first Major Port in India, is a riverine port. It serves a vast hinterland comprising of the States of West Bengal, Bihar, Uttar Pradesh, Madhya Pradesh, Punjab, Haryana, Rajasthan, Assam, other North Eastern States and the two neighbouring landlocked countries of Nepal and Bhutan.

The history of Kolkata Port is inter-twined with that of the city of Kolkata. Kolkata (earlier known as Calcutta) was the second largest city in the British Empire - second only to London and a Jewel in the Crown. What was described as “one of the best and most convenient port out of Europe” by the Lt. Governor of Bengal in 1877, still retains an eminent position among the nation’s major ports. This port was established in 1870.

Its 232 km channel consists of the deepest draft at one end and the lowest at the other. Its history of the past 153 years is closely linked to the emergence of Kolkata as a bustling, modern metropolis, often called the gateway to Eastern India. Kolkata Port’s two dock systems viz. Kolkata Dock System (KDS) and Haldia Dock Complex (HDC) successfully face the challenges that are common to riverine ports the world over. The pilotage distance from Haldia to Sandheads is 130 km and from HDC to Kolkata is 104 km upstream. During 2005-06, Kolkata Port recorded the highest absolute growth in traffic and ranked second amongst all major ports in India in terms of total traffic handling. Kolkata Port Trust (KoPT) has handled 53.143 million tonnes of cargo out of which HDC handled 42.337 million tonnes of cargo. Recently, during 2022 – 23, in its 153 years history, SMPK (including KDS and HDC) for the first time handled 65.66 million tons of cargo recording an all-time high throughput and 12.87% increase from 58.175 million tons handled in 2021 – 22.

Purpose of Kolkata port, is to construct, operate, build, develop and maintain port related infrastructure including but not limited to rail, road, air, sea, river, streams, waterways, over and under bridges, civil

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C1 - 2
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and other infrastructures, accommodation and conveyance along with other related facilities.

As per EIA Notification 2006, published on 14th September 2006, all projects or activities, including expansion and modernization of existing projects or activities or change in Product Mix, falling under Category 'B' in the Schedule shall require prior Environmental Clearance from State Level Environment Impact Assessment Authority (SEIAA), West Bengal.

The proposed expansion project of Syama Prasad Mookerjee Port (erstwhile Kolkata Port Trust) falls under Sl. No. - 7(e) of the Category B of the Schedule of the EIA Notification 2006. (Ports/Harbours; <5 million TPA of Cargo handling capacity under category 'B' of the EIA Notification, 2006.

The company submitted an online application along with filled up 'Form 1' in the prescribed format and Pre-feasibility Report to State Level Environment Impact Assessment Authority (SEIAA), West Bengal, dated 20th December, 2021 for seeking prior Environmental Clearance for its proposed development of an extended port gate system of **Kolkata Port**. Accordingly, SEIAA issued one letter [Ref. File No. 444/EN/T-II-I/169/2021] dated 15th March, 2022, with mention of the finalized Standard Terms of Reference (**Annexure-I**) for the purpose of preparing Environment Impact Assessment (EIA) report and Environment Management Plan (EMP) for obtaining prior environment clearance has been prescribed.

As advised by the State Environment Impact Assessment Authority (SEIAA), West Bengal, the Draft EIA/EMP Report was prepared, accommodating all the components, based on Standard TORs for its submission to West Bengal Pollution Control Board (WBPCB) for the conduction of Public Hearing / Consultation.

This EIA Report is prepared on the basis of the available secondary data/ literature along with the on-site data during the period (1st January, 2023 to 31st March, 2023), generated through on-site monitoring of relevant environmental components and parameters.

1.2 IDENTIFICATION OF THE PROJECT

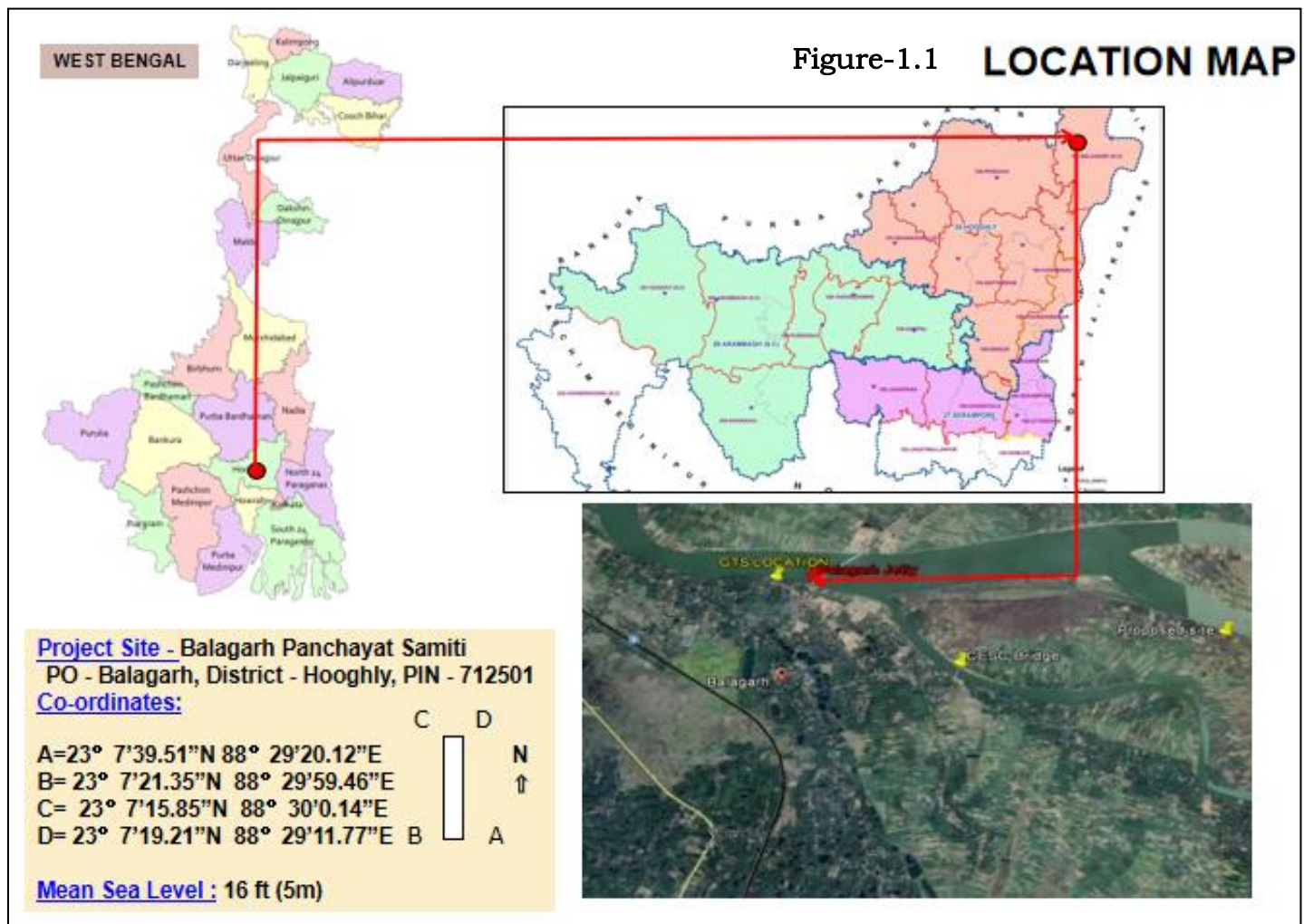
The traffic at Kolkata Dock System has followed a steady growth in the past 5 years. The Kolkata Port expects rise in Container and General cargo volumes in near future.

In order to cater up with projected increase in traffic and to overcome the problem of restricted cargo movement within the city limits, SMPK (erstwhile Kolkata Port Trust) intends to shift part of its operation to Balagarh, a site 45 Nautical Miles upstream of Kolkata.

The Balagarh Island has a total land area of about 900 acres - ownership shared by Kolkata Port Trust, State Government and Calcutta Electricity Supply Company. The Port owns about 300 acres of land in this Island.

The photographs of the location map and project site on google map are given below in **Figure-1.1**, 1.2 and 1.3 respectively.

Figure-1.1 LOCATION MAP



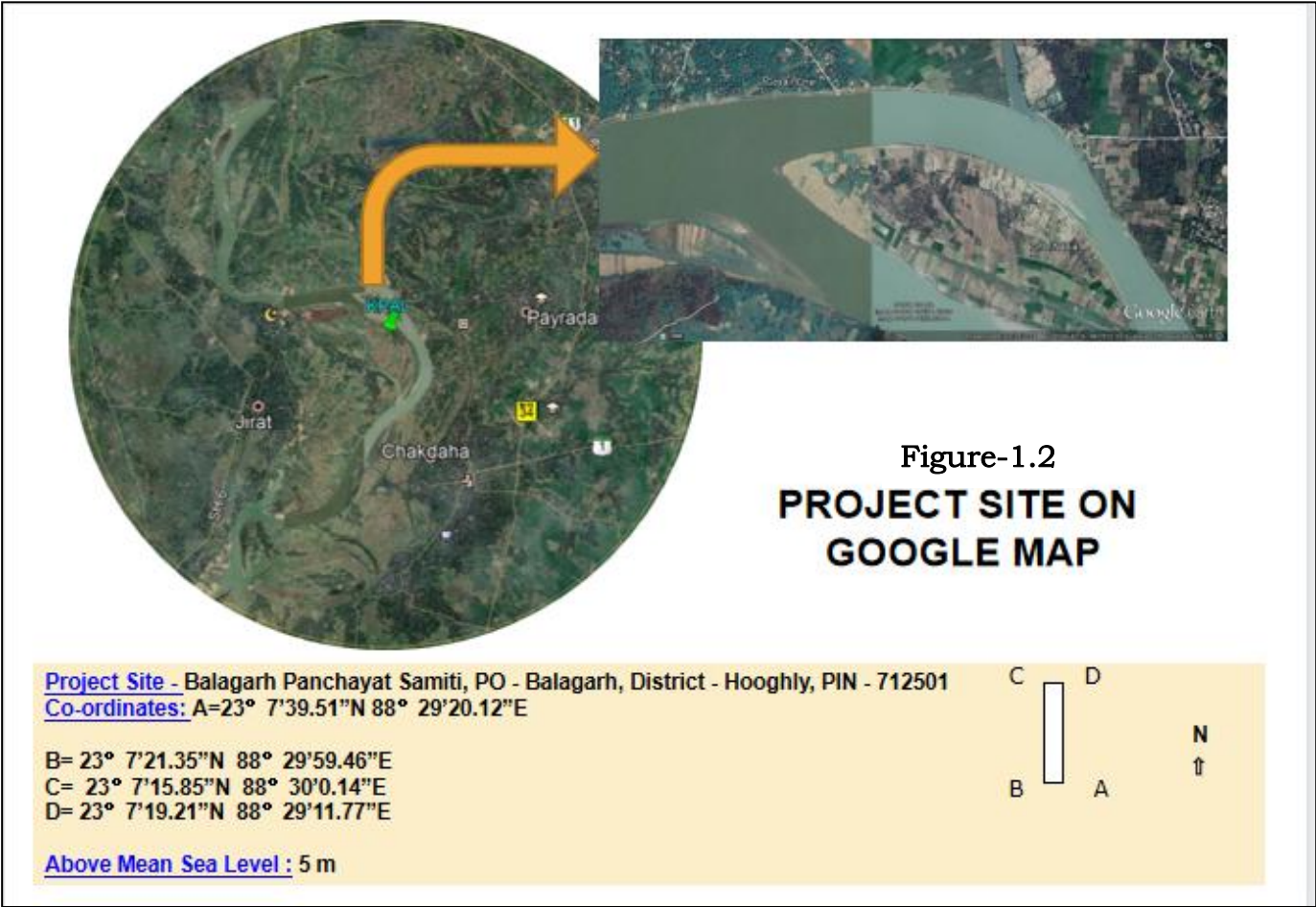


Figure-1.3
PROJECT SITE PHOTOGRAPHS

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C1 - 5
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1.3 PROJECT PROPONENT

Syama Prasad Mookerjee Port (erstwhile Port of Kolkata), is considered the gateway of eastern India. Apart from serving the neighbouring countries of Nepal and Bhutan and Bangladesh, it serves the vast hinterland of West Bengal, Bihar, Uttar Pradesh, Madhya Pradesh, Punjab, Haryana, Rajasthan, Assam and other North Eastern States. SMPK handled record traffic of 65.66 MTPA in 2022-23 and got elevated from 6th position to 5th position among all the major ports of India.

1.4 TRAFFIC FORECAST

Container, peas and pulses, and coal are key cargo types currently handled at KDS. At the initial stage the port anticipates shifting of part of these cargo to the chosen complementary location. Coal is looked upon as an alternative commodity which can be partly moved to Balagarh, while, peas and pulses are only considered in one of the scenarios (optimistic) developed for forecasted traffic.

TCE undertook assessment of the influence zone through a combination of secondary and primary research. This included understanding of existing freight market in the region (in terms of cargo profiles, value chain, key stakeholders, current mode of transport etc.) and projection of anticipated freight market for the study period. Forecast was performed taking into account all likely future developments and thereby estimating cargo to be handled at Balagarh. Assessment was performed through review of logistics requirements of key stakeholders, current and future logistics service offerings, and policy implications. Inputs received from a series of stakeholder interactions and other secondary databases were used to assess likely cargo streams. Demand assessment provides future traffic projections for the proposed facility till year 2039-40.

Traffic Forecast Summary has been presented in Table 1-0.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C1 - 6
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Table 1-0
Traffic Forecast Summary (Base Case)

Year	Container				Peas Pulses	Coking Coal	Non- coking Coal	TOTAL
	Exports	Imports	Total (MTEU)	Total (MTPA)	MTPA*	MTPA	MTPA	MTPA
2022-23	0.08	0.10	0.18	2.35	-	0.73	1.13	4.21
2023-24	0.09	0.10	0.19	2.48	-	0.76	1.18	4.42
2024-25	0.09	0.11	0.20	2.61	-	0.79	1.23	4.64
2025-26	0.10	0.11	0.21	2.76	-	0.82	1.28	4.86
2026-27	0.10	0.12	0.22	2.91	-	0.86	1.33	5.09
2027-28	0.11	0.13	0.24	3.07	-	0.89	1.38	5.33
2028-29	0.11	0.13	0.25	3.24	-	0.92	1.43	5.59
2029-30	0.12	0.14	0.26	3.42	-	0.96	1.48	5.86
2030-31	0.13	0.15	0.28	3.60	-	0.99	1.54	6.13
2031-32	0.13	0.16	0.29	3.80	-	1.03	1.60	6.42
2032-33	0.14	0.17	0.31	4.01	-	1.07	1.65	6.73
2033-34	0.15	0.18	0.33	4.23	-	1.11	1.72	7.05
2034-35	0.16	0.19	0.34	4.47	-	1.15	1.78	7.40
2035-36	0.17	0.20	0.36	4.72	-	1.19	1.84	7.74
2036-37	0.18	0.21	0.38	4.98	-	1.22	1.90	8.11
2037-38	0.19	0.22	0.41	5.27	-	1.26	1.96	8.49
2038-39	0.20	0.23	0.43	5.58	-	1.31	2.02	8.91
2039-40	0.21	0.24	0.45	5.90	-	1.35	2.09	9.34

* Peas and Pulses – Traffic is considered only in optimistic case and not in base case

1.5 BRIEF DESCRIPTION OF THE PROJECT

1.5.1 Nature of the Project

The proposed project of SMPK (erstwhile Kolkata Port Trust), falls under Sl. No. - 7(e) of the Category B of the Schedule of the EIA Notification 2006. (Ports/Harbours; <5 million TPA of Cargo handling capacity under category 'B' of the EIA Notification, 2006 and its subsequent amendments.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C1 - 7
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1.5.2 Size

The salient features of this project are described in **Table 1.2**.

Design Vessel		3000 DWT
Approach Channel	Width	75 m
	Length	1200 m
Turning Circle Diameter		190 m
Length of Bank Protection		1000 m
Types Of Cargo Handled		Container/ Coal
Total Cargo Handling Capacity		2.7 MTPA Container: 1.1 MTPA Coal: 1.6 MTPA
No. of Berths		2 (two) - 1 (one), dedicated for Container Traffic & 1 (one), dedicated for Coal Traffic
Size of each berth		120m Length x 30m Width
Storage Area		Total : 3.2 Hectares Container : 1.2 Hectares Coal : 2.0 Hectares
Capital Dredging		a) Berth Pocket: 1.5 lakhs cubic meter (approx.) b) Reclamation by hydraulic filling: 4.3 lakh cubic meter (approx.)

1.5.3 Land

The proposed project will be set up on a total Land area of 124.95 Hectares (308.75 Acres). The proposed land area is vacant with scanty vegetation and no habitation. The entire land is already owned by SMPK (erstwhile Kolkata Port Trust).

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C1 - 8
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1.5.4 Location

The proposed project of M/s SMPK (erstwhile Kolkata Port Trust) is situated at Village & PO - Balagarh, District - Hooghly, PIN - 712501, West Bengal. Its geo-graphical coordinates are Latitude 23°38'25.28"N and Longitude 87°17'10.17"E with Above Mean Sea Level 38 meters (125 ft.)

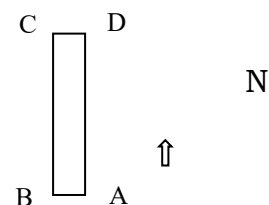
The four points on the boundary of the project site are as follows:

A=23°7'39.51"N 88°29'20.12"E

B= 23°7'21.35"N 88°29'59.46"E

C= 23°7'15.85"N 88°30'0.14"E

D= 23°7'19.21"N 88°29'11.77"E



(Where, T: Top, B: Bottom, L: Left, R: Right, C: Corner)

1.5.5 Description of Surroundings

Ranaghat is located 7.5 km from project site in North-east direction from the project site. Chuchura is situated 29 km from the project site in SSW direction from the project site. Balagarh Railway Station is 5.1 km from the project site in the West direction. Jirat Railway station is 4.7 km from the project site in the SW directions. NSCBI Airport, Kolkata is 49.2 km from the project site in South East Direction. Hooghly River is flowing at close vicinity [The Balagarh Island is surrounded by Hooghly River] from the project site. There is no National Park, Reserve Forest & Wildlife Sanctuary within 10 km radius of the Project Site. The surrounding area is presented in **Figure-1.4**. 10 km radius study area of the project is presented in **Figure-1.5**.

No industry is located in the 10 km radius study area.

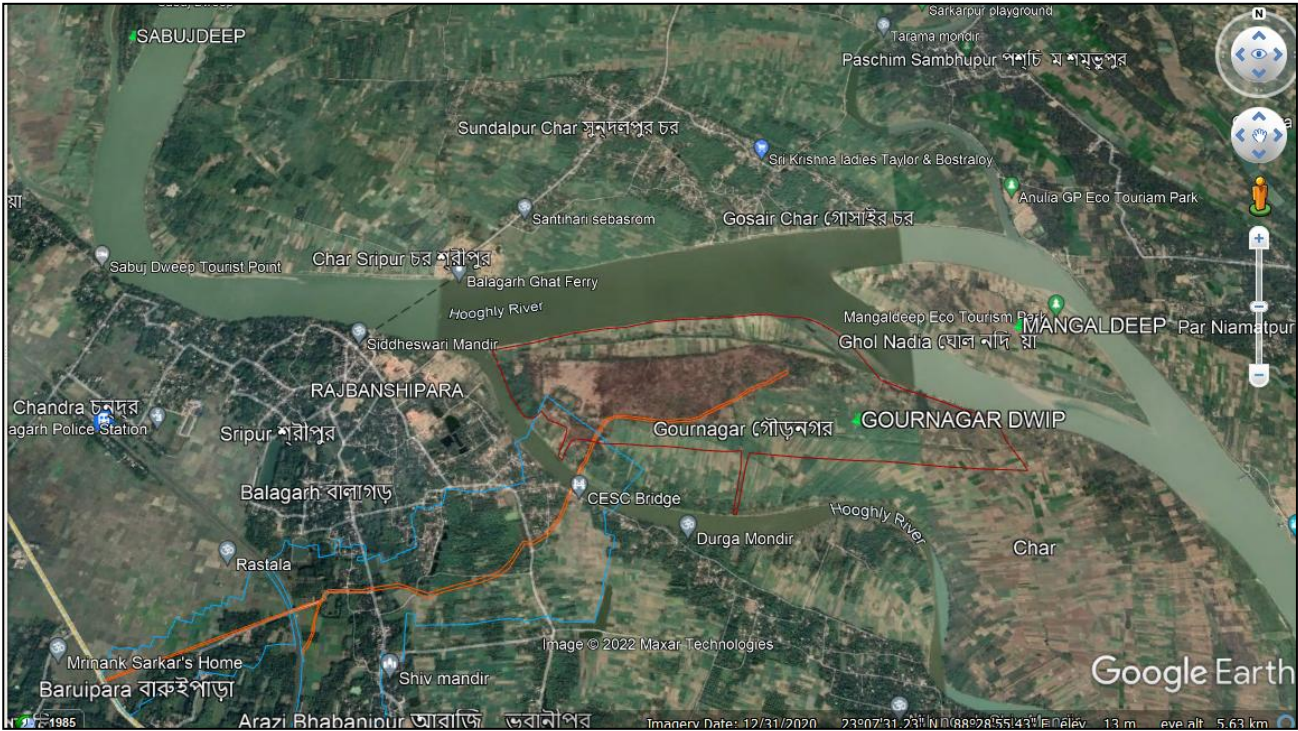


FIGURE-1.4: SURROUNDINGS OF BALAGARH

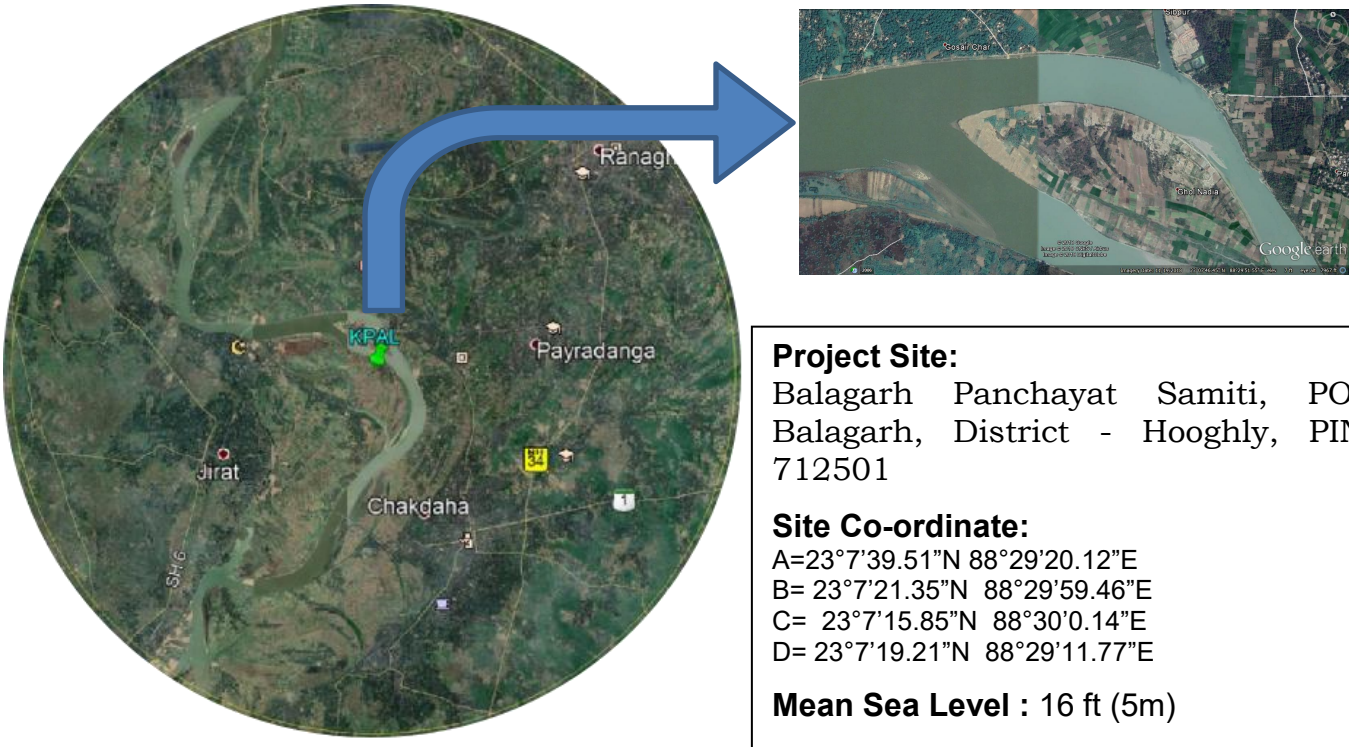
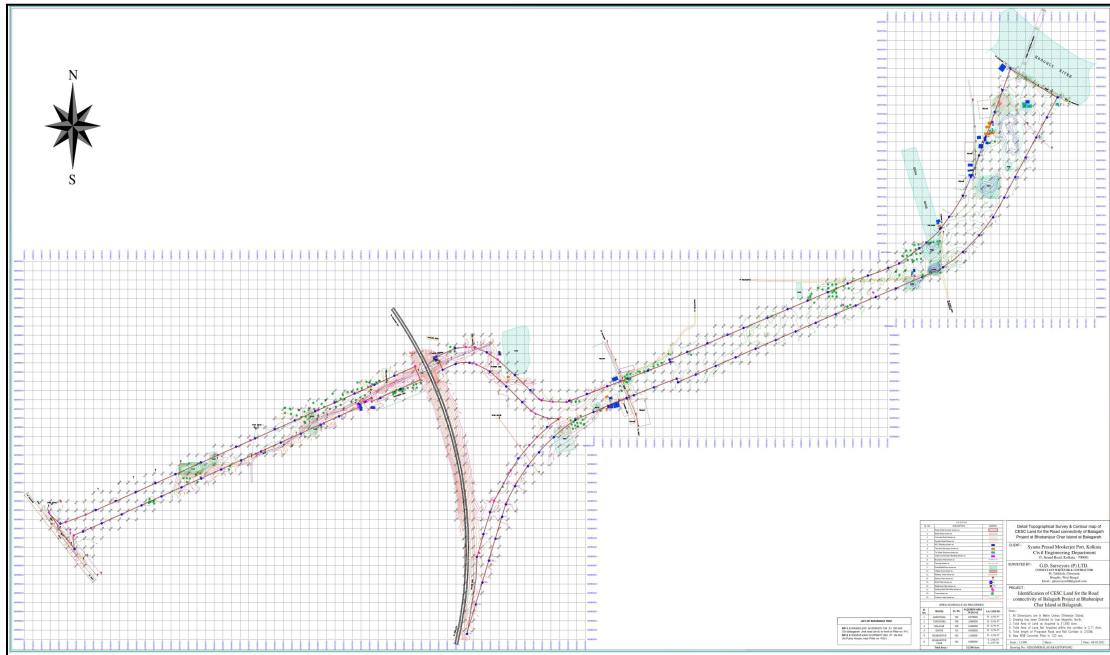


FIGURE-1.5: PROJECT SITE & 10 KM RADIUS AREA

1.5.6. Existing Road Connectivity



State Highway Road No.6 passes through Balagarh. The distance from SH6 to the proposed development location is about 5 km. It has been noted that a bridge connecting the main land to the Island was constructed by CESC. This bridge is partially completed and abandoned with connecting approaches yet to be constructed on either side of it.

A four lane road connectivity with 60 m right off way has been proposed upto the terminal from the take off point at SH – 6. This alignment is proposed through the existing CESC bridge, considering that the bridge will be made available and utilised for this project.



Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C1 - 11
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1.5.7 Importance to country & region

The traffic at Kolkata Dock System has followed a steady growth in the past 5 years. The SMPK (erstwhile Kolkata Port Trust) expects rise in Container, Coal and General cargo volumes in near future.

In order to cater up with projected increase in traffic and to overcome the problem of restricted cargo movement within the city limits, SMPK (erstwhile Kolkata Port Trust) intends to shift part of its operation to Balagarh, a site 45 Nautical Miles upstream of Kolkata.

1.6 LEGAL BRIEF & LEGAL FRAMEWORK FOR EIA STUDY

1.6.1 Procedure for Environmental Clearance

Environmental clearance of any new project or expansion of existing projects is done as per the notification of the Ministry of Environment, Forest and Climate Change (MoEF&CC), Govt. of India dated 14th September 2006 and its subsequent amendments. The notification deals with prior environmental clearance required for the projects from competent central govt. or state govt. authorities, as may be the case. The projects are classified into Category “A” or Category “B” based on spatial extent of potential impacts on human health and natural & man-made resources. The Category “A” projects require prior clearance by MoEF&CC, Govt. of India while the Category “B” projects have to get clearance from the State Level Environment Impact Assessment Authority (SEIAA).

The environment clearance procedure for projects will require maximum of four stages all of which may not be applicable to all the projects. These four stages in sequential order are as follows:

Stage 1 - Screening: It refers to the definite assignment of environmental category to projects or activities where the same is not completely specified. In case of Category 'B' projects scrutiny of application at State level to categorize project in 'B1' or 'B2' is done. The B2 projects do not require EIA Reports. The present project is categorized as Category 'B1' project and thus, this stage is not applicable.

Stage 2 - Scoping: It refers to the process by which the Expert Appraisal Committee in the case of Category 'A' projects and State-Level Expert Appraisal Committee in the case of Category 'B1'

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C1 - 12
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projects determine detailed and comprehensive Terms of Reference (ToR) addressing all relevant environmental concerns for the preparation of EIA report with respect to the project for which prior environmental clearance is sought. The Standard ToR for this project was granted on 15th March, 2022.

Stage 3 - Public Consultation: It refers to the process by which concern of local people and other stakeholders are ascertained and their views taken regarding the project. The Public Consultation takes place in two steps: Public hearing and written responses. The public hearing will be conducted under the supervision of State Pollution Control Board close to the site of the project.

Stage 4 - Appraisal: This refers to detailed scrutiny by the Expert Appraisal Committee or State Level Expert Appraisal Committee of the application and other documents like the final EIA report. The final EIA report for this project will be prepared after Public Hearing for the final appraisal by EAC for grant of Environment Clearance.

BOX 1.1: SCOPE OF THE STUDY

- To conduct literature review and collect the data relevant to study area
- Project appreciation in terms of its environmental pollution potential and detrimental impacts on different environmental attributes.
- To undertake environmental monitoring so as to establish the baseline environmental status of the study area
- To identify existing pollution load due to various activities in the ambient levels
- To identify the basic environmental status including the meteorological parameters and socio-economic environment of the proposed study area
- To predict incremental levels of pollutants in the study area due to the proposed plant activities
- To evaluate the predicted impact on the various environmental attributes in the study area by using scientifically developed and widely accepted environmental impact methodologies
- To prepare an environmental management plan outlining the measures for improving the environmental quality for environmentally sustainable development
- To identify critical environmental attributes required to be monitored

The steps of Environmental Clearance for proposed project is shown in **Figure-1.7**.

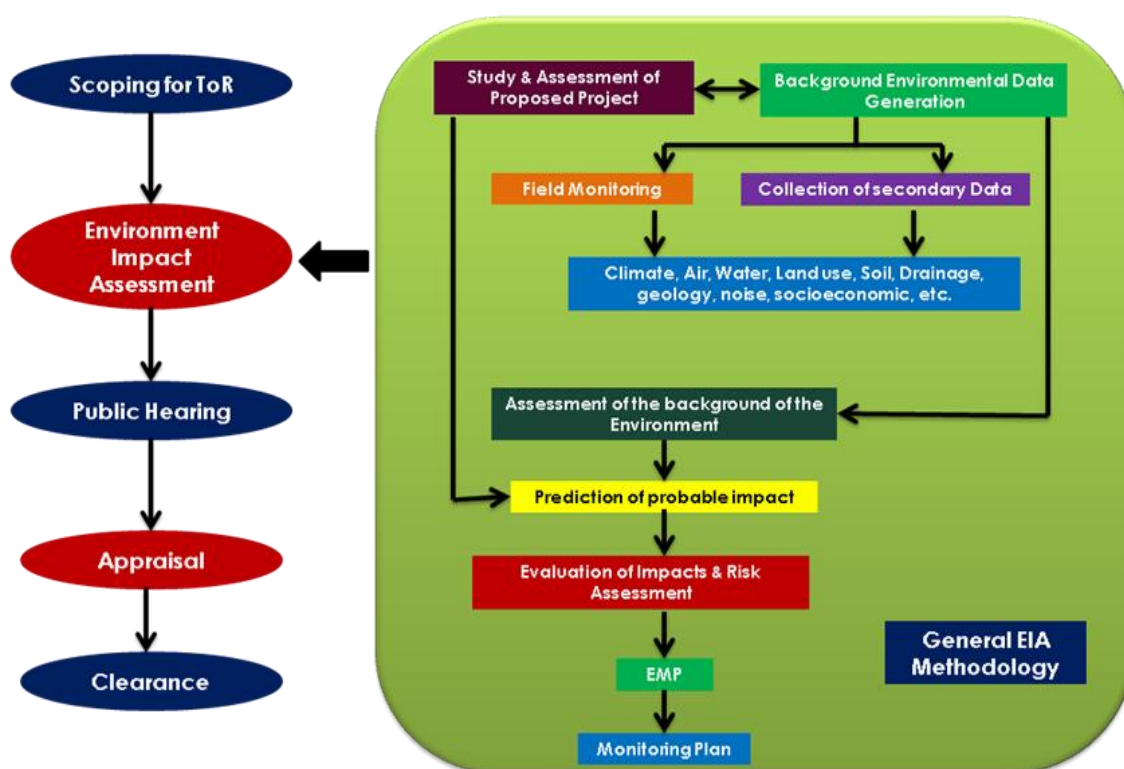
1.6.2 Post Environmental Clearance Monitoring

For category “A” projects, the project proponent shall prominently advertise in the newspapers indicating that the project has been accorded environmental clearance and the details of MoEF&CC website where it is displayed.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C1 - 13
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The project proponent shall submit half-yearly compliance reports in respect of the stipulated prior environmental clearance terms and conditions in hard & soft copies to the regulatory authority concerned on 1st June and 1st December of each calendar year. All such reports shall be public documents. The latest such compliance report shall be displayed on the website of the concerned regulatory authority.

FIGURE 1.7: STEPS OF ENVIRONMENTAL CLEARANCE FOR PROPOSED PROJECT



1.7 SCOPE OF STUDY- DETAILS OF REGULATORY SCOPING CARRIED OUT AS PER TERMS OF REFERENCE

The Environmental Impact Assessment and Environment Management Plan for the proposed expansion-cum-modification project addressing the environment related issues have been prepared in accordance with the requirements of Standard terms of reference (TOR) prescribed by State Environment Impact Assessment Authority (SEIAA).

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C1 - 14
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The study evaluates the prevailing environmental conditions. The adverse impacts have been identified and possible mitigation measures have been drawn in order to protect the environment. In order to carry out the study, the baseline environmental scenario has been established.

The main objectives of the present EIA/EMP study are briefly summarized below:

- To establish the baseline environmental scenario.
- To identify, predict and assess the impacts of proposed future project on the environment.
- To prepare a detailed action plan for implementation of mitigative measures.
- To suggest preventive measures to minimize adverse impacts and to maximize beneficial impacts.
- To suggest a monitoring programme to evaluate the effectiveness of mitigative measures.
- To suggest the formation of a core group responsible for implementation of the EMP.
- To prepare a capital cost estimate for environment management plan.
- To address the concerns of disaster management, CER and points raised in public hearing.

The scope of the present study is to conduct EIA covering all the disciplines of environment and field monitoring in relevant disciplines over one full season of 3 (three) months (excluding monsoon months). The draft EIA report has been prepared as per the MoEF&CC Notification for Public Hearing purpose. After completion of the Public Hearing, all the environmental concerns and issues expressed by the Public will be addressed and appropriate changes in the draft EIA Report will be made and Final EIA Report will be prepared.

Secondary and primary data collection was done comprising of, but not restricted to the following:

- Long Term Climatic data from Indian Meteorological Department (IMD) for available previous decade
- Geo-hydrological aspects based on available data from various sources

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C1 - 15
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- Identification of water bodies, hills, roads etc. within 10 km radius
- Details of fauna, flora, major habitats, within a distance of 10 km from the project site.
- Major industries within 10 km radius.
- Land use pattern within core zone and buffer zone (10 km radius around the core zone)
- Demography and Socio-economic based on last available Census data for entire study area

The preparation of EIA/EMP has been done as per the generic structure prescribed in EIA Notification dated 14th September 2006.

In line with the TOR, baseline environmental data was generated as shown below,

AREA	PARAMETERS	NO. OF LOCATIONS	FREQUENCY
Air Quality	PM ₁₀ , PM _{2.5} , SO ₂ , NO ₂ & CO	8	Twice in a week
Micro Meteorology	1. Temperature, 2. Relative Humidity, 3. Atmospheric Pressure 4. Wind Speed, 5. Wind Direction, 6. Rainfall etc.	1	Continuous on 24-hourly basis
Water Quality (Surface & Ground)	<u>Surface Water Quality:</u> Colour, Odour, pH, Conductivity, Dissolved Oxygen, Biochemical Oxygen Demand, Chemical Oxygen Demand, Total Coliforms, Total Dissolved Oxygen, Oil & Grease, Cyanide, Phenol, Total Hardness (as CaCO₃), Chloride, Sulphate, Nitrate, Fluoride, Calcium Magnesium, Copper, Iron, Manganese, Zinc, Boron, Arsenic, Mercury, Lead, cadmium, Alkalinity, Hexavalent Chromium, Free Ammonia, Sodium Absorption ratio <u>Ground Water Quality:</u> Colour, Odour, taste, Turbidity,	10 (Surface) 9 (Ground)	Once in the study period

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C1 - 16
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	pH, Conductivity, Total Hardness (as CaCO ₃), Iron, Chloride, Sulphate, Nitrate, Fluoride, Residual Free Chlorine, Fluoride, Total Dissolved Solids, Calcium, Magnesium, Copper, Manganese, Sulphate, Nitrate, Phenol Compounds, Mercury, Cadmium, Arsenic, Lead, Zinc, Hexavalent Chromium, Alkalinity, Boron, Total Coliforms		
Soil Quality	A) Physical parameters: 1. Colour 2. Texture a) Sand (%) b) Silt (%) c) Clay (%) 3. Bulk Density (gm/cm³) 4. Porosity (%) 5. Water Holding Capacity (%) B) Chemical Parameters: 1. pH 2. EC (µmhos/cm), 1:2 3. Calcium (%) 4. Magnesium (%) 5. Sodium (%) 6. Potassium (%) 7. Sulphur (%) 8. Nitrogen (%) 9. Phosphorus (%) 10. CEC (meq/100 g) 11. Organic Matter (%) 12. Copper (mg/Kg) 13. Chromium (mg/Kg) 14. Zinc (mg/Kg) 15. Lead (mg/Kg)	4	Once in the study period
Land Use	Land use using Satellite Imagery, To study and map the land use pattern of the 10 km radius study area, IRS1D LISS IV multispectral imagery with center at the project site has been used as input data.	Study area	Once in the study period
Noise Level	1. Leq in dB(A)_{day} 2. Leq in dB(A)_{night}	10	Once in the study period (Day & Night)

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C1 - 17
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Ecology & Bio-diversity	Terrestrial & Aquatic Flora and Fauna	Study area	Once in the study period
Demography & Socio-economy	Population Profile, Socio-economic scenario & Infrastructural Facilities	Study Area	Based on census data and sample survey

1.8 STATUS OF LITIGATIONS

There are no litigations / court cases pending against the project.

1.9 COMPLIANCE OF TERMS OF REFERENCE (TOR)

State Level Environment Impact Assessment Authority (SEIAA) Govt. of West Bengal issued Standard Terms of Reference vide letter (Ref. F. No. 444/EN/T-II-I/169/2021 dated 15th March, 2022 **(Annexure-I)** for undertaking detailed EIA study for obtaining EC in accordance with the provisions of the EIA Notification 2006.

This EIA Report is prepared on the basis of the available secondary data/ literature along with the on-site data during the period (January, 2023 - March, 2023), generated through on-site monitoring of relevant environmental components and parameters.

STANDARD TERMS OF REFERENCE & REFERENCE IN EIA REPORT

1	Executive Summary - Annexure - A	Prepared & included in the EIA Report
2	Reason for selecting the site with details of alternate sites examined/rejected/selected on merit with comparative statement and reason/basis for selection. The examination should justify site suitability in terms of environmental angle, resources sustainability associated with selected site as compared to rejected sites. The analysis should include parameters considered along with weight age criteria for short-listing selected site.	Chapter 5.0
3	Details of the land use break-up for the proposed project. Details of land use around 10 km radius of the project site. Examine and submit detail of land use around 10 km radius of the project site and map of the project area and 10 km area from boundary of the proposed/existing project area, delineating project areas notified under the wild life (Protection) Act, 1972/critically polluted areas as identified by the CPCB from time to time/notified Eco-sensitive areas/interstate boundaries and international boundaries. Analysis should be made based on latest satellite imagery for land use with raw images.	Chapter 2.0
4	Submit the present land use and permission required for any conversion such as forest, agriculture etc. land acquisition status, rehabilitation of communities/ villages and present status of such activities.	Chapter 2.0
5	Examine and submit the water bodies including the seasonal ones within the corridor of impacts along with their status, volumetric capacity, quality likely impacts on them due to the project.	Chapter 2.0
6	Submit a copy of the contour plan with slopes, drainage pattern of the site and surrounding area.	Chapter 2.0
7	Submit the details of terrain, level with respect to MSL, filling required, source of	Chapter 2.0

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal
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	filling materials and transportation details etc	
8	Examine road/rail connectivity to the project site and impact on the existing traffic network due to the proposed project/activities. A detailed traffic and transportation study should be made for existing and projected passenger and cargo traffic.	Chapter 2.0
9	Submit details regarding R&R involved in the project.	The entire land is already acquired the Company.
10	Submit a copy of layout superimposed on the HTL/LTL map demarcated by an authorized agency on 1:4000 scale along with the recommendation of the SCZMA	Chapter 2.0
11	Submit the status of shore line charge at the project site	Chapter 2.0
12	Details of the layout plan including details of channel, breakwaters, dredging, disposal and reclamation.	Chapter 2.0
13	Details of handling of each cargo, storage transport along with spillage control, dust preventive measures. In case of coal, mineral cargo, details of storage and closed conveyance, dust suppression and prevention filters.	Chapter 2.0
14	Submit the details of fishing activity and likely impacts on the fishing activity due to the project. Specific study on effects of construction activity and pile driving on marine life.	Chapter 4.0
15	Details of oil spill contingency plan.	Chapter 4.0
16	Details of bathymetry study.	Chapter 2.0
17	Details of ship tranquility study.	Chapter 2.0
18	Examine the details of water requirement, impact on competitive user, treatment details, use of treated waste water. Prepare a water balance chart.	Chapter 2.0
19	Details of rainwater harvesting and utilization of rain water.	Chapter 2.0
20	Examine details of Solid waste generation treatment and its disposal.	Chapter 2.0
21	Details of desalination plant and the study for outfall and intake.	NA
22	Examine baseline environmental quality along with projected incremental load due	Chapter 4.0

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal
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	to the proposed project/activities.	
23	The air quality monitoring should be carried out according to the notification issued on 16 th November, 2009	Chapter 3.0
24	Examine separately the details for construction and operation phases both for Environmental Management Plan and Environmental Monitoring Plan with cost and parameters	Chapter 10.0
25	Submit details of a comprehensive Risk Assessment and Disaster Management Plan including emergency evacuation during natural and man-made disasters.	Chapter 7.0
26	Submit details of the trees to be cut including their species and whether it also involves any protected or endangered species. Measures taken to reduce the number of the trees to be removed should be explained in detail. Submit the details of compensatory plantation. Explore the possibilities of relocating the existing trees.	No trees have been cut
27	Examine the details of afforestation measures indicating land and financial outlay. Landscape plan, green belts and open spaces may be described. A thick green belt should be planned all around the nearest settlement to mitigate noise and vibrations. The identification of species/plants should be made based on the botanical studies	Chapter 10.0
28	The Public Hearing should be conducted for the project in accordance with provisions of Environmental Impact Assessment Notification, 2006 and the issues raised by the public should be addressed in the Environmental Management Plan. The Public Hearing should be conducted based on the ToR letter issued by the Ministry and not on the basis of Minutes of the Meeting available on the web-site.	Public Hearing should be conducted
29	A detailed draft EIA/EMP report should be prepared in accordance with the above additional ToR and should be submitted to the Ministry in accordance with the Notification.	Detailed draft EIA/EMP report has been prepared in accordance with the above additional ToR.
30	Details of litigation pending against the project, if any, with direction/order passed	There is no court case or violation under EIA Notification against the

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal
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	by any Court of Law against the Project should be given	project or related activity.
31	The cost of the project (capital cost and recurring cost) as well as the cost towards implementation of EMP should be clearly spelt out.	Chapter 2.0
32	Any further clarification on carrying out the above studies including anticipated impacts due to the project and mitigative measure, project proponent can refer to the model ToR available on Ministry website " http://moef.nic.in/Manual/Port and harbour "	Complied

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C2 - 1
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CHAPTER-2.0

PROJECT DESCRIPTION

2.1 INTRODUCTION

The traffic at Kolkata Dock System has followed a steady growth in the past 5 years. The Syama Prasad Mookerjee Port (erstwhile Kolkata Port Trust) expects rise in Container and General cargo volumes in near future.

In order to cater up with projected increase in traffic and to overcome the problem of restricted cargo movement within the city limits, SMPK intends to shift part of its operation to Balagarh, a site 45 Nautical Miles upstream of Kolkata.

Two dedicated berths, one for container and one for coal have been planned commensurate with 85000 TEU (1.1 MTPA) container traffic and 1.6 MTPA coal traffic. The total capacity of the terminal works for two berths works out to about 2.7 MTPA.

The berths are planned as open pile structure each having length 120m and width 30 m. The Berths will be connected to the shore through Approach Trestles (also founded on piles) of 50 m length and 15 m width. As stated above, one dedicated coal berth and one dedicated berth for handling container have been considered.

Container, peas and pulses, and coal are key cargo types currently handled at KDS. At the initial stage the port anticipate shifting of part of these cargo to the chosen complementary location at Balagarh. Coal is looked upon as an alternative commodity which can be partly moved, while, peas and pulses is only considered in one of the scenarios developed for forecasted traffic.

The overall project scenario is presented in **Table - 2.1**.

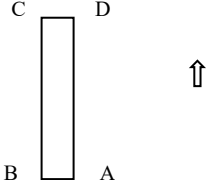
Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C2 - 2
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TABLE - 2.1
OVERALL PROJECT SCENARIO

Design Vessel		3000 DWT
Approach Channel	Width	75 m
	Length	1200 m
Turning Circle Diameter		190 m
Length of Bank Protection		1000 m
Types Of Cargo Handled		Container/ Coal
Total Cargo Handling Capacity		2.7 MTPA Container: 1.1 MTPA Coal: 1.6 MTPA
No. of Berths		2 (two) - 1 (one), dedicated for Container Traffic & 1 (one), dedicated for Coal Traffic
Size of each berth		120m Length x 30m Width
Storage Area		Total : 3.2 Hectares Container : 1.2 Hectares Coal : 2.0 Hectares
Capital Dredging		a) Berth Pocket: 1.5 lakhs cubic meter (approx.) b) Reclamation / Hydraulic Filling: 4.3 lakh cubic meter (approx..)

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C2 - 3
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The principal features or highlights of the proposed project of SMPK, under study are as follows:

PROPOSED PROJECT HIGHLIGHTS	
Location	Village & PO - Balagarh, District - Hooghly, PIN - 712501, West Bengal. Its geographical co-ordinates are as follows A=23°7'39.51"N88°29'20.12"E N B= 23°7'21.35"N 88°29'59.46"E C= 23°7'15.85"N 88°30'0.14"E D= 23°7'19.21"N 88°29'11.77"E Mean Sea Level : 16 ft (5m) 
Land requirement	Total Land area is 124.95 Hectares (308.75 Acres). The proposed land area is vacant with scanty vegetation and no habitation.
Raw water requirement & source	As per initial estimation, water demand of the proposed project is expected to be around 60 cum/day. Such water will be made available from the River Hooghly.
Power requirement	As per estimation, about 817 KVA of electricity will be required during operational stage, which will be sourced from WBSEDCL.
Effluent generation & disposal	The proposed project will be designed based on zero discharge concept. Entire treated effluent meeting the CPCB/SPCB standard will be used in plantation, development of green belt, suppression of dust and other non critical purposes within the Port area. Domestic wastewater will be treated in Sewage Treatment Plant (STP).
Air pollution control	Dust will be generated during construction phase from earthworks, movement of vehicles. Appropriate fugitive dust control measures, like water sprinkling of exposed areas and dust covers for trucks, would be employed to minimize the impact. No significant impacts to air quality from fugitive dust emissions are anticipated during construction and during operation phases of the proposed project.
Solid Waste Management	➤ Dust generated during dry bulk handling will be stacked separately for further disposal / re-handling. ➤ Solid waste of domestic / commercial origin that would be

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C2 - 4
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	generated in the proposed port project will be disposed off suitably in consultation with the concerned local body.
Manpower	150 persons - During Construction Phase 150 persons - During Operation Phase
Project cost	Rs. 445.50 Crores

2.2 LOCATION FOR NEW BERTH & ALLOCATION OF CARGO

Mathematical model studies have been carried out for assessing the flow pattern and sediment transport regime with the baseline conditions and proposed port development in the Balagarh approaches as shown in Figure 2-1.

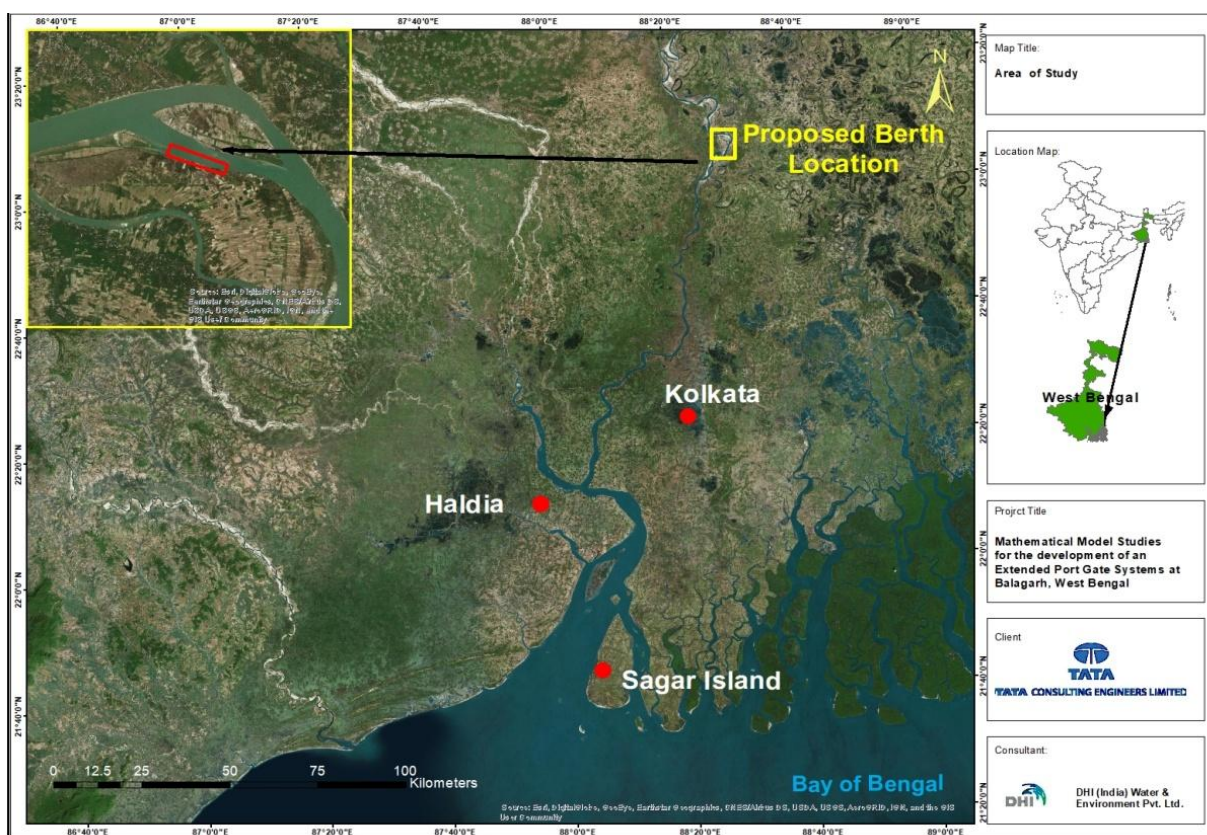


Figure 2-1: Study area location

Proposed berth layout of the proposed development in AutoCAD format as shown in Figure 2-2 and Figure 2-3, to incorporate into the modelling studies. The Layout Plan contains berth layout, approach channel and turning circle with the following specifications:

- Series of 6 berths (future projection) each having length of 120 m and 30m width;

- All the berths/jetties are having berthing area deepened to (-) 3.3m CD;
- Approach channel is deepened to (-) 3.3m CD; and
- Turning circle is deepened to (-) 3.45m CD

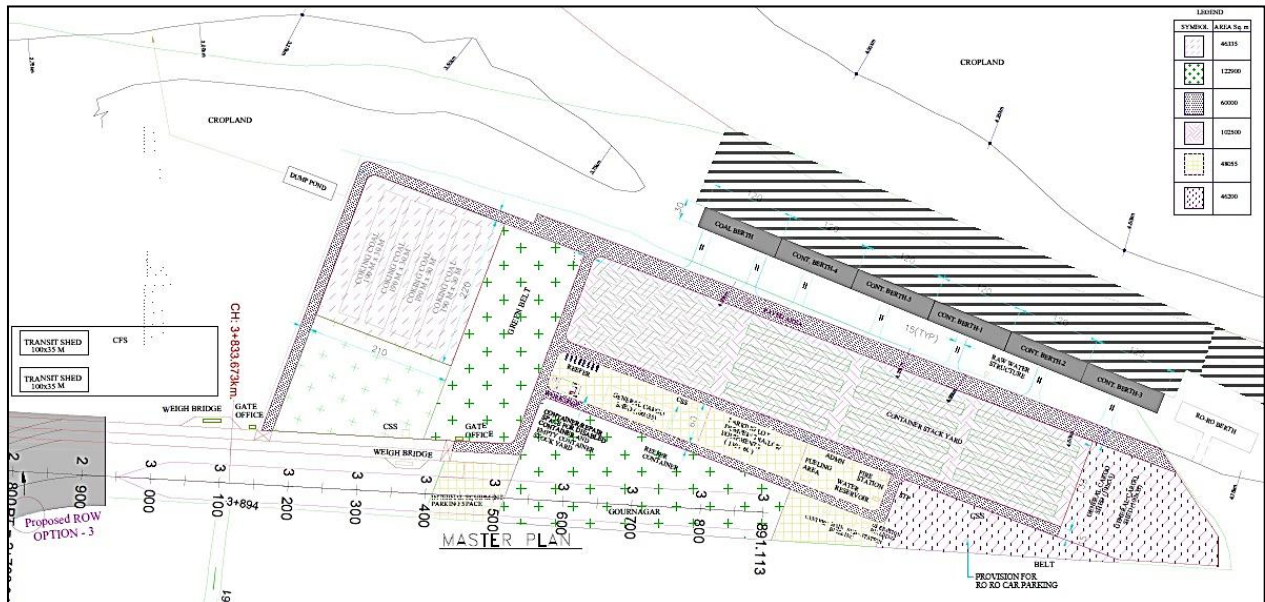


Figure 2-2: Overall Proposed Layout with 6 berths

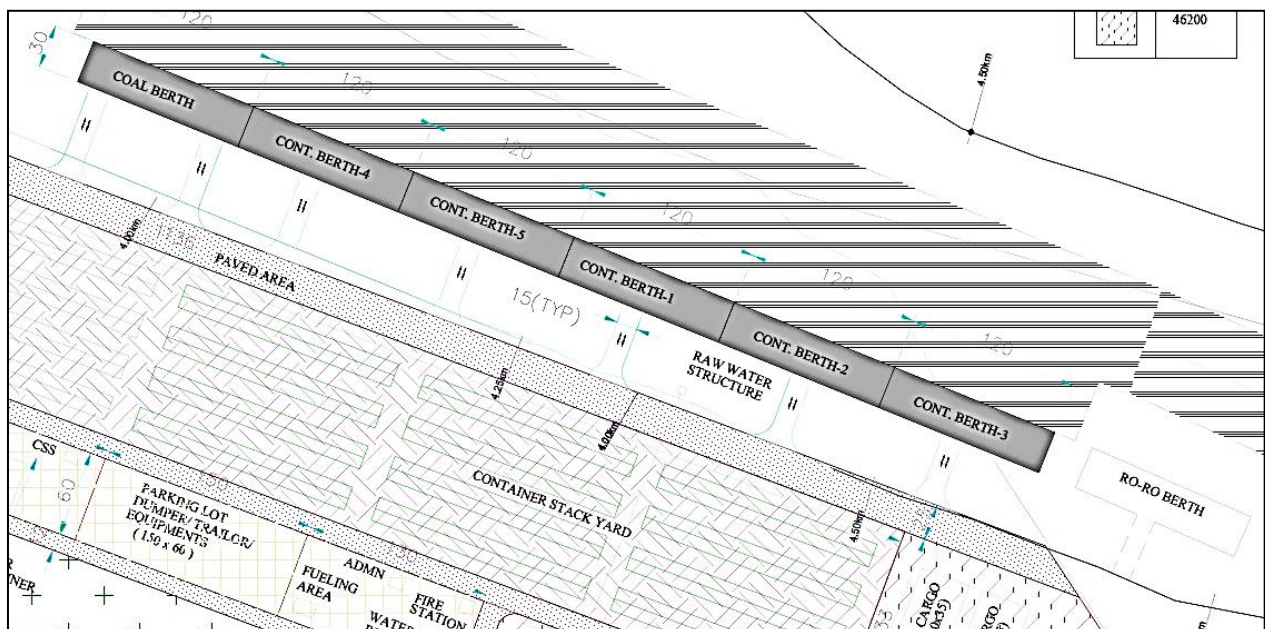


Figure 2-3: Zoom-in view

Proposed layout having series of six berths (future projection) having length of 120m each and width of 30m is analyzed for hydrodynamic

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C2 - 6
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and sediment transport regime. However, present project consists of only two berths (one for coal and another for container traffic).

The approach channel dimensions are determined by the vessel maneuvering speed, draft requirement, maneuvering lanes requirement, stopping distance, effects of cross current and wind.

The approach channel is planned from the National Waterway-1 to the proposed project site. The length of the approach channel is approx.. 1.2 km and corresponding width of 75m. The draft shall be maintained below (-) 3.3mCD.

As per IS: 4651 (Part V) – 1980, the minimum diameter of the turning circle should be 1.7 to 2.0 times (1.7 for protected locations and 2.0 for exposed locations) the length of the largest vessel. The proposed diameter and draft of the turning circle are 190m and (-) 3.45mCD m respectively.

Vessel maneuvering area in front of the berths, berthing area and the water depths in the berth, should be sufficient to permit largest design vessel to be serviced without causing undue risks for the vessels.

According IS: 4651 (Part V) – 1980, The vessel maneuvering area including berthing area is as follows.

The width required in front of the berth for berthing vessels and maneuvering activity is 45m. In case of single berth the length of the berthing area is 150m. The draft shall be maintained at berth below (-) 3.3m CD.

2.2.1 Cargo Handling Rate and Transportation

In the proposed terminal following types of cargo need to be handled.

- Containerised Cargo
- General Cargo
- Coal

2.2.1.1 Containerised Cargo

Containerised cargo are planned to be handled i.e loading and unloading operation, from the barges with tyre mounted mobile harbour cranes. From the vessel unloaded containers loaded to Tractor Trailer

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C2 - 7
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and transported to the stack yards. The stacking of the containers will be carried out by Reach Stackers in the yard area.

The containerised cargo from the stack yard shall be transported through road to the hinterland by the terminal users initially and will also be transported through rail in future.

With the above handling arrangement, the average handling rate at berth shall be limited to about 440 TEU per day only. It may be noted that the handling rates mentioned are limited to barge to shore handling.

Refrigerated Containers handled at present at KDS is about 2.2% of the total container traffic. Consequently, an area designated for Reefer Platforms has been provided in the layout plan.

2.2.1.2 Coal

Coal is planned to be handled (i.e., unloading operation), from the vessel with tyre mounted mobile harbour cranes. These cargos loaded to dumper trucks and transported to coal stockyard and from the stockyards, cargo shall be transported through road to the hinterland by the terminal users initially and will also be transported through rail in future.

With the above semi mechanised handling arrangement, the average handling rate at berth shall be limited to about 7,000 to 7,700 TPD only.

2.3 PROJECT SURVEYS & STUDIES

2.3.1 Survey and Investigations

The survey and investigations were carried out through Constell Consultants Pvt. Ltd. (Kolkata). The summary of the bathymetric and topography survey, Geotechnical and other marine investigation are presented below.

Bathymetric Survey

The bathymetric survey area for the proposed project is 489 Hectare. The survey map has been plotted on scale 1:2000 scale with contours at 1.0 metre interval. Taking cross section at 50 metre interval with spot levels at 10 meter interval along the cross section.

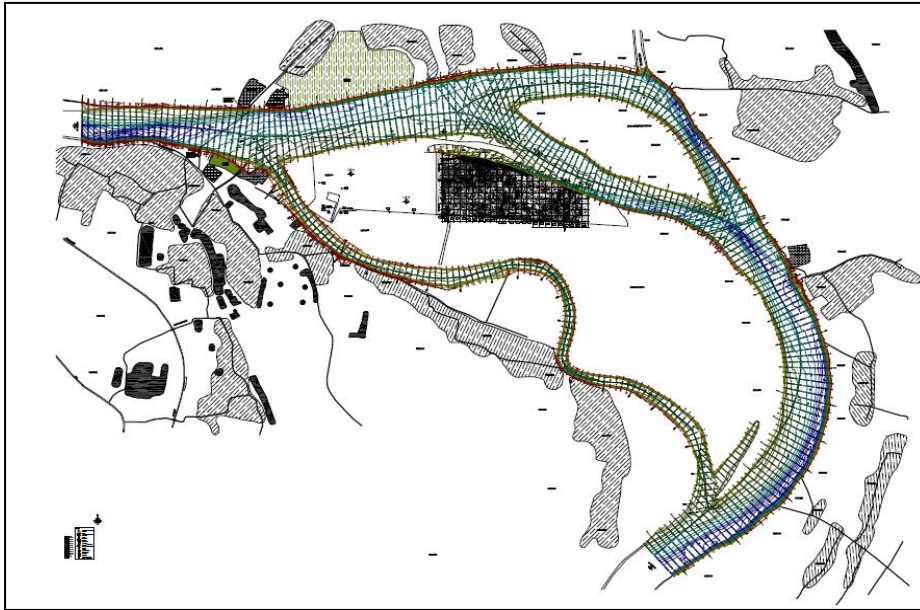


Figure 2.4: Bathymetric survey area

Topography Survey

The area surveyed for the proposed project is 50.142 Hectare. The survey map has been plotted on scale 1:1000 with contours at 0.2-meter interval. The grid lines have been drawn at 50m interval. The survey area is of undulating nature though the height ranges from 3.9m to 10.2m.

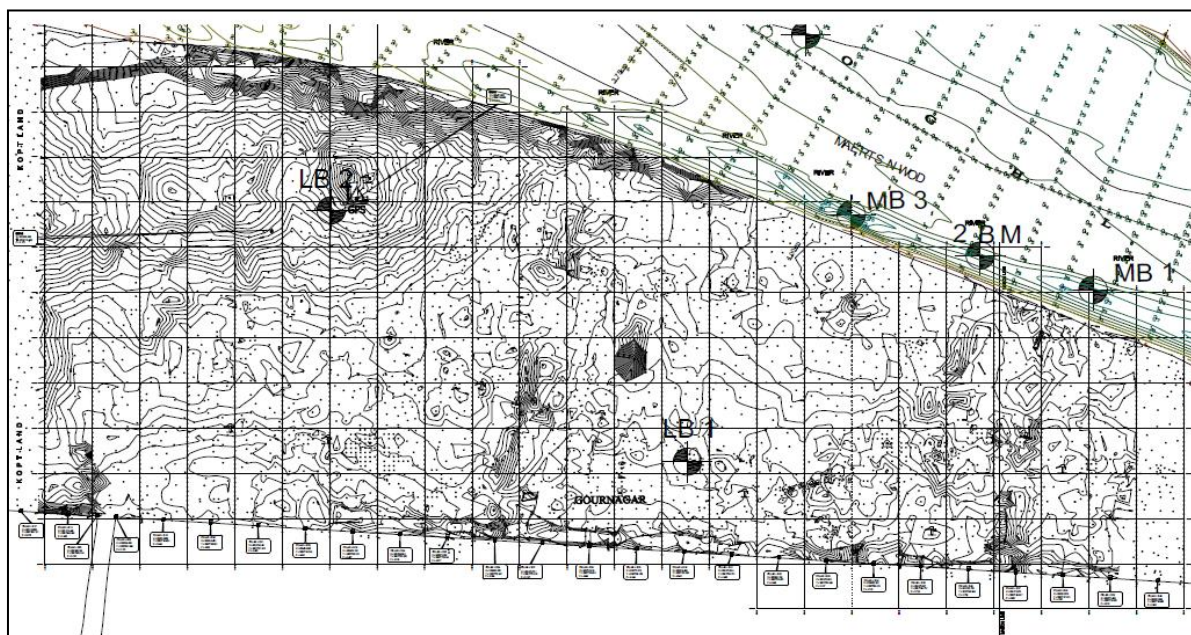


Figure 2.5: Topography survey area

Soil Investigation

Ten exploratory boreholes were drilled till refusal ($N > 100$) with breakup as follows:

- 6 marine boreholes
- 4 land boreholes

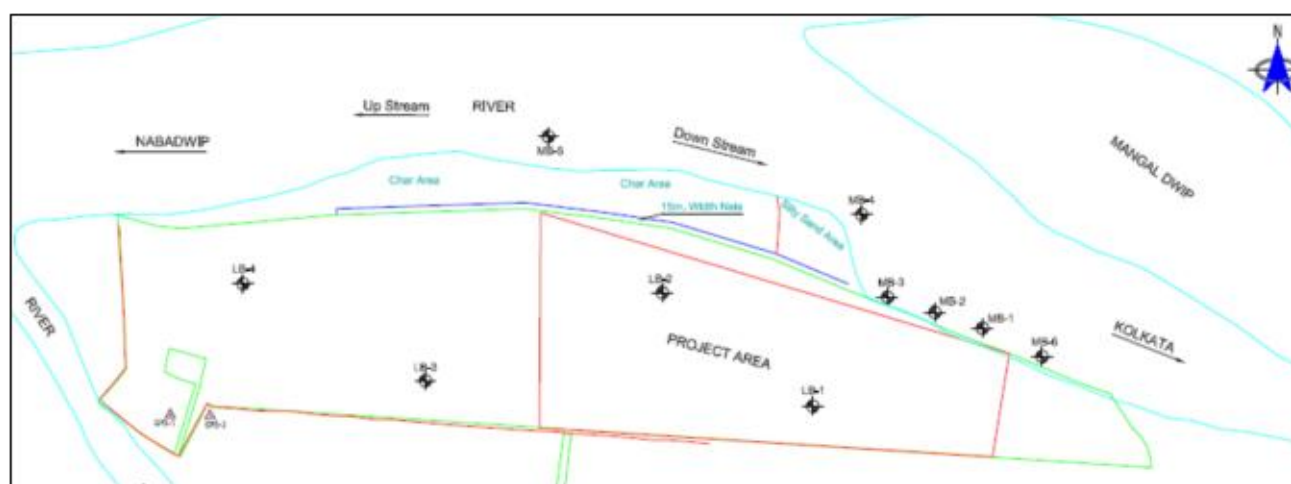


Figure 2.6 : Borehole location Plan

Summary of Stratification of Marine & Land boreholes are presented in Table 2.7 & 2.8.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C2 - 10
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Table 2.7: Summary of Stratification of Marine boreholes

Layer No.	Description	Layer Thickness (m)					
		BH-MB-1	BH-MB-2	BH-MB-3	BH-MB-4	BH-MB-5	BH-MB-6
I	Loose / medium dense / dense silty sand / fine sand	15.00	17.00	18.00	21.00	22.50	14.50
II	Stiff / very stiff silty clay with varying percentage of sand / sandy silty clay	6.00	4.50	5.00	1.00	7.00	5.50
III	Medium dense / dense / very dense silty sand / fine sand	29.10	28.55	27.10	28.10	20.55	30.00

Table 2.8: Summary of Stratification of Land boreholes

Layer No.	Description	Layer Thickness (m)			
		BH-LB-1	BH-LB-2	BH-LB-3	BH-LB-4
I	Loose / medium dense / dense silty sand / fine sand	29.00	32.00	36.00	37.50
II	Stiff / very stiff silty clay with varying percentage of sand / sandy silty clay	6.00	6.50	2.50	2.50
III	Medium dense / dense / very dense silty sand / fine sand	15.05	11.50	11.55	10.00

2.3.2 Navigation Study

Navigation study is carried out using DHI's 2D Desktop Navigation Simulation of up to 12 runs including emergency scenarios to examine the navigational aspects of the approach channel and to assess the safe navigation of the largest design vessel maneuvering to and from the proposed terminal. DHI's closest ship model to the design vessel used for the simulations, is a freighter type ship with overall length of 95.5m, beam of 18.25m and draft of 5.5m.

The grading of the simulation runs are categorized based on the difficulty levels as shown in the Table 2-9.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C2 - 11
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Table 2.9: Simulation categories

Degree of difficulty	Description
High	- Many challenges encountered during maneuvering - Uncomfortable maneuvers with no room for errors - Low safety margin
Medium	- Some challenges encountered during maneuvering - Sufficient resources to correct misjudgment and set the vessel back to safety - Medium safety margin
Low	- Routine operation - Comfortable maneuvering - Adequate safety margin

Following inputs based on site data were used for the simulations,

- Peak currents of 1.2 knots along the approach channel is considered.
- Prevailing winds are considered to be from North – Northwest (5 knots x 350 degrees) and South – Southwest (8 knots x 200 degrees) direction.
- Based on the under-keel clearance requirement and tide data, 3.5m depth is considered in the simulation.

Table 2.10: Simulation run matrix

Run No.	Vessel	Currents	Wind		Manoeuvre		Alongside	Berth
	Freighter	Peak	NNW	SSW	Arrival	Departure	Portside	
1	✓	✓	✓		✓		✓	Coal Berth
2	✓	✓	✓		✓		✓	Coal Berth
3	✓	✓	✓			✓	✓	Coal Berth
4	✓	✓	✓			✓	✓	Coal Berth
5	✓	✓		✓	✓		✓	Coal Berth
6	✓	✓		✓	✓		✓	Coal Berth
7	✓	✓		✓		✓	✓	Coal Berth
8	✓	✓		✓		✓	✓	Coal Berth
9 to 12	Emergency scenarios							

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C2 - 12
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These scenarios are chosen based on the combination of predominant winds and peak southeast going currents for the worst-case condition in terms of strength and angle made to the coal berth (innermost berth).

Summary

The findings of the simulation runs conducted were:

- The width of the approach channel is adequate for approach and departure of the largest design vessel.
- The size of the turning circle located at the confluence of the secondary and main channel is adequate for swinging the vessel around during departure.
- The wind and current conditions do not pose any significant difficulty for maneuvering. All the maneuvers conducted, were in the “Low” or “Medium” degree of difficulty category.
- Only the swing off the berth required two tugs to assist. All other simulations were successfully conducted using one 17 tonne bollard pull tug operating at a maximum of Half Power (except in the emergency scenarios).
- The vessel speed during the approach was over 5 knots, this was reduced to about 4 knots to pick up the tugs at the eastern part of the terminal. There was sufficient room to slow down and stop the vessel from running aground in the emergency scenarios simulated.

The design of the approach channel allows for navigation even if some minor maneuvering mistakes are made. The design vessel has a higher displacement than the largest vessels expected to berth at the terminal. With one small tug assisting, the vessel was able to land on the fenders at a speed of 0.15 knots or less. Similar vessels of smaller displacement could berth without tug assistance (by using the anchor). The maneuver will however take a longer time and possibly reduce the life of the fender system. It would be prudent to consider tug assistance as part of the operational requirements of the terminal.

Recommendations

The following recommendations can be considered:

- Shaving the bend leading to the secondary channel to allow more room for the set caused by the southeast-going currents.
- Increasing the channel width off the berth to about 140m or creating a turning circle to the west of the coal berth. The turning circle at

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C2 - 13
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the confluence of the channels may then not be necessary (no issues with other traffic transiting the main channel).

- Aids to navigation will be required to be provided to mark the boundaries of the safe water when the channel configuration is finalized. This will allow both day and night navigation.

2.3.2 Terminal Facility Planning

The proposed port development is in consideration with a primary objective of an extension gate to the KDS. Container is a predominant commodity handled at the KDS and observed a steady growth in the past 5 years. Increasing container cargo volumes is putting pressure on port's cargo handling infrastructure and the port may further struggle to handle the excess volume. Moreover, evacuation of the cargo in the land side is also becoming increasingly challenging. Port's present cargo volume is creating enough load on city's road network. Due to this, local traffic authorities have imposed time restrictions on the movement of cargo vehicles on the city's roads. This is further impacting the cost of shipment by additional vehicle waiting (idle) time cost & larger dwell time and cargo storage space, chances of losing port users interest due to the same. In order to grapple with the anticipated increase in traffic and to resolve the problem of restricted movement of its outgoing cargo, it will be advantageous to shift the part of the container traffic to the Balagarh island as an extended gate of KDS.

In view of above, Balagarh terminal is planned to handle Container as a major commodity. Discussions were held with the port officials along with some shipping lines regarding mid sea operation & vessel calling of the container at the port. It was informed that the vessel calling at the port of Kolkata will be predominantly from Vizag, Krishnapatnam, Colombo or Singapore through feeder vessels mostly wherein segregation can be managed with the designated tags at the time of booking of the parcel. Accordingly, SMPK may arrange a different designation code for the Balagarh Port terminal.

All the parameters have been studied which are relevant to the choice of location and layout for the development of Balagarh. This section of the report summarises the main criteria that have been considered in arriving at the marine layout at the selected site. The main factors are:

- Mathematical model study report shows occurrence of minimum siltation in the proposed berth location.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C2 - 14
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- Adequate maneuvering area for the design barges and stopping distance
- Limited effective waterfront to accommodate required berths to meet cargo projections upto development plan horizon
- Adequate back-up land for storage of containers and other cargo for port operations
- Provision for Road Connectivity
- Optimum capital cost of the overall development

While carrying out traffic potential assessment for the Balagarh terminal development, it has been noted that the Container and Coal cargo are the potential cargo which will be handled at Balagarh terminal. These cargos have different properties and thus different handling and storage requirements, suitable space has been earmarked for group of commodities based on mode of handling and compatibility.

2.3.2.1 Navigational and Operational Requirements

The basic navigational needs for barge operation are sufficient water depth, width in the approach channel and berthing area, sufficient stopping distance, and adequate water area for easy maneuverability throughout the year.

The essential activity that needs to be carried out before initiating the planning of the terminal layout is setting the basic criteria for the design of navigational and operational aspects. This for handling various types of barges likely to call at the berth for loading and unloading operations. The basic navigational and operational requirements to service the vessels calling at a terminal are:

- Barge type and dimensions
- Approach channel and Turning circle
- Berthing area dimensions
- Berth infrastructure
- Dredging

Barge Size Analysis and Design Barge Sizes

The size of vessels calling at the proposed terminal are restricted by the availability of draft in the navigation channel of National Waterway-1. Based on the data available and survey conducted 3.0 m draft is available in the navigational channel from Kolkata Dock System to

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C2 - 15
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Balagarh. The vessel sizes presented in table below can ply between Kolkata Dock System and Balagarh.

Table 2.11: Design vessel

DWT (T)	Length (m)	Beam(m)	Draft (m)
650 -1,000	60-80	8.20	2.20
1,000-1,500	80- 85	9.50	2.20
1,500 – 3,000	85 – 95	15.00	2.50 ~3

As per the proposed plan, the minimum assured water depth at Balagarh terminal would be (-) 3.3 m CD (lowest water level), loaded draft taken into consideration for a design vessel of 3000 DWT is 3.0 m assuming the design vessel will be fully loaded.

Approach Channel and Turning Circle

The approach channel dimensions are determined by the vessel maneuvering speed, draft requirement, maneuvering lanes requirement, stopping distance, effects of cross current and wind.

The approach channel is planned from the National Waterway-1 to the proposed project site. The length of the approach channel is approx. 1.2 km and corresponding width of 75m. The draft shall be maintained below (-) 3.3mCD.

As per IS: 4651 (Part V) – 1980, the minimum diameter of the turning circle should be 1.7 to 2.0 times (1.7 for protected locations and 2.0 for exposed locations) the length of the largest vessel. The proposed diameter and draft of the turning circle are 190m and (-) 3.45mCD m respectively.

Berthing Area Dimensions

Vessel maneuvering area in front of the berths, berthing area and the water depths in the berth, should be sufficient to permit largest design vessel to be serviced without causing undue risks for the vessels.

According IS: 4651 (Part V) – 1980, the vessel maneuvering area including berthing area is as follows.

The width required in front of the berth for berthing vessels and maneuvering activity is 45m. In case of single berth, the length of the berthing area is 150m. The draft shall be maintained at berth below (-) 3.3m CD.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C2 - 16
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Dredging

Dredging shall be carried out in the approach channel, turning circle and in the berthing area. The dredge depths requirements in the mentioned location are given in the table below.

Table 2-11: Dredge details

Description	Dredge Depths
Approach Channel	(-) 3.3 m CD
Turning Circle	(-) 3.45 m CD
Berthing Area	(-) 3.3 m CD

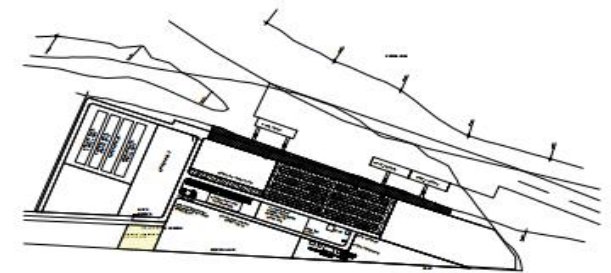
The quantity for berth pocket dredging is estimated to be around 0.15 Million cubic meters. Quantity required for reclamation purpose of the low-lying area of the port owned area of the Balagarh island to arrive at a Ground level of (+) 7.5 m CD is estimated to be approximately 4.3 lakh cubic meters. This will be achieved by dredging and hydraulic filling.

Bank Protection

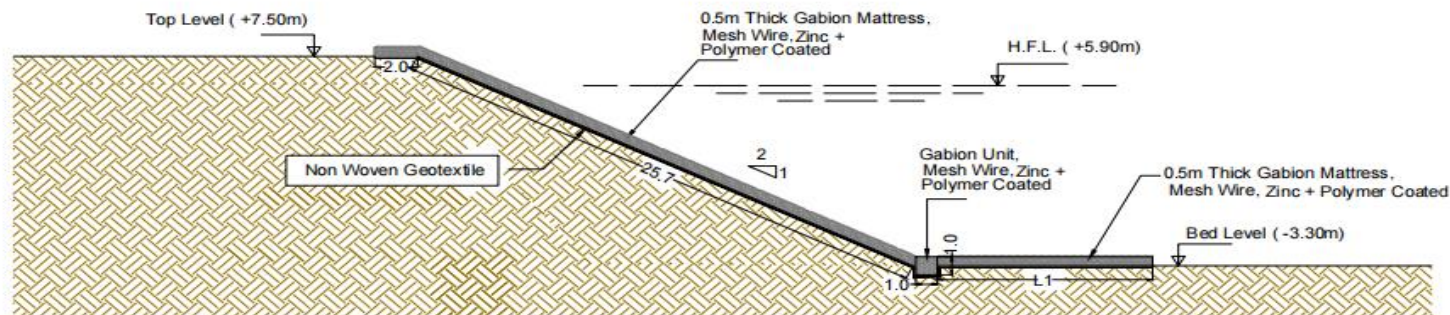
Bank protection shall be carried out along the shore in the berthing area to the extent of about 1 km on eroding zones specified by Model study to protect the river bank from the erosion along the proposed development.

Bank protection is to be provided behind the berthing structures for a distance of 1000m as shown in .

- NOTES:**
- General**
1. All dimensions are in meters unless otherwise specified.
 2. This drawing is read in conjunction with,
TCE.11290A-CV-3000-MP-30003A GAD showing road and rail connectivity for master plan
- NOTE:-**
1. The Slope is considered as Geotechnically Stable.
 2. The backfill soil shall be well compacted to density greater than or equal to 95% Modified Proctor value.
 3. Gabions shall be placed at the levels/locations as indicated in the drawing.
 4. The front face shall be neatly packed with good facia rocks for the facing of Gabion wall.
 5. Work shall be carried out strictly as per Manufacturer's Installation Guidelines.



KEY PLAN



TYPICAL CROSS SECTION OF SLOPE RETENTION WORK AT KOLKATA PORT

- NOTES:-**
1. ALL DIMENSIONS ARE IN MILLIMETRES.
 2. THIS DRAWING IS READ IN CONJUNCTION WITH,
TCE.11290A-CV-3000-MP-30001

Fig.2.7 Bank Protection Plan

DO NOT SCALE		FOR SITE PURPOSE ONLY	
K.P.A.L. PORT GATE SYSTEM AT BALAGARH, WEST BENGAL			
BANK PROTECTION DETAILS			
TCE CONSULTING ENGINEERS LIMITED			
DATE: 1999	APPROVED: PL	DATE OF REVISION: 2001	REVISION: 01
TCE.11290A-CV-3000-MP-30003A			

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C2 - 18
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The Gabion Mattresses can be described as rectangular cages having hexagonal double-twist wire mesh filled with appropriately sized cobbles or quarry stones, with small depths in proportion to its length and width. They are used for protection against scouring in water- front structures, erosion control applications, bank protections, groynes and weirs.

Gabion mattress are assembled by opening, unfolding and pressing out to their original shape. The inner diaphragm panels are lifted into a vertical position and secured by lacing wire. All edges of the diaphragms and end panels are tied to the front and back of the Gabion mattress unit by lacing. Lacing is done by cutting and twisting enough length of wire to secure lacing wire to the wire mesh. The basket pieces should be pulled tightly together during the tying operation. Pliers are to be used to create tight joints.

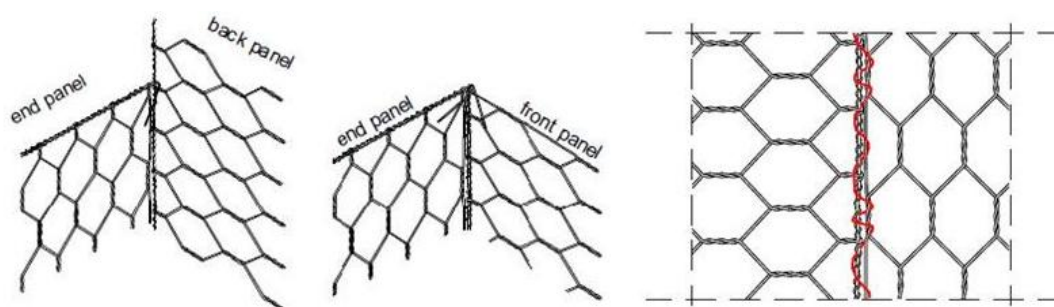


Figure 2.8: Gabion Mattress unit assembly

The surface on which the Gabion mattress units are to be placed should be levelled and graded to the elevations as shown on the project construction drawings. Appropriate measures should be taken for filtering and drainage of the surface, as per the project specifications (filter cloth, drain works, etc.).

After the surface preparation, pre-assembled empty Gabion Mattress units are placed in position and tied to adjacent units along all containing edges to form a continuously connected, monolithic structural unit. Gabion mattress should be placed front to front and back to back in order to expedite the stone filling and lid lacing operations. Rocks for Gabion Mattress should be of required sizes within the chosen gradation limits. Rocks should be hard, angular to round, durable and of such quality that they do not disintegrate on exposure to water or weathering. The fill layer should never be 300 mm higher than

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C2 - 19
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any adjoining cell. After each layer of rock is placed in the cell, sufficient hand manipulation of the rock is done to minimize the voids and densify the units. The top surface should be smoothly levelled, minimizing the voids.



Figure 2.9: Filling of rocks in mattress units



Figure 2.10: Lid closing operation

After the rock has been levelled and voids minimized, lid is folded down and edges of the panels are pulled together. The lid is then tightly tied along all edges, ends and tops of diaphragms. Adjacent lids must be tied or attached simultaneously. All projecting sharp ends of wire are turned in on the completed gabion mattress structure.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C2 - 20
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2.3.4 Parameters Determining Berth Capacity

The capacity of proposed multi cargo barge terminal mainly depends on the rate at which the various cargos are handled. Other factors that influence the capacity of berth and their value considered in the present case are given below:

Operational Time

It is assumed that terminal will work seven days a week, which brings the effective number of working days to 350 days per year, allowing for 15 non-operational days due to weather.

Further, it is assumed that the port will operate round the clock i.e. three shifts of eight hours each. This results in an effective working of 22 hours a day.

Time Required for Peripheral Activities

Apart from the time involved in loading / unloading of cargo, additional time is required for peripheral activities such as berthing and de-berthing of the vessels, customs clearance, waiting for clearance to sail, etc. As due to small sizes barges and limited cargo size per barge, these activities are assumed to take, on an average, 1.5 hours per barge call.

Allowable Levels of Berth Occupancy

Berth occupancy is expressed as the ratio of the total number of days per year that a berth is occupied by a vessel (including the time spent in peripheral activities) to the number of port operational days in a year. High levels of berth occupancy will result in bunching of barges resulting in undesirable pre-berthing detention. It may be noted that due to higher berth numbers and higher flexibility at the terminal for handling multiple cargo, the Berth occupancy factor has been assumed slightly higher at around 70 % to 75% as compared to norms of 65% to 70% for general cargo, to intensely use its capacity in order to serve multiple users who in any case have to put-up with even higher pre-berthing detention at other competing facilities.

Total Numbers of Berths proposed

Based on the traffic potential of both container and coal cargo, limited water front area available and findings of model studies, a total 2 numbers of berths have been proposed for the terminal.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C2 - 21
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2.3.5 Berth Capacity

Considering traffic congestion at KDS and assessing coal potential at Balagarh terminal it has been proposed to construct two berths. Out of the same, 1 berth will be dedicated for handling container cargo and the other one for coal cargo.

Considering the above factors, the capacity of the berth has been worked out as shown in the table below.

Table 2-12: Berth Capacity

Description	Container		Coal	
Annual cargo	85,000	TEU's	1.6	MTPA
Barge size	3,000	DWT	3,000	DWT
Avg parcel size	100	TEU's	2,400	T
No of Barges	850	no.	667	no.
Effective working hours	22	hrs	22	hrs
Average cargo handling rate	20	TEU's/hr	350	tph
Service time per vessel	5.0	hrs	6.9	hrs
Additional time for peripheral activities	1.5	hrs	1.5	hrs
Total time per vessel	6.5	hrs	8.4	hrs
Days	0.3		0.4	
Total berth days required	251	days	253	days
Number of berths	1	no.	1	no.
Total berth days available	350	days	350	days
Berth occupancy	71.8	%	72.4	%

2.3.6 Berth Structure

The capacity of the berth works out to be about 0.085 MTEU (1.1 MTPA) per annum for container and 1.60 MTPA for coal cargo, total capacity of the terminal being 2.7 MTPA.

It has been assessed, the proposed Balagarh terminal requires 2 numbers of berths. The berthing structure is planned to accommodate

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C2 - 22
---	--	---------

3000 DWT vessels. The dimension of the berth is planned as per the vessel size and the cargo handling requirements.

The total length of the berthing structure is $120 \times 2 = 240\text{m}$ and the width is 30m for each.

The berthing structure is of open pile type. The structure comprises of bored-cast-in-situ piles. The super structure shall be made up of combination of pre-cast and cast-in-situ concrete deck. Berthing face will be provided with fenders at suitable intervals for safe berthing and also bollards at same interval for mooring of vessels. The top deck level of the berth structure shall be fixed at level of (+) 7.5m CD considering HFL of (+) 5.9m CD.

2.3.7 Storage Area Requirement

As per industry norms the storage capacity at port, for a particular commodity, should at least cater to the higher of the following:

- For containers the dwell time at port is a deciding factor
- For General & Coal Cargo
 - 5% of the annual cargo throughput; or
 - One month storage or
 - The maximum parcel size

Other factors to be taken into account in determining the size of the storage areas are stacked densities, angle of repose, maximum and average stacking height, aisle space, reserve capacity factor, peaking factor, etc.

The cargo storage space requirement for handling the cargo has been evaluated and the storage area demand based on cargo handling type is given below.

Containerised Cargo

The storage area demand for handling the Containerised Cargo is considered around 1.2 hectares as consulted with SMP, Kolkata.

Coal

About 68,000 T coal cargo storage needs to be considered for 1.6 MTPA based on 15 days dwell time for coal. The storage area required for coal cargo is estimated around 2 hectares as consulted with SMP, Kolkata.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C2 - 23
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2.3.8 Cargo Handling and Transportation

In view of the significant traffic throughput of container, it is proposed to provide one mobile harbour cranes to have flexibility in handling container and other break bulk cargos. A fleet of dedicated Dumpers/ Trailer Trucks shall be put in operation to ensure faster vessel loading and unloading operations.

In view of the handling arrangement of the container and bulk cargoes and to allow the common handling equipment with appropriate utilization factor, it is proposed to provide the following handling equipment in development of the terminal:

Table 2-13: Cargo Handling Equipment

Sl.	Description	Unit	Nos.
1	Mobile Harbour Crane	nos.	2
2	Reach Stacker	nos.	2
3	Front End loader	nos.	4
4	20 T capacity Dumper	nos.	10
5	Tractor Trailer 40 ft	nos.	4
6	Dozer	nos.	1
7	Road Weigh Bridge	nos.	2
8	Coles Crane 25 ton capacity	nos.	1

2.3.9 On-shore Infrastructure

2.3.9.1 Land Development

The land area earmarked for development on shore facility is on virgin land and no major reclamation is necessary. To arrive at uniform made up ground level of (+) 7.5 m CD, filling/cutting as necessary shall be undertaken. In case of filling, area shall be developed with proper compaction / ground improvement measures satisfying the proposed surcharge load particularly at stack yards as well as other areas.

2.3.9.2 Boundary Wall & Gate

The terminal area is to be protected by fencing / boundary wall with provision of gate, complying with the requirement of ISPS, customs and security. Two gates, one each at the entry of Coal stackyard and Container stackyard have been considered.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C2 - 24
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2.3.9.3 Internal Road

Road network within the terminal area shall provide smooth flow of traffic. Width and length shall satisfy the traffic requirement and terminal area planning.

2.3.10 Terminal Buildings

Administration Building

Administration building shall be planned in the proposed development. The Administration Building shall have office for finance, marine, operation, marketing, planning environmental and engineering departments with conference hall and dispensary etc. It will be of 2-storeyed building with a floor built-up area of 100 sq.m.

Terminal Operations Building

The proposed development shall consist of terminal operation building. The building will have control towers for housing the control panels and ancillary equipment and will also be planned with suitable communication systems to contact ground staff. This building will be of 2-storeyed building with a floor built-up area of 100 sq.m. It also comprises of Signal station with radar and communication facilities.

Electrical Buildings

The proposed development shall consist of substation building. The substation building will have area for control room. This building will have about total area of 450 sqm, will be located at appropriate place near the load centres. Apart from the main Substation three compact substations have also been considered.

Main Gate House Complex

Main Gate house complex principally consists of gates for entry and exit of vehicles, security staff etc. A main gate house complex will have built-up area about 100 sq.m. Two separate Gate houses shall be provided (one each for Coal stackyard and Container cum General Cargo stackyard) to avoid traffic congestion. There will be provision of cabins for Customs and Security personals near the main entrance and exit gates of the terminals to ensure speedy implementation of customs and security regulations. The gate complex will have a computerised system for recording all data pertaining to movement of cargo and personnel through the gates.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C2 - 25
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Workshop / Stores Buildings

These buildings mainly comprise of a central maintenance / stores building having total built up area of 150 sqm. These building comprises a repair workshop and servicing facilities for mechanical and electrical repairs for all equipment. This will also house the equipment spare parts and the offices of the workshop and service facility staff.

Summary of Buildings at Terminal

The summary of proposed buildings at terminal is given in Table below:

Table 2-14 :Terminal Buildings

S. No.	Type of Building	Area (sqm)
1.	Gate Complex	100
2.	Administrative Building (G + 1)	100 x 2
3.	Port Operations Building (G + 1)	100 x 2
4.	Workshop / Stores Buildings	150
5.	Electrical Sub Stations	450
Total Area (sqm)		1,100

2.3.11 Roads and Paved Areas

Internal roads in the terminal area have been considered as 12 and 15 m wide for two-way movement of vehicles considering their usage. The main road abutting the berths have been considered of 25 m width. The main entry road shall be four lanes, with two lanes for entry and exit each. Adequate area for parking of the vehicles shall be provided on either side of the main entry road to the terminal.

2.4 PROJECT ENGINEERING

2.4.1 Berthing Facilities

Codes & References

IS:2911: Design of Pile Foundation

IS:1893: Criteria for Earthquake resistant Design of Structures

IS:875: Code of Practice for Design Loads

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C2 - 26
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IS:456: Code of Practice for Plain and Reinforced Concrete
 IRC:6: Standard Specifications and Code of practice for Road
 Bridges – Section 2
 IRC:78: Standard Specifications and Code of practice for Road
 Bridges – Section 7
 IS: 4651: Code of Practice for Planning and Design of Ports &
 Harbours (Parts 1 – 4)
 BS 6349: British Standard code of practice for Maritime Structures
 (Parts 1 – 7)

2.4.2 Design Life

The permanent works are designed to provide design life as follows:

- Berth, Approach and Buildings : 50 years
- Fenders, bollards and ladders : 8 years

2.4.3 Water Levels

The following levels shall be considered for the planning and design of berthing facilities:

- Highest Flood Level (HFL) : (+) 5.90 m CD
- High Water Level (HWL) : (+) 4.60 m CD
- Low Water Level (LWL) : (+) 1.23 m CD
- Dredge Depth at Berth : (-) 3.30 m CD
- Scour Level : (-) 14.5 m CD

The deck elevation of the berths has been fixed at (+) 7.5 m CD. This deck elevation is kept above the highest flood level of (+) 5.9 m CD. This deck level will also ensure adequate clearance between the deck and tidal water level during operational conditions.

Materials considered for design of berthing structures shall be of the following specifications:

- Reinforced Cement Concrete : M40 Grade
- Levelling Concrete : M15 Grade
- Cement : OPC of Minimum Grade 43 or
Slag cement as per
relevant IS code
- Steel Reinforcement : TMT corrosion resistant steel of
Grade Fe-500

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C2 - 27
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2.4.4 Design Loads

The following loads are used for basic engineering of berthing facilities:

A. Dead Load

The unit weight of all other materials shall be as per IS: 875.

Plain Concrete	: 24.00 kN/m ³
Reinforced Cement Concrete	: 25.00 kN/m ³
Steel	: 78.50 kN/m ³
River Water	: 10.00 kN/m ³

The unit weight of all other materials shall be as per IS: 875.

B. Live Load

Superimposed uniformly distributed load of 5 T/m² shall be considered on the berth. In addition, loads due to the following vehicles shall be considered for design of berth:

- Mobile Harbour Cranes LMH400 or equivalent
- Single train of IRC class AA vehicle or Loads due to mobile crane of 70 T lifting capacity
- Loads due to Container Gantry cranes with rail centres at 18 m c/c (provision to be kept for berths)

Single train of IRC class AA vehicle or equivalent uniformly distributed load of 1.0 T/m² is considered on the carriage way of approach trestle.

C. Current Load

The riverine structures shall be designed for the following flood currents:

- Operating current velocity : 2.0 m/s
- Extreme current velocity : 3.5 m/s

D. Berthing load

Berthing force calculations are as per IS 4651/ BS 6349. Details of the design vessels are presented below:

Table 2.15: Characteristics of Design Vessel

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C2 - 28
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DWT (T)	Length (m)	Beam(m)	Draft (m)
650 -1000	60-80	8.20	2.20
1000-1500	80- 85	9.50	2.20
1500 - 3000	85 – 95	15.00	2.50 ~3

Berthing energy shall be calculated for the largest barge under fully loaded condition at an angle of approach of 10° with a velocity of 0.25 m/s.

Dual Cone fender of grade SCN 800 F 1.2 or equivalent shall be provided on the berthing face to cater to the berthing energy of 18.7 ton- m. Refer to Drawing No. TCE.11290A-CV-3036-RC-30004 for details.

E. Mooring load

Mooring loads are calculated as per specifications laid down in IS4651 (Part 3) for the largest vessel specified in **Table 2.15**. The following wind speeds shall be taken into account for computing mooring loads:

Operating Wind : 24 m/s
Extreme Wind : 50 m/s

30 T bollards shall be considered on the berth at locations as necessary to cater to the various barge sizes envisaged at berth.

F. Seismic Force

Seismic force is calculated for Zone-V according to IS 1893. As per IS code, the project location falls in Zone IV and the basic horizontal seismic coefficient is calculated accordingly.

$$A_h = \frac{Z \times I}{2R} \left(\frac{S_a}{g} \right)$$

Z - Zone factor = 0.24

I - Importance factor = 1.5

R - Response reduction factor = 3

Seismic Force = A_h (DL+0.5 LL)

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C2 - 29
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2.4.2 Load Combinations

The loads to be considered for the design of berthing facilities have been described above. The loads with appropriate load combination, as per IS 4651 (Part 4): 2014 shall be applied on the different components of the jetty. The berth shall be designed based on limit state design method. The members shall be designed to restrict the crack width within permissible limits.

2.4.3 Durability Requirements

- Cover to Reinforcement shall be in accordance with IS 456:2000 as provided below:

Piles	– 75 mm
Beams and Slabs	– 50 mm
- Deflection of beams and slabs shall be limited to $L/350$, where 'L' is the span of the member.
- Deflection of piles shall be limited to $L/250$, where 'L' is the free length of pile.
- All designs shall be done to ensure crack width is within limitation imposed by IS 4651 for marine environment.

2.4.4 Geotechnical Criteria

The brief description of the existing geotechnical information at site has been provided in section 2 of this report. The preliminary design of the berths has been carried out based on the subsoil profiles.

The following safety factors are used to establish the safe geotechnical working load capacities of the piles.

End Bearing	SF = 2.5
Skin Friction on compression piles	SF = 2.5
Skin Friction on tension piles	SF = 3.0
Lateral load capacity	SF = 2.0

2.4.5 Scour Depth

Scour and siltation are very significant in the project location. Scour depth shall be calculated as per IRC:78. Historical maximum discharge in the location is 6150 cu.m/s. Maximum scour depth anticipated in the region is (-) 14.5 m CD and the same shall be considered for design of piles.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C2 - 30
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2.4.6 Stackyard and Pavement

Preliminary design of stackyard shall be as per Structural Design for heavy duty pavements for Ports and other Industries, Edition 4, published by Interpave. M 50 Heavy Duty 100 mm thick paver blocks over 50 mm sand cushion with suitable base and subbase have been provided. Subgrade CBR to be 10% (min) - to be achieved by ground improvement, if necessary.

Rigid pavement, i.e. jointed Pavement Quality Concrete (PQC) shall be provided for internal roads . Preliminary design shall be as per IRC 58-2002 with the following considerations

- | | |
|-------------------------|---|
| • Grade of Concrete | M50 |
| • Maximum Tyre Pressure | 10 Kg/sqm |
| • Design Wheel Load | 12,500 Kg |
| • Subgrade CBR | 10% (to be achieved by ground improvement if necessary) |

2.5 CARGO HANDLING EQUIPMENTS

2.5.1 Mobile Harbour Cranes

MHC shall be of proven design complete with onboard diesel engine and alternator, multi axle chassis, torsion resistant steel structure, hydraulic propping system, self-adjusting stabilizer, hydraulic travel drive with hydraulic steering, machinery house, hoist drive, slewing gear drive, operators cabin, control and instrumentation equipment, lighting, communication and all safety devices.

The crane shall be provided with multi-axle travel drive. The drives shall be of hydraulic type and shall ensure that the torque is distributed equally between the driven axels. The axles shall be suspended in an equalizer suspender system, which shall ensure that the total load is distributed equally to all axles irrespective of ground conditions.

All steered axles shall be connected by tie rods so that simultaneous steering is guaranteed. Suitable brake shall be provided for travel drive and also for parking.

Suitable propping system with stabilizer pads shall be provided for propping the crane during normal operation. The system shall ensure uniform distribution of the total load between each propping pad.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C2 - 31
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The boom luffing device shall be either hydraulic or mechanical depending on manufacturers' standard. The luffing motion shall be smooth and infinitely variable. Suitable braking system shall be provided for the luffing drive.

A general cargo lifting beam of adequate capacity shall be required with the crane which shall be connected with hoist ropes for lifting and break bulk in palletised form for loading to / unloading from barges. For container handling operations automatic spreader beams shall be required.

The operator's cab shall be of enclosed type with sheet metal panelling and thermal insulation. The operator's cab shall be provided with a window type air conditioner and heat resistant glass to give a good view over the area of operation. Specified requirement of the Mobile Harbour Crane proposed are as follows:

- Numbers of MHC 2 Nos.
- Maximum lifting capacity at minimum radius about 60 T
- Minimum capacity at 22 m outreach about 20 T
- Rated container handling rate 30 cycles per hour
- Type of drive system Diesel – electric
- Types of spreader required Automatic

2.5.2 Reach Stacker

A reach stacker is a equipment used for handling intermodal cargo containers especially in small or medium-sized terminals. Reach stackers are able to transport a container within short distances very quickly and pile them in various rows depending on its access. These stackers have a loading capacity of about 40 Tonnes. Total 5 nos. of Reach stackers are considered for development of Balagarh terminal.

2.5.3 Road Weigh Bridge

The road weigh bridges are basically meant to weigh the entire vehicles and their contents. By weighing the vehicle when empty and when loaded, the load carried by the vehicle is computed. The purpose of a weigh bridge is two fold viz., for computing the contents loaded for charging purposes and check weighing both axle weights and gross vehicle weights to help stop axle overloading for safety purposes and to avoid heavy penalties.

There are different types of road vehicle weigh bridges like mechanical type, electronic type depending upon the technology used and the

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C2 - 32
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preferred is of course electronic type. In the Electronic type, they are categorised depending upon the type of foundation like deep pit type, shallow pit type, Pit less type etc.

The most preferred and with latest and proven technology is that of Electronic pit less, digital type. It will essentially consist of multiple load cells that connect to electronic equipment that totalizes the inputs.

The main features of the weigh bridges proposed are listed below.

- The weigh bridge structure shall be robust in construction with ample safety margin above the rated capacity.
- The lower structure of the platform shall comprise of wide flanged steel beams and high grade tested steel. The structure shall be sand blasted to SA 2½ grade and suitably painted with special anti-corrosion epoxy based paint.
- The assembly shall be designed to compensate for expansion and contraction between the Weigh Bridge and foundation, caused by temperature variation.
- The load cells shall be sealed and compression type suitable for pit less weigh bridge installation.
- The load cells (6 nos.) shall be of rated capacity 23T (approx..) each having safe overload limit of 150% and breaking load of 300% of rated capacity.
- Each load cell shall have safe temperature range 0-65 degree Celsius and shall be weather proof IP-68 protection.
- Weigh bridge electronics shall be micro controller based with standard software capable of providing various kind of information on selectable basis.
- The system shall be provided with communication facility with the main PIC in the control room and a real time clock to print date and time on the printouts.
- The system shall be provided with suitable PC with software and dot matrix printer of latest technology.

2.5.4 Trailer Truck

The container terminal trailers will be designed to carry one 40' container or two 20' containers. The trailers are equipped with special guides and a locking system to secure the containers during transport.

The salient features of the trailers are:

Design load	50 T
Overall length	12.3m
Overall width	2.44m
Wheel base	9.5m

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C2 - 33
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2.5.5. Dumper Truck

Dumper truck are required to handle General / Dry bulk cargo from berth to stockyard area or vice versa. This will be used for both type of cargo, either for handling dry bulk or for handling bagged cargo. A typical dumper truck is equipped with an open-box bed, which is hinged at the rear and equipped with hydraulic rams to lift the front, allowing the material in the bed to be deposited ("dumped") on the ground behind the truck at the site of delivery.

2.6 WATER SUPPLY, SEWERAGE & DRAINAGE

For the purpose of this terminal a dedicated water supply arrangement has been proposed. The source of raw water is river Hooghly. Water supply system includes the following major units apart from the connecting pipelines:

- Intake structure & pumps (to be located near the approach trestle of container berth) to pump raw water to underground reservoir through raw water rising main.
- A 60 cum/hr capacity dual media filter system to be located on the top of underground reservoir complete with filtered water storage tank & pumping arrangement.
- A common Over Head Tank of 60 kL capacity shall be provided along with required filtered water distribution system to all building under gravity by underground HDPE pipeline & fittings considering the condition of exposure vis-à-vis cost. Raw water for use in firefighting system shall be withdrawn directly from River or underground reservoir as the case may be.
- Provision of UV/RO units connected with filtered water supply at individual buildings;

The following design basis are to be considered;

<i>Design life (civil structures)</i>	<i>50 years</i>
<i>Design life (E& M equipment)</i>	<i>15 years</i>
<i>Wastage and leakages in system</i>	<i>15% of the total theoretical demand</i>
<i>Hydraulic design of the pipeline</i>	<i>Using Hazen-Williams formula (with Hazen-William coefficient 110)</i>
<i>Minimum cushion on top of</i>	<i>0.9 m</i>

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C2 - 34
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<i>pipes</i>	
<i>Pump House Roof</i>	<i>Non-accessible</i>
<i>Tension face of all walls and raft in contact with water or ground of the water reservoirs will be designed as uncracked section as per IS:3370. Other areas of the reservoir and other structures will be designed following limit state of design as per IS: 456:2000.</i>	
<i>Live Loads</i>	<i>As per IS 875 depending upon the usage.</i>
<i>Condition of Exposure</i>	<i>Severe</i>
<i>Minimum depth of Foundation below GL</i>	<i>1.50m</i>
<i>Allowable Bearing Capacity at a depth of 1.5 m below GL is about 8 t/m² based on Soil Investigation report.</i>	
<i>Reservoir tops shall be provided with ventilation arrangement.</i>	
<i>For access to the tank bottom encapsulated PVC footrest shall be proposed</i>	

Total water demand is broadly classified in the following categories:

- Potable water for consumption of Port personnel.
- Potable water for other than port building.
- Water for firefighting system in buildings.
- Water for Washing and Servicing.

Water for consumption by the port personnel (considered 200 nos.) at 150 LPCD per person has been considered for estimation of water demand. With this, estimated total daily water demand has been presented below in **Table 2.16**. Water balance diagram is represented in **Fig no 2.10A**,

Table 2.16: Estimated Water Demand

Sr. No.	ITEM	Estimated Demand (KLD)
(a)	Other than Port Building	10
(b)	Port Users & Buildings	30
(c)	Fire Tender	10
(d)	Water Demand for washing and servicing	10

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C2 - 35
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Sr. No.	ITEM	Estimated Demand (KLD)
	Total	60

It is considered that a static storage capacity of about 200 KL would be required for the daily demand, for that an underground reservoir and an overhead tank has been proposed.

Before proposing dedicated water supply arrangement as above, we have checked the availability of water supply from existing sources of the locality i.e., SREEPUR BALAGARH GRAM PANCHAYAT. It has been observed that this Gram Panchayat have very limited capacity of potable water. At present there are five deep tube-well with filtering stations to supply drinking water to neighbouring areas as follows: -

- Sahebdaanga Ferry Ghat (3 km from project site)
- Balagarh Station (4 km from project site)
- Baruipara (5 km from project site)
- Barujebee (4 km from project site)
- Milangarh (5 km from project site)

Apart from above five filtering stations there is one deep tube well near panchayat office supplying water to neighbouring area within 500 m radius.

2.6.1 Sewerage System Design

A Sewage Treatment Plant for treatment of the sewage from the buildings of the new terminal has been proposed.

Features of the proposed sewerage system will be as below:

- Sewage from the independent building unit to STP will be conveyed through underground conduits;
- Conveyance of flow will be under gravity only;
- Inspection chamber of each building unit will collect the sewage of that unit. Thereafter the same will be conveyed to the nearest sewage collection pit connected to the main sewer line of STP. Manhole will be proposed when the length of individual sewer line is more than 30m;
- A package STP for the sewage from the buildings of the new terminal will be provided;
- The treated effluent from STP will be collected in a treated effluent tank. The same will then be utilized for plantation and Green belt development.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C2 - 36
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The following design basis are to be considered;

- Design life (civil structures) : 50 years
- All conduits will be HDPE conforming to IS 14333;
- System design will be based on the Manual on “Sewerage and Sewage Treatment” - Central Public Health and Environmental Engineering Organization (CPHEEO), Govt. of India and prevailing standard practice;
- Hydraulic analysis for the design of the sewerage system shall be carried out using Manning’s formula. The manning roughness coefficient shall be 0.013. Sewage contribution would be 80% of water consumption;
- The minimum size of sewer shall be 150 mm in consideration of maintenance ease. A minimum velocity of 0.6 m/s shall be ensured to avoid deposition in the sewers;
- Manholes will be proposed at every change point of alignment / gradient / diameter/ junction of two or more sewers and at the head of all sewers. Maximum spacing between manholes in the sewers will be restricted to 30 m;
- Inspection Pit, sewage collection pit, Manholes will be of circular / rectangular in shape;
- Sewers will be designed to carry the peak flow for the number of users in the year 2035.
- Minimum cushion on top of pipes : 0.9 m

2.6.2 Power

As per estimation, about 817 KVA of electricity will be required during operational stage, which will be sourced from WBSEDCL.

2.7 FIRE FIGHTING SYSTEM

Three types of cargos (General Cargo, Containers and Coal) will be handled at the port. Stripping / stuffing of containers will not be carried out at the terminal generally. Therefore, elaborate arrangement of firefighting may not be required at the container handling area. There will be a Reefer zone for storage of refrigerated containers, where there is possibility of electrical fire. Hence all arrangements to fight electrical fire will be made. There will be machines like Tractor-Trailers, Reach Stackers, MHCs etc. which themselves are self-contained with portable fire extinguishers. All buildings including the substations are required to be covered as per National building Code of India.

Firefighting system will be required at Coal, Container and General Cargo stackyards and the same also has to be dealt as per the provisions of National Building Code.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C2 - 37
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Generally, the new terminal will have the following two firefighting system:

- Internal firefighting System
- External Fire Fighting System

2.7.1 Internal Fire Fighting System

Internal fire Fighting system has been proposed as per the provision of National Building Code (NBC) and TAC. Features of the system are as below:

- Terrace water tank of adequate capacity on top of Administrative to generate required pressure.
- Down Comer of pipe size 100 mm dia. as single outlet landing valve
- Fire Extinguishers - As per TAC rules
- Hose Reel - As per TAC rules
- Manually Operated Electric Fire Alarm System - As per TAC rules

2.7.2 External Fire Fighting System

The external firefighting fixed system has been considered in line with the requirement of the TAC and considering the yard area. System will comprise of the following:

- River Water intake system with pumping arrangement (1- electric pump + 1- Diesel pump and jockey pump of desired capacity) to maintain pressure within the entire fire water network and to feed the fire hydrants. Pumping capacity will be decided based on the layout of the pipe drain vis-à-vis the pressure requirement of 3.5 Kg/ sq. cm at the remotest hydrant point. The system will be designed to withstand a working pressure 10.5 Kg/sq. cm.
- Peripheral pressure pipeline of Ductile Iron of adequate size
- Double out let Fire hydrants (63 mm dia. hose outlet) valve shall be proposed for every 45 m of the periphery of the terminal.

2.8 MANPOWER PLANNING

Operation and maintenance of proposed project require human resources in different categories like managers, engineers of different discipline like metallurgical, mechanical, electrical, electronics, computer, civil, structural etc., highly skilled, skilled and semi-skilled work force in different disciplines, commercial, accountants and financial managers, unskilled labour force, clerical, security personal, etc.

In order to operate and maintain the project facilities, including its technical and general administration needs, the estimated manpower requirement for the proposed project has been estimated to be 300

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C2 - 38
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persons (150 persons - During Construction Phase and 150 persons - During Operation Phase).

2.9 SOLID WASTE MANAGEMENT

Cargo operations produce wastes like remains of bulk cargo storage, waste packaging materials, floating garbage and other wastes, generated from day to day activities. But for a modern Dock, as has been envisaged in this case, generation of such wastes will be minimum, if not nil. However, such wastes, whatever may be, the quantity, will be stored separately (recyclable and non recyclable) within the port premises from where the recyclable wastes will be periodically handed over to the registered recyclers. The non-recyclable wastes will be handed over the concerned Civic Body for ultimate disposal.

Arrangements will be made within the port area for collection and temporary storage of Hazardous and non hazardous wastes within the port.

The hazardous wastes will be stored separately. It will be sold/handed over periodically to registered recyclers/re-refiners having the approval of CPCB/WBPCB.

Besides, solid waste of domestic origin would also be generated. Such waste volume will comprise of waste generated by the Port population and the domestic waste from the visiting ships. As per an initial estimate, municipal solid waste to the tune of 12 TPA would be generated in the port complex. Such waste would be segregated under biodegradable and non biodegradable fraction. Both fractions would ultimately be disposed of suitably in consultation with the concerned local body.

2.10 CONTROL OF FUGITIVE EMISSIONS AT VARIOUS AUXILIARY FACILITIES INSIDE THE PORT

There will be Windscreen around coal stackyard and other Dust Extraction / Dust Suppression Systems to control fugitive emissions, material handling section and various other facilities inside the Port.

2.11 WASTEWATER MANGEMENT

The proposed project will be designed based on zero discharge concept. Entire treated effluent meeting the CPCB/SPCB standard will be used in plantation, development of green belt, suppression of dust and other non-critical purposes within the Port area. Wastewater generated from domestic sources will be treated in Sewage treatment plant. Port is required to provide proper treatment facility so that no untreated

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C2 - 39
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wastewater is discharged to surface waters. Treated wastewater conforming to the relevant standard will be used for gardening or for suppression of dust generated in and around port premises. Flow sheet of recommended Sewage Treatment Plant is presented in **Figure- 2.11**.

2.12 RAIN WATER HARVESTING

The entire land of the plant area has to be levelled in such a way that Rain Water flows down to the RCC constructed Rain Water storage pond. Water will enter into the storage pond through filter bed. Filter bed will be made with different size of gravels and core sand. The filtrate will be stored in the pond. The same water will be used for industrial / fire fighting purposes as well as for other non-critical purposes. The residue of the filter bed will be removed manually from time to time. Rain water in excess will flow into river Hooghly.

2.13 STORM WATER DRAINAGE DESIGN

Drainage network shall be proposed taking into consideration of rainfall & duration of rain to keep the terminal including container and Coal stack-yards free from water logging.

Features of the proposed storm water drainage system for the terminal area has been presented below:

- The drainage system shall be separate system to carry only storm runoff of the entire terminal;
- Storm run-off from the terminal area will be collected in catch pits. Such catch pits will be connected with buried pipe conduit for conveyance and discharge into river through a number of out-falls;
- Outfall location and numbers will be proposed considering the piled berthing structure, type of bank protection, site conditions vis-a-vis economy. The invert level of such out fall will be kept above HWL (i.e. + 4.6 m CD);
- Conveyance of flow will be under gravity only.
- The drainage system for container terminal will be a separate system to carry only storm runoff of the entire container terminal;
- The drainage system for Coal terminal will be separate and will carry the storm runoff of the Coal terminal to the adjacent Dump Pond. The coal sludge will be collected in the Dump Pond by gravity. The clear supernatant water overflowing into the adjacent chamber of the Dump Pond will be discharged to the river through outfalls. The coal sludge will be collected from Dump Ponds at

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C2 - 40
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regular intervals and disposed off to designated and approved disposal location outside the terminal.

The following design basis are to be considered;

- Design life (civil structures) : 50 years
- All conduits will be HDPE conforming to IS 4984 & IS 14333
- System design will be based on the Manual on “Sewerage and Sewage Treatment” - Central Public Health and Environmental Engineering Organization (CPHEEO), Govt. of India and IRC: SP-50, Guidelines on Urban Drainage, 1999 published by Indian Roads Congress,
- A maximum and minimum velocity through the conduit shall be 2.50 m/sec and 0.6 m/sec respectively (as per CPHEEO manual)
- Minimum diameter of the conduit :150 mm (as per CPHEEO manual)
- Estimation of Run-off :Rational Formula, $Q = 10$ CIA

Where,

$Q = \text{Runoff in } m^3/hr.$

$C = \text{Coefficient of runoff} = 0.90 \text{ (as per CPHEEO Manual)}$

$I = \text{Intensity of rainfall in mm/hr.} = 25 \text{ mm/hr. (as per IRC: SP: 50)}$

$A = \text{Area of drainage in hectares.}$

- Minimum cushion on top of pipes :0.9 m

2.14 LAND & GREENBELT DEVELOPMENT

Total Land area is 124.95 Hectares (308.75 Acres). The proposed land area is vacant with scanty vegetation and no habitation. The project area is mostly flat in nature.

Considering the need of open space for fire fighting and safety requirement, greenbelt has been planned along the periphery in addition to small patches of green area in the unutilized open space, roadside tree plantation and grass lawns. The peripheral green belt varies in width to suit the plant design requirement. The greenery is shown in the plant layout (**Annexure IV**).

M/s SMPK has earmarked total 13 hectares (33 acres) land (33% of 40 hectares (100 acres)) within its proposed site at Village: Balagarh, Dist.-

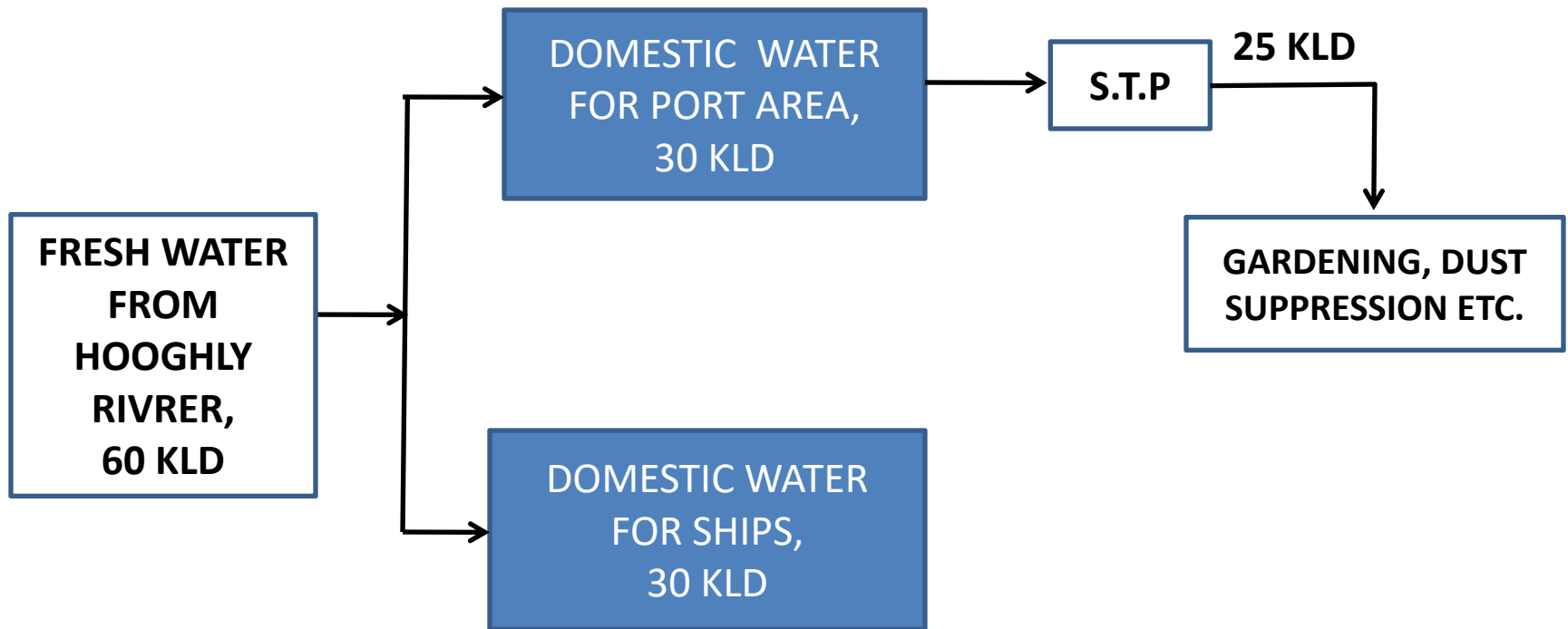
Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C2 - 41
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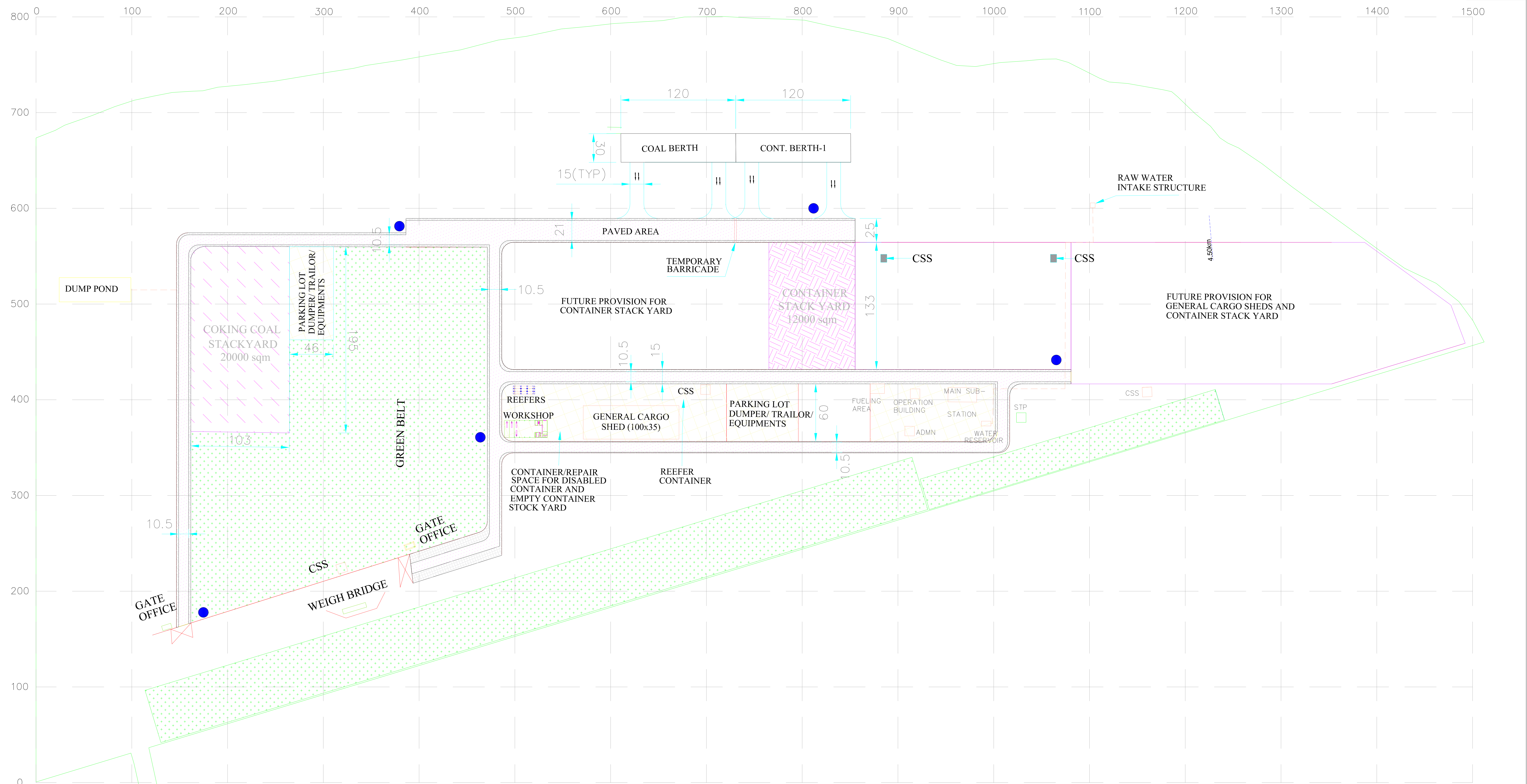
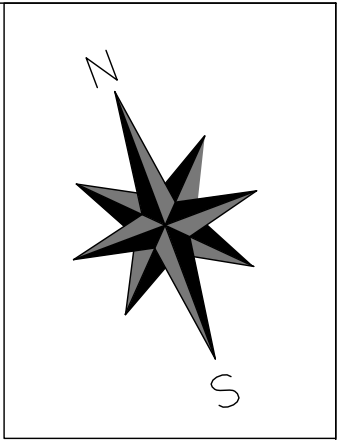
Hooghly, West Bengal. Total 19,500 number of trees (@1500 nos. of trees per hectares) will come under greenbelt.

2.15 PROJECT COST

DESCRIPTION	COST
Total Capital Cost of the Project	Rs. 445.5 Crores
Total Capital Cost for Environmental Pollution Control Measures	Rs. 12.85 Crores
Recurring Cost / annum for Environmental Pollution Control Measures	Rs. 1.29 Crores

FIGURE 2.10A : INDICATIVE WATER USE DIAGRAM





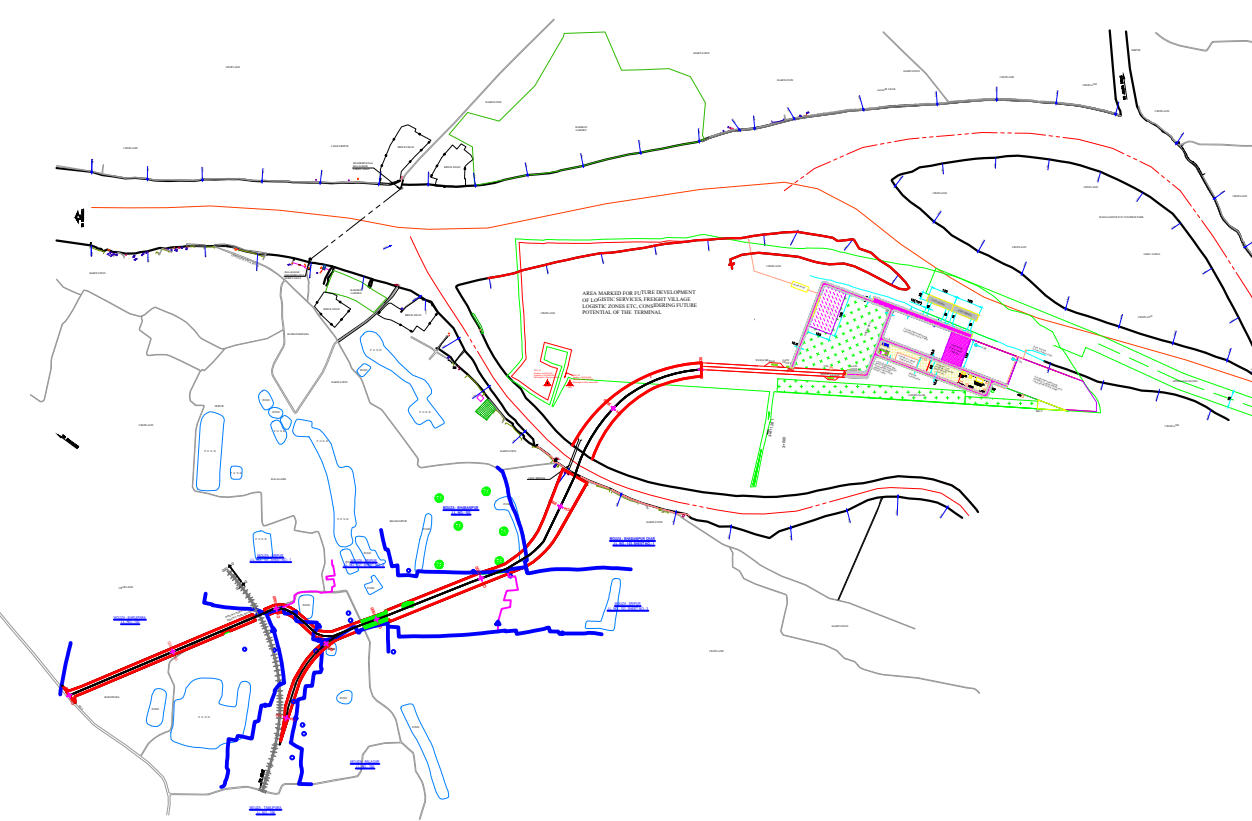
NOTES

- 1) ALL DIMENSIONS ARE IN M.
- 2) ALL GRID SPACING ARE @ 100.0 METERS BOTHWAYS.
- 3) ASSEMBLY POINT DURING EMERGENCY ●

LAND USE PATERN			
DESCRIPTION	AREA (Sq.m)	AREA (Acre)	SYMBOL
COAL STACKYARD	20000	4.94	
GREEN BELT	133545	33.00	
INTERNAL ROAD	34000	8.40	
CONTAINER STACKYARD	12000	2.97	
OTHER PAVED AREAS	31000	7.66	
BERM	12000	2.97	
UTILITIES	2224	0.55	
BERTH AREA (02 Nos)	7200	1.78	
MISCELLANEOUS	152713	37.73	
TOTAL	404682	100	

SCALE- NTS

Itemref	Quantity	Title/Name, designation, material, dimension etc		Article No./Reference		
Drawn by <i>Partha Bag</i>		Checked by - date		Approved by - date	Filename	Date
SYAMA PRASAD MOOKERJEE PORT, Kolkata Balagarh, Dist : Hooghly,West Bengal		PLANT LAYOUT				
				KOPT/LAYOUT/01	REV. 1	Sheet 1 OF 1



KEY PLAN

LEGEND :

S.NO.	DESCRIPTION	SYMBOL	AREA (Sq.m)
01	COAL STACKYARD		20,000
02	GREEN BELT		1,44,808
03	INTERNAL ROAD		34,000
04	CONTAINER STACKYARD		12,000
05	OTHER PAVED AREAS		25,560
06	BERM		12,000
07	OTHER / VACANT AREA / FUTURE PROVISIONS		1,85,721
TOTAL			4,34,089

NOTES:

1. ALL DIMENSIONS ARE IN METRES.
2. THIS DRAWING IS READ IN CONJUNCTION WITH
TCE.11290A-CV-3000-MP-30001A
TCE.11290A-CV-3036-RC-30004
TCE.11290A-CV-3035-RC-30005
TCE.11290A-CV-3000-RC-30006
TCE.11290A-CV-3055-SI-30007
TCE.11290A-CV-3003-GI-30008

[illegible]

Purpose : For Tender Only

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THE SMALL BLOCK ABOVE THIS BLOCK.
CONSTRUCTION / FABRICATION WORK IS PERMITTED ON IT (RELEASED) ISSUE
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FILE NAME : 11290A-CV-30002-Rev-P1

DEVELOPMENT OF AN EXTENDED PORT GATE SYSTEM BY SMPK AT BALAGARH WEST BENGAL

GENERAL LAYOUT PLAN



MUMBA

SCALE

G. NO. _____

ISSUE

TCE FORM

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C3 - 1
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CHAPTER-3.0

DESCRIPTION OF THE ENVIRONMENT

3.1 GENERAL DESCRIPTION

3.1.1 INTRODUCTION

The proposed project of **M/s Syama Prasad Mookerjee Port (erstwhile Kolkata Port Trust)** is situated at Village & PO - Balagarh, District - Hooghly, PIN - 712501, West Bengal. Its geo-graphical coordinates are Latitude 23°38'25.28"N and Longitude 87°17'10.17"E with Above Mean Sea Level 5 meters (16 ft.)

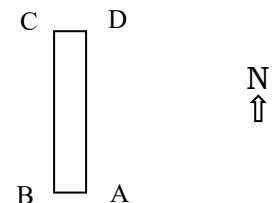
The four points on the boundary of the project site are as follows:

A=23°7'39.51"N 88°29'20.12"E

B= 23°7'21.35"N 88°29'59.46"E

C= 23°7'15.85"N 88°30'0.14"E

D= 23°7'19.21"N 88°29'11.77"E



(Where, T: Top, B: Bottom, L: Left, R: Right, C: Corner)

The proposed project will be set up on total Land area of 124.95 Hectares (308.75 Acres). The proposed land area is vacant with scanty vegetation and no habitation. The entire land is already owned by Syama Prasad Mookerjee Port, Kolkata.

The map of the project site and the same on google map are given below in **Figure-3.1.1** and **3.1.2** respectively.

The Toposheet and the surrounding area is presented in **Figure-3.2** . 10 km radius study area of the project is presented in **Figure-3.3..**

3.1.2 TRANSPORTATION & SURROUNDINGS

Ranaghat is located 7.5 km from project site in North-east direction from the project site. Chuchura is situated 29 km from the project site in SSW direction from the project site. Balagarh Railway Station is 5.1 km from the project site in the West direction. Jirat Railway station is 4.7 km from the project site in the WSW directions. NSCBI Airport, Kolkata is

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C3 - 2
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49.2 km from the project site in South Direction. Hooghly River is flowing at close vicinity [The Balagarh Island is surrounded by Hooghly River] from the project site. There is no National Park, Reserve Forest & Wildlife Sanctuary within 10 km radius of the Project Site

3.1.3 COVERAGE OF THE STUDY AREA

The EIA is aimed for determining the environmental impacts on the "Study Area", which encompasses all areas falling within a radius of 10 Kms around the project site. There are no eco-sensitive areas like National Park/ Wildlife Sanctuary/ Bird Sanctuary etc. within 10 km radius around the project site. The 10 Km radius study area around the project site on Google map and Toposheet Map has been presented in **Figure-3.1.4** and **Figure-3.1.5**.

The major environmental disciplines studied in this EIA report include soil, land use, meteorology, air quality, surface and ground water quality, noise, ecology, demography and socio-economics.

The following chapter present the detailed discussion on the field data, generated for soil, meteorology, air quality, water quality, noise, ecology and socio-economics during three months' period (**01st January, 2023 – 01st March, 2023**) along with the relevant secondary data, collected from various agencies on the relevant disciplines.

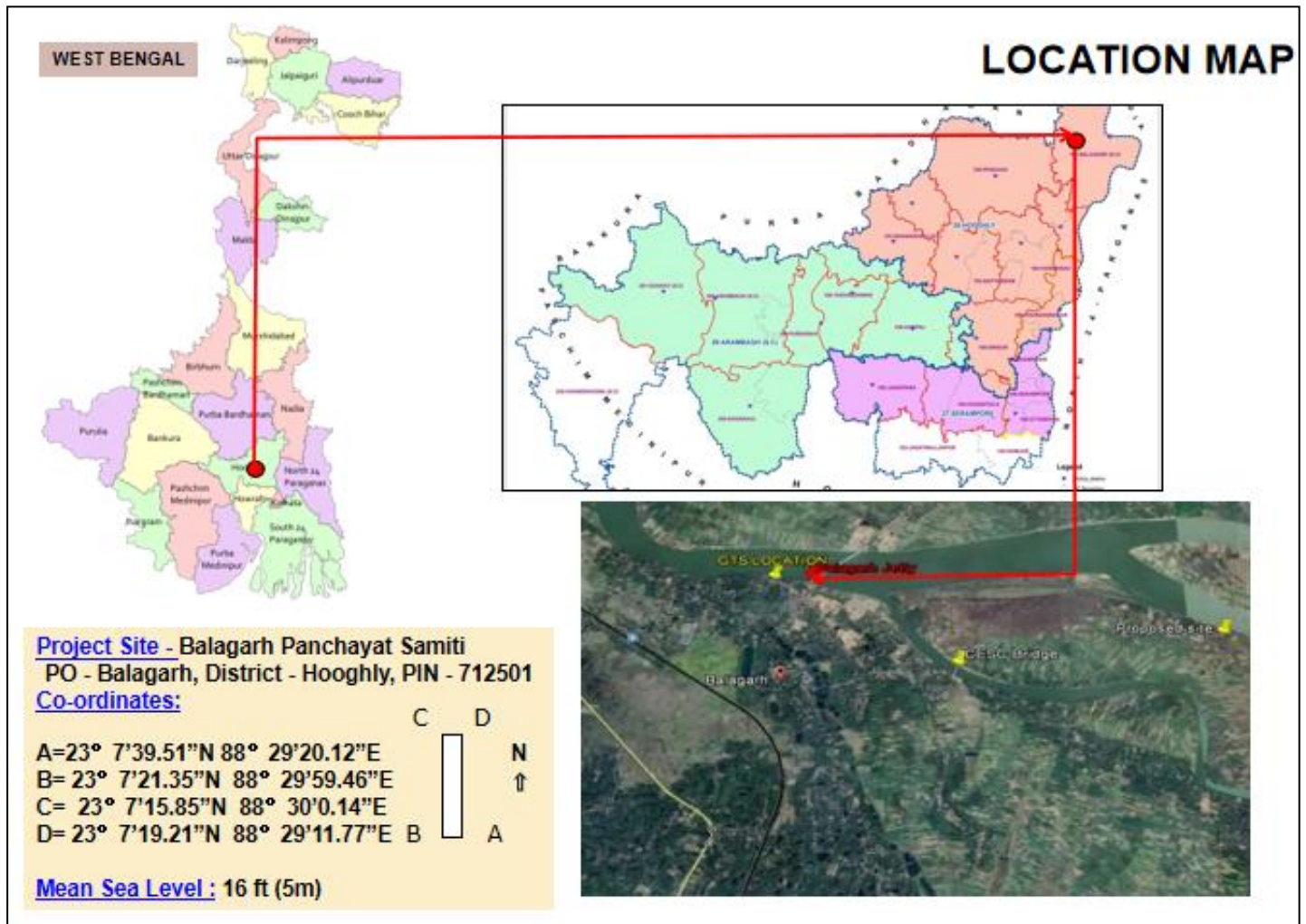


FIGURE-3.1.1: PROJECT SITE

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C3 - 4
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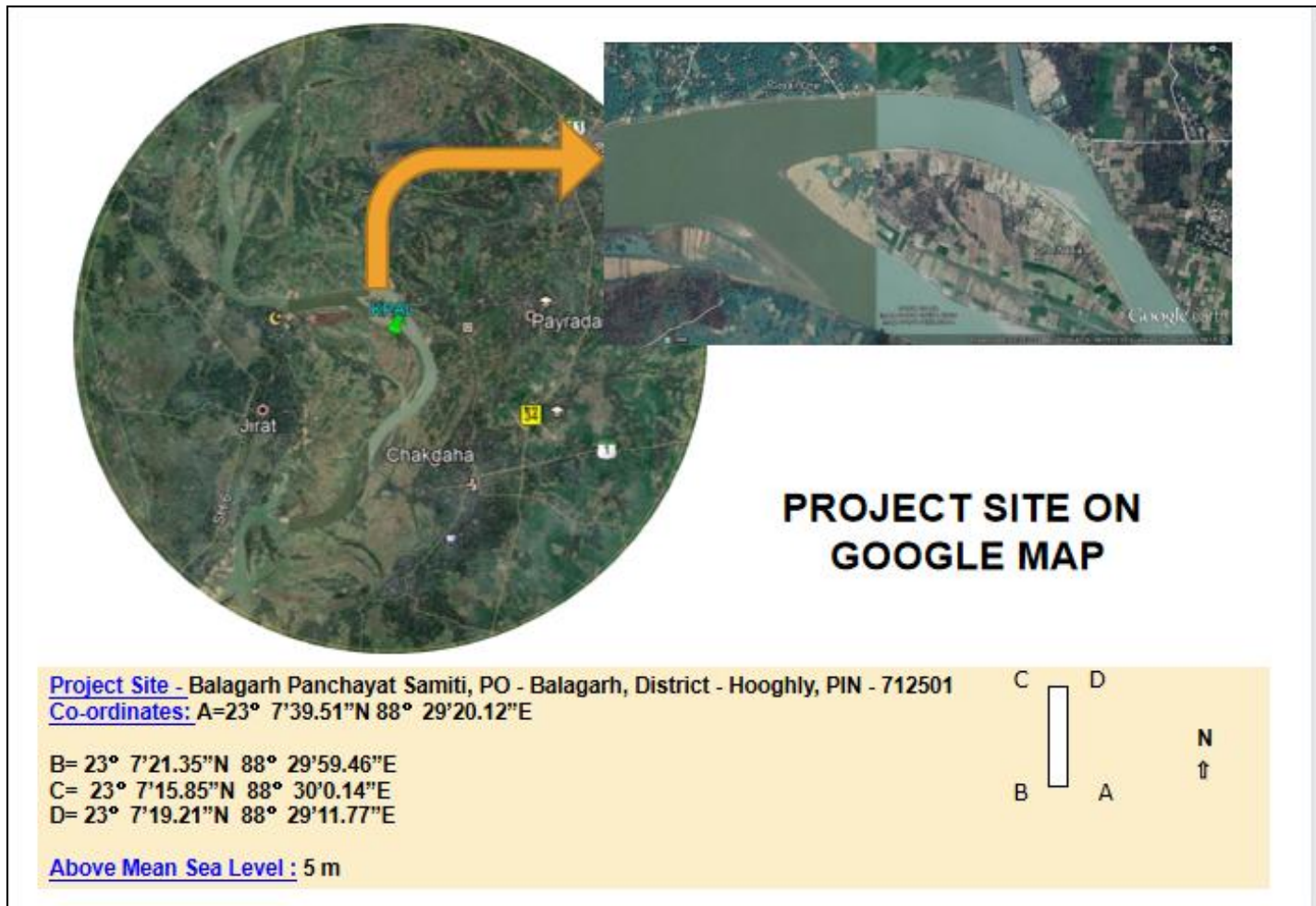


**FIGURE-3.1.2 : GOOGLE VIEW POINT
PROJECT SITE & ITS SURROUNDING AREA**

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C3 - 5
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Project Site:

Balagarh Panchayat Samiti, PO -
Balagarh, District - Hooghly, PIN -
712501

Site Co-ordinate:

A=23°7'39.51"N 88°29'20.12"E
B= 23°7'21.35"N 88°29'59.46"E
C= 23°7'15.85"N 88°30'0.14"E
D= 23°7'19.21"N 88°29'11.77"E

Mean Sea Level : 16 ft (5m)

FIGURE-3.3
10 KM RADIUS STUDY AREA ON GOOGLE MAP

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C3 - 6
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3.1.4 STUDY METHODOLOGY

The baseline environmental quality for winter season has been assessed based on primary data generated during field survey and secondary data available for the project site.

Table-3.1
Baseline data generation Matrix

Attribute	Parameters	Locations/Source
Land Environment	Physiography & Drainage	Primary & Secondary information
	Geology & Geo-Hydrology	Primary & Secondary data
	Land use	Primary & secondary data
	Soil Quality	4 Locations/ Primary & Secondary data
Meteorology	Temperature, Humidity, Atmospheric Pressure, Wind speed & Direction etc.	1 Location/ Primary & Secondary data
Air Environment	PM ₁₀ , PM _{2.5} , Sulphur Dioxide (SO ₂), Nitrogen Dioxide (NO ₂), and Carbon Monoxide (CO)	8 Locations / Primary & Secondary data
Noise	Noise Level (dB Leq)	10 Locations/Primary data
Surface water	Physical, Chemical & Biological Parameters	10 Locations/Primary data
Ground water	Physical, Chemical & Biological Parameters	9 Locations/Primary data
Ecology	Terrestrial & Aquatic	Core and Buffer Zone, Primary & Secondary data
Demography & Socio-economy	Demography & Socio-economy	Core and Buffer Zone, Primary & Secondary data

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C3 - 7
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3.2 GEOLOGY & GEOHYDROLOGY OF THE STUDY AREA

3.2.1 GEOLOGY OF THE STUDY AREA

The whole study area has spread along the east bank of the River Hooghly in Hooghly district. The whole study area is in the Ganges Delta and is monotonously plain. As with most of the Indo-Gangetic Plain, the soil and water are predominantly alluvial in origin.

The master slope of the land is towards south. Younger levee, deltaic plain, inter-dis-tributary marsh, paleo-channels and younger levee adjacent to river Hooghly are the important geomorphological units present in the area. The area is covered with younger alluvial soil mainly of silty & clayey loams.

Geological Formations:

The study area is located over the "Bengal basin", a pericratonic tertiary basin with enormous thickness of fluvio-marine sediments. The basin can be divided into three structural units:

- 1) The westernmost shelf or platform,
- 2) Central hinge or shelf/slope break; and
- 3) Deep Basinal part in the east and southeast that open in the present bay of Bengal.

The study area is located atop the western part of the hinge zone across which sediment thickness and facies significantly varies for shelf area in the west to deep basin area in the east. The hinge zone and the shelf area are traversed by many faults; some of them are reported to be tectonically active at present. The hinge zone is about 25 km (16 mi) wide at a depth of about 45,000 m (148,000 ft) below the surface. Total thickness of sediments below the land is nearly 7,500 m (24,600 ft) above the crystalline basement; in which:

- a) the top 350 – 450 m (1,150 – 1,480 ft) is quaternary,
- b) followed by 4,500 – 5,500 m (14,760 – 18,040 ft) of tertiary sediments,
- c) 500 – 700 m (1,640 – 2,300 ft) trap wash of cretaceous trap, and
- d) 600 – 800 m (1,970 – 2,620 ft) permian-carboniferous Gondwana rocks.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C3 - 8
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The Quaternary sediments consist of clay, silt, and several grades of sand and gravel. These sediments are sandwiched between two clay beds: the lower one at a depth of 250–650 m (820–2,130 ft); the upper one 10–40 m (30–130 ft) in thickness. The Quaternary alluvium comprising several cycles of sand, silt and clay and shows facies variation in both vertical as well as in horizontal sections.

A fill layer of varying thickness is observed at the top and its thickness naturally increases to a maximum value of 4m probably due to developing land of low-lying areas. However below this layer a thin layer of light brown silty clay layer exists with varying thickness and extends over all these sections. Below this layer a very weak layer of blackish Grey silty clay/clayey silt with decayed wood exists over a consolidated thickness of 8 to 10 m over most of the places.

However the thickness and extent of the layer is also widely varying over different sections. Below this layer bluish grey silty clay exists in most of the section with typical variation in their thickness and extent. Below the above layer, a layer of brown laminated silt with fine sand and dense brown silty fine sand exists in all boreholes over the sections indicating again typical variation in their thickness and extent.

The detail soil profiles along various sections in N-S and E-W direction over a depth of 30 m bgl have been shown in **Figure-3.2.1**.

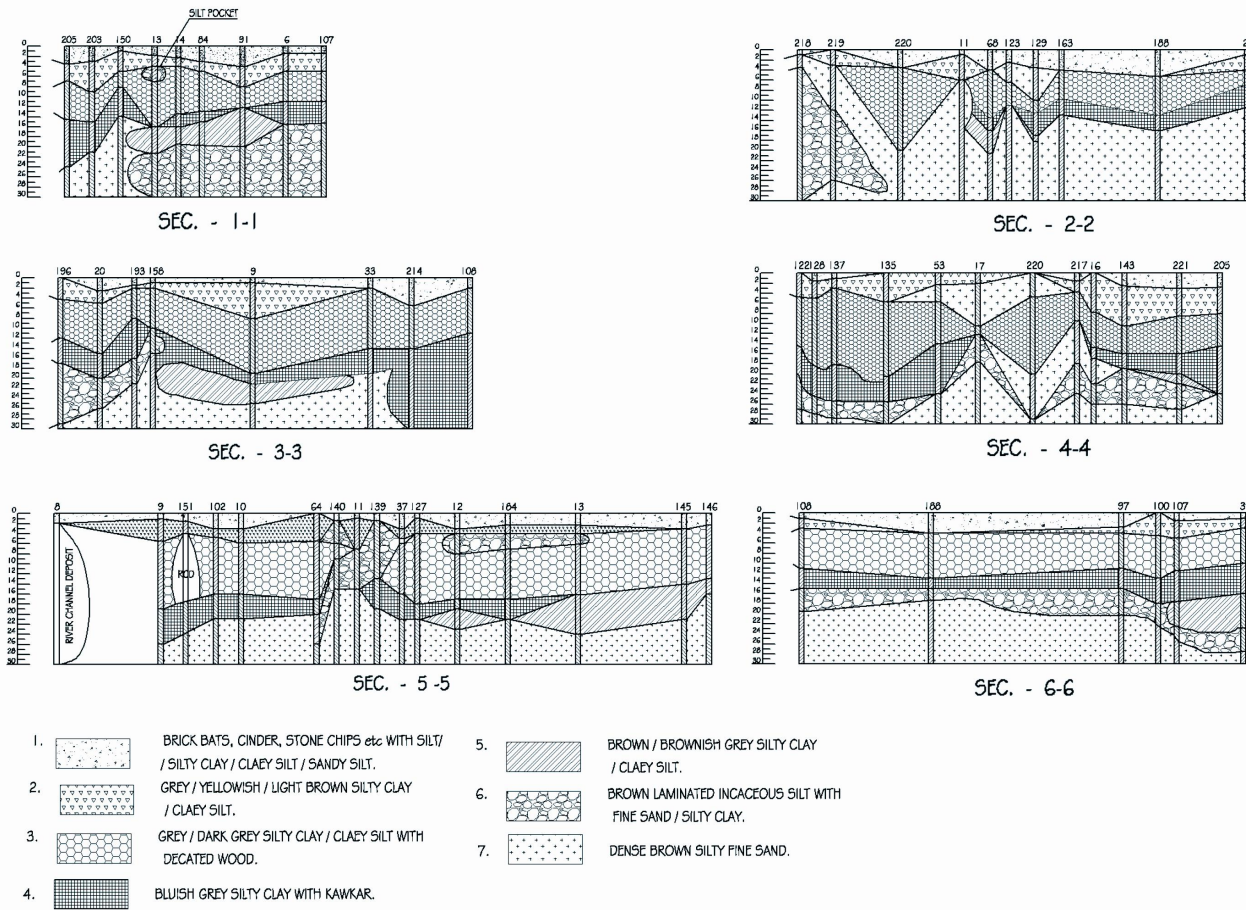


FIGURE – 3.2.1
Soil Profiles in N-S & E-W Direction

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C3 - 10
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3.2.2 GEOHYDROLOGY OF THE STUDY AREA

3.2.2.1 GROUND WATER GEOHYDROLOGY

Ground-water in the study area occurs both under water-table condition and confined condition. Ground-water in the near surface aquifers occur under water-table condition and in deep aquifers, under confined or sub-artesian condition in favourable terrain. The primary source of ground-water is rainfall, a part of which is lost as evaporation and transpiration and another part moves as surface run-off and remaining part percolates into the ground from direct rainfall or by lateral infiltration from surface water-bodies to form saturated ground-water zone.

The subsurface lithology consists of sediments of Quaternary age. Occurrence of groundwater in the study area is controlled by geological set-up. There are two regionally extensive clay beds throughout the study area within the depth of 400mbgl. The depth of occurrence of the basal clay bed varies from place to place but in general it occurs from 300 to 450m bgl and the depth gradually decreases southward. The top clay bed of 10 to more than 60m thick occurs above the entire alluvium sequence from the ground surface in the study area. The thickness of this clay bed varies from place to place. Both top and bottom clays are dark grey in colour, sticky, plastic and often found to contain strings of silt and fine sand. The upper clay bed often contains peaty matter within the depth of 10m bgl indicating earlier land subsidence in recent past. Sands of various grades with occasional gravel occur between these two clay beds form the main aquifer system in study area. Presence of several clay layers and lenses at various depths at different places divides the above mentioned sand zones into several layers.

Nature and depth of aquifer system:

The sub-surface disposition of the aquifers indicates that the blanket of clay (10 to 60m thick) at the top of the sedimentary sequence imparts confined to semi confined nature to the groundwater occurring in the aquifers below this clay blanket. The aquifers below this clay bed consist of fine to coarse sand, which are occasionally mixed with gravel. The sediments show facies variation at a few places, which is characteristic of typical deltaic deposition and the top claybed shows a transition from aquiclude to aquitard. The thickness of the individual aquifer varies from place to place with the frequent occurrence of clay lens within them. The principal productive fresh water aquifer occurs within the depth span of 60-180m below ground level (bgl) in the major part of the area except in the western part.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C3 - 11
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It has been seen that the depth of water level varies from 6m bgl to 18m bgl during the pre-monsoon season in the study area.

3.2.2.2 SURFACE WATER HYDROLOGY

The drainage basin is a fundamental geomorphic unit and the watershed acts as a source area for precipitation that eventually provide to the stream channels by various path. The drainage basin morphology being an important aspect of geomorphic analysis has been undertaken in the present context to determine the various properties of form elements, their distributional variation, interrelationship, determination of correlation coefficients etc. Geo-hydrology and groundwater exploration means to identify and to locate the zone of recharge of groundwater in a particular river basin or a catchment. Geological set up is established for knowing about surface and subsurface nature of terrain. Topographic and surface features are mapped in order to determine from highest to lowest area, where water from different higher places can move and accumulate. These particular zones are present in various terrains. The identification of such places from the entire area, are thus selected for groundwater exploration.

Drainage Network: Drainage network analysis is important for geo-hydrological studies. Drainage pattern reflects the characteristic of surface as well as subsurface formation. Drainage density indicates closeness of spacing of channels as well as the nature of surface material. More the drainage density, higher would be runoff. Thus, the drainage density characterizes the runoff in the area or in other words, the quantum of relative rainwater that could have infiltrated. Hence lesser the drainage density, higher is the probability of recharge or potential groundwater zone. Hence, drainage density is an important index in geo-hydrological studies, and can be evaluated from the satellite images or others.

River Basin: A river basin is the portion of land drained by a river and its tributaries. It encompasses the land surface dissected and drained by many streams and creeks that flow downhill into one another. A river basin collects all water from an area then moves it through the water system, where it eventually empties into an ocean or sea. A river basin is generally composed of many areas called watersheds.

In [hydrology](#), the River basin is a logical unit of focus for studying the movement of water within the [hydrological cycle](#), because the majority of

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C3 - 12
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water that discharges from the basin outlet originated as [precipitation](#) falling on the basin. A portion of the water that enters the [groundwater](#) system beneath the river basin may flow towards the outlet of another drainage basin because groundwater flow directions do not always match those of their overlying drainage network. Measurement of the discharge of water from a basin may be made by a [stream gauge](#) located at the basin's outlet.

Drainage Density: The drainage density (D) is an important indicator of the linear Scale of land-form elements in stream-eroded topography. It is the ratio of total channel segment lengths cumulated for all orders within a basin to the basin area, which is expressed in terms of km/sq. km. The drainage density indicates the closeness of spacing of channels, providing a quantitative measure of the average length of stream channel for the whole basin. It has been observed from drainage density measurements made over a wide range of geologic and climatic types that a low drainage density is more likely to occur in regions of highly resistant or highly permeable subsoil material under dense vegetative cover, and where relief is low. High drainage density is the resultant of weak or impermeable subsurface material, sparse vegetation and mountainous relief. Low drainage density leads to coarse drainage texture while high drainage density leads to fine drainage texture.

RIVER HOOGHLY:

Ganges enters West Bengal near Rajmahal and then flows in a southeasterly direction. It divides into two near north of Dhulian in Murshidabad district. One branch enters Bangladesh as the Padma while the other flows through West Bengal as the Bhagirathi River and Hooghly River in a southern direction. Hooghly River or the Bhagirathi-Hooghly is an approximately 260 kilometres long distributary of the Ganges River in West Bengal. The Bhagirathi is the main river in West Bengal which flows past some of the important cities like Murshidabad, Baharampur, Nabadwip, Chinsura, Chandannagar, Srirampur, Howrah, Kolkata, Diamond Harbour and Haldia. It releases its water into Bay of Bengal near Sagar Island in the South 24 Parganas. The drainage network and river basin of Hooghly River has been shown in **Figure-3.2.2**.

The Mayurakshi, Ajay, Damodar, Kangsabati, Rupnarayan and their tributaries which rise in the Western plateau and high lands flow eastwards through the different districts of West Bengal and joins the Bhagirathi on the right bank.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C3 - 13
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Hooghly River is flowing at close vicinity [The Balagarh Island is surrounded by Hooghly River] from the project site.

3.4 SEISMIC HISTORY OF THE STUDY AREA

West Bengal experiences earthquakes at a relatively lower frequency of the seismic hazard zonation map. According to the IMD catalogue, regions are divided in the seismic zones II to V (low damage to very high damage), corresponding to PEAK GROUND ACCELERATION (PGA) of 0.1, 0.2 and 0.25 (1 g = 980 Gal²) respectively.

According to IS: 1893-1984, the study area falls under Zone-III. It means that the area is covered under “low hazard zone”. The region has considerable area close to river basins and deltas that are characterized by Holocene alluvium deposits, which are likely to soften and hence are susceptible to liquefaction during an earthquake. There is no major earthquake episode recorded in the study area till date. Seismicity map of West Bengal with indicating the study area has been presented in **Figure-3.4.1**.

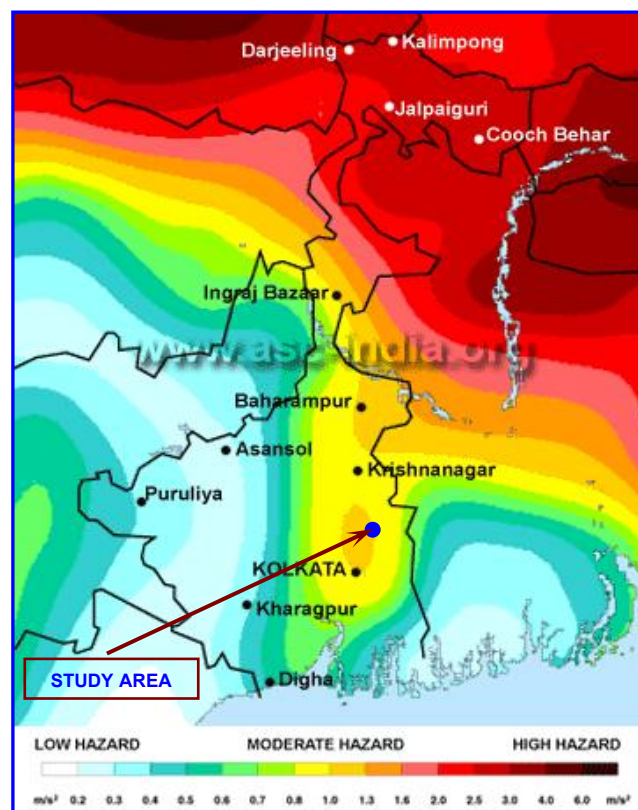


FIGURE – 3.4.1:
SEISMICITY MAP OF WEST BENGAL WITH INDICATING
THE STUDY AREA

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C3 - 14
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3.6 INDUSTRIAL ENVIRONMENT

There is no major industries found within the 10 km radius study area .

3.7 LAND USE

3.7.1 INTRODUCTION

The proposed project of **M/s KOPT** is situated at Village & PO - Balagarh, District - Hooghly, PIN - 712501, West Bengal. Its geo-graphical coordinates are Latitude 23°38'25.28"N and Longitude 87°17'10.17"E with Above Mean Sea Level 5 meters (16 ft.)

3.7.2 METHODOLOGY

The sensitivity of the environment i.e., existing land use is studied through Geographical Information System (GIS). Geographic Information System (GIS) is a scientific technique, which has revolutionized the way that land is inventoried, managed, planned and studied. GIS provides the theories and methods for organization and analysis of original measurements of location and secondary spatial data as well as topography. As an information system GIS provides the theories and methods for organization, storage, analysis, modeling, mapping and display of physical and biological data, as well as the distribution of cultural or socio-economic data. GIS applications are diverse. They include determining the suitability of land for different uses, planning future land uses for different objectives, analyzing land and land-cover properties for both resource inventories and scientific studies, and sitting of developmental activities.

3.7.3 DATA ANALYSIS

Remote Sensing Data

To study and map the land use pattern of the area, LANDSAT TM-1 multispectral imagery has been used as input data. The spatial resolution of the satellite data is 30 m. The bands used as input data for the current study have the following features:

Band 2: 0.52 - 0.59 μ m (green): This band corresponds to the green reflectance of healthy vegetation and is spanning the region between the blue and red chlorophyll absorption bands.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C3 - 15
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Band 3: 0.62 - 0.68 μm (red): This red chlorophyll absorption band of healthy green vegetation is one of the most important bands for vegetation discrimination. In addition, it is useful for soil-boundary and geological boundary mapping. Band 3 may exhibit more contrast than bands 1 and 2 because the effect of the atmosphere is reduced. The 0.69 m cut-off represents the beginning of a spectral region from 0.68 to 0.75 m where vegetation reflectance crossovers occur that can reduce the accuracy of vegetation studies.

Step - I	Layer stacking of three distinct file into a single file and create FCC
Step - II	Select an appropriate band used throughout the analysis. An examination of the three bands shows that the one visible band (2) provides less evidence of the various water surfaces across the image. Band 4, the near infrared band, clearly separates water bodies from other surfaces. Band 3 help to distinguish vegetation cover.
Step - III	Digital classification: Un-supervised ISO data classification carried out considering green, red, NIR bands with 5 iteration and expected number of classes 50
Step - IV	Aggregation of classes obtain through this classification session into classes having significance on the physical world was then carried out based on DN value.
Step - V	Visual interpretation is also done since digital classification only consider pixel values not the geographic location, association, shape, etc.
Step -VI	Area Calculation of each Land Use/Land Cover Classes
Step- VII	Comparison with some reference data and sample ground validation
Step - VIII	Final Map and Report

Band 4: 0.77 - 0.86 μm (near infrared): For reasons discussed above, the lower cut-off for this band was placed above 0.75 m. This band is especially responsive to the amount of vegetation biomass present in a scene. It is useful for identification of vegetation types, and emphasizes soil-crop and land-water contrasts.

3.7.4 OTHER SECONDARY DATA

The secondary database considered for validation and geo-referencing of the image is as follows:

- Topographical map in 1inch: 1mile of Survey of India: 73N/7 & 73N/8 and District Planning Series Map, NATMO, 1998;

3.7.5 DIGITAL IMAGE PROCESSING

The digital image processing includes image rectification; image enhancement; visual interpretation and land use mapping.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C3 - 16
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Image Rectification

The satellite images are given in BSQ (Band Sequential) format. These are imported to Erdas environment. Then geometric correction applied to the images to correct the distorted image data to create a more faithful representation of original scene. Image rectification procedures are often termed 'pre- processing' operations because they normally precede further manipulation and analysis of the image data to extract specific information.

Image Enhancement

This procedure is applied to the images in order to more effectively display or record the data for subsequent visual interpretation. High pass filter used to visualize more correctly the linear features such as, roads, rail, canal, river etc. Histogram Equalization was used to distinguished area of the same tone.

Visual Interpretation and Land use Mapping

Satellite imagery contains detail records of features on the ground at the time of satellite overpass. An image interpreter systematically examines the images for generating the information required by him. Other supporting materials such as published maps and reports from various sources will increase the accuracy of the interpretation. The chain of process in visual interpretation of the shape and pattern in an image begins with detection. There are certain fundamental characteristics seen on images which aid in the visual interpretation of satellite imagery. These are tone/ color, size, shape, texture, pattern, location, association, resolution and season. Visual interpretation is subjective and differs from person to person and also upon the season, scale, spectral bands, spatial resolution, overall image contrast & quality of the data.

The procedure for mapping for land use from satellite imagery of different season & on different scale is well established. Several parameters like terrain, climatic conditions, socio-economic trends, and environmental influences etc. play vital role in the existence of various land use categories.

Study limitation

Some limitations for the interpretation of the satellite data are:

- One season data sometimes give same spectral response of different objects creates confusion in image analysis and sub classification.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C3 - 17
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- One time data is unable to show sub-classification in the study area.
- Area of the line features like road; rail etc. is not been included since GIS does not give any calculation.

The topography of the Study Area does not show much variation in the land use / land cover pattern. The region is mostly covered by agricultural land with some forest land and patches of green vegetations either planted by local inhabitants or are the natural vegetations within the study area.

The land use / land cover pattern of the Study Area have been framed from the Satellite Imagery and Toposheet and authenticated by field visit. The land use / land cover pattern of the Study Area, may be divided into following 8 categories: (i) Built up land (ii) Crop land (iii) Plantation / Orchard (iv) Evergreen/Semi-green / Deciduous Forest (v) Grassland & Grazing Land (vi) Other Wasteland/ Scrubland (vii) Water Bodies; (viii) Shifting Cultivation.

The above categories of land use and land cover pattern cover an area of about 314 sq km. The percentage of land area covered in figures is mentioned in the Table and has been illustrated through the pie diagram.

The area under different land use/ land cover of Study Area is presented in the following Land use and Land cover Map.

3.7.6 LAND UTILIZATION PATTERN

The land use describes the change in pattern of land features due to the human activity whereas the land cover refers to the existing surface features on the earth. Thus it describes the pattern of development of the area. The pattern of land use and land cover is less variable as the land is alluvial plain. So the fertile land of the study area is mostly covered by green vegetation or agricultural crops and grasslands. The study area is spread over 314 sq km area. The green natural vegetation surrounding the settlements, forests open area, sand / shallow water, river and water-bodies are the land cover in the study area and the agricultural land or open crops and grasslands and the built-up area is the type of land use. The pattern of land use and land cover is described below: Classification of Land Use Land Cover (LULC) in the study area is tabulated in **Table-3.7.1**. **Figure-3.7.1** shows the Pie diagram of LULC in the study area.

Table-3.7.1
Classification of Land Use Land Cover (LULC) in the study area

Sl. No	Class	Area (in km ²)	Area (in Percentage)
1	Built Up Land	32.50	10.34
2	Crop Land	207.46	66.01
3	Plantation / Orchard	3.02	0.96
4	Evergreen/Semi-green / Deciduous Forest	25.39	8.08
5	Grassland & Grazing Land	5.69	1.81
6	Other Wasteland/ Scrubland	13.83	4.40
7	Water Bodies	10.34	3.29
8	Shifting Cultivation	16.06	5.11
Total of all classes		314.29	100.00

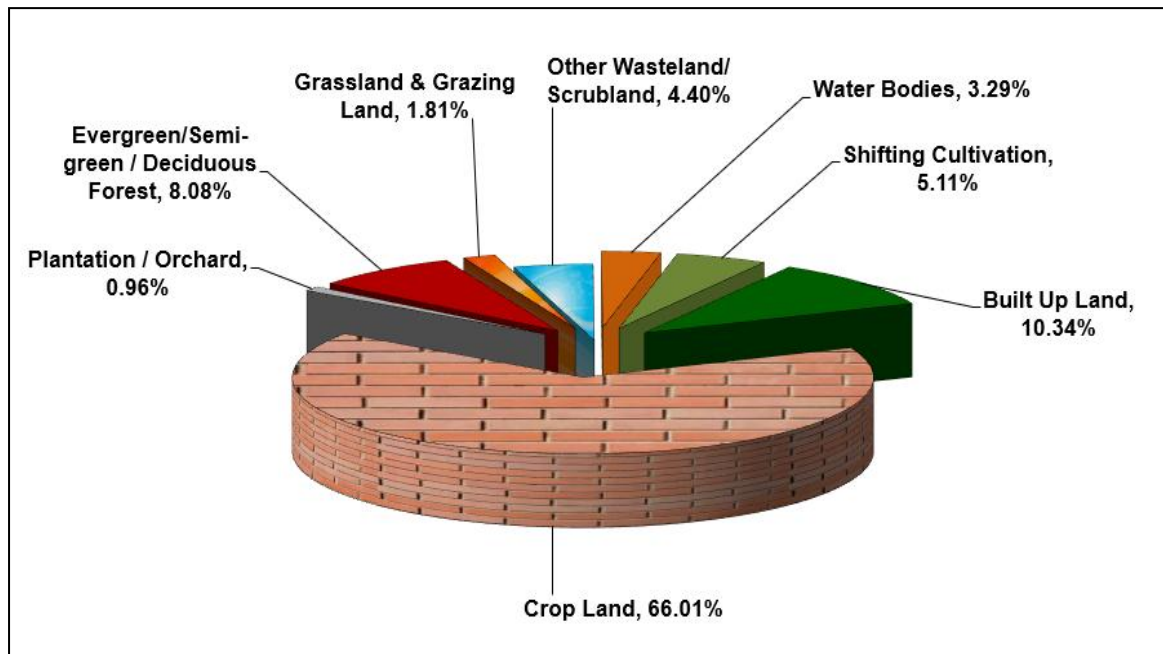


Figure-3.7.1
Pie Diagram of Land Use Land Cover (LULC) in the study area

3.7.7 LAND USE PATTERN

The data base on land use / land cover for the study area is discussed as follows:

a) Built up Land:

This is the next most dominant land use/land cover class present within the study area. About 10.34% of the total area comes under this category.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C3 - 19
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b) Crop Land:

This is the most dominant land use class present within the study area. Nearly 66% of study area is under this category. The crop land contains both single crop and double crop pattern.

c) Plantation / Orchard:

About 0.96% of the study area is occupied by this land use category.

d) Evergreen/Semi-green / Deciduous Forest Land:

About 8% of the study area falls under the Forest land category. The forest land is present in the south-west and north-west directions w.r.t. the project site.

e) Grassland & Grazing Land:

About 1.81% of the study area is occupied by this land use category.

f) Other Wasteland/ Scrubland:

About 4.4% of the study area is occupied by this land use category. This class is present in the south-west and north-west directions w.r.t the project site.

g) Waterbody:

Waterbody, which constitutes mainly Kanshabati river & ponds occupies nearly 3.29% of the total study area.

h) Shifting Cultivation:

About 5.11% of the study area is occupied by this land use category. This class is present in scattered form around the project site.

Overall Observation & Conclusion:

Crop Land is the most dominant land use pattern surrounding the 10 km radius of the project site. Built up land comes next to it. Forest Land is the next leading category. Shifting Cultivation comes next in abundance in the 10 km radius of the project site. Other Wasteland/ Scrubland comes subsequent to Shifting Cultivation. "Water Bodies" is the next leading category in the land use pattern of the study area. Presence of some other categories of land use classes such as Plantation/Orchard and Grassland & Grazing Land are also noticed within the said area of 314 sq. km.

The proposed expansion project of M/s BEL shall be installed on the available land within the existing plant premises of 190.202 ha (470

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C3 - 20
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acre). The land is industrial in nature. Hence, there will be no adverse impact on the existing land use pattern of the area.



Symbol & LU/LC Class

FIGURE 3.7.2 : LAND USE PATTERN OF THE STUDY AREA

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C3 - 21
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The samples were collected during February, 2023. A number of parameters were determined, which are indicative of physical, chemical and fertility characteristics. The physico-chemical characteristics of the soils in the study area, as obtained from the analysis of the soil samples, are presented in **Table-3.8.2**.

3.8.2 CHARACTERISTICS OF SOIL IN THE STUDY AREA

The soils of Midnapore uplands developed on Pleistocenes alluvial are generally coloured in different shades of red, brown, yellow etc. These soils are made up of one or more number of type horizons. The horizons included red loamy soils, soils dominantly made up of ferric oxide nodules, firm indurated laterite and soft plinthites. The generalized sequence in a profile is red loamy soil-nodule dominant brown soil-firm laterite-yellow and white variegated soil from top downward. The horizons have variable characteristics but all of them are low in organic matter, total nitrogen and reserve fertility. It has been found that profile with about 1 metre of red loamy soil on the top is the best rooting medium for the forest growth.

Red soil has limited distribution in the north-western part of the area. They are the red coloured sedentary soils found mainly on laterite supporting Sal vegetation. They are also found along the margins of small hills base of vegetation. They are free from calcium carbonate (CaCO_3), low in Base Exchange capacity and a highly unsaturated base.

The laterite soil has wide distribution in the central, western and southwestern parts of the area. Such soils are distinguished from the red soils by the occurrence of ferruginous concretions in a definite layer.

According to textural type, soils in the district of West Midnapore can be classified as following types – a) Sandy, b) Sandy loam, c) Loam, d) Sandy clay loam and f) clay.

Clay, clay dominated loamy soils are the most characteristics features of soil in the study area.

Locations of soil sampling with code number are shown in **Table-3.8.1** and soil characteristics of these soil samples have been summarized in **Table-3.8.2**.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C3 - 22
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**FIGURE-3.8.1
SOIL SAMPLING LOCATIONS**

**TABLE-3.8.1
CODE NO. & NAME OF LOCATIONS**

Code	Sampling Location	Sampling Season	Distance & Direction from the Project Site	Latitude	Longitude
SQ-1	Near Project Site	February, 2022	2.5 km, W	23° 7'13.30"N	88°28'43.80"E
SQ-2	Near Jirat		5.4 km, WSW	23° 5'27.14"N	88°27'37.85"E
SQ-3	Near Pachim Sambhupur		2.5 km, N	23° 8'30.31"N	88°30'22.92"E
SQ-4	Near Chakda		4.0 km, SSE	23° 5'7.37"N	88°30'55.40"E

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C3 - 23
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3.8.2.1 PHYSICAL CHARACTERISTICS

The physical properties examined include colour, texture, bulk density, porosity and water holding capacity. Colour of soils was observed generally as reddish brown. It is well documented that reddish brown soil are slightly acidic in nature with sufficient amount of nitrogen, calcium, phosphate and other plant nutrients.

Soils having larger particles usually have higher bulk density than those of smaller particles. Bulk density of soils in the study area varied between (1.18 - 1.46) gm/cm³ which is in normal range for such soils. Water Holding Capacity of these soils ranged between (35.1 – 36.8)%.

3.8.2.2 CHEMICAL CHARACTERISTICS

The soils were almost neutral pH range (6.5 - 6.8). Electrical conductivity (EC) was found varying between (495 - 566) µmhos/cm. In soil samples, calcium content of the soils varied between (411 - 467) mg/kg. Ranges of sodium in the soils varied between (191 - 237) mg/kg. In soils, sodium generally occurs as NaCl, Na₂SO₄ and sometimes, as Na₂CO₃ and other soluble salts. In comparison to sodium, potassium levels were slightly low. Range of potassium varied between (114 - 138) mg/kg. In the study area, Nitrogen level varied between (71 - 95) mg/kg. Most of the nitrogen is available in form of nitrates, nitrites, NH₄⁺ and organic nitrogen. The Phosphorous content ranged between (27.1 - 29.5) mg/kg. Cation Exchange Capacity (CEC) varied between (16.9 – 22.7) meq/100 gm. Ranges of Magnesium and Sulphur were varied between (184 - 214) mg/kg and (28.4 - 33.6) mg/kg. Organic Matter in the soils was observed to be ranging between (1.9 – 2.7)%.

TABLE-3.8.2
SOIL QUALITY IN THE STUDY AREA

Sl. No	PARAMETERS	UNIT	SAMPLING LOCATIONS			
			SQ-1	SQ-2	SQ-3	SQ-4
PHYSICAL CHARACTERESTICS						
1	TEXTURE	-	Clay Loam	Sandy Clay Loam	Sandy Clay Loam	Clay Loam
a)	Sand	%	46	48	43	44
b)	Silt	%	26	21	25	26
c)	Clay	%	28	31	32	30
2	BULK DENSITY	gm/cm ³	1.38	1.46	1.18	1.27
3	POROSITY	%	35.3	34.5	38.5	37.4
4	WATER HOLDING	%	35.1	36.2	36.8	35.8

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C3 - 24
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	CAPACITY					
CHEMICAL CHARACTERISTICS						
1	pH (1:5 extraction)	-	6.7	6.5	6.8	6.6
2	EC (1:5 extraction)	µmhos/cm	530	566	495	525
3	Calcium (as Ca)	mg/kg	435	467	414	411
4	Magnessium (as Mg)	mg/kg	214	206	191	184
5	Sodium (as Na)	mg/kg	216	237	202	191
6	Potassium (as K)	mg/kg	138	132	114	120
7	Sulphur (as S)	mg/kg	30.5	33.6	28.4	31.1
8	Nitrogen (as N)	mg/kg	84	95	80	71
9	Phosphorous (as P)	mg/kg	27.5	29.5	27.3	27.1
10	CEC	meq/100 gm	19	16.9	17.9	22.7
11	Organic Matter	%	2.2	2.7	1.9	2.5
12	Copper (as Cu)	mg/kg	10.7	12.1	10.1	11.7
13	Chromium (as Cr)	mg/kg	13.1	16	12.8	11.5
14	Zinc (as Zn)	mg/kg	17.1	16.8	14.8	15.7
15	Lead (as Pb)	mg/kg	5.4	6.6	6.1	5.1
16	SAR	-	2.1	2.3	2.1	2.0

3.8.3 OBSERVATION & CONCLUSION

Observation on soil characteristics:

- 1) The pH of the soil was found to be slightly acidic, which will favour the growth of biota.
- 2) Texture was found to be clayey loam with good water holding capacity
- 3) Plant nutrient like phosphorus, nitrogen, potassium and organic matter were found to be moderate level as per ICAR Handbook.
- 4) Trace metals and non metals also were found to be sufficient for Plant growth.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C3 - 25
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3.9 METEOROLOGY

3.9.1 SEASONS

The climate of the project area is humid and tropical. It is characterised by a hot and dry summer from March to May, a south-west monsoon or rainy season from June to September, a pleasant post-monsoon or retreating monsoon from October to November and a cool winter from December to February. Therefore, climatologically, four seasons viz. summer (pre-monsoon), monsoon, post-monsoon and winter could be deciphered comprising the following months:

Summer	:	March, April, May
Monsoon	:	June, July, August, and September
Post-monsoon	:	October, November
Winter	:	December, January, and February

3.9.2 PAST RECORDS OF IMD, BAGHATI, HOOGHLY

3.9.2.1 Data Collected

The meteorological data described in this section have been collected from the IMD Station located at Baghati, which is around 8 km from the project site and deemed to be representative of the study area. Available meteorological data for the past 30 years' period (1971-2000) have been collected and have been summarized. The climatic features of this station are presented in **Tables 3.9.1**.

3.9.2.2 Temperature

At Baghati, (Hooghly), the overall mean dry bulb temperature for the past 30 years' period (1971 – 2000) was recorded 25.1°C in night time and 28.2°C in day time while the overall mean wet bulb temperature for the past 30 years' period (1971 – 2000) was recorded 22.8°C in night time and 24.4°C in day time (**Table-3.9.1**).

3.9.2.3 Relative Humidity

Humidity was fairly high through the major part of the year at Bagati, (Hooghly). In day time the overall mean relative humidity was 81% while in night time it was 72% (**Table-3.9.1**). The mean relative humidity of Monsoon and Post monsoon seasons was ranging between 79% - 87% in day time and 69% - 84% in night time. The mean relative humidity of summer seasons was ranging between 75% - 80% day time and 63% - 70% in the night time and winter seasons was ranging between 75% - 79% in day time and 60% - 62% in night time. From these 30 years' IMD

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C3 - 26
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data it was found that the relative humidity was fairly very high in Monsoon season (June, July, August, and September).

3.9.2.4 Rainfall and Rainy Days

The total annual mean rainfall received is about 1546.5 mm at Bagati,(Hooghly) (**Table-3.9.1**). Rainfall was peaked during the month of July (mean monthly rainfall in July was 329.7 mm). The lowest rainfall was occurred during the month of December (mean monthly rainfall in January was 10.5 mm). Total annual mean number of rainy days was about 75.4 at Bagati,(Hooghly).

3.9.2.5 Cloud Cover

The mean monthly data revealed that the cloud cover in day time ranged between 0.6 Oktas (at month of December) to 5.9 Oktas (at month of August) and in night time it ranged between 0.4 Oktas (at month of December) to 5.2 Oktas (at month of August). The overall annual mean cloud cover was found 3.0 Oktas in day and 2.3 Oktas night time (**Table-3.9.1**).

3.9.2.6 Wind Speed and Direction

The annual mean wind speed is around 2.2 km/hr at Bagati,(Hooghly). with the mean monthly wind speed was ranged between 1.4 km/hr (during December) and 4.1 km/hr (during May) at Bagati,(Hooghly). (**Table-3.9.1**). The predominant wind direction was observed South-West, followed by North and South.

3.9.3 ON-SITE METEOROLOGICAL OBSERVATORY

Air Pollutants upon discharge to atmosphere pass through a number of mechanisms, which include diffusion and transportation leading to dispersion. These mechanisms are governed by the local atmospheric conditions. All these results in the necessity to collect the meteorological parameters like ambient temperature, wind speed, wind direction, and other weather conditions (relative humidity, atmospheric pressure etc.), which will be ultimately used for the prediction of the ground level concentrations of the air pollutants through mathematical modelling.

For this purpose as also to corroborate and supplement the long term meteorological data availed from IMD, Bagati,(Hooghly). a sophisticated on-site meteorological observatory was established close to the project site and operated continuously for three months period (**January, 2023 – March, 2023**).

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C3 - 27
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The observatory was located about 10 m above the ground level and ensured to be free from any obstruction to wind. Besides, this location was found to be most suitable one being close to the project site. The summary of the on-site data generated in respect of the above parameters for the period mentioned above are presented in **Table-3.9.2**. The Wind rose diagram for the entire period is shown in **Figure-3.9.1** to **Figure-3.9.4**.

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3.9.4 ON-SITE METEOROLOGICAL DATA

3.9.3.1 TEMPERATURE

The monthly maximum and minimum temperatures recorded on-site during the aforesaid Study period (**January, 2023 – March, 2023**) varied between (27.5 - 38.0)°C and (9.5 - 17.0)°C respectively with overall maximum and minimum temperatures being 38.0°C and 9.5°C respectively (**Table-3.9.1**). It could be observed that, the pattern of data recorded on-site generally matches with the past data of IMD data.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C3 - 28
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3.9.3.2 RELATIVE HUMIDITY

The monthly maximum and minimum relative humidity recorded on-site during the said Study period varied between (72 - 74)% and (46 - 59)% respectively, the overall maximum and minimum being 74.0% and 46.0% respectively (**Table-3.9.1**).

3.9.3.3 ATMOSPHERIC PRESSURE

The overall maximum and minimum atmospheric pressures recorded on-site during the said monitoring period were 757.3 mmHg and 753.4 mmHg respectively (**Table-3.9.1**).

3.9.3.4 WIND SPEED & DIRECTION

The maximum wind speed 5.1 Km/hr was recorded in the month of March, 2023 while the overall mean wind speed during the whole monitoring period was 3.9 Km/hr. (**Table-3.9.1**). The predominant wind direction was observed as North & North-East.

Mean Monthly Summary of Climatological Data Collected from IMD, Bagati,(Hooghly) (1971-2000)

BACK

जलवायवी सारणी
CLIMATOLOGICAL TABLE

स्थान : खाम्नी
STATION : Bagauli

अक्षांश
LAT. 22° 59'

देशांतर
LONG. 88° 22'

समुद्री सतह यात्रा से ऊँचाई
HEIGHT ABOVE M.S.L.

मीटर
METRES

प्राप्तियों पर अवलोकन
BASED ON OBSERVATIONS 1971-2000

मास	स्टेशन का मास संख्या	आर्द्र तापमान										अधुना	दिनांक की गणना		वर्षिक औसत	जहाँ की विशेषताएँ	बारिश						मासिक वर्षा मिमी
		रात					दिन						विशेष और	विशेष और			जनरल बारिश	जनरल बारिश	24 घण्टे की अधिकतम बारिश	विशेष और			
		सबसे कम	गर्म	औसत न्यूनतम	औसत न्यूनतम	सबसे उच्चतम	सबसे उच्चतम	उच्चतम	निम्नतम														
		AIR TEMPERATURE																					
MONTH	STATION LEVEL PRESSURE	MEAN						EXTREMES				HUMIDITY		CLOUD AMOUNTS		TOTAL IN VET TEST MONTH WITH YEAR						MEAN WIND SPEED K.M.P.H. or M.P.H.	
		DRY BULB	WET BULB	DAILY MAX	DAILY MIN	HIGHEST IN THE MONTH	LOWEST IN THE MONTH	HIGHEST	DATE AND YEAR	LOWEST	DATE AND YEAR	RELATIVE HUMIDITY	VAPOUR PRESSURE	ALL CLOUDS	LOW CLOUDS	MONTHLY TOTAL	NO. OF RAINY DAYS	TOTAL IN DREST MONTH WITH YEAR	HEAVIEST FALL IN 24 HOURS	DATE AND YEAR			
		समुद्री hPa	°C	°C	°C	°C	°C	°C		°C		%	समुद्री hPa	अक्षरों के अक्षरों के Class of sky		mm		mm	mm				
जनवरी JAN	I II	1014.9	16.8 21.6	14.7 16.9	25.1 12.3	29.2	8.6	33.3 1973	30 1983	4.8	17 1983	79 60	15.2 15.6	0.7 0.5	0.4 0.3	12.2	1.0	89.0 1998	0.0	31.0 1992	16		
फरवरी FEB	I II	1012.8	20.0 25.0	17.3 19.8	28.8 15.3	32.8	10.9	36.3 1974	25 1974	5.5	11 1974	75 60	17.8 19.1	1.3 0.7	0.7 0.5	38.9	1.9	128.5 1972	0.0	60.1 1977	24		
मार्च MAR	I II	1009.5	24.9 29.8	21.9 24.5	33.3 20.0	37.3	15.0	39.8 1975	6 1979	11.0	11 1979	75 63	24.0 26.7	1.4 0.7	0.8 0.5	34.3	1.8	142.1 1981	0.0	125.0 1981	26		
अप्रैल APR	I II	1005.5	28.0 32.0	25.2 27.1	36.2 23.5	39.6	18.8	44.5 1974	22 1968	15.1	1 1968	79 67	29.8 31.8	2.3 1.5	1.4 1.0	64.5	3.5	260.1 1981	0.0	90.0 1981	19		
मई MAY	I II	1002.6	29.4 32.2	26.7 27.8	36.3 24.7	40.0	20.3	45.5 1974	9 1973	14.5	2 1973	80 70	32.8 33.6	3.5 2.3	2.1 1.7	148.2	7.4	347.2 2000	11.0 1979	90.0 1994	20		
जून JUN	I II	998.5	29.3 31.1	27.1 27.9	34.6 25.4	38.9	21.9	46.2 1974	3 1974	14.2	24 1971	83 78	34.0 34.8	5.1 3.9	3.1 2.9	263.6	11.1	657.2 1977	66.3 1981	171.0 1988	27		
जुलाई JUL	I II	997.9	28.6 29.7	26.9 27.6	32.9 25.5	35.7	23.2	42.3 1975	4 1971	12.8	4 1971	87 84	34.0 35.0	5.8 5.0	3.6 3.7	329.7	15.6	563.9 1974	80.2 1982	235.3 1968	9		
अगस्त AUG	I II	999.2	28.6 29.8	26.9 27.6	32.6 25.6	34.9	23.3	37.3 1973	20 1984	20.8	1 1984	87 84	34.1 35.1	5.9 5.2	3.7 3.8	295.9	16.0	635.6 1971	132.9 1977	174.2 1971	30		
सितंबर SEP	I II	1003.6	28.4 29.7	26.7 27.3	32.7 25.3	35.2	22.5	37.9 1965	15 1971	16.7	30 1971	86 83	33.4 34.4	5.0 4.4	3.2 3.3	229.1	10.6	774.6 1978	40.0 1994	280.2 1978	28		
अक्टूबर OCT	I II	1008.9	27.1 29.1	25.0 26.2	32.6 23.3	34.7	19.5	38.4 1973	30 1971	16.6	1 1971	83 78	29.9 31.7	2.9 2.4	1.8 1.8	95.2	5.0	341.8 1970	0.0	106.4 1970	23		
नवंबर NOV	I II	1012.4	22.9 26.5	20.4 22.6	30.5 18.2	33.1	13.9	38.5 1976	6 1982	10.0	30 1982	79 69	22.2 24.4	1.3 0.8	0.7 0.6	24.5	0.9	139.8 1998	0.0	109.0 1986	9		
दिसंबर DEC	I II	1015.1	17.9 22.6	15.7 18.1	27.3 12.9	30.1	9.8	36.5 1984	30 1968	6.4	30 1968	78 62	16.2 17.2	0.6 0.4	0.3 0.2	10.5	0.5	102.6 1977	0.0	80.6 1977	29		
सर्वाधिक औसत या सबसे कम वार्षिक औसत	I II	1006.8	25.1 28.2	22.8 24.4	32.0 21.0	40.7	8.3	46.2 6	3 1974	4.8 1	17 1983	81 72	26.9 28.2	3.0 2.3	1.8 1.7	1546.5	75.4	2082.9 1970	592.1 1982	280.2 9	28 1978		
सर्वाधिक वर्षा का मास	I II	27	30	30	30	30	30	32	32	32	30	30	30	30	28	28	30	30	30	30	30		

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C3 - 30
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जलवायवी सारणी
CLIMATOLOGICAL TABLE

स्टेशन : बालगढ़
STATION : Balagarh

		मौसम परिघटना						पवन														मेघ										दृश्यता						
		के सभ दिनो की संख्या						सबन की गती के सभ दिनो की संख्या (दि. की म. र.)				सबन की दिशा के दिनो की संख्या का प्रतिशत										मेघ सभ (गुनी मेघ) सभ दिनो की संख्या - अल्पमैत्र					दिन सभ मेघ सभ सभ दिनो की संख्या - अल्पमैत्र					दृश्यता सभ दिनो की संख्या						
मंथ	दि. मंथ	अल्पमै	मैत्र	सहमै	सुसमै	अल्पमै	अल्पमै	20-40	41-60	61-80	81-100	अल्पमै	अल्पमै	अल्पमै	अल्पमै	अल्पमै	अल्पमै	अल्पमै	अल्पमै	अल्पमै	अल्पमै	अल्पमै	अल्पमै	अल्पमै	अल्पमै	अल्पमै	अल्पमै	अल्पमै	अल्पमै	अल्पमै	अल्पमै	अल्पमै	अल्पमै	अल्पमै	अल्पमै	अल्पमै		
		WEATHER PHENOMENA						WIND						CLOUD										VISIBILITY														
		No. OF DAYS WITH						No. OF DAYS WITH WIND SPEED (K.M. P.H.)						PERCENTAGE No. OF DAYS WIND FROM										No. OF DAYS WITH CLOUD AMOUNT (ALL CLOUDS) O.K.T.A.S					No. OF DAYS WITH LOW CLOUD AMOUNT O.K.T.A.S					No. OF DAYS WITH VISIBILITY				
MONTH	दि. मंथ	HA	TH	DU	FO	CU	SC	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100	0-10	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100	
असरी JAN	I II	1.2 0.0	0.0 0.0	0.1 0.0	0.1 0.0	0.0 0.0	0.0 0.0	0 0	0 0	24 25	7 6	54 61	6 3	1 0	1 0	2 4	4 5	6 1	4 7	22 19	26 28	1 1	2 1	2 1	0 0	27 28	1 1	3 2	0 0	0 0	0 0	0 0	0.4 0.0	3.1 4.1	8.1 6.4	16.1 11.8	3.4 8.7	
फरवरी FEB	I II	2.5 0.0	0.0 0.0	0.7 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0 0	0 0	23 24	5 4	40 45	11 3	1 1	2 2	4 12	14 11	7 4	3 7	18 15	23 24	0 0	2 2	3 2	0 0	22 24	1 1	5 3	0 0	0 0	0 0	0.1 0.0	3.5 2.2	8.8 5.7	11.5 12.7	4.2 7.4		
मार्च MAR	I II	2.2 0.0	0.0 0.0	1.1 0.1	0.1 0.0	0.0 0.0	0.0 0.0	0 0	0 0	28 28	3 3	13 10	3 2	2 0	1 5	13 45	42 21	12 2	2 4	12 11	25 27	0 1	3 2	3 1	0 0	24 27	1 1	6 3	0 0	0 0	0 0	0.0 0.0	3.0 1.6	10.5 6.1	12.1 10.6	5.4 12.7		
अप्रैल APR	I II	3.9 0.0	0.0 0.0	2.3 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0 0	0 0	28 29	2 1	4 2	3 2	2 1	5 6	19 61	54 22	5 1	1 4	7 1	17 21	1 1	6 4	6 3	0 1	19 22	1 1	10 7	0 0	0 0	0 0	0.0 0.1	3.9 1.8	11.7 6.4	8.1 10.6	6.3 11.2		
मई MAY	I II	7.9 0.1	0.1 0.0	4.1 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0 0	0 0	29 30	2 1	1 1	7 1	5 2	11 11	21 60	43 21	5 1	0 1	7 2	12 17	0 1	10 7	8 4	1 2	12 18	2 1	16 11	1 1	0 0	0 0	0.0 0.0	6.3 2.0	11.5 7.9	7.9 10.1	5.3 11.0		
जून JUN	I II	12.8 0.0	0.0 0.0	2.6 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0 0	0 0	27 29	3 1	1 1	8 2	7 3	17 14	20 62	33 12	5 1	0 4	9 9	5 9	0 1	8 10	14 7	3 3	6 10	1 1	21 17	2 2	0 0	0 0	0.0 0.0	9.1 4.8	9.8 7.7	7.1 10.3	4.1 7.2		
जुलाई JUL	I II	17.9 0.0	0.0 0.0	1.8 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0 0	0 0	28 29	3 2	0 1	9 2	9 5	15 17	23 56	27 11	7 1	0 0	10 7	2 4	0 0	9 12	17 11	3 4	3 4	1 1	25 23	2 3	0 0	0 0	0.0 0.0	9.2 6.5	11.3 8.3	6.9 11.0	3.6 5.1		
अगस्त AUG	I II	18.0 0.0	0.0 0.0	1.6 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0 0	0 0	27 28	4 3	2 0	12 1	15 9	15 19	23 54	17 7	5 1	13 0	8 8	2 3	0 1	8 12	18 11	3 4	2 3	1 1	25 24	3 3	0 0	0 0	0.0 0.0	9.3 7.6	11.3 8.9	6.7 8.1	3.7 6.4		
सितम्बर SEP	I II	13.1 0.0	0.0 0.0	1.4 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0 0	0 0	26 26	4 4	5 2	9 3	9 4	17 17	18 50	22 11	7 1	1 0	12 12	5 6	0 0	9 13	13 8	3 3	5 6	2 1	21 21	2 2	0 0	0 0	0.0 0.0	6.9 5.3	10.8 6.9	8.1 9.9	4.2 7.9		
अक्टूबर OCT	I II	6.3 0.0	0.0 0.0	1.1 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0 0	0 0	27 27	4 4	31 20	9 3	4 1	7 7	7 31	16 15	9 2	3 6	14 15	15 17	1 1	7 7	7 5	1 1	16 17	1 1	13 12	1 1	0 0	0 0	0.0 0.0	3.5 4.1	9.1 6.0	13.3 12.6	5.1 8.4		
नवम्बर NOV	I II	0.8 0.0	0.0 0.0	0.0 0.1	0.0 0.0	0.0 0.0	0.0 0.0	0 0	0 0	27 24	3 6	63 53	7 5	2 0	0 2	1 6	6 6	5 1	4 6	12 21	24 25	0 0	3 3	3 2	0 0	24 26	1 0	5 4	0 0	0 0	0 0	0.1 0.0	1.9 3.7	6.8 5.1	15.0 12.5	6.2 8.7		
दिसम्बर DEC	I II	0.7 0.0	0.0 0.0	0.0 0.5	0.0 0.0	0.0 0.0	0.0 0.0	0 0	0 0	27 27	4 4	70 72	3 2	1 0	1 0	2 3	4 3	5 1	13 13	28 28	0 0	2 2	1 1	0 0	28 29	1 0	2 2	0 0	0 0	0 0	0.0 0.0	3.0 4.0	6.5 5.4	16.4 11.9	5.1 9.7			
सर्वोच्च औसत या मासिक ANNUAL TOTAL OR MEAN	I II	87.3 0.1	16.8 0.8	0.8 0.0	0.0 0.0	0.0 0.0	0.0 0.0	0 0	0 0	321 326	44 39	23 22	7 2	5 2	8 8	13 39	23 12	7 1	2 3	12 11	182 210	5 5	69 73	93 57	16 20	191 216	12 9	150 127	12 13	0 0	0 0	0.5 0.1	62.6 47.6	112.9 80.3	132.5 134.4	56.5 102.7		
सर्वोच्च सं. NUMBER OF YEARS	I II	30						30						30										30										30				

TABLE-3.9.1
ON-SITE METEOROLOGICAL DATA
(JANUARY, 2023 – March, 2023)

Month	Temperature (°C)		Relative Humidity (%)		Barometric Pressure (mm Hg)		Average Velocity (Km/hr)
	Max.	Min.	08:30 hrs.	17:30 hrs.	08:30 hrs.	17:30 hrs.	
JANUARY, 2023	27.5	9.5	73	52	761.3	756.5	3.2
FEBRUARY, 2023	31.5	11.5	72	46	759.1	754.9	3.4
MARCH, 2023	38.0	17.0	74	59	757.3	753.4	5.1
OVERALL	38.0	9.5	74	46	757.3	753.4	3.9

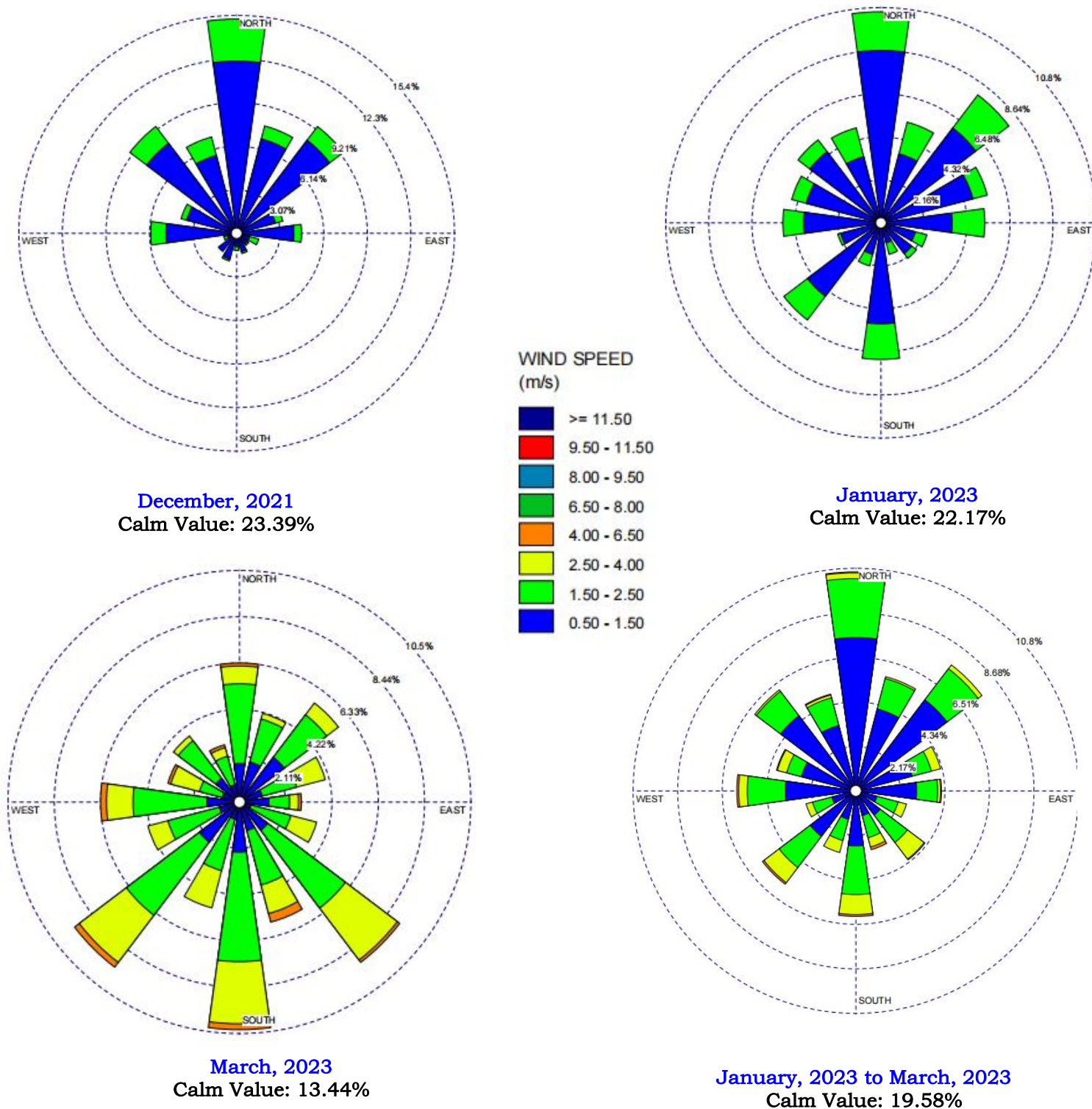


FIGURE-3.9.1
WIND ROSE DIAGRAM FOR THE PERIOD OF
JANUARY, 2023 TO MARCH, 2023

3.10 AIR QUALITY

3.10.1 SELECTION OF MONITORING STATIONS

The sources of air pollution in the region are industrial emissions, vehicular traffic, dust arising from unpaved village roads and domestic fuel burning. The prime objective of the baseline air quality study was to establish the existing ambient air quality of the area. This will be useful for assessing the conformity to standards of the ambient air quality during the operation of the proposed expansion project.

The monitoring locations for establishing the baseline status of ambient air quality has been identified on the basis of the following considerations:

1. Meteorological conditions
2. Topography of the study area
3. Category of the area like habitat, forest etc.
4. Representative of likely affected area

Further, due considerations were also given to the likely affected zones during construction and operation of the plant. The location of human habitation and other sensitive areas within the study area were also considered in selection of ambient air quality monitoring locations.

Eight (8) numbers of monitoring stations were set up to assess the existing air quality of the study area. The locations of the monitoring stations were based on the frequent wind directions in order to site the stations as close as feasible to the anticipated maximum pollutant deposition areas, moreover, duly considering human habitation and proximity to sensitive zones within the study area. Logistic considerations as ready accessibility, security, availability of reliable power supply etc. were examined while finalizing the monitoring locations.

The Ambient Air Quality Monitoring locations have been presented in **Figure-3.10.1**. The relative direction, distance, latitude and longitude of these locations with respect to the project site have been tabulated in **Table-3.10.1**.

3.10.2 PARAMETERS & FREQUENCY OF MONITORING

Ambient Air Quality Monitoring has been conducted for the period **(January, 2023 – March, 2023)** at a frequency of twice a week at each station adopting a continuous 24 hours schedule in respect of the following parameters:

- Particulate Matter-10 (PM₁₀)
- Particulate Matter-2.5 (PM_{2.5})
- Sulphur Dioxide (SO₂)
- Nitrogen Dioxide (NO₂)

Carbon Monoxide (CO) monitoring has been conducted for the same period at a frequency of twice a week at each station adopting a continuous 8 hours schedule.

Description of Monitoring Stations

- 1) **Near Project Site (Gournagar) (AQ1):** The monitoring station (Latitude - 23° 6'56.93"N & Longitude - 88°29'32.65"E) is located close to the project site. This station is located in the village area and the data collected represents the background air quality of the project site area.
- 2) **West Sambhupur Netaji Vidyaniketan (H.S.) (AQ2):** West Sambhupur Netaji Vidyaniketan (H.S.) is a village. The monitoring station (Latitude - 23° 8'37.35"N & Longitude - 88°30'2.14"E) is located at a distance of around 2.8 km in N direction from the project site. This location represents the most pre-dominant upwind direction. Air quality monitoring instruments were placed on the roof top of a building in this village. There are agricultural lands all around this village. There is human population around this monitoring station and electricity is available in this location.
- 3) **Kayet Para (AQ3):** Kayet Para is a Village and residential area. The monitoring station (Latitude - 23° 8'57.60"N & Longitude - 88°32'1.80"E) is located at a distance of 4.6 km in NE direction w.r.t. the project site. This location represents the 2nd most pre-dominant downwind direction. The station is located in settlement area. There are agriculture lands all around this area. Air quality monitoring instruments were placed on the rooftop of a village building. All necessary infrastructures like accessible road, electricity etc. are available in the vicinity.

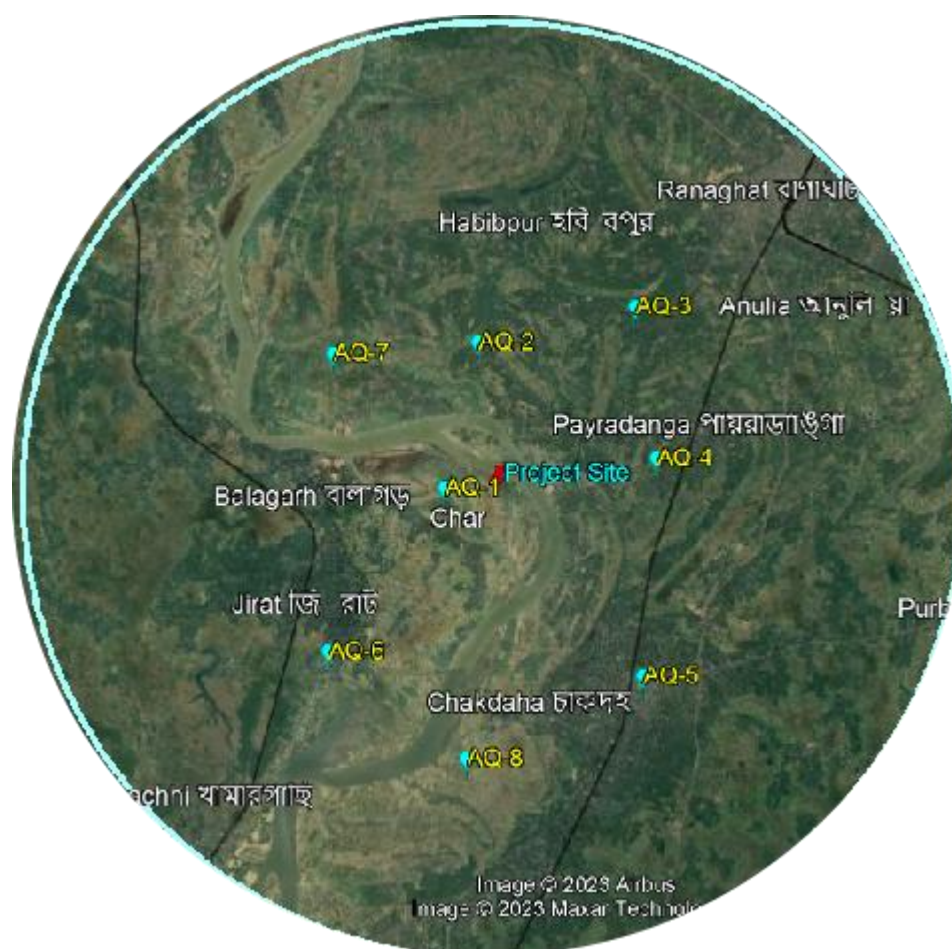
- 4) **Payradanga (AQ4):** Payradanga is a residential area, located at a distance of 3.5 km in E direction w.r.t. the project site. The monitoring station (Latitude - 23° 7'11.76"N & Longitude - 88°32'13.27"E) is located in the settlement area. This village is surrounded by agricultural and Residential area. Air quality monitoring instruments were placed on the rooftop of a residential building. Electricity & all other infrastructure facilities are available in the village.
- 5) **Chakda Narendra Pally (AQ5):** The monitoring station (Latitude - 23° 4'40.75"N & Longitude - 88°31'56.35"E) in the village is located at a distance of around 5.4 km in SE direction w.r.t. the project site. This location represents the agricultural and Residential area. Air quality monitoring instruments were placed on the rooftop of a village building and the monitoring station is surrounded by the human settlement. Electricity & all other infrastructures are available in this village.
- 6) **Chakda Narendra Pally (AQ6):** Chakda Narendra Pally is a small settlement area. The monitoring station (Latitude - 23° 4'40.75"N & Longitude - 88°31'56.35"E) in this settlement area is located at a distance of 5.4 km in SE direction w.r.t. the project site. This location represents the most pre-dominant down-wind direction. This village is surrounded by some small-scale industries, agricultural and Settlement area. Air quality monitoring instruments were placed on the rooftop of a building in the settlement area. All types of infrastructure are available in this area.
- 7) **Uttar Gopalpur Jirat (AQ7):** Uttar Gopalpur Jiratis a small village. The monitoring station (Latitude -23° 5'6.60"N & Longitude - 88°27'59.93"E) is located at a distance of 5.2 km in SW direction w.r.t. the project site. This location represents the 2nd most pre-dominant downwind direction. Surrounded by agricultural and settlement area. Air quality monitoring instruments were placed on the rooftop of a village building. Electricity & all other infrastructures are available in this area.
- 8) **Balagarghat Habibpur (AQ8):** Balagarghat Habibpur is a large size village, located at a distance of 4.3 km in NW direction w.r.t. the project site. The monitoring station (Latitude - 23° 8'33.54"N & Longitude - 88°28'12.55"E) was set up on the rooftop of a building in this village. This village is surrounded by agricultural and

settlement area. Air quality monitoring instruments were placed on the rooftop of a village building. Electricity is available in this village.

TABLE - 3.10.1
AMBIENT AIR QUALITY MONITORING LOCATIONS

Sl. No.	Location Code	Location	Aerial Distance w.r.t. Project site (km)	Direction w.r.t. Project site	Criteria for Selection
1	AQ1	Near Project Site (Gournagar)	1.1	WSW	Representation of the Project Site.
2	AQ2	West Sambhupur Netaji Vidyaniketan (H.S.)	2.8	N	Located in the settlement area and Pre-dominant up-wind direction
3	AQ3	Kayet Para	4.6	NE	Located in the settlement area and representing the 2 nd predominant up-wind direction.
4	AQ4	Payradanga	3.5	E	Located in the Settlement and agriculture & Industrial area
5	AQ5	Chakda Narendra Pally	5.4	SE	Location in the Settlement and agriculture & Industrial area
6	AQ6	Uttar Gopalpur Jirat	5.2	SW	Located in the settlement area represents the most pre-dominant down-wind direction
7	AQ7	Balagarghat Habibpur	4.3	NW	Located in the settlement area represents the 2 nd most pre-dominant up-wind direction
8	AQ8	Sanyalchar	6.2	S	Located in the village and Settlement area

Location Code	Location	Co-ordinates	
		Latitude	Longitude
AQ1	Near Project Site (Gournagar)	23° 6'56.93"N	88°29'32.65"E
AQ2	West Sambhupur Netaji Vidyaniketan	23° 8'37.35"N	88°30'2.14"E
AQ3	Kayet Para	23° 8'57.60"N	88°32'1.80"E
AQ4	Payradanga	23° 7'11.76"N	88°32'13.27"E
AQ5	Chakda Narendra Pally	23° 4'40.75"N	88°31'56.35"E
AQ6	Uttar Gopalpur Jirat	23° 5'6.60"N	88°27'59.93"E
AQ7	Balagarghat Habibpur	23° 8'33.54"N	88°28'12.55"E
AQ8	Sanyalchar	23° 3'48.14"N	88°29'40.96"E



Location Code	Location Name	Distance	Direction
AQ1	Near Project Site (Gournagar)	1.1 Km	WSW
AQ2	West Sambhupur Netaji Vidyaniketan (H.S.)	2.8 Km	N
AQ3	Kayet Para	4.6 Km	NE
AQ4	Payradanga	3.5 Km	E
AQ5	Chakda Narendra Pally	5.4 Km	SE
AQ6	Uttar Gopalpur Jirat	5.2 Km	SW
AQ7	Balagarghat Habibpur	4.3 Km	NW
AQ8	Sanyalchar	6.2 Km	S

FIGURE-3.10.1
AMBIENT AIR QUALITY MONITORING STATIONS

TABLE-3.10.2
STATISTICAL ANALYSIS RESULTS OF AIR POLLUTANTS
(Period: January, 2023 - March, 2023)

POLLUTANTS	LOCATIONS	MES	MIN	MAX	A.M.	P - 98
PM10 ($\mu\text{g}/\text{m}^3$)	Near Project Site (Gournagar)	26	47	63	54.1	62.5
	West Sambhupur Netaji Vidyaniketan	26	50	68	58.9	67.0
	Kayet Para	26	55	72	63.8	71.5
	Payradanga	26	52	70	60.5	70.0
	Chakda Narendra Pally	26	63	80	68.4	80.0
	Uttar Gopalpur Jirat	26	57	76	64.2	75.0
	Balagarghat Habibpur	26	45	63	53.8	62.5
	Sanyalchar	26	48	67	57.3	66.5
	Overall	208	45	80	60.1	-
PM2.5 ($\mu\text{g}/\text{m}^3$)	Near Project Site (Gournagar)	26	17	28	22.6	28.1
	West Sambhupur Netaji Vidyaniketan	26	18	30	24.4	29.8
	Kayet Para	26	23	35	29.2	34.3
	Payradanga	26	21	32	27.8	31.5
	Chakda Narendra Pally	26	25	38	30.5	37.6
	Uttar Gopalpur Jirat	26	20	35	27.8	34.9
	Balagarghat Habibpur	26	15	27	21.6	27.2
	Sanyalchar	26	19	31	24.6	30.6
	Overall	208	15	38	26.1	-
SO₂ ($\mu\text{g}/\text{m}^3$)	Near Project Site (Gournagar)	26	4	9	6.6	9.0
	West Sambhupur Netaji Vidyaniketan	26	5	10	7.4	10.0
	Kayet Para	26	6	13	8.7	12.5
	Payradanga	26	5	12	8.1	12.0
	Chakda Narendra Pally	26	8	17	11.5	16.0
	Uttar Gopalpur Jirat	26	7	14	9.0	14.0
	Balagarghat Habibpur	26	4	8	6.0	8.0
	Sanyalchar	26	5	11	6.8	10.5
	Overall	208	4	17	8.0	-
NO_x ($\mu\text{g}/\text{m}^3$)	Near Project Site (Gournagar)	26	12	23	15.9	22.0
	West Sambhupur Netaji Vidyaniketan	26	14	28	20.5	27.0
	Kayet Para	26	15	32	21.1	32.0
	Payradanga	26	13	25	18.6	24.5
	Chakda Narendra Pally	26	17	37	26.3	36.0
	Uttar Gopalpur Jirat	26	16	33	22.7	32.5
	Balagarghat Habibpur	26	10	21	16.5	21.0
	Sanyalchar	26	12	25	17.5	25.0
	Overall	208	10	37	19.9	-

TABLE-3.10.2 (Contd...)
STATISTICAL ANALYSIS RESULTS OF AIR POLLUTANTS
(Period: January, 2023 - March, 2023)

POLLUTANTS	LOCATIONS	MES	MIN	MAX	A.M.	P -98
CO (mg/m ³)	Near Project Site (Gournagar)	78	0.099	0.609	0.329	0.578
	West Sambhupur Netaji Vidyaniketan (H.S.)	78	0.101	0.585	0.329	0.547
	Kayet Para	78	0.179	0.695	0.376	0.640
	Payradanga	78	0.143	0.606	0.365	0.593
	Chakda Narendra Pally	78	0.149	1.102	0.575	1.053
	Uttar Gopalpur Jirat	78	0.182	0.789	0.386	0.746
	Balagarchat Habibpur	78	0.095	0.512	0.297	0.495
	Sanyalchar	78	0.108	0.678	0.356	0.674
	Overall	624	0.095	1.102	0.377	-
N.B.: MES - No. of measurements, MIN - Minimum, MAX - Maximum, A.M. - Arithmetic Mean, P-98 - 98 Percentile.						

3.10.3 RESULTS & DISCUSSIONS

Statistical analysis (minimum, maximum, arithmetic mean) of the ambient air quality in the study area for the entire three months monitoring period are shown in **Table-3.10.2**.

The following implications can be made on the basis of the obtained results:

3.10.3.1 Particulate Matter-10 (PM₁₀)

Arithmetic Mean of the 24-hourly average values of PM₁₀ varied station-wise between 80.0 µg/m³ (at Chakda Narendra Pally) to 45 µg/m³ (at Balagarchat Habibpur) with overall mean of all 8 stations being 60.1 µg/m³.

Arithmetic Mean of the 24-hourly average values of PM₁₀ at all locations is under the limit of (100 µg/m³) National Ambient Air Quality Standards, 2009.

3.10.3.2 Particulate Matter - 2.5 (PM_{2.5})

Arithmetic Mean of the 24-hourly average values of PM_{2.5} varied station-wise between 38 µg/m³ (at Chakda Narendra Pally) to 15.0

$\mu\text{g}/\text{m}^3$ (at Balagarghat Habibpur) with overall mean of all 8 stations being $26.1 \mu\text{g}/\text{m}^3$.

Arithmetic Mean of the 24-hourly average values of $\text{PM}_{2.5}$ at all locations is under the limit of ($60 \mu\text{g}/\text{m}^3$) National Ambient Air Quality Standards, 2009.

3.10.3.3 Sulphur Dioxide (SO_2)

Arithmetic mean of 24-hourly average values of SO_2 varied station wise between $4.0 \mu\text{g}/\text{m}^3$ ((at Near Project Site (Gournagar) and at Balagarghat Habibpur)) to $17 \mu\text{g}/\text{m}^3$ (Near Chakda Narendra Pally) with overall mean of all 8 stations being $8.0 \mu\text{g}/\text{m}^3$.

Arithmetic Mean of the 24-hourly average values of SO_2 at all locations is under the limit of ($80 \mu\text{g}/\text{m}^3$) National Ambient Air Quality Standards, 2009.

3.10.3.4 Nitrogen Dioxide (NO_2)

The overall arithmetic mean of 24-hourly average values of NO_2 over the entire study area was $19.9 \mu\text{g}/\text{m}^3$ while individual arithmetic mean levels computed at 8 stations ranged between $10.0 \mu\text{g}/\text{m}^3$ (at Balagarghat Habibpur) to $37 \mu\text{g}/\text{m}^3$ (Near Chakda Narendra Pally).

Arithmetic Mean of the 24-hourly average values of NO_2 at all locations is under the limit of ($80 \mu\text{g}/\text{m}^3$) National Ambient Air Quality Standards, 2009.

3.10.3.5 Carbon Monoxide (CO)

The overall arithmetic mean of 8-hourly average values of CO over the entire study area was $0.377 \text{ mg}/\text{m}^3$ while individual arithmetic mean levels computed at 8 stations ranged between $0.297 \text{ mg}/\text{m}^3$ (at Balagarghat Habibpur) to $0.386 \text{ mg}/\text{m}^3$ (at Uttar Gopalpur Jirat).

Arithmetic Mean of the 24-hourly average values of CO at all locations is under the limit of ($2 \text{ mg}/\text{m}^3$) National Ambient Air Quality Standards, 2009.

The graphical analyses of the concentrations of all pollutants have been shown in **Figure-3.10.2** to **Figure-3.10.6**.

National Ambient Air Quality Standards

S. No.	Pollutant	Time Weighted Average	Concentration in Ambient Air		
			Industrial, Residential, Rural and Other Area	Ecologically Sensitive Area (notified by Central Government)	Methods of Measurement
(1)	(2)	(3)	(4)	(5)	(6)
1	Sulphur Dioxide (SO ₂), µg/m ³	Annual* 24 hours**	50 80	20 80	- Improved West and Gaeke - Ultraviolet fluorescence
2	Nitrogen Dioxide (NO ₂), µg/m ³	Annual* 24 hours**	40 80	30 80	- Modified Jacob & Hochheiser (Na-Arsenite) - Chemiluminescence
3	Particulate Matter (size less than 10µm) or PM ₁₀ µg/m ³	Annual* 24 hours**	60 100	60 100	- Gravimetric - TOEM - Beta attenuation
4	Particulate Matter (size less than 2.5µm) or PM _{2.5} µg/m ³	Annual* 24 hours**	40 60	40 60	- Gravimetric - TOEM - Beta attenuation
5	Ozone (O ₃) µg/m ³	8 hours** 1 hour**	100 180	100 180	- UV photometric - Chemiluminescence - Chemical Method
6	Lead (Pb) µg/m ³	Annual* 24 hours**	0.50 1.0	0.50 1.0	- AAS /ICP method after sampling on EPM 2000 or equivalent filter paper - ED-XRF using Teflon filter
7	Carbon Monoxide (CO) mg/m ³	8 hours** 1 hour**	02 04	02 04	- Non Dispersive Infra Red (NDIR) spectroscopy
8	Ammonia (NH ₃) µg/m ³	Annual* 24 hours**	100 400	100 400	- Chemiluminescence - Indophenol blue method

(1)	(2)	(3)	(4)	(5)	(6)
9	Benzene (C ₆ H ₆) µg/m ³	Annual*	05	05	- Gas chromatography based continuous analyzer - Adsorption and Desorption followed by GC analysis
10	Benzo(a)Pyrene (BaP) - particulate phase only, ng/m ³	Annual*	01	01	- Solvent extraction followed by HPLC/GC analysis
11	Arsenic (As), ng/m ³	Annual*	06	06	- AAS /ICP method after sampling on EPM 2000 or equivalent filter paper
12	Nickel (Ni), ng/m ³	Annual*	20	20	- AAS /ICP method after sampling on EPM 2000 or equivalent filter paper

* Annual arithmetic mean of minimum 104 measurements in a year at a particular site taken twice a week 24 hourly at uniform intervals.

** 24 hourly or 08 hourly or 01 hourly monitored values, as applicable, shall be complied with 98% of the time in a year. 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.

Note. — Whenever and wherever monitoring results on two consecutive days of monitoring exceed the limits specified above for the respective category, it shall be considered adequate reason to institute regular or continuous monitoring and further investigation.

SANT PRASAD GAUTAM, Chairman
[ADVT-III/4/184/09/Exty.]

Note: The notifications on National Ambient Air Quality Standards were published by the Central Pollution Control Board in the Gazette of India, Extraordinary vide notification No(s). S.O. 384(E), dated 11th April, 1994 and S.O. 935(E), dated 14th October, 1998.

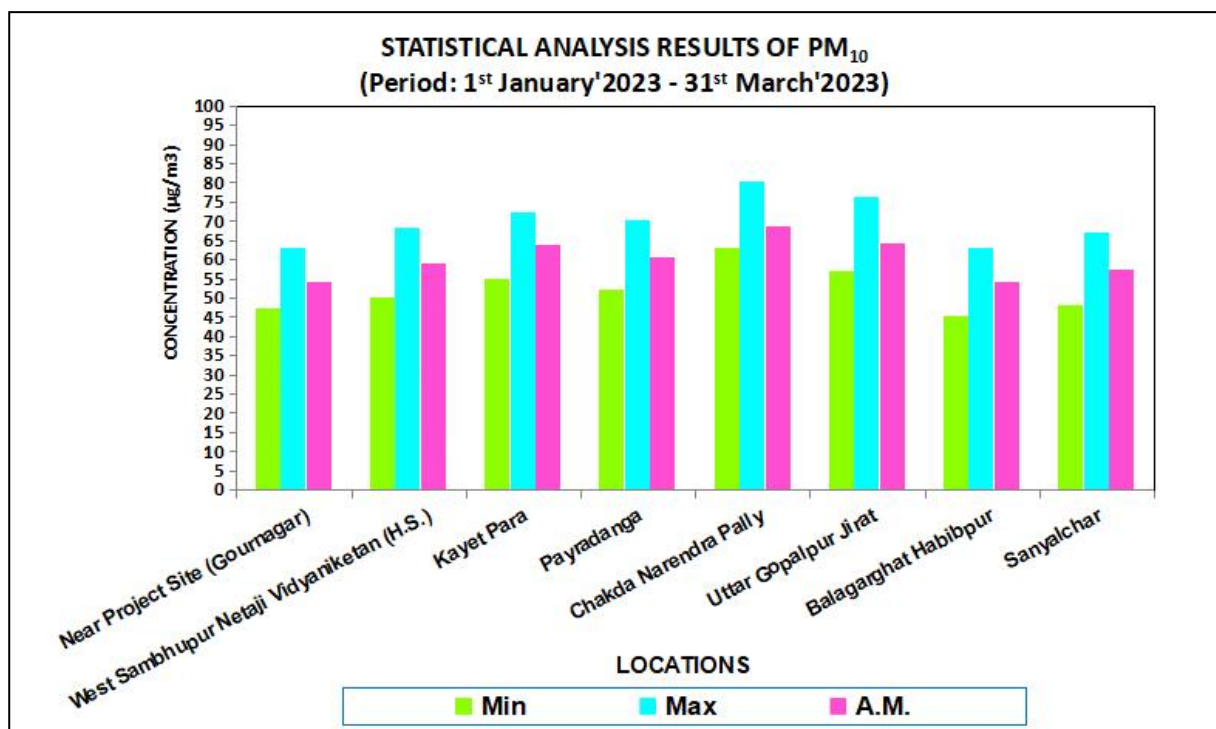


FIGURE-3.10.2: DIAGRAM OF PM₁₀ OF ALL AAQM STATIONS

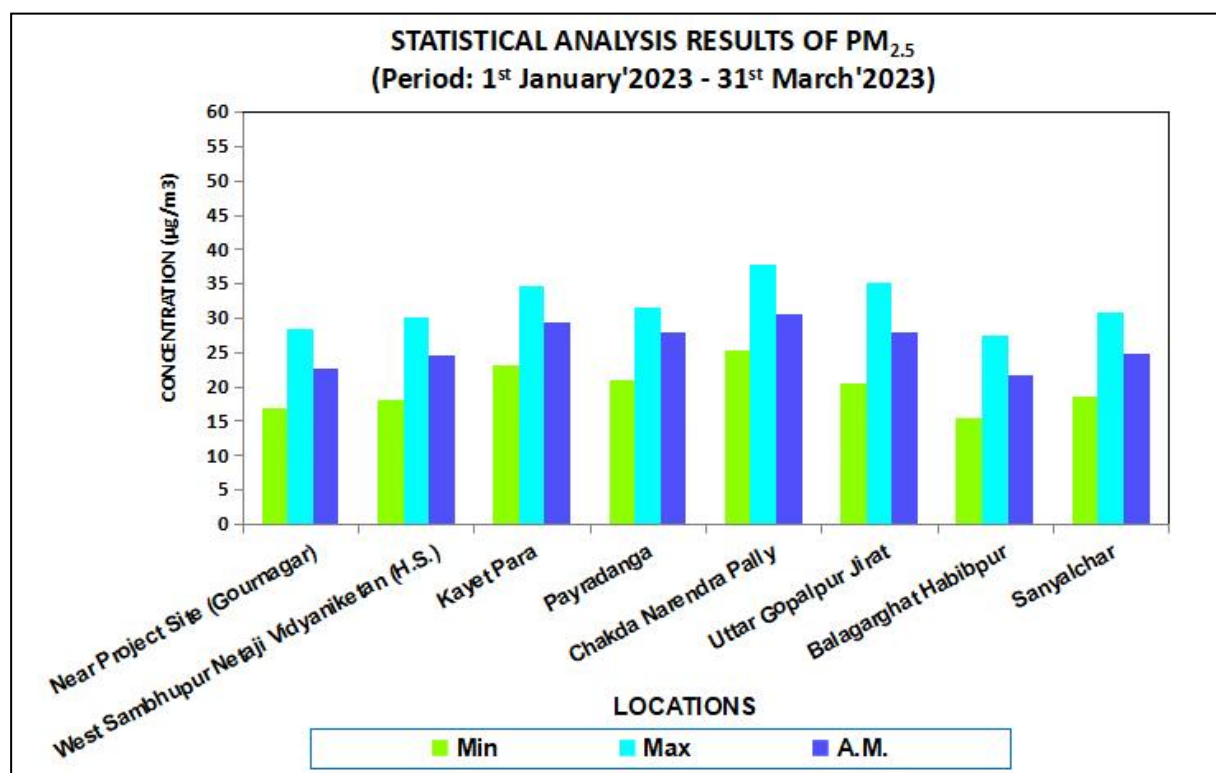


FIGURE-3.10.3: DIAGRAM OF PM_{2.5} OF ALL AAQM STATIONS

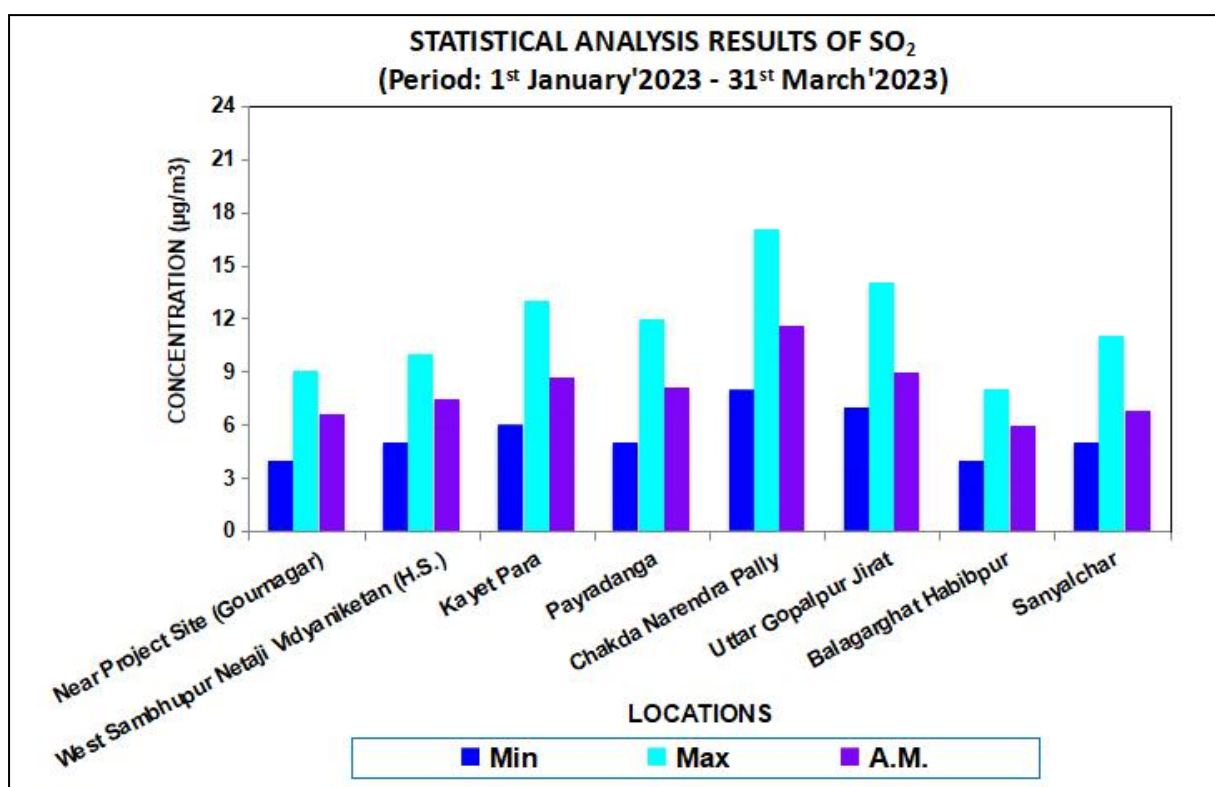


FIGURE-3.10.4: DIAGRAM OF SO₂ OF ALL AAQM STATIONS

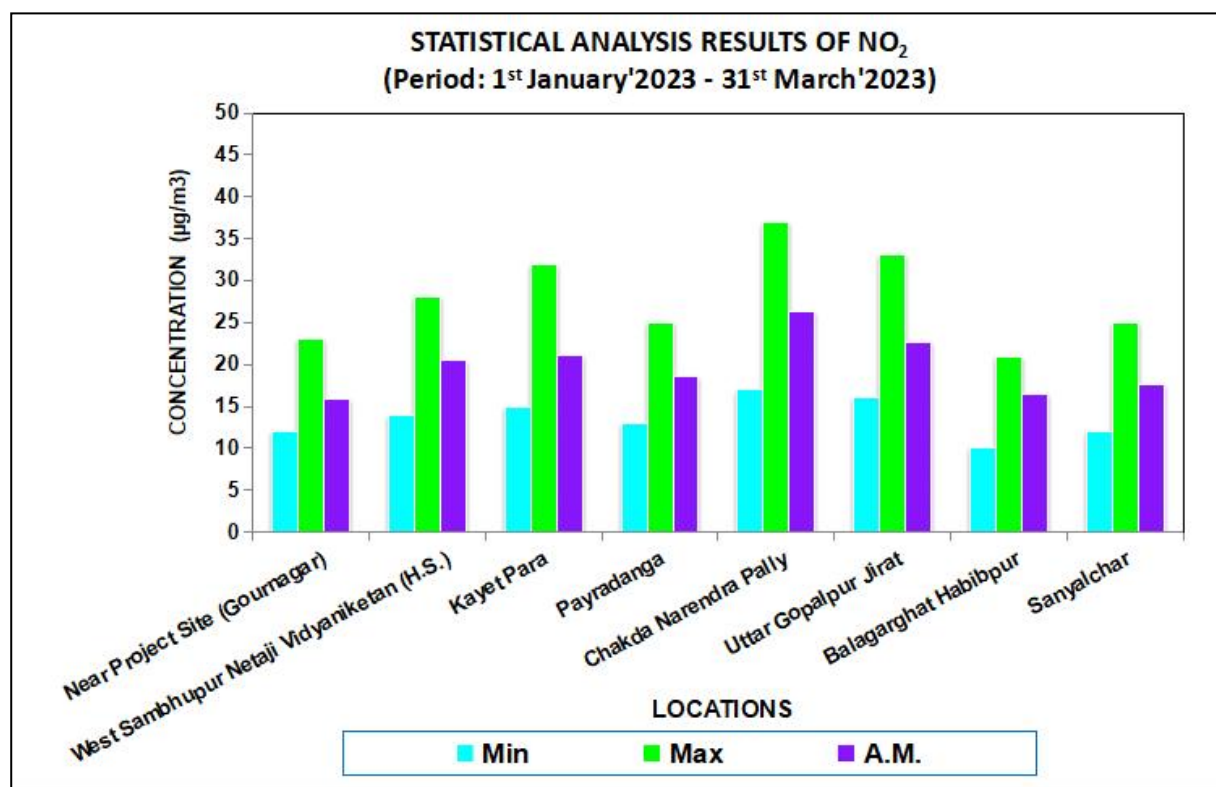


FIGURE-3.10.5: DIAGRAM OF NO₂ OF ALL AAQM STATIONS

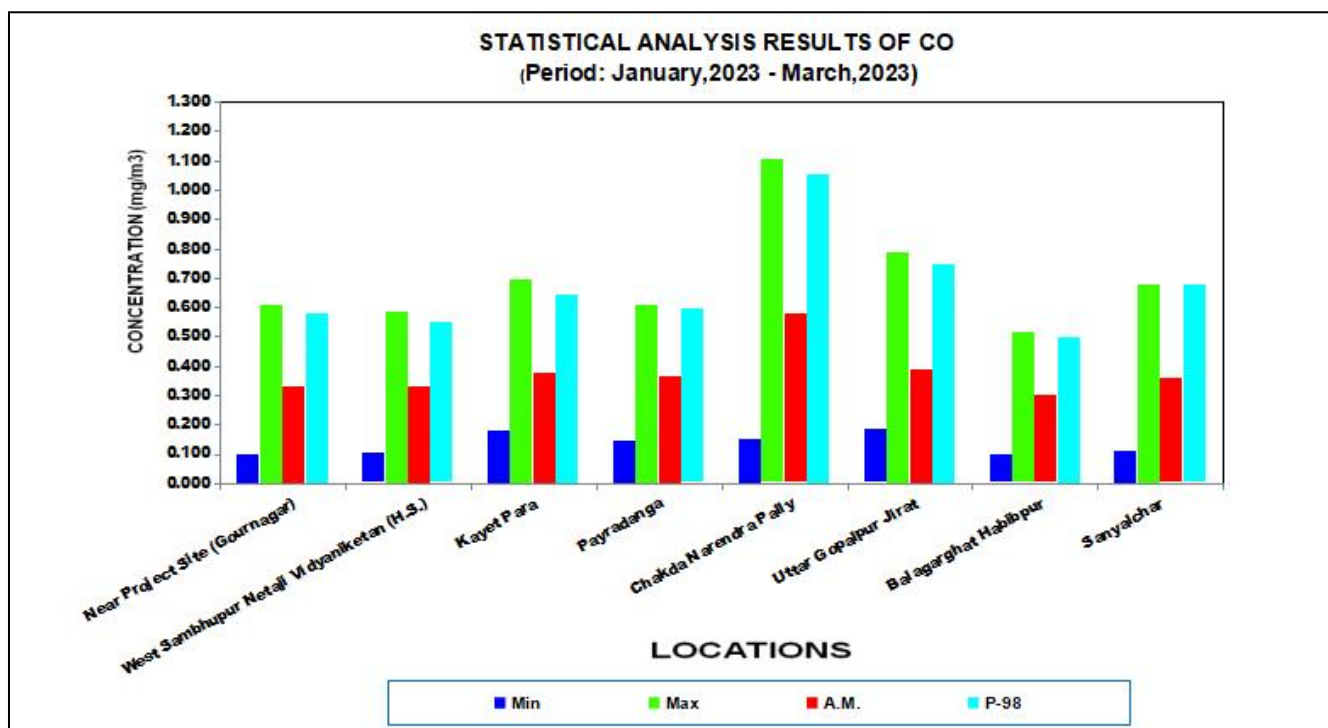


FIGURE-3.10.6: DIAGRAM OF CO OF ALL AAQM STATIONS

3.10.4 Conclusion

The above table reveals that the ambient air quality monitoring stations near (AQ1), (AQ2), (AQ3), (AQ4) and (AQ5) are likely to be affected by pollution arising due to industries and transportation of materials during the operational phase of the project.

The values of all the ambient air parameters i.e., PM_{10} , $PM_{2.5}$, SO_2 , NO_2 and CO at the respective 8 monitoring locations are within the stipulated limits on all the occasions as per NAAQ Standard. The maximum value of PM_{10} was observed at Chakda Narendra Pally ($80.0 \mu g/m^3$), which is considerably on higher side, but is still within the standard. This may be attributed to the wind blown dust due to the unpaved roads and the vehicular emissions in the area.

3.11 WATER ENVIRONMENT

3.11.1 WATER BODIES IN THE STUDY AREA

The main surface water body in the study area is the river Hooghly. This river is mainly perennial in nature, which means it has sufficient water to flow all around the year. Besides, a number of confined water bodies, viz. Tanks, Ponds, Jheels, road side burrows etc. which form a part of surface hydrological system, exist within the study area. Ground water sources are mainly bore wells, tube wells and dug wells which are scattered in the whole study area.

3.11.2 WATER SAMPLING

As surface water, water samples were collected and analyzed from total ten (10) locations, including two (2) different locations from the Hooghly River water, one from Churni River and seven (7) from different ponds of different locations, Ground water samples were collected and analyzed from total nine (9) different locations from tube wells /bore wells to assess the baseline status of the whole water quality in the study area.

Out of two water samples of Hooghly River, one was collected at Gour Nagar ghat) and the other Balagarh ghat.

All the samples were analyzed with respect to physical, chemical and biological parameters including toxic organics and metals, adopting Standard methods. The locations of the sampling points for both surface and ground water are tabulated in **Table-3.11.1**. Surface water and Ground water sampling locations have been presented in **Figure-3.11.1** and **Figure-3.11.2** respectively.

3.11.3 SURFACE WATER QUALITY

All the samples were analyzed with respect to physical, chemical and biological parameters including toxic organics and metals, adopting Standard methods. Sampling and analysis of surface water were carried out following the analysis techniques and methodology described in relevant Indian Standards and as per 23rd edition of "Standard Methods for the Examination of Water and Waste Water" published by American Public Health Association (APHA), 2017. Analysis results of all surface water samples were compared with CPCB Water Quality Criteria for Surface Water.

3.11.3.1 RESULTS OF SURFACE WATER QUALITY MONITORING:

Results of Water Quality from the River Water:

The water quality monitoring results of river water samples (SW1, SW-2 & SW-10) have been compiled in Table-3.11.3.

The pH values of the collected two water samples (SW1, SW2 and SW10) from the river water were found pH 7.25 - 7.34. Value of Dissolved Oxygen were observed (7.1- 7.3) mg/lit. Total Dissolved Solids were found (157 - 198) mg/lit while value of total Hardness (as CaCO₃) & total Alkalinity (as CaCO₃) were found (103 - 124) mg/lit & (99 - 116) mg/lit respectively. Calcium (as Ca) & Magnesium (as Mg) were found (25 - 30) mg/lit and (10 - 21) mg/lit respectively. Oil and grease was below detection limit (<1.4 mg/lit) in these sample. Sulphate (as SO₄), Nitrate (as NO₃) and Chloride (as Cl) were observed (12 - 23) mg/lit, (1.2 - 2.8) mg/lit and (27 - 32) mg/lit respectively. Iron (as Fe) contents were found (0.11 - 0.14) mg/lit and BOD were found (2 - 3) mg/lit respectively.

Heavy metals like Copper (as Cu), Lead (as Pb), Cadmium (as Cd), Chromium (as Cr), Manganese (as Mn), Arsenic (as As) and Mercury (as Hg) in these Canal water sample (SW1 & SW2) were below their respective detection limits.

Results of Pond Water Quality:

The water quality monitoring results of ten (10) pond water samples (SW3 to SW9) have been compiled in Table-3.13.2.

The pH values of the collected pond water samples were found in the range of (7.16 – 7.47). Dissolved Oxygen was observed in the ranges of (6.1 – 6.8) mg/lit. Total Dissolved Solids were found in the ranges of (250 – 389) mg/lit while total Hardness (as CaCO₃) & total Alkalinity (as CaCO₃) were found (132 - 153) mg/lit & (127 - 160) mg/lit respectively. Calcium (as Ca) & Magnesium (as Mg) were found varying in the ranges of (31 – 47) mg/lit and (9 – 14) mg/lit respectively. Oil and grease was below detection limit (<1.4 mg/lit) in these samples. Sulphate (as SO₄), Nitrate (as NO₃) and Chloride (as Cl) were observed varying in the ranges of (21 – 59) mg/lit, (2.2 – 5.5) mg/lit and (51 – 91) mg/lit respectively. Values of Iron (as Fe) were found in the ranges of (0.13 – 0.21) mg/lit.

Heavy metals like Copper (as Cu), Lead (as Pb), Cadmium (as Cd), Chromium (as Cr), Manganese (as Mn), Arsenic (as As) and Mercury (as Hg) of these pond water samples (**SW3** to **SW12**) were below their respective detection limits.

3.11.4 GROUND WATER QUALITY

Ground Water samples (from bore-well and Tube well) were collected from 9 locations (GW1 to GW9). Locations of ground water sampling have been shown in **Table-3.11.1**. The ground water quality monitoring results have been presented in **Table-3.11.2**.

Sampling and analysis of ground water were carried out following the analysis techniques and methodology described in relevant Indian Standards. The ground water quality monitoring results have been tabulated in **Table-3.11.2**.

3.11.4.1 RESULTS OF GROUND WATER QUALITY MONITORING:

The pH values of collected ground water samples were found in the range of (6.85 – 7.34) with an average of 7.09. Total Dissolved Solids (TDS) was found in the range of (295 – 467) mg/lit with an average of 381 mg/l, while Total Hardness (as CaCO₃) was found in the ranges of (167 – 237) mg/lit with an average of 202 mg/l. Alkalinity (as CaCO₃) was found in the ranges of (162 – 228) mg/lit with an average of 195 mg/l. Calcium (as Ca) and Magnesium (as Mg) were found varying in the ranges of (48 – 71) mg/lit and (7 – 16) mg/lit respectively. Sulphate (as SO₄), Nitrate (as NO₃) and Chloride (as Cl) were observed in the ranges of (15 – 57) mg/lit, (2.8 – 4.5) mg/lit and (59 – 119) mg/lit respectively. Iron (as Fe) content was found in the range of (0.22 – 0.72) mg/lit with an average of 0.32 mg/l and Zinc (as Zn) content was found (0.06 – 0.18) mg/lit.

Other heavy metals like Copper (as Cu), Lead (as Pb), Cadmium (as Cd), Chromium (as Cr), Manganese (as Mn), Arsenic (as As) and Mercury (as Hg) were below their respective detection limits.

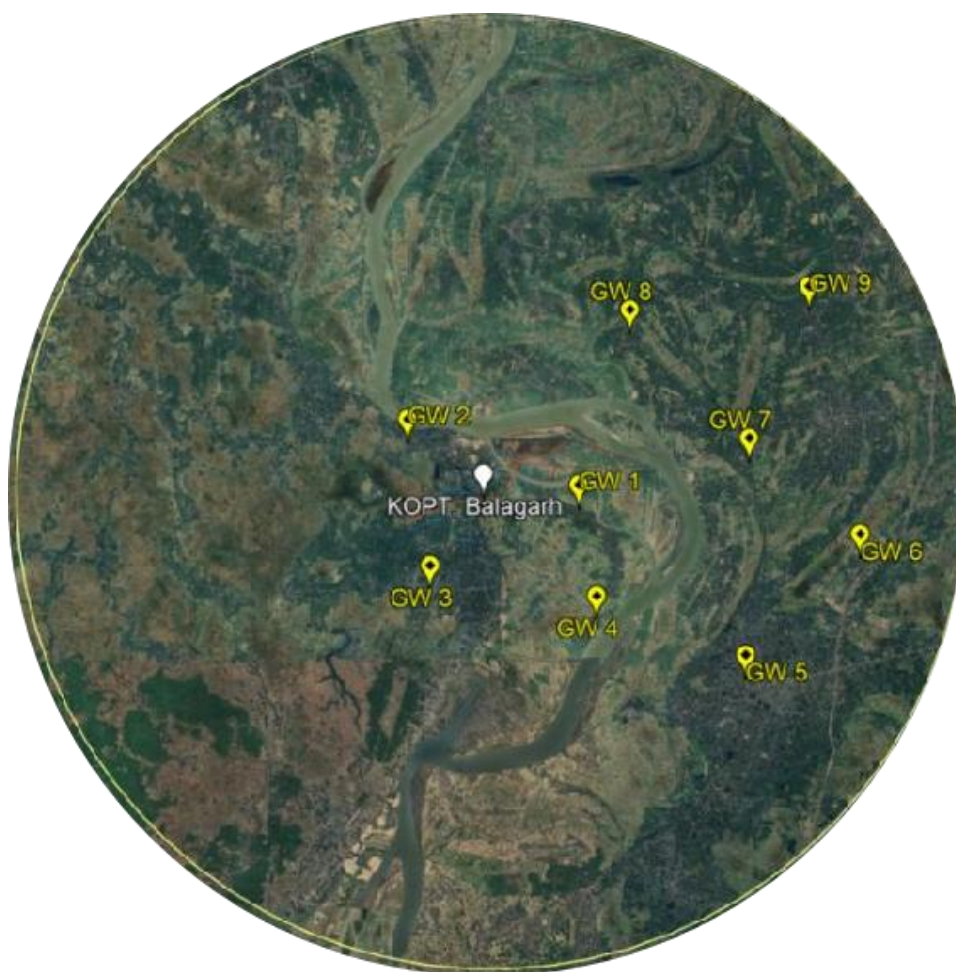
TABLE-3.11.1

WATER QUALITY MONITORING LOCATIONS IN THE STUDY AREA

Sample Code	Locations	Latitude	Longitude
SURFACE WATER:			
SW1	Near Project Site (Gournagar)	23° 6'21.61"N	88°30'48.04"E
SW2	West Sambhupur Netaji Vidyaniketan (H.S.)	23° 7'26.61"N	88°29'46.72"E
SW3	Kayet Para	23° 7'13.98"N	88°27'56.88"E
SW4	Payradanga	23° 6'20.63"N	88°27'35.71"E
SW5	Chakda Narendra Pally	23° 6'12.27"N	88°28'42.88"E
SW6	Uttar Gopalpur Jirat	23° 5'4.12"N	88°27'47.17"E
SW7	Balagarghat Habibpur	23° 4'49.19"N	88°31'39.85"E
SW8	Sanyalchar	23° 5'45.94"N	88°31'3.87"E
SW9	Near Project Site (Gournagar)	23° 7'23.18"N	88°31'34.92"E
SW10	West Sambhupur Netaji Vidyaniketan (H.S.)	23° 9'22.74"N	88°31'6.60"E
GROUND WATER:			
GW1	Near Project Site (Tube well)	23° 6'44.82"N	88°29'28.84"E
GW2	Chandra (Tube well)	23° 7'30.45"N	88°27'21.89"E
GW3	Jirat (Tube well)	23° 5'50.38"N	88°27'37.75"E
GW4	Babupara (Tube well)	23° 5'28.82"N	88°29'41.50"E
GW5	Chakda Narendra Pally (Tube well)	23° 4'47.88"N	88°31'32.06"E
GW6	Chandrapur (Tube well)	23° 6'9.70"N	88°32'58.06"E
GW7	Jagapur (Tube well)	23° 7'15.82"N	88°31'35.88"E
GW8	Pachim Sambhupur (Tube well)	23° 8'44.03"N	88°30'7.83"E
GW9	Kayet Pur (Tube well)	23° 8'59.13"N	88°32'21.39"E



Sample Code	Location	Direction & Distance from centre of project site (km)		Date of Sampling
SW1	Keliaghai River (Khelar)	1.7	SE	13.02.2023
SW2	Keliaghai River (Kulboni)	0.95	NW	13.02.2023
SW3	Pond Water (Near Project Site, Shyamalpur)	3.8	W	13.02.2023
SW4	Pond Water (Benapur)	4.6	WSW	13.02.2023
SW5	Pond Water (Near Project Site, Chakturia)	3.0	WSW	13.02.2023
SW6	Pond Water (Chakmakrampur)	5.5	SW	13.02.2023
SW7	Pond Water (Lakichak)	4.9	SE	13.02.2023
SW8	Pond Water (Khuntya Simulya)	3.0	SE	13.02.2023
SW9	Pond Water (Bhadrikali)	2.5	ENE	13.02.2023
SW10	Pond Water (Makrampur)	4.5	NNE	13.02.2023
SW11	Pond Water (Sitli)	1.7	SE	13.02.2023
SW12	Pond Water (Banpatna)	0.95	NW	13.02.2023



Sample Code	Location	Direction & Distance from centre of project site (km)		Date of Sampling
GW1	Near Project Site (Tube well)	1.4	WSW	14.02.2023
GW2	Chandra (Tube well)	4.9	W	14.02.2023
GW3	Jirat (Tube well)	5.0	WSW	14.02.2023
GW4	Babupara (Tube well)	3.1	SSW	14.02.2023
GW5	Chakda Narendra Pally (Tube well)	4.9	SSE	14.02.2023
GW6	Chandrapur (Tube well)	5.1	ESE	14.02.2023
GW7	Jagapur (Tube well)	2.4	E	14.02.2023
GW8	Pachim Sambhupur (Tube well)	3.0	N	14.02.2023
GW9	Kayet Pur (Tube well)	5.1	NE	14.02.2023

FIGURE-3.11.2
GROUND WATER SAMPLING LOCATIONS

TABLE-3.11.2
GROUND WATER QUALITY

Sl.NO	Parameter	Unit	Concentrations (Code : GW_1 to GW_5)				
			GW_1	GW_2	GW_3	GW_4	GW_5
1	Colour	Hazen	<5	<5	<5	<5	<5
2	Odour		Unobj.	Unobj.	Unobj.	Unobj.	Unobj.
3	Taste		Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
4	Turbidity	NTU	<1	<1	<1	<1	<1
5	pH	-	7.34	6.91	6.85	7.25	6.86
6	Conductivity	μS/cm	618	497	562	769	639
7	Free Residual Chlorine (mg/L)	mg/L	184	173	167	219	213
8	Total Dissolved Solids	mg/L	0.22	0.34	0.41	0.39	0.34
9	Phenol (as C6H5OH)	mg/L	92	64	81	84	102
10	Total Hardness (as CaCO3)	mg/L	<0.1	<0.1	<0.1	<0.1	<0.1
11	Total Alkalinity (as CaCO3)	mg/L	0.18	0.15	0.13	0.16	0.19
12	Chloride (as Cl)	mg/L	363	295	329	453	378
13	Sulphate (as SO4)	mg/L	54	48	51	66	68
14	Nitrate (as NO3)	mg/L	12	13	9	13	11
15	Fluoride (as F)	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05
16	Calcium (as Ca)	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05
17	Magnesium (as Mg)	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05
18	Ammonia (as Total NH3-N)	mg/L	19	15	25	57	16
19	Boron (as B)	mg/L	3.8	3.2	2.8	3.5	4.2
20	Chromium (as Cr)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
21	Copper (as Cu)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001
22	Manganese (as Mn)	mg/L	<0.003	<0.003	<0.003	<0.003	<0.003
23	Zinc (as Zn)	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002
24	Cadmium (as Cd)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
25	Iron (as Fe)	mg/L	0.1	0.06	0.09	0.18	0.08
26	Lead (as Pb)	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05
27	Silver (as Ag)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01
28	Nickel (as Ni)	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05
29	Arsenic (as As)	ppb	<0.02	<0.02	<0.02	<0.02	<0.02
30	Mercury (as Hg)	ppb	188	169	162	228	186
31	Total Coliforms	MPN/100	N.D.	N.D.	N.D.	N.D.	N.D.

Unobj. – Unobjectional

CODE	LOCATION NAME
GW1	Near Project Site (Tube well)
GW2	Chandra (Tube well)
GW3	Jirat (Tube well)
GW4	Babupara (Tube well)
GW5	Chakda Narendra Pally (Tube well)

TABLE-3.11.2 (Continued)

GROUND WATER QUALITY

Sl.NO	Parameter	Unit	Concentrations (Code : GW_6 to GW_9)			
			GW_6	GW_7	GW_8	GW_9
1	Colour	Hazen	<5	<5	<5	<5
2	Odour		Unobj.	Unobj.	Unobj.	Unobj.
3	Taste		Agreeable	Agreeable	Agreeable	Agreeable
4	Turbidity	NTU	<1	<1	<1	<1
5	pH	-	6.86	6.93	7.21	7.27
6	Conductivity	µS/cm	785	691	527	595
7	Free Residual Chlorine (mg/L)	mg/L	237	223	169	215
8	Total Dissolved Solids	mg/L	0.42	0.36	0.27	0.27
9	Phenol (as C6H5OH)	mg/L	119	94	59	84
10	Total Hardness (as CaCO3)	mg/L	<0.1	<0.1	<0.1	<0.1
11	Total Alkalinity (as CaCO3)	mg/L	0.21	0.18	0.15	0.19
12	Chloride (as Cl)	mg/L	467	412	313	354
13	Sulphate (as SO4)	mg/L	71	68	57	60
14	Nitrate (as NO3)	mg/L	15	13	7	16
15	Fluoride (as F)	mg/L	<0.05	<0.05	<0.05	<0.05
16	Calcium (as Ca)	mg/L	<0.05	<0.05	<0.05	<0.05
17	Magnesium (as Mg)	mg/L	<0.05	<0.05	<0.05	<0.05
18	Ammonia (as Total NH3-N)	mg/L	34	46	25	29
19	Boron (as B)	mg/L	3.4	4.5	2.8	3.2
20	Chromium (as Cr)	mg/L	<0.001	<0.001	<0.001	<0.001
21	Copper (as Cu)	mg/L	<0.001	<0.001	<0.001	<0.001
22	Manganese (as Mn)	mg/L	<0.003	<0.003	<0.003	<0.003
23	Zinc (as Zn)	mg/L	<0.002	<0.002	<0.002	<0.002
24	Cadmium (as Cd)	mg/L	<0.01	<0.01	<0.01	<0.01
25	Iron (as Fe)	mg/L	0.14	0.11	0.07	0.06
26	Lead (as Pb)	mg/L	<0.05	<0.05	<0.05	<0.05
27	Silver (as Ag)	mg/L	<0.01	<0.01	<0.01	<0.01
28	Nickel (as Ni)	mg/L	<0.05	<0.05	<0.05	<0.05
29	Arsenic (as As)	ppb	<0.02	<0.02	<0.02	<0.02
30	Mercury (as Hg)	ppb	220	192	167	182
31	Total Coliforms	MPN/100	N.D.	N.D.	N.D.	N.D.

Unobj. – Unobjectional

CODE	LOCATION NAME
GW6	Chandrapur (Tube well)
GW7	Jagapur (Tube well)
GW8	Pachim Sambhupur (Tube well)
GW9	Kayet Pur (Tube well)

TABLE-3.11.3
SURFACE WATER QUALITY

Sl.No.	Parameter	Unit	Concentrations (Code : SW_1 to SW_6)					
			SW_1	SW_2	SW_3	SW_4	SW_5	SW_6
1	Colour	Hazen Unit	<5	<5	<5	<5	<5	<5
2	Odour		Unobj.	Unobj.	Unobj.	Unobj.	Unobj.	Unobj.
3	pH		7.28	7.34	7.37	7.24	7.38	7.26
4	Conductivity	µS/cm	269	307	451	625	662	553
5	Dissolved Oxygen	mg/L	7.3	7.1	6.8	6.4	6.2	6.5
6	Chemical Oxygen Demand	mg/L	8	10	11	18	22	16
7	Biochemical Oxygen Demand (3 days at 270C)	mg/L	2	3	3	6	7	5
8	Total Coliforms	MPN/100	2100	2400	1100	1400	1500	1200
9	Total Dissolved Solids	mg/L	157	181	262	364	389	322
10	Oil & Grease	mg/L	<1.4	<1.4	<1.4	<1.4	<1.4	<1.4
11	Total Hardness (as CaCO3)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
12	Total Alkalinity (as CaCO3)	mg/L	103	111	132	146	153	138
13	Chloride (as Cl)	mg/L	27	30	56	91	85	62
14	Sulphate (as SO4)	mg/L	12	20	25	41	59	49
15	Nitrate (as NO3)	mg/L	1.2	1.5	2.2	2.8	5.5	3.8
16	Fluoride (as F)	mg/L	0.25	0.28	0.35	0.48	0.38	0.51
17	Calcium (as Ca)	mg/L	25	27	31	36	39	35
18	Magnesium (as Mg)	mg/L	10	10	13	14	14	12
19	Phenol (as C6H5OH)	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
20	Copper (as Cu)	mg/L	0.12	0.14	0.21	0.18	0.15	0.16
21	Iron (as Fe)	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
22	Manganese (as Mn)	mg/L	<0.05	<0.05	0.09	<0.05	<0.05	<0.05
23	Zinc (as Zn)	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
24	Boron (as B)	mg/L	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
25	Lead (as Pb)	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
26	Cadmium (as Cd)	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
27	Hexavalent Chromium (as Cr+6)	mg/L	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
28	Arsenic (as As)	ppb	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
29	Mercury (as Hg)	ppb	99	103	129	154	160	144
30	Ammonia (as NH3-N)	mg/L	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
31	Sodium Absorbance Ratio	-	0.6	0.8	1.5	2.7	2.6	2.2

Unobj. – Unobjectionable

CODE	LOCATION NAME
SW1	Hooghly River (at Gour nagar ghat)
SW2	Hooghly River (at Balagarh ghat)
SW3	Pond Water (at Balagarh)
SW4	Pond Water (at Netajinagar)
SW5	Pond Water (at Bhabanipur char)
SW6	Pond Water (at Uttar Gopalpur)

TABLE-3.11.3 (Continued)
SURFACE WATER QUALITY

Sl.No.	Parameter	Unit	Concentrations (Code : SW_7 to SW_10)			
			SW_7	SW_8	SW_9	SW_10
1	Colour	Hazen Unit	<5	<5	<5	<5
2	Odour		Unobj.	Unobj.	Unobj.	Unobj.
3	pH		7.13	7.27	7.48	7.27
4	Conductivity	µS/cm	477	533	612	622
5	Dissolved Oxygen	mg/L	6.5	6.7	6.4	6.5
6	Chemical Oxygen Demand	mg/L	21	16	18	20
7	Biochemical Oxygen Demand (3 days at 27°C)	mg/L	6	4	5	4
8	Total Coliforms	MPN/100	1500	1100	1400	1200
9	Total Dissolved Solids	mg/L	285	316	379	363
10	Oil & Grease	mg/L	<2	<2	<2	<2
11	Total Hardness (as CaCO ₃)	mg/L	165	149	176	165
12	Total Alkalinity (as CaCO ₃)	mg/L	134	143	172	168
13	Chloride (as Cl)	mg/L	59	73	89	79
14	Sulphate (as SO ₄)	mg/L	41	29	35	41
15	Nitrate (as NO ₃)	mg/L	6.5	3.9	5.5	3.8
16	Fluoride (as F)	mg/L	0.51	0.42	0.64	0.46
17	Calcium (as Ca)	mg/L	30	43	43	37
18	Magnesium (as Mg)	mg/L	22	10	17	18
19	Phenol (as C ₆ H ₅ OH)	mg/L	<0.001	<0.001	<0.001	<0.001
20	Copper (as Cu)	mg/L	<0.05	<0.05	<0.05	<0.05
21	Iron (as Fe)	mg/L	0.14	0.17	0.19	0.16
22	Manganese (as Mn)	mg/L	<0.05	<0.05	<0.05	<0.05
23	Zinc (as Zn)	mg/L	<0.05	<0.05	<0.05	<0.05
24	Boron (as B)	mg/L	<0.02	<0.02	<0.02	<0.02
25	Lead (as Pb)	mg/L	<0.01	<0.01	<0.01	<0.01
26	Cadmium (as Cd)	mg/L	<0.003	<0.003	<0.003	<0.003
27	Hexavalent Chromium (as Cr+6)	mg/L	<0.05	<0.05	<0.05	<0.05
28	Arsenic (as As)	ppb	<2	<2	<2	<2
29	Mercury (as Hg)	ppb	<1	<1	<1	<1
30	Ammonia (as NH ₃ -N)	mg/L	<0.05	<0.05	<0.05	<0.05
31	Sodium Absorbance Ratio	-	1.2	1.8	2	2

Unobj. – Unobjectionable

CODE	LOCATION NAME
SW7	Pond Water (Chakda Narendra Pally)
SW8	Pond Water (at Gournagar)
SW9	Pond Water (at Jagapur)
SW10	Churni River (at Nandi Ghat)

TABLE-3.11.4
SURFACE WATER QUALITY CRITERIA AS PER CPCB

Sl. No.	Parameters	Class A	Class B	Class C	Class D	Class E
1	pH	6.5–8.5	6.5–8.5	6.0–9.0	6.5–8.5	6.0–8.5
2	Dissolved Oxygen (as O ₂), mg/l, min	6	5	4	4	-
3	BOD, 5 days at 20°C, max	2	3	3	-	-
4	Total Coliform organism, MPN/100 ml, max	50	500	5000	-	-
5	Free ammonia (as N), mg/l, max	-	-	-	1.2	-
6	Electrical Conductivity, µmhos/cm, max	-	-	-	-	2250
7	Sodium Absorption Ratio, max	-	-	-	-	26
8	Boron (as B), mg/l, max	-	-	-	-	2

Class A: Drinking water source without conventional treatment but after disinfection.
Class B: Outdoor bathing (organized).
Class C: Drinking water source after conventional treatment and after disinfection.
Class D: Propagation of Wild life and Fisheries.
Class E: Irrigation, Industrial Cooling, and Controlled Waste Disposal.
Below E: Not meeting A, B, C, D & E Criteria.

Designated Best Use Water Quality Criteria

Designated-Best-Use	Class of water	Criteria
Drinking Water Source without conventional treatment but after disinfection	A	Total Coliforms Organism MPN/100ml shall be 50 or less pH between 6.5 and 8.5 Dissolved Oxygen 6mg/l or more Biochemical Oxygen Demand 5 days 20C 2mg/l or less
Outdoor bathing (Organised)	B	Total Coliforms Organism MPN/100ml shall be 500 or less pH between 6.5 and 8.5 Dissolved Oxygen 5mg/l or more Biochemical Oxygen Demand 5 days 20C 3mg/l or less
Drinking water source after conventional treatment and disinfection	C	Total Coliforms Organism MPN/100ml shall be 5000 or less pH between 6 to 9 Dissolved Oxygen 4mg/l or more Biochemical Oxygen Demand 5 days 20C 3mg/l or less
Propagation of Wild life and Fisheries	D	pH between 6.5 to 8.5 Dissolved Oxygen 4mg/l or more Free Ammonia (as N) 1.2 mg/l or less
Irrigation, Industrial Cooling, Controlled Waste disposal	E	pH between 6.0 to 8.5 Electrical Conductivity at 25C micro mhos/cm Max. 2250 Sodium absorption Ratio Max. 26 Boron Max. 2mg/l

[Source: https://cpcb.nic.in/wqm/Designated_Best_Use_Water_Quality_Criteria.pdf]

CONCLUSION FROM SURFACE WATER ANALYSIS

As per CPCB norms of classification of surface water,

- Hooghly river water quality (SW1 & SW2) and Churni River water Quality (SW10) parameters are within the standard for Class C i.e., Drinking water source after conventional treatment and after disinfection.
- The Pond water quality (SW3) parameters are within the standard for Class C except for BOD levels in case of SW4, SW5, SW6, SW7, SW8 and SW9 where the values are 6 mg/l, 7 mg/l, 5 mg/l, 4 mg/l, 6 mg/l and 4 mg/l respectively, which is more than the standard (3 mg/l). Hence, this water is suitable for "Propagation of Wildlife & Fisheries" (i.e., Class D) and "Irrigation, Industrial Cooling, and Controlled Waste Disposal" (i.e., Class E).

TABLE-3.11.5
IS 10500:2012 LIMITS

Sl. No.	Parameter	Unit	Acceptable Limit of IS:10500:2012	Permissible limit of IS:10500:2012
1	Colour	Hazen unit	5	15
2	Odour		Agreeable	Agreeable
3	Taste		Agreeable	Agreeable
4	Turbidity	NTU	1	5
5	pH	-	6.5 – 8.5	No relaxation
6	Temperature	⁰ C	-	-
7	Conductivity	μS/cm	-	-
8	Free Residual Chlorine	mg/L	0.2	1
9	Total Dissolved Solids	mg/L	500	2000
10	Phenol (as C ₆ H ₅ OH)	mg/L	0.001	No relaxation
11	Total Hardness (as CaCO ₃)	mg/L	200	600
12	Total Alkalinity (as CaCO ₃)	mg/L	200	600
13	Chloride (as Cl)	mg/L	250	1000
14	Sulphate (as SO ₄)	mg/L	200	400
15	Nitrate (as NO ₃)	mg/L	45	No relaxation
16	Fluoride (as F)	mg/L	1	1.5
17	Calcium (as Ca)	mg/L	75	200
18	Magnesium (as Mg)	mg/L	30	100
19	Ammonia (as Total NH ₃ -N)	mg/L	0.5	No relaxation
20	Boron (as B)	mg/L	0.5	2.4
21	Chromium (as Cr)	mg/L	0.05	No relaxation
22	Copper (as Cu)	mg/L	0.05	1.5
23	Manganese (as Mn)	mg/L	0.1	0.3
24	Zinc (as Zn)	mg/L	5	15
25	Cadmium (as Cd)	mg/L	0.003	No relaxation

26	Iron (as Fe)	mg/L	1	No relaxation
27	Lead (as Pb)	mg/L	0.01	No relaxation
28	Silver (as Ag)	mg/L	0.1	No relaxation
29	Nickel (as Ni)	mg/L	0.02	No relaxation
30	Arsenic (as As)	ppb	10	No relaxation
31	Mercury (as Hg)	ppb	1	No relaxation
32	Total Coliforms	MPN/ 100 ml	Shall not be detectable in any 100 ml sample	Shall not be detectable in any 100 ml sample

CONCLUSION FROM GROUND WATER SAMPLE ANALYSIS

Ground water physico-chemical properties in the study area showed that the water strata mainly from Bicarbonate buffer system has appreciable amount of alkalinity & Hardness. Calcium & Magnesium which are beneficial for human health are found satisfactory. The other parameters (i.e. Sulphate, Chloride etc.) fall within satisfactory level. While comparing with IS 10500:2012, it can be concluded that all ground water samples are within permissible limit & can be used as drinking water source.

The plant will be based on Zero Liquid Discharge (ZLD) Concept. Therefore, there will be no impact on any surface or ground water quality of the area.

3.12 NOISE

A total of Ten (10) locations within the study area have been selected for measurement of ambient noise levels. These locations have been displayed in **Table-3.12.1**.

3.12.1 MAJOR SOURCES OF NOISE IN THE STUDY AREA

The study area is of both industrial & residential in nature. Vehicular movement on the roads is a source of noise in those residential & industrial areas. This increases the ambient noise levels. There are also a number of other domestic noise sources such as television, radio, loud speakers, etc.

3.12.2 AMBIENT NOISE MONITORING

In the present study, a sound level meter has measured sound pressure levels. Since loudness of sound is important for its effects on people, the dependence of loudness on frequency must be taken into account in environmental noise assessment. This has been achieved by using A-weighting filters in the noise measuring instrument which gives a direct reading of approximate loudness. Moreover, A-weighted equivalent continuous sound pressure level (L_{eq}) values have been computed from the values of A-weighted sound pressure level (SPL) measured with the help of a noise meter.

A preliminary reconnaissance survey was undertaken to identify the major noise sources in the area. The sampling location in the area was identified considering location of industry, commercial shopping complex activities, residential areas with various traffic activity and sensitive areas like hospital, court, temple, schools etc.

At each location, readings were taken at uniform interval over a twenty-four hours period, divided into day and night shifts. For a particular location daytime L_{eq} has been computed from the SPL values measured between 6.00 A.M to 10.00 P.M and night time L_{eq} from the SPL values measured between 10.00 P.M to 6.00 A.M, such that comparison could be made with the National Ambient Noise Standards. Name of the locations with their latitude and longitude have been tabulated in **Table-3.12.1**. These locations are presented in **Figure-3.12.1**.

3.12.3 NOISE LEVELS IN THE STUDY AREA

The noise levels were monitored at 10 (Ten) locations. Monitoring was done, covering both day and night time. Noise levels in L_{eq} at the respective locations separately for Day and Night times have been presented in **Table-3.12.2**.

During the day time, the equivalent noise levels were found to vary in the range of (50.8 - 60.8) dB (A) while in the night time, the equivalent noise levels were observed to be varying in the range of (39.5 - 44.7) dB (A). The variation of noise level in day & night time is presented in **Figure-3.12.2**.

As usual, the day time noise levels were found to be higher than those, observed at night level.

TABLE-3.12.1
NOISE LEVEL MONITORING LOCATIONS

SL. NO	CODE	LOCATIONS	LATITUDE	LONGITUDE	DISTANCE FROM THE PROJECT SITE	DIRECTION FROM THE PROJECT SITE
1.	N-1	Near Project Site	23° 7'4.63"N	88°29'58.69"E	0.3 km	WSW
2.	N-2	Sripur Temple Complex	23° 7'9.90"N	88°27'50.71"E	4.0 km	W
3.	N-3	Bhabanipur Char	23° 6'19.01"N	88°28'44.91"E	2.8 km	WSW
4.	N-4	Milangarh High School	23° 6'29.10"N	88°29'45.96"E	1.4 km	SSW
5.	N-5	Jirat school	23° 5'50.83"N	88°28'7.57"E	4.2 km	WSW
6.	N-6	Babupara Village	23° 5'29.23"N	88°29'43.14"E	3.1 km	SSW
7.	N-7	Supreme Paper Mills	23° 4'29.14"N	88°30'3.42"E	4.9 km	S
8.	N-8	Gaurnagar	23° 5'43.68"N	88°31'7.64"E	3.0 km	SE
9.	N-9	Mukundanagar K.C. High School	23° 6'56.49"N	88°31'1.90"E	1.5 km	ESE
10.	N-10	Rabanbore Health Sub Centre	23° 8'42.63"N	88°30'2.10"E	2.9 km	N

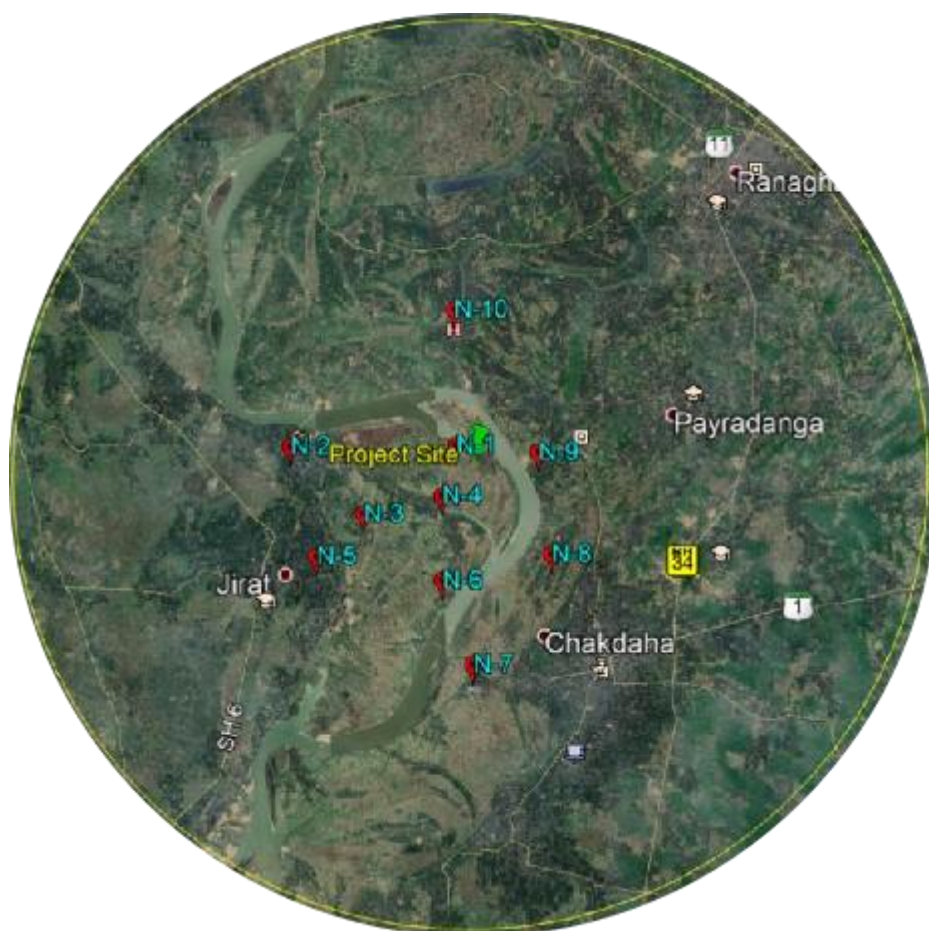


FIGURE-3.12.1
NOISE LEVEL MONITORING LOCATIONS IN THE STUDY AREA

CODE	LOCATIONS
N-1	Near Project Site
N-2	Sripur Temple Complex
N-3	Bhabanipur Char
N-4	Milangarh High School
N-5	Jirat school
N-6	Babupara Village
N-7	Supreme Paper Mills
N-8	Gaurnagar
N-9	Mukundanagar K.C. High School
N-10	Rabanbore Health Sub Centre

TABLE-3.12.2
EQUIVALENT NOISE LEVEL IN THE STUDY AREA, L_{eq} in dB(A)

SL. NO.	LOCATIONS	EQUIVALENT NOISE LEVEL, L_{eq} in dB(A)		SECTOR
		DAY	NIGHT	
1.	Near Project Site	53.3	42.2	Industrial
2.	Sripur Temple Complex	55.8	43.7	Commercial
3.	Bhabanipur Char	54.9	42.2	Residential
4.	Milangarh High School	52.4	43.0	Silence
5.	Jirat school	53.7	41.7	Silence
6.	Babupara Village	55.7	42.7	Residential
7.	Supreme Paper Mills	60.8	44.7	Industrial
8.	Gauranagar	56.5	43.1	Residential
9.	Mukundanagar K.C. High School	54.6	41.4	Silence
10.	Rabanbore Health Sub Centre	50.8	39.5	Silence
N.B. Day time is reckoned between 0600 HOURS TO 2200 HOURS Night Time is reckoned between 2200 HOURS TO 0600 HOURS				

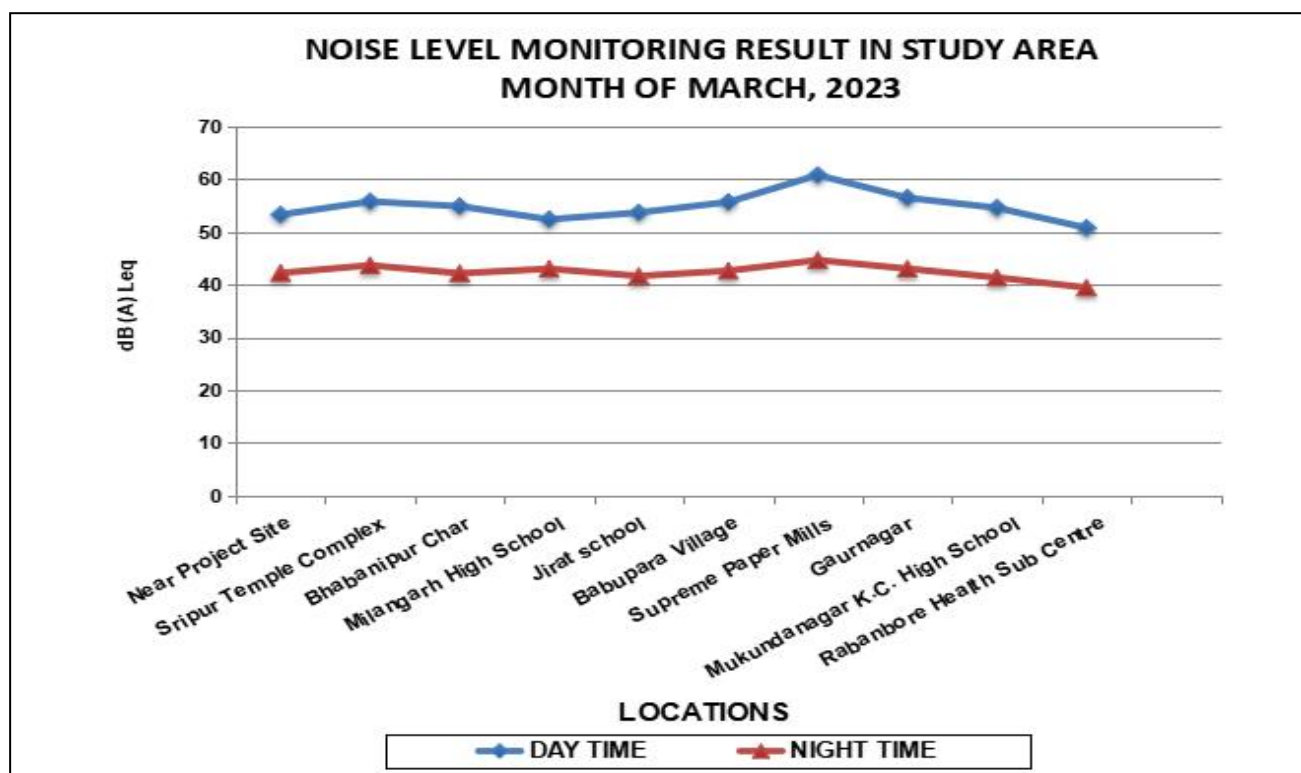


FIGURE: 3.12.2
GRAPHICAL REPRESENTATION OF THE NOISE LEVEL MONITORING RESULTS IN THE STUDY AREA

CONCLUSION OF NOISE LEVEL MONITORING:

The Equivalent Noise Levels in the Industrial locations are within permissible limits. However, the noise level has exceeded the permissible limits for Residential, Commercial and Sensitive locations in the study area. Such high noise levels may be attributed mainly to the noise, generated due to the vehicular traffic.

Trees and shrubs can make a contribution to noise reduction. The attenuation of sound by vegetation is commonly attributed to the processes of reflection, scattering and absorption. Reflection and scattering from the surfaces of leaves, branches, trunks and the ground can alter the phase of sound, which can cause interference in the sound waves and a reduction in noise level. The study area is rich in floral composition with much concentration of large and medium size trees which can effectively reduce noise level in the study area.

3.13 ECOLOGY

Field study was carried out during one season along with literature reviews / desk research to understand the ecological (both terrestrial and aquatic) condition of the study area. Biological environment assessment plays a significant role in environmental impact assessment for any development project. This type of assessment includes evaluation of both the terrestrial & aquatic ecology.

3.13.1 STUDY METHODOLOGY

Biological environment is a good bio-indicator of changing environmental quality. Reconnaissance survey was undertaken around the project site. In the present survey, 10 km radius area around the project site was considered as study area. Both terrestrial and aquatic ecological analysis was carried out in the field and in the laboratory. Assessment of flora and fauna was undertaken in the study area. The field study was undertaken during the month of March, 2023.

In addition to the field study, literature review/desk research was carried out to determine the existing conditions within the study area and to identify habitats and species of potential importance that may be affected by the Project.

The following parameters were primarily considered in the study.

- Assessment of present state of vegetation, flora and fauna in the study area.
- Collection of data from literature about the floral and faunal accounts
- Identification of rare endangered plants and animal species (if any).
- Identification of important plants/animal species having diverse economic values.

3.13.2 DESCRIPTION OF THE STUDY AREA

In the present survey, the 10 km radius study area is an alluvial land. The project site and its surrounding area in 10 km radius are located in the Hooghly District of West Bengal. The periphery of the study area is mainly rural-urban mixed in nature. There are various large and medium scale industries

found within the study area. One and only major River in the study area is River Keleighai.

The soil in the study area is loamy and is rich with high amounts of nutrients having high water retention capacity. The ground water table is moderate in this region. All these factors help in prolific growth of a variety of plants and vegetation in the study area.

Assessment of flora and fauna of both terrestrial and aquatic ecology was undertaken in the study area. Sampling of flora and fauna was done on random basis and were considered separately and their distribution in the above mentioned study area was represented separately.

3.13.2.1 TERRESTRIAL ECOLOGY

The natural trees are combination of both deciduous and evergreen plants mixed with some exotic species.

TERRESTRIAL FLORA:

The natural vegetation of the area has been broadly noted with few natural vegetation and roadside social plantation and avenue trees in the villages. The bio-diversity of such naturally growing plant species would indicate environmental quality.

Vegetation of a particular area depends upon the interaction of various natural factors including plants, animals, micro-organisms of that particular area in which they live and influence one another.

Natural Trees:

The study area is rural-urban mixed in nature. There is sufficient natural vegetation all around the study area.

The most common natural tree species found within the study area are Akashmoni (*Acacia auriculiformis*), Siris (*Albizia lebbek*), Kadam (*Anthocephalus cadamba*), Kathal (*Artocarpus heterophyllus*), Neem (*Azadirachta indica*), Palm Tree (*Borassus flabellifer*), Amaltas (*Cassia fistula*), Radhachura (*Peltophorum pterocarpum*), Mahua (*Madhuca indica*), Devdaru (*Polyalthia longifolia*), Arjun (*Terminalia arjuna*), Eucalyptus (*Eucalyptus globules*), Mango (*Mangifera indica*) etc. Natural tree species was analyzed and calculated by Quadrat method at different

places in the study area like inside and outside of the patchy area, just beside of the project site, roadside land, domestic land, small patchy area etc.

A checklist of natural tree species has been given in **Table-3.13.1** and composite

The following survey was undertaken in the study area during field trips:

- (I) **Forest/Vegetation composition analysis:** Recording and its detail phyto-sociological analysis was done by the following quadrat (10 m x 10 m) method.

The following parameters were primarily considered in the study and computed in the following way:

Frequency: The degree of dispersion of individual species in an area is called frequency. It is expressed as percentage occurrence.

$$\text{Frequency (f)} = \frac{\text{Number of quadrates in which a species occurs}}{\text{Total number of quadrates sampled}} \times 100$$

Abundance: This is the study of number of individual of different species in community per unit area.

$$\text{Abundance (A)} = \frac{\text{Total No. of individuals of a species in all quadrates}}{\text{Total number of quadrates in which the species occurs}}$$

Relative Abundance: It is the determination of the percentage of individual of one genera in composition to the total of all individual as a given area.

$$\text{Relative Abundance (A)} = \frac{\text{Total No. of individuals species in the sample}}{\text{Number of quadrat in which a species occurs}}$$

Density: It is the numerical strength of a species.

(II)
$$\text{Density (D)} = \frac{\text{Total No. of individuals of a species in all quadrates}}{\text{Total No. of quadrat sampled}}$$

expressed by **Shannon-Weiner Index** (1948) in the following way:

$$H = \sum_{i=1}^S -(P_i \times \ln P_i)$$

Where,

H = Species diversity index

S = the number of species in a sample

P_i = (n_i/N)

N = the total number of individuals of all the species in a sample

n_i = the number of individuals of a species.

Shrubs, Herbs & Climbers:

The shrubs and herbs like Mimosa pudica, Adhatoda vasica, Datura metel, Hibiscus rosa sinensis etc. dominate this area.

Some of the species of shrubs, herbs, climbers and ferns recorded during field investigation have been listed in **Table-3.13.2**.

Table-3.13.1

Checklist of most common terrestrial plants species in the study area

A. TREES :

Sl. No.	Scientific Name	Common Name	Family
1	<i>Musa acuminata</i> <i>Musa balbisiana</i> <i>Musa sapientum</i> <i>Musa paradisiaca</i>	Banana	Musaceae
2	<i>Acacia nilotica</i>	Babla	Leguminosae
3	<i>A. auriculiformis</i>	Akashmani	Fabaceae
4	<i>Aegle marmelos</i>	Bel	Rutaceae
5	<i>Albizia lebbek</i>	Siris	Leguminosae
6	<i>Alstonia scholaris</i>	Chhatim	Apocynaceae
7	<i>Areca catechu</i>	Supari	Arecaceae
8	<i>Artocarpus heterophyllus</i>	Kanthal	Moraceae
9	<i>Borassus flabellifer</i>	Tal	Arecaceae

10	<i>Cocos nucifera</i>	Narkel (coconut)	Arecaceae
11	<i>Ficus benghalensis</i>	Banyan/ Bat	Mulberry
12	<i>Ficus hispida</i>	Dumoor	Moraceae
13	<i>Ficus religiosa</i>	Asathha	Moraceae
14	<i>Lagerstroemia speciosa</i>	Jarul	Lythraceae
15	<i>Mangifer indica</i>	Aam (mango)	Anacardiaceae
16	<i>Azadirachta indica</i>	Neem	Meliaceae
17	<i>Moringa oleifera</i>	Sajina	Moringaceae
18	<i>Phoenix sylvestris</i>	Khejur	Arecaceae
19	<i>Sonneratia apetala</i>	Keora	Lythraceae
20	<i>Spondias pinnata</i>	Aamra	Anacardiaceae
21	<i>Tamarindus Indica</i>	Tentul	Leguminosae
22	<i>Bambusa vulgaris</i>	Bamboo	Poaceae
23	<i>Bombax ceiba</i>	Shimul	Bombacaceae
24	<i>Polyalthia longifolia</i>	Davdaru	Annonaceae
25	<i>Mimusops elengi</i>	<i>Bakul</i>	Sapotaceae
26	<i>Ziziphus mauritiana</i>	<i>Kul</i>	Sapotaceae
27	<i>Delonix regia</i>	<i>Krishnachura</i>	Fabaceae
28	<i>Caesalpinia pulcherrima</i>	<i>Radhachura</i>	Leguminosae
29	<i>Anthocephalus cadamba</i>	<i>Kadam</i>	Rubiaceae
30	<i>Streblus asper</i>	<i>Shewra</i>	Moraceae

TABLE-3.13.2
CHECKLIST OF NATURAL SHRUBS,
HERBS & CLIMBERS IDENTIFIED

Sl. No.	Scientific Name	Common Name	Family
SHRUBS & HERBS			
1	<i>Abutilon indicum</i>	Potari	Malvaceae
2	<i>Achyranthes aspera</i>	Latjira	Amaranthaceae
3	<i>Adhatoda vasica</i>	Basak	Acanthaceae
4	<i>Ageratum conyzoides</i>	Uchunti	Asteraceae
5	<i>Amaranthus viridis</i>	Kata Note	Amaranthaceae
6	<i>Amorphophallus paeoniifolius</i>	Oal/Gandira	Araceae
7	<i>Andrographis paniculata</i>	Kalmegh	Acanthaceae
8	<i>Bambusa bambos</i>	Bamboo/ Baans	Poaceae
9	<i>Blumea lacera</i>	Kukurmata/ Kakronda	Asteraceae
10	<i>Bryophyllum pinnatum</i>	Patharkuchi	Crassulaceae
11	<i>Calotropis gigantea</i>	Akanda	Apocynaceae
12	<i>Catharanthus roseus</i>	Nayantara	Apocynaceae
13	<i>Centella asiatica</i>	Thankuni	Apiaceae
14	<i>Cestrum diurnum</i>	Day jasmine	Solanaceae
15	<i>Clerodendrum infortunatum</i>	Ghentu	Verbenaceae
16	<i>Clitoria ternatea</i>	Aparajita	Fabaceae
17	<i>Coccinia grandis</i>	Telakucha	Cucurbitaceae
18	<i>Commelina benghalensis</i>	Bengal Dayflower/ Kanchira	Commelinaceae
19	<i>Cynodon dactylon</i>	Doobghas	Poaceae
20	<i>Datura metel</i>	Dhutura	Solanaceae
21	<i>Dentella repens</i>	Creeping Dentella	Rubiaceae
22	<i>Dryopteris filixmas</i>	Fern	Dryopteridaceae
23	<i>Euphorbia neriifolia</i>	Mansa	Euphorbiaceae
24	<i>Grangea maderaspatana</i>	Namuti	Asteraceae
25	<i>Grewia hirsuta</i>	Kukurbicha	Tiliaceae
26	<i>Hibiscus rosa sinensis</i>	Joba	Malvaceae
27	<i>Leucas aspera</i>	Swet Dron/ Ghal ghase	Lamiaceae
28	<i>Mikania scandens</i>	Climbing Hempweed	Asteraceae
29	<i>Mimosa pudica</i>	Lajjabati	Fabaceae
30	<i>Musa paradisiaca</i>	Kachkola	Musaceae
31	<i>Nerium oleander</i>	Raktakarabi	Apocynaceae
32	<i>Ocimum basilicum</i>	Bantulsi	Lamiaceae
33	<i>Ocimum sanctum</i>	Tulshi	Lamiaceae
34	<i>Parthenium hysterophorus</i>	Parthenium	Asteraceae
35	<i>Solanum surattense</i>	Kanta Begun	Solanaceae
36	<i>Tragia involucrata</i>	Bichuti	Euphorbiaceae
37	<i>Vitex negundo</i>	Nishinda	Verbenaceae
CLIMBERS			
1	<i>Abrus precatorius</i>	Gunch	Fabaceae
2	<i>Asparagus racemosus</i>	Shatamuli	Asparagaceae
3	<i>Bougainvillea spectabilis</i>	Baganbilas	Nyctaginaceae
4	<i>Gymnema sylvestre</i>	Gurmar/ Chhota- dudhilata	Asclepiadaceae
5	<i>Ichnocarpus frutescens</i>	Kalidudhi	Apocynaceae
6	<i>Luffa aegyptiaca</i>	Purul gach	Cucurbitaceae
7	<i>Paederia scandens</i>	Gandal	Rubiaceae
8	<i>Tinospora cordifolia</i>	Nimgilo/ Gulancha	Menispermaceae

TABLE-3.13.3
LIST OF AGRICULTURAL SPECIES

Sl. No.	Common Name	scientific Name
CEREALS		
1	Rice	<i>Oryza sativa</i>
2	Wheat	<i>Triticum aestivum</i>
3	Maize	<i>Zea mays</i>
PULSES		
1	Pea	<i>Pisum sativum</i>
2	Mung bean/ Greengram	<i>Vigna radiata</i>
3	Groundnut	<i>Arachis hypogaea</i>
4	Cowpea/ Badbati	<i>Vigna unguiculata</i>
5	Pigeon pea	<i>Cajanus cajan</i>
OILSEEDS		
1	Mustard Seed	<i>Brassica nigra</i>
2	Sesame/ Til	<i>Sesamum indicum</i>
VEGETABLES		
1	Potato	<i>Solanum tuberosum</i>
2	Brinjal	<i>Solanum melongena</i>
3	Cucurbits	<i>Cucurbita maxima</i>
4	Cucumber	<i>Cucumis melo</i>
5	Ladies finger	<i>Abelmoschus esculentus</i>
6	Cabbage	<i>Brassica oleracea var. capitata</i>
7	Cauliflower	<i>Brassica oleracea var. botrytis</i>
8	Tomato	<i>Solanum lycopersicum</i>
9	Radish	<i>Raphanus sativus</i>
10	Carrot	<i>Daucus carota sativus</i>
11	Chilli	<i>Capsicum frutescens</i>
12	Onion	<i>Allium cepa</i>
13	Spinach	<i>Spinacia oleracea</i>
14	Bitter Gourd	<i>Momordica charantia</i>
FRUITS		
1	Mango	<i>Mangifera indica</i>
2	Jaam	<i>Syzygium cumini</i>
3	Date Palm/ Khejur	<i>Phoenix sylvestris</i>
4	Banana	<i>Musa sapientum</i>
5	Papaya	<i>Carica papaya</i>
6	Guava	<i>Psidium guajava</i>
7	Jack fruit	<i>Artocarpus heterophyllus</i>
OTHER CROPS		
1	White Jute	<i>Corchorus capsularis</i>
2	Tossa jute	<i>Corchorus olitorius</i>

Terrestrial Fauna

Since there is no eco-sensitive zone like National Park, Wildlife Sanctuary, Reserve Forest etc. in the study area, wild animals in the study area are rare. Only a few wild animals like Fox, Common Langur, and Porcupine etc. could be observed in the study area occasionally.

Survey of terrestrial fauna reveals that in general there has been no impact of pollution on fauna. Destructive habits of human population are the only reason for the declining numbers of animals.

During the present investigation, species which were examined include mammals, birds, reptiles and amphibians. The same have been presented in **Table-3.13.4** according to their schedule number of The Wildlife (Protection) Act, 1972.

TABLE-3.13.4
CHECKLIST OF FAUNAL SPECIES

Scientific Name		Local Name
Aquatic Fauna	Anabus testudinius	Koi
	Barbus sp	Punti
	Catla catla	Katla
	Cirrhina mrigala	Mrigel
	Clarius batrachus	Magur
	Heteropneustes fassilis	Singhi
	Labeo bata	Baata
	Labio rohita	Rui
	Mystus seenghala	Tengra
	Natopterus chitala	Chital
	N. natropterus	Folui
	Ochiocephalus gachua	Chang
	O. punctatus	Letha
	O. striatus	Shole
	Tilapia sp	Tilapia
	Trichogaster	Khalisha
	Wallagonia attu	Boaal
Terrestrial Fauna	Amphibians	Bufo sp Toad
		Rana sp Frogs
	Birds	Milvas migrans govinda Pariah Kite
		Gyps bengalensis White back vulture
		Columba livia Pigeon
		Eudynamis scolopacca Cuckoo
		Halcyon smyrnesis White back kingfisher
		Alcedo atthis Small blue kingfisher

Scientific Name			Local Name
		<i>Pycnonotus cafer</i>	Red vent Bulbul
		<i>Corvus splendens</i>	House crow
		<i>Passer domestica</i>	House sparrow
		<i>Acridatheres</i>	Common mynah
	Mammals	<i>Presbytis entellus</i>	Common Langur
		<i>Canis familiaris</i>	Dog
		<i>Felis domestica</i>	Cat
		<i>Capra benghalensis</i>	Goat
		<i>Bandicota bengalensis</i>	Indian mole rat
		<i>Funumbulus palmerum</i>	Squirrel
		<i>Sus cristatus</i>	Pig
		<i>Bubalus bubalis</i>	Buffalo
	Reptiles	<i>Lissemis punctata</i>	Indian mud turtle
		<i>Hemidactylus flaviviridis</i>	Tiktiki (house gheko)
		<i>H. leschenaultia</i>	Tiktiki (bark gheko)
		<i>Colotes versicolor</i>	Girgiti (graden lizard)

3.13.7 AQUATIC ECOLOGY

The study area has a major river, i.e., Keliaghai River; several big and small ponds, jheels, beels, tanks, ditches etc., which form the ecology of aquatic environment. So, the richness and diversity of aquatic flora and fauna is enough in the study area. The major forms of aquatic biota as recorded during the survey are as follows:

- Macro-phytic flora,
- Planktons, and
- Fishes.

MACRO-PHYTIC FLORA:

There are a number of vegetations found in various water bodies like ponds, beels, Jheels, ditches etc. including Keliaghai River. All such water bodies are more or less vegetated by different aquatic macrophytic flora and marshy plants in the study area. The details of aquatic macrophytic flora and marshy plants have been summarized in **Table-3.13.5**.

TABLE-3.13.5
CHECKLIST OF AQUATIC MACROPHYTES & MARSHY PLANTS

Sl. No.	Scientific Name	Common Name	Family
1	<i>Alternanthera philoxeroides</i>	Alligatorweed	Amaranthaceae
2	<i>Azolla pinnata</i>	Water velvet	Azollaceae
3	<i>Colocasia esculenta</i>	Green Taro	Araceae
4	<i>Eichhornia crassipes</i>	Common water hyacinth	Pontederiaceae
5	<i>Enhydra fluctuans Lour</i>	Helencha/ Hingcha	Asteraceae
6	<i>Hygrophila spinosa</i>	Kulekhara	Acanthaceae
7	<i>Ipomoea aquatica</i>	Kalmi	Convolvulaceae
8	<i>Ludwigia adscendens</i>	Keshardam	Onagraceae
9	<i>Lemna perpusilla</i>	Minute Duckweed	Araceae
10	<i>Marsilea quadrifolia</i>	Susni	Marsileaceae
11	<i>Monochoria hastata</i>	Leaf Pondweed	Pontederiaceae
12	<i>Nymphaea nouchali</i>	Blue water lily	Nymphaeaceae
13	<i>Oxalis corniculata</i>	Amrulshak	Oxalidaceae
14	<i>Pistia stratiotes</i>	Water Cabbage	Araceae
15	<i>Spirodela polyrhiza</i>	Common duckweed	Araceae
16	<i>Salvinia natans</i>	Floating watermoss	Salviniaceae
17	<i>Trapa bispinosa</i>	Water Chestnut	Trapaceae

PLANKTONS

The phytoplanktons are the primary producers and form the base of the food chain. The zooplanktons are the secondary producers and they feed on phytoplanktons. A study of the density, composition, and species diversity of these two organisms gives an idea about the nutrient content, trophic condition of the total aquatic ecosystem and the quality of the water.

Phytoplanktons:

Phytoplankton is the primary producers of an ecosystem and thus helps maintain DO of a water body. Any reduction in number of phytoplankton would ultimately affect the whole ecosystem. Some major phytoplanktons, which are found in aquatic ecosystem of the study area are *Euglena sp.*, *Microcystis sp.*, *Diatoma sp.*, *Spirogyra sp.*, *Oedogonium sp.*, *Zygnema sp.*, *Closterium sp.* etc. (Table-3.13.6).

Zooplanktons:

Zooplanktons are animals that occur in the water column of either marine or freshwater ecosystems. Zooplanktons are an important link in the transfer of energy from the algae (the primary producers) to the ecologically and economically important fish community (the consumers).

In the aquatic ecosystem of the study area most species in the small zooplankton community fall into three major groups - Crustacea, Rotifers, and Protozoans. Crustaceans are the most abundant, especially those in the order Cladocera (waterfleas), and the class Copepoda (the copepods), particularly the orders Calanoida and Cyclopoida. Cladocerans are typically most abundant in freshwater, with common genera including *Daphnia* sp. and *Bosmina* sp. The pollution indicator species like *Brachionus calyciflorus*, *Filinia terminalis* and *Keratella toopica* etc. (Table-3.13.6).

TABLE-3.13.6
CHECKLIST OF PLANKTON SPECIES

Sl. No.	PHYTOPLANKTON	ZOOPLANKTON
1	<i>Microcystis</i> sp.	<i>Brachionus</i> sp.
2	<i>Euglena</i> sp.	<i>Daphnia</i> sp.
3	<i>Diatoma</i> sp.	<i>Cyclops</i> sp.
4	<i>Achnanthes</i> sp.	<i>Diaptomus</i> sp.
5	<i>Zygnema</i> sp.	<i>Moina</i> sp.
6	<i>Spirogyra</i> sp.	<i>Cypris</i> sp.
7	<i>Oscillatoria</i> sp.	<i>Keratella</i> sp.
8	<i>Scenedesmus</i> sp.	<i>Mysis</i> sp.
9	<i>Cymbella</i> sp.	<i>Diaptomus</i> sp.
10	<i>Closterium</i> sp.	<i>Filinia terminalis</i>
11	<i>Oedogonium</i> sp.	-

FISHES:

Fishes are at the tertiary level of the food chain of aquatic ecology. As the study area having many inland water bodies like several ponds, jheels, beels, ditches and the important river Keliaghai, so the biodiversity of fishes is rich. Types of freshwater fishes of both confined and unconfined (flowing) surface water bodies in the study area were known by talking with local fishermen and local people and have been summarized in Table-3.13.7.

TABLE-3.13.7
CHECKLIST OF FISH SPECIES

CHECKLIST OF FISHES IN THE STUDY AREA			
Sl. No.	Scientific Name	Common Name	Family
1	<i>Amblypharyngodon mola</i>	Morala	Cyprinidae
2	<i>Catla catla</i>	Catla	Cyprinidae
3	<i>Cirrhina mrigala</i>	Mrigal	Cyprinidae
4	<i>Ctenopharyngodon idella</i>	Grass carp	Cyprinidae
5	<i>Cyprinus carpio</i>	Common carp	Cyprinidae
6	<i>Esomus danricus</i>	Dadhikha	Cyprinidae

7	<i>Hypophthalmichthys molitrix</i>	Silver carp	Cyprinidae
8	<i>Hypophthalmichthys nobilis</i>	Bighead carp	Cyprinidae
9	<i>Labeo bata</i>	Bata	Cyprinidae
10	<i>Labeo Calbasu</i>	Calbasu	Cyprinidae
11	<i>Labeo rohita</i>	Rohu	Cyprinidae
12	<i>Puntius chola</i>	Punti	Cyprinidae
13	<i>Puntius sarana</i>	Swarna punti	Cyprinidae
14	<i>Puntius ticto</i>	Teto Punti	Cyprinidae
15	<i>Rasbora daniconius</i>	Dankuni	Cyprinidae
16	<i>Salmostoma sardinella</i>	Chela	Cyprinidae
17	<i>Channam arulius</i>	Shal	Channidae
18	<i>Channa orientalis</i>	Chang	Channidae
19	<i>Channa punctatus</i>	Leta	Channidae
20	<i>Channa striatus</i>	Shol	Channidae
21	<i>Chanda nama</i>	Chanda	Chandidae
22	<i>Chanda ranga</i>	Chanda	Chandidae
23	<i>Clarius batrachus</i>	Magur	Clariidae
24	<i>Clarias gariepinus</i>	Thai magur	Clariidae
25	<i>Pangasius sutchi</i>	Pangus	Clariidae
26	<i>Mystus menoda</i>	Aarr	Bagridae
27	<i>Mystus tengara</i>	Tengra	Bagridae
28	<i>Mystus vittatus</i>	Bitengra	Bagridae
29	<i>Notopterus chitala</i>	Chital	Notopteridae
30	<i>Notopterus notopterus</i>	Falui	Notopteridae
31	<i>Heteropneustes fossilis</i>	Singi	Heteropneustidae
32	<i>Wallago attu</i>	Boal	Siliridae
33	<i>Monopterusuchia</i>	Ban	Symbranchidae
34	<i>Anabas testudineus</i>	Koi	Anabantidae
35	<i>Colisa fasciata</i>	Khalsha	Belontiidae
36	<i>Glossogobius giuris</i>	Beley	Gobiidae
37	<i>Nandus nandus</i>	Bheda	Nandidae
38	<i>Oreochromis sp.</i>	Tilapia	Cichlidae
39	<i>Rhinomugil corsula</i>	Kharsula	Mugilidae
40	<i>Mastacembelus aculeatus</i>	Pakal	Mastacembelidae

Conclusion

The present observation revealed that the terrestrial & aquatic vegetation in 10 km radius of the project site is very rich and diverse.

Enough richness has been observed in aquatic flora and fauna. Thus, it may be concluded that the water reservoirs of the study area are rich in primary producers (i.e., phytoplankton) and any reduction in their numbers may affect the level of dissolved oxygen in water.

By contrast the zooplankton constitutes a link between primary producers and ecologically important consumers i.e., fish community (33 species). Hence, any destruction of zooplankton may lead to break in transfer of

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C3 - 76
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energy from producers to consumers. It causes imbalance in aquatic ecosystems.

No species were found to be endangered. There were no migratory routes of fauna, presence of breeding grounds and sensitive habitats and absence of protected areas.

Since the proposed project shall adopt zero discharge concept, no adverse impact on aquatic ecology will be seen. The plant drainage system will be suitably designed so that the storm water does not carry any pollutants.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C3 - 77
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3.14 DEMOGRAPHY & SOCIO-ECONOMIC STATUS

3.14.1 GENERAL DESCRIPTION

The growth of industrial sectors and infrastructure development in and around the agriculture dominant areas, village and towns is bound to create its impact on the socio-economic aspects of the local population of the area experiencing development. The impacts may be positive or negative depending upon the development activity. To assess the anticipated impacts of the project and industrial growth on the socio-economic aspects of people, it is necessary to study the existing socio-economic status of the local population, which will be helpful for making efforts to further improve the quality of life in the area under study.

The sociological aspects of this study include human settlements, demography and social strata such as Scheduled Castes and Scheduled Tribes and literacy levels besides infrastructural facilities available in the study area. The economic aspects include occupational structure of workers.

The Baseline Demographic and Socio-economic characteristics with regards to demography, literacy and occupational status have been described based on the Primary Census Abstract, 2011. The proposed expansion project site is located at Village & PO - Balagarh, District - Hooghly, PIN - 712501, West Bengal. The 10 km radius study area around the proposed project site comprises of 215 villages and 2 CT wards. A comparative assessment has been made for the respective demographic aspects, based on the year 2011 Census data, which has been discussed in the following sections.

The study area is rural in nature and Moderate populated with the total population of 6,41,514 (as per 2011 Census). Scheduled Caste (SC) and Scheduled Tribe (ST) population in the study area is about 30.72% and 5.02% w.r.t. the total population respectively. The sex ratio in the study area is about 958 females per 1000 males. The overall literacy rate is about 75.0% w.r.t. total population. The principal language is Bengali and the principal staple food is rice. The primary sources of drinking water are tube wells, Hand pump water in rural areas and tube wells, Hand pump and Supply water.

3.14.2 DEMOGRAPHIC ASPECTS

3.14.2.1 Average Household Size:

The Study area has an average family size of around 4.14 persons per household. This is considered to be the average family size in West Bengal.

3.14.2.2 Overall population density and family size:

As per 2011 census, the total population in the study area is 6,41,514. According to this population in the study area Population Density is approximately 1279 persons per square kilometer. Total population, population density & family size have been shown below in **Table-3.14.1**.

TABLE-3.14.1
OVERALL POPULATION DENSITY AND FAMILY SIZE

Sl. No.	Particulars	Number
1	No. of Household	154858
2	Population Density	2043 Nos./sq.km
3	Family Size	4.14
4	Male Population	327706
5	Female Population	313808
6	Total Population	641514

Source: Census of India, 2011

3.14.2.3 Sex Ratio:

According to 2011 census, the sex ratio (female per 1000 male) in the rural segment of the study area is 958 sex ratio of the study area is tabulated in **Table-3.14.2**.

TABLE-3.14.2
SEX RATIO OF THE STUDY AREA

Sl. No.	Segment of the area	Females per 1000 males
1	Whole	958

Source: Census of India, 2011

3.14.2.4 Population structure:

As per 2011 census total population within the study area is 6,41,514 having 51.08% of male and 48.92% of female population.

3.14.2.5 Social Structure:

As per 2011 census, the Scheduled caste (SC) population in the study area is 30.72% of the total population,

As per 2011 census, Scheduled Tribe (ST) population in the study area is 5.02% of the total population Scheduled caste and scheduled tribe population in rural segment of the study area is shown in **Table-3.14.3**.

TABLE-3.14.3
SOCIAL STRUCTURE OF THE STUDY AREA

Number of population								
Total Population			Scheduled Caste			Scheduled Tribe		
Male	Female	Total	Male	Female	Total	Male	Female	Total
327706	313808	641514	101425	95673	197098	16108	16078	32186

3.14.2.6 Literacy Level:

Total literacy rate in study area is 75.0% whereas male literacy rate is 78.7% of the total male population and female literacy rate is 71.1% of total population. Population classification for literates in the study area is presented **Table-3.14.4**.

TABLE-3.14.4
LITERACY LEVEL IN THE STUDY AREA

No. of Literates		
Male	Female	Total
69841	90589	160430

Source: Census of India, 2011

3.14.3 OCCUPATIONAL STRUCTURE

The occupational structure of population in the study area is studied with reference to main workers and marginal workers. As per Census of India, all persons engaged in 'work' defined as participation in any economically productive activity with or without compensation, wages or profit are workers. The Reference period for determining a person as worker and non-worker is one year preceding the date of enumeration. The Census classifies Total Workers into two groups namely, (i) Main workers (ii) Marginal workers. Main Workers are those workers who had worked for the major part of the reference period i.e., 6 months or more. Marginal Workers are those workers, who had not worked for the major part of the reference period i.e., less than 6 months.

The main workers include 10 categories of workers defined by the Census Department, which consists of cultivators, agricultural laborers, those engaged in live-stock, forestry, fishing, mining and quarrying; manufacturing, processing and repairs in household industry; and other

than household industry, construction, trade and commerce, transport and communication and other services.

3.14.3.1 Workers and Non-workers:

i) Total Workers:

Total Worker in is 37.0% of the total population in the study area according to 2011 Census. The total workers are divided into main and marginal workers.

ii) Main Workers:

Main Worker is 86.44% of the total population in the study area according to 2011 Census.

iii) Marginal Workers:

Marginal Worker is 13.6% of the total population in the study area according to 2011 Census.

iv) Non-workers:

Non-Worker is 63.0% of the total population in the study area according to 2011 Census.

The occupational status of workers and non-workers has been shown in **Table – 3.14.5**.

TABLE – 3.14.5
OCCUPATIONAL STATUS OF THE STUDY AREA

No. of workers						No. of non-workers		
Main Workers			Marginal Workers					
Male	Female	Total	Male	Female	Total	Male	Female	Total
179293	25919	205212	19483	12711	32194	128930	275178	404108

3.14.3.2 Classified Occupational Status:

Cultivators and agricultural workers are 4.5% and 7.5% respectively w.r.t. the total population in the study area. The classified occupational status in the study area has been tabulated in **Table-3.14.6**.

TABLE-3.14.6
CLASSIFIED OCCUPATIONAL STATUS

Total Workers	Cultivators	Agricultural Workers
237406	29121	47854

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C3 - 81
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Graphical presentations of demographical and occupational status have been given below in **FIGURE-3.14.1**.

3.14.4 INFRASTRUCTURE FACILITIES:

Medical Facilities

Medical facility in some form or the other is available to the population residing within the study area.

Drinking Water Facilities

Tap water, ground water and surface water is being used in the different villages.

Electricity

Most of the villages have electricity. Available for domestic purposes.

Communication Transport & Access Facilities

Approach paved road is available in the all village areas.

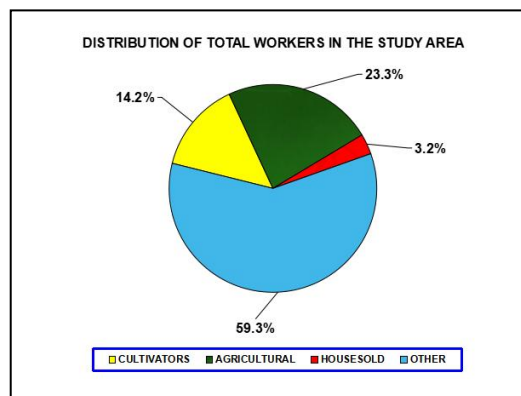
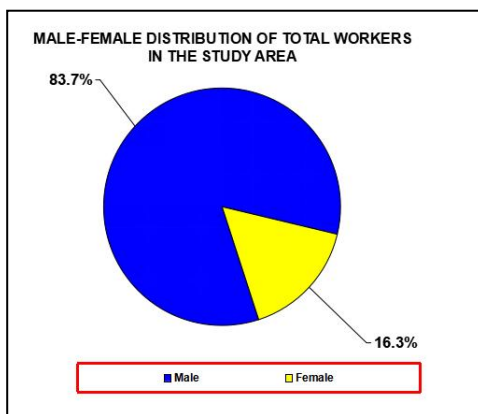
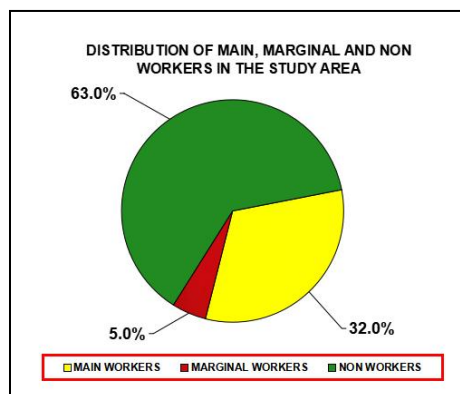
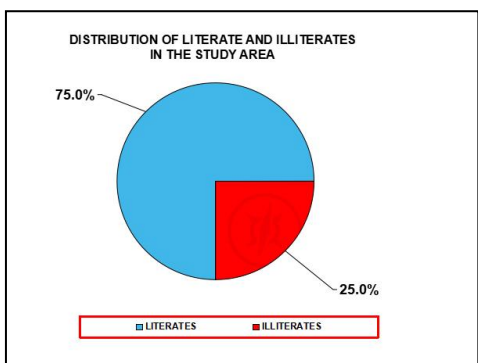
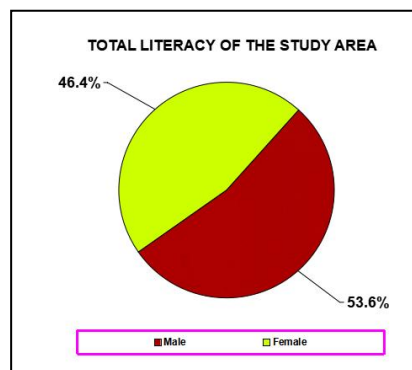
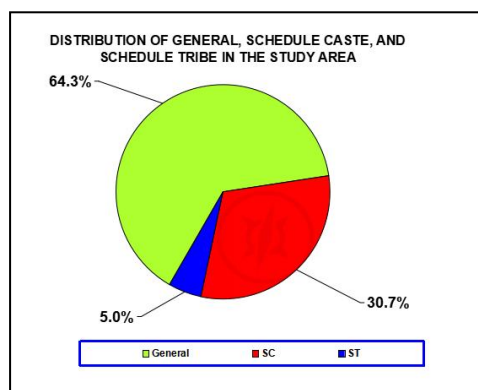
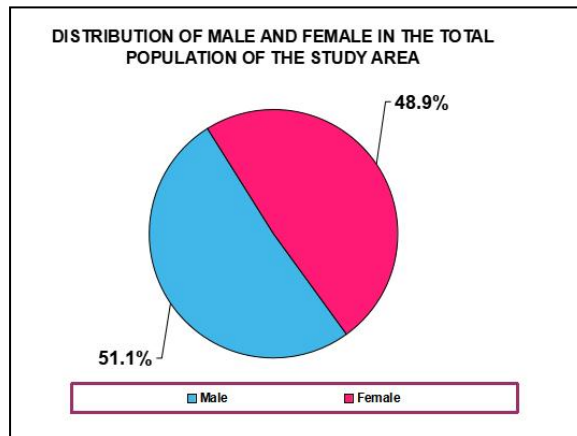
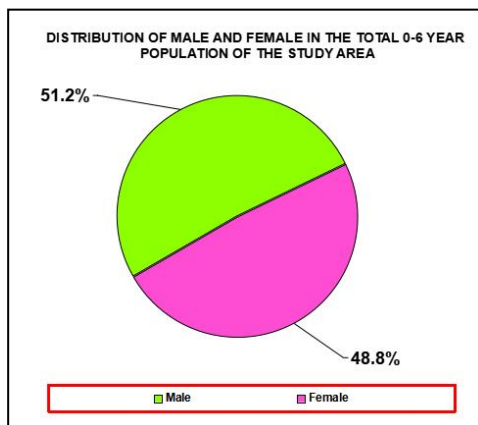


FIGURE-3.14.1
GRAPHICAL PRESENTATION OF DEMOGRAPHIC & SOCIAL STATUS (BASED ON 2011 CENSUS DATA)

3.15 SOCIO-ECONOMIC SURVEY

The 2011 census data have been supplemented and corroborated by a socio-economic sample survey, conducted in February, 2023, covering a sample population size of 5225 numbers covering 1298 number of Households, distributed over 13 villages and 2 Census Towns within the study area including the project site through structured questionnaires portraying demographic and socio-economic aspects of the study area population. The names of the villages, considered for the sample survey have been gathered in in **Table-3.15.1**. The data of this socio-economic survey including demographic and socio-economic characteristics, income profiles, household amenities, educational status etc. have also been summarized in the Chapter-7.0. The salient findings of this sample survey are presented below:

Table-3.15.1 : Summary of Sample Survey

Total Population	5225 (Male: 2664, Female: 2561)
No. of Households	1298 (Distributed over 13 Villages and 2 Census Towns)
Family Size	4.03
Sex ratio	961 females per 1000 males
Caste	SC & ST (41.19% w.r.t total Sampling population)
Literacy Level in Area	Total Literate 70.39%, Male Literate 71.81%, Female Literate, 68.92%
Build of House of sample Households	Brick (55.16%), Multistoried Brick (36.44%), Thatched Roof Brick (8.01%), Mud (0.39%)
Lighting source of sample Households	Electricity (98.60%), Kerosene (1.4%), Others (0.00%)
Source of Income	Workers (43.6%), Non-Workers (56.4%)

Comparison of the findings of the socio-economic sample survey with the 2011 census data are presented in **Table-3.15.2**.

Table-3.15.2

Comparison of the Findings of the Socio-Economic Sample Survey

Particulates	2011 Census	2022 Sample Survey
Family Size (persons per household)	4.14	4.03
Literacy Level in Area (% of total population)	75.0	70.39
Sex ratio in rural area	958 females per	961 females per

	1000 males	1000 males
Occupational Status in area of the total worker population	Workers (37.0%), Non-Workers (63.0%)	Workers (43.6%), Non-Workers (56.4%)

It is evident from the above comparison that there has been slight increase in the family size, literacy rate has increased, sex ratio has increased and percentage of workers has slightly increased in the villages under sample survey.

Table-3.15.3 : List of Villages & Census Towns for Sample Survey

S.N	Name of Village / town	No. of Households	Population		
			T	M	F
1	Sripur (CT) WARD NO.-0001	181	723	360	363
2	Jirat (CT) WARD NO.-0001	206	817	420	397
3	Baruipara	55	212	106	106
4	Bhabanipur	35	137	69	68
5	Bhabanipur Char	210	868	443	425
6	Arazi Bhabanipur	16	58	32	26
7	Balagarh	77	330	169	161
8	Tamlipara	44	184	96	88
9	Gournagar	16	69	37	32
10	Paschim Sambhupur	62	229	115	114
11	Par Niamatpur	94	373	192	181
12	Jagapur	70	309	153	156
13	Gosair Char	56	220	115	105
14	Balagari Char	138	532	272	260
15	Raninagar	38	164	85	79
TOTAL		1298	5225	2664	2561

The detailed data of sample survey has been presented in **Chapter-7.0** of the EIA Report.

3.16 OVERALL SUMMARY & CONCLUSION

The field data were generated for soil, meteorology, air quality, water quality, noise & ecology during three months' period (**1st January, 2023 - 31st March, 2023**) along with the relevant secondary data, collected from various agencies on the relevant disciplines like Geology and Geo-hydrology, Land Use, Meteorology and Demography & Socio-Economy.

While analyzing the Landuse Pattern of the 10 km radius study area, it is observed that it contains 66.01% Agricultural Land. Open area comes next to it. Land with grasses & scrubs is the next leading category. Forest area comes next in abundance in the 10 km radius of the project site.

The soils are suitable for cultivation of paddy, wheat and seasonal vegetables. As per FAO-UNESCO soil classification, this soil is of Ultisols and is suitable for paddy rice, sesame, ground nut, chillies, mango, rose etc. It is also home for many beneficial biological organisms like bacteria, fungi, lichen, etc. The nutrient status and pH of the soil certainly produces the food and fodder to the end user and retain the sustainability of top soil. No impact of surrounding industry has been found.

The overall mean wind speed during the entire monitoring period was 3.9 Km/hr. The predominant wind direction was North & North-East.

The values of all the ambient air parameters i.e., PM₁₀, PM_{2.5}, SO₂, NO₂ and CO at the respective 8 monitoring locations are within the stipulated limits on all the occasions as per NAAQ Standard. The maximum value of PM₁₀ was observed near project site (at Chakda Narendra Pally) i.e., 80 µg/m³, which is considerably on higher side, but is still within the standard. This may be attributed to the wind blown dust due to the unpaved roads and the vehicular emissions in the area.

All the tested parameters of Ground water sources in the study area are complied with the Drinking Water Quality Standards as per IS 10500:2012. The ground water is suitable for drinking purpose as per BIS 10500.

The river water quality (SW1 & SW2) parameters are within the standard for Class C i.e., Drinking water source after conventional treatment and after disinfection.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C3 - 86
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The Equivalent Noise Levels at the Industrial locations are within permissible limits, but they have exceeded the permissible limits at the Commercial, Residential and Sensitive locations in the study area. Such high noise levels may be attributed mainly to the noise, generated due to the vehicular traffic.

The observations reflected good vegetation within 10 km radius around the project site. The terrestrial and aquatic ecological scenario constitutes various types of trees, bamboos, herbs, climbers, insects, amphibians, reptiles, birds, mammals, fish, etc. Altogether 30 species of trees, 8 species of climbers and 37 species of herbs and shrubs indicate a diversified vegetation. Similarly, the faunal communities of the area are also fairly rich. The study area has river, canals, beels, ponds and several other categories of water bodies, so the richness and diversity of aquatic flora and fauna is also high. A good number of birds (10 species) were also observed which is due to good vegetation cover and open fields in the area.

The study area is rural in nature and moderately populated with the population density of approximately 2043 persons per square kilometer. The Study area has an average family size of around 4.14 persons per household which is considered to be a normal family size. As a whole, SC & ST population is 30.72% and 5.02% respectively w.r.t. the total population in the study area. The overall literacy rate in the study area is about 75.0% w.r.t. the total population i.e., the literacy level in the study area is quite satisfactory. Total worker is 37.0% of the total population. Presence of water availability in the region is mainly in the form of tube wells and tap water.

CHAPTER-4.0

ENVIRONMENTAL IMPACTS & MITIGATION MEASURES

4.1 PREDICTION OF IMPACTS

Many techniques and methodologies are available to predict impacts on environment. Such predictions are superimposed over the baseline status of environmental quality to derive the ultimate scenario of environmental conditions. Prediction of impacts helps in formulation of appropriate environmental management plan to minimize the deterioration of environmental quality due to construction and operation of a project.

There are two phases of impact, one that occurs during the construction period and the other that takes place during the operation phase of a project. The impacts can be classified as direct / in-direct, short term / long term and permanent / temporary.

4.2 IMPACTS DURING CONSTRUCTION PHASE

4.2.1 Activities during Construction Phase

During the construction phase, the following activities are considered to be important towards development of impacts:

- a) Site preparation
- b) Excavation and backfilling
- c) Hauling of earth materials
- d) Piling, cutting and drilling
- e) Erection of concrete and steel structures
- f) Road construction
- g) Painting and finishing
- h) Clean up operations
- i) Landscaping and Green belt development

Construction phase activities will have moderate impacts on land use, demography and socio-economics, on-site soils and on-site noise. It could also develop minor impacts on water use, air and water quality and ecology.

The activities can be divided into two categories, viz. sub-structural and super-structural work. Certain foundation would require pile driving and the machineries would pose noise and gaseous pollution.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C4 - 2
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Moreover, construction work will involve cutting of trenches, excavation, concreting etc. There may be dust, gaseous and noise pollution from these activities.

Mechanical erection work involves use of mechanical equipment for storage, transportation, erection and on-site fabrication work. These activities generally produce some air contaminants and noise pollution which will be contained by using water sprinkling and noise abatement measures.

4.2.2 Impacts on Air Quality

Particulate matter would be the predominant pollutant affecting the air quality during the construction phase. Dust will be generated mainly during excavation, back filling and hauling operations along with transportation activities.

Sprinkling of water from tankers or other suitable means would be undertaken at the construction sites for the suppression of fugitive dust.

Undesirable gaseous pollutants will be generated mostly by the traffic and use of machineries. However, this would not lead to any tangible effect, as the expected emission volume is low.

The project during its construction phase will involve plying of trucks for carriage of construction materials. The movement of trucks will reach a peak during construction of the super structure. Such plying of trucks on un-metalled roads may primarily cause some dust pollution to the ambient air thereby causing temporal disturbance to the population residing nearby. However, such impact will be for short duration and reversible in nature.

It would be ensured that all the vehicles plying during construction are properly tuned and maintained to keep emissions within the permissible limits.

4.2.3 Impacts on Hydrology and Water Use

The construction activities will take place inside the already acquired land. The proposed project has been planned in such a manner so as to follow the existing ground profile and the local drainage pattern. As such, the proposed project is not expected to have any impact on the local hydrology.

4.2.4 Impacts on Water Quality

Wastewater from construction activities would mostly contain suspended impurities. Other pollutants which may find their way into it will be in insignificant concentrations and may be safely

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C4 - 3
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disregarded. Drains from different construction sites will be led to sedimentation pits where excess suspended solids will be settled out and relatively clear supernatant will be reused in the construction/ dust suppression inside the project area.

4.2.5 Impacts on Noise

During the construction phase, noise will be generated due to movement of vehicles and operation of light and heavy construction machineries including pneumatic tools and compressors, which are expected to emit sounds with moderate to high decibel value. Careful planning of their operation will be made so that minimum disturbances are caused. The construction personnel would be located away from the major road traffic. The construction personnel will be made to use appropriate personnel protective equipment. There is no residential area in the neighbourhood of the project site. As such, no impact of noise pollution is expected on the population.

4.2.6 Impacts on Ecology

Terrestrial Ecology

- ✓ The impact of construction activities will be primarily confined to the project site. As stated earlier, the existing site is a piece of vacant land. The site does not involve any forestland. Thus, the site development work will not lead to any significant loss of any important taxa.
- ✓ Deposition of fugitive dust on leaves of nearby vegetation may lead to temporary reduction of photosynthesis. Such impacts will, however, be confined mostly to the initial periods of the construction phase.
- ✓ The entire Project site would be extensively landscaped with a variety of taxa.
- ✓ The levels of pollutants expected to be maintained around the project site are much lower and are not envisaged to cause any stress on the biota.

There is no likely tangible impact from higher noise and emissions during construction on the common animals and birds in the area.

Aquatic Ecology

- ✓ As the water quality of the surface water bodies is not likely to change significantly due to the construction activities, no tangible impact on the aquatic life is expected. No tangible effect is expected to be felt on the surface water quality in the

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C4 - 4
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study area. As such, the existing aquatic biota is not expected to suffer any undue stress due to the said activities.

- ✓ As observed from the present status of terrestrial flora and fauna, it appears that the developmental programme will not cause any significant damage or adversely affect the diversity of terrestrial flora and fauna.

There will be insignificant adverse impact on the ecology of the surface water resources in the area due to this proposed project.

4.2.7 Impacts on Soil and Land Use

All major construction activities tend to create certain changes in the soils of the area. However, it would be confined within & around the boundary of the allocated land only, earmarked for the project purpose. Therefore, the impacts will be minimum.

During storms, some of the excavated soil and construction materials such as sand etc. would be blown up in the air and dispersed around the project site; some would also tend to be driven into the soil and clog inter granular spaces.

Preparatory activities like construction of access roads, temporary offices, quarters and godowns, piling, storage of construction materials etc. will be confined within the project area. These will not generally exercise any significant impact except altering the land use pattern of the proposed site. There will be no impact on the adjoining land.

As a result, the impact on land use would be very insignificant and any impact due to construction will be confined within the project area and will not hamper the land use aspects outside.

Overall, it could be easily inferred that there will be no adverse impact on soil quality & land use in the study area.

However, in order to minimise such impacts, sprinkling of water shall be done.

4.2.8 Impacts on Demography & Socioeconomics

It is estimated that a large number of workers, comprising of skilled, semi-skilled and unskilled labourers, shall be employed by various contractors at site during the construction phase. Significant number of semiskilled and unskilled labourers would be recruited from the nearby areas. This would create some employment opportunities in the area.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C4 - 5
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Since most of sizeable labour force will be drawn from neighbourhood, no change in demographic profile is anticipated. However, there will be increased economic opportunities for the local people.

Most of the construction work is labour intensive. As most of the job will be done by the contractors, it will be ensured that the contractor's workers are provided with proper facilities including sanitation and drinking water supply.

4.3 IMPACTS DURING OPERATION PHASE

4.3.1 Impact on Air Quality

Operation of ships, operation of different cargo handling equipment, handling of bulk cargo, movement of automobiles etc. are likely to generate air emissions, which may affect the air quality in the neighborhood. The main pollutants of concern include:

Particulate Matters (PM)

Suspended as well as respirable particulates are expected to be generated from cargo handling, operation of different plants and equipment, operation of ship engines as well as generators, vehicular movement, stack yard etc.

Sulphur dioxide (SO₂)

Operation of ships and other plants & equipment and different transportation activities are the probable causes of SO₂ emission.

Nitrogen oxides (NO_x)

Operation of ships and automobiles are the primary sources of NO_x emission.

Carbon mono-oxide (CO)

CO emissions are directly related to incomplete combustion of fossil fuel by ships, automobiles and other cargo handling equipment.

4.3.2 Impact due to transportation of materials

Most of the dry bulk cargo shall be transported by rail. As such due to this activity, some negligible adverse impact will be on the surrounding environment.

Presently, the background emissions in the project area are primarily confined to emissions from traffic plying on the near road in the vicinity of the site. During the operation phase of the proposed project, movement of goods' vehicles and loading and unloading operations may contribute to air emissions. But with advanced and stringent traffic management system within the project site, scope for such emission will be minimized. The layout of the proposed project has generous area

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C4 - 6
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earmarked for greenery development. This will act as effective media for arresting the emissions within the project site.

The vehicular traffic plying in and out of the project site will be one of the significant sources of air pollution. If the site is not properly regulated, it can create disruption in free traffic movement leading to air pollution problems. This difficulty can be tackled to a great extent by properly regulating the traffic and by following strict and disciplined vehicular movement and operation in the project site. By imposing vehicular emission standards, this problem can be further mitigated to a large extent. Adequate and planned road network will be set up in the proposed project for smooth movement of the goods vehicles.

IMPACT ON AIR QUALITY

The background emissions in the project area are primarily confined to the emissions from traffic plying on the State Highway-6 in the vicinity of the site. During the operation phase of the project, movement of goods' vehicles and loading and unloading operations may contribute to air emissions. The vehicular traffic plying in and out of the project site will be one of the significant sources of air pollution. But, with advanced and stringent traffic management system within the project site, scope for such emission will be minimized.

There will be some impact on the surrounding environment due to NO_x emission. The impact due to the emission of other pollutants will be insignificant.

Trucks transporting materials shall be covered closely to avoid dust pollution and to prevent theft during transit.

With strict traffic management system and various environmental management practices, contribution of pollutants in the ambient air will be kept under control so as to create minimum disturbances in the neighbourhood.

4.3.3 Impact on Noise

During the operation phase, noise pollution would be generated mainly from ships' generators, engines and propellers, ship loading and reloading, horn soundings, warning alarms; and, road transportation, shipping and cargo handling activities, etc. It is proposed that all the cargo handling equipments will comply with the MoEF&CC rules and stipulations. All vehicles including Cargo handling equipment will be maintained to mitigate undesired noise pollution. Well developed green belt will also reduce noise pollution within project premises.

It is expected that the ultimate noise level in the project area will be within the stipulated norm of 75 dB(A) in day time and 70 dB(A) in the night time (10:00 PM to 06:00 AM).

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C4 - 7
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4.3.4 Impact of Oil Spills

Oil spills may occur accidentally during bunkering operations/loading & unloading operation/grounding & accidents of ships. Oil spills often poses a great threat to the natural resources, fishes, birds and mammals as also to a wide range of subsurface marine organisms. However, this will be mitigated by adopting a well defined on-site Emergency Plan.

4.3.5 Impact of Bulk Cargo Handling & Stacking

Dry bulk cargo such as iron ore, coal will be unloaded on berths. If not handled with due precaution, soil, surface water and groundwater contamination may take place by the leachates from these materials. Stacking of such cargo will be made on concrete surface to ensure all safeguards towards protection of soil and ground water from any type of contamination. Water sprinkling will be done regularly to mitigate dust emission. If proper water sprinkling not done at the above cargo handling locations negative impact is expected in that area.

Liquid bulk cargo will be transported to the respective end users through the pipelines. So, there will be no impact on the air environment, surface or ground water and soil.

4.3.6 Impact of Solid Wastes

Cargo operations produce wastes like remains of bulk cargo storage, waste packaging materials, floating garbage and other wastes, generated from day to day activities. But for a modern project, as has been envisaged in this case, generation of such wastes will be minimum, if not nil. However, such wastes, whatever may be, the quantity, will be stored separately (recyclable and non recyclable) within the port premises from where the recyclable wastes will be periodically handed over to the registered recyclers. The non-recyclable wastes will be handed over the concerned Civic Body for ultimate disposal.

4.3.7 Land Environment

The project area is a piece of vacant land which is owned by SMPK having no human settlement. Setting up of the project will change the land use pattern of the land. However, the change in the land use will have beneficial impact due to the conversion of the unused vacant land into a needful use in the regional context.

4.3.8 Biological Environment

As discussed earlier, the proposed project is not going to generate wastes of concern except some fugitive dust emissions, thus impact of such wastes on the biological environment of the area would be minimum. In addition, a green belt would be developed which will not only improve the aesthetic value of the area, but also act as a very good sink for absorption of air pollutants, attenuation of noise pollution and

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C4 - 8
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provide avenue for reusing/recycling of wastewater. In addition, it will create a good habitat for the birds and other terrestrial fauna.

The storm water will undergo proper treatment before discharge into the river. Hence, there will be insignificant impact on the aquatic environment of the river. Waste water generated from the office will be treated as per CPCB standards & the same will be used for gardening/dust suppression. Hence, no negative impact is expected. Proper greenbelt along with landscape garden will be developed within port premises, which is expected to improve aesthetic value of the project area.

4.3.9 Socio-Economic Environment

The economic condition along with employment opportunities of unskilled and semi-skilled workers are likely to improve. In addition, this proposed project will be a catalyst to growth of supporting industries, transport and communication system in the region. Thus, a significant positive impact on the socio-economy of the study area is expected due to the proposed project.

Due to the construction, the industries of entire hinterland of this port will be benefited. Thus, this will not only improve the economy of the port but also the economy of the entire region as a whole.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C5 - 1
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CHAPTER-5.0

ANALYSIS OF ALTERNATIVES

5.1 ANALYSIS OF ALTERNATIVES

The traffic at Kolkata Dock System has followed a steady growth in the past 5 years. The Syama Prasad Mookerjee Port (erstwhile Kolkata Port Trust) expects rise in Container and General cargo volumes in near future.

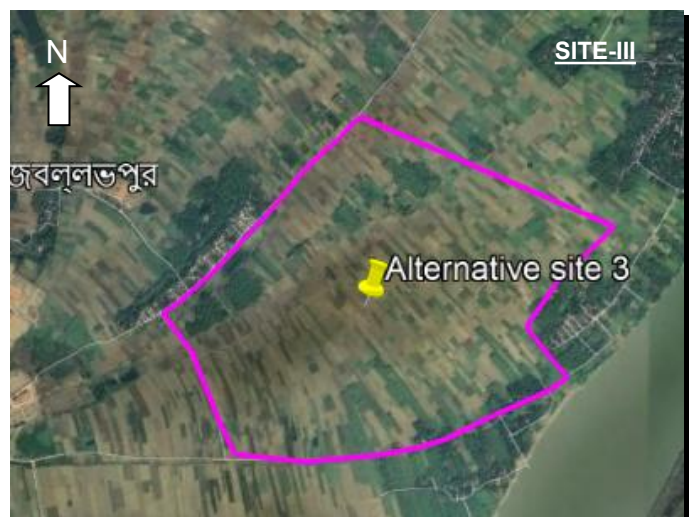
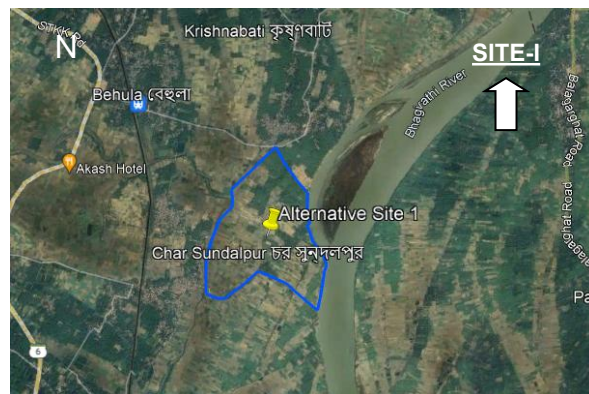
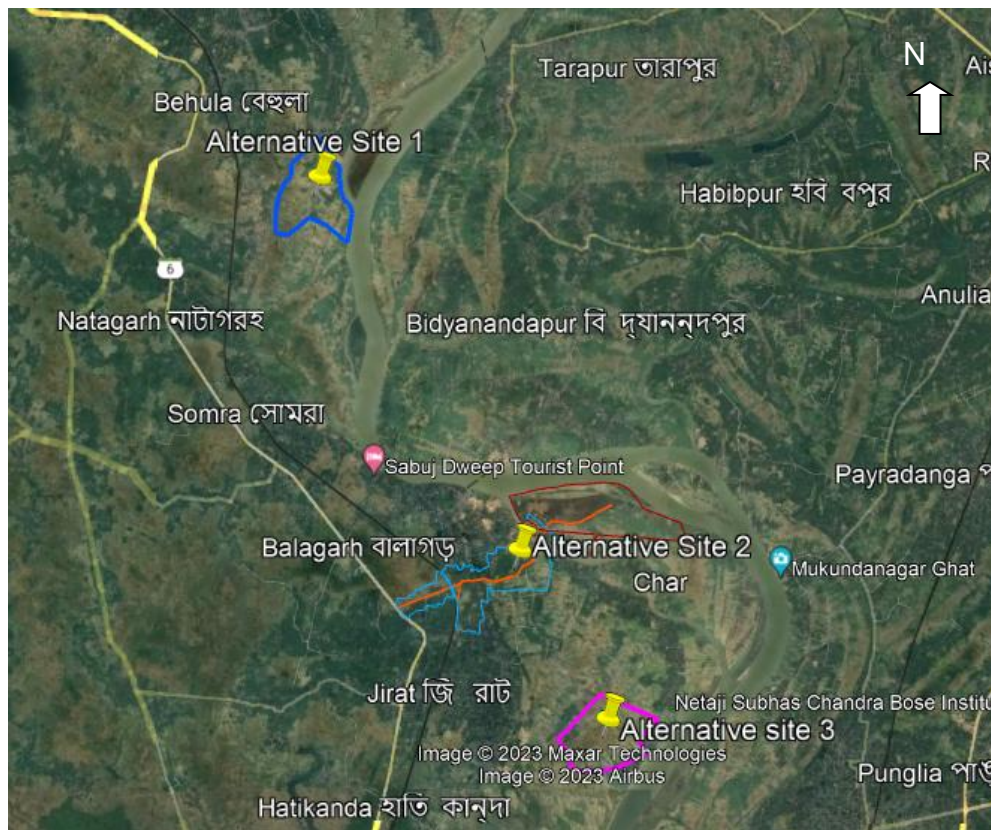
In order to cater up with projected increase in traffic and to overcome the problem of restricted cargo movement within the city limits, KPAL (wholly owned subsidiary of Kolkata Port) intends to shift part of its operation to Balagarh, a site 45 Nautical Miles upstream of Kolkata.

The Balagarh Island has a total land area of about 900 acres - ownership shared by Kolkata Port Trust, State Government and Calcutta Electricity Supply Company. The Port owns about 308 acres of land in this Island.

The following alternative locations/sites were considered and analyzed to select the most suitable location for development of proposed project on the basis of raw material, power & water availability, area requirement and accessibility via road or port.

- ❑ **Alternative Site 1:** Village & PO - Balagarh, District - Hooghly, Pin - 712501, West Bengal (Geographical Co-ordinates: Latitude 23°10'12.16"N and Longitude 88°26'33.55"E with Above Mean Sea Level 27 meters (89ft.))
- ❑ **Alternative Site 2:** Village & PO - Balagarh, District - Hooghly, Pin - 712501, West Bengal (Geo-graphical coordinates are Latitude 23°38'25.28"N and Longitude 87°17'10.17"E with Above Mean Sea Level 38 meters (125 ft.))
- ❑ **Alternative Site 3:** Village & PO - Balagarh, District - Hooghly, Pin - 712501, West Bengal (Geo-graphical coordinates are Latitude 23°05'29.69"N and Longitude 88°29'14.61"E with Above Mean Sea Level 32 meters (105 ft.))

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C5 - 2
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KML OF ALTERNATIVE SITES

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C5 - 3
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5.2 Criteria for Site Evaluation

The following factors have been considered for site evaluation:

- ❖ Away from environmentally sensitive areas
- ❖ Availability of adequate land with favourable terrain and soil condition
- ❖ Availability of infrastructural facilities viz. power, water, road and port facilities.
- ❖ Proximity to the port for transportation of feedstock as well as dispatch of final products.
- ❖ Site slope and drainage pattern

Keeping the above facilities in view, an attempt is made to select a suitable site which meets the above requirements and also results in optimization of not only the initial investment cost but also the operating costs.

5.3 Description of all the considered sites

A. Site – I (at Sundalpur Char)

i. Location

The proposed areas is located at Village & PO - Balagarh, District - Hooghly, PIN - 712501, West Bengal. Its geo-graphical coordinates are Latitude 23°10'12.16"N and Longitude 88°26'33.55"E with Above Mean Sea Level 27 meters (89ft.)

ii. Land & Terrain

Total Land area is 120 Hectares (295 Acres). The proposed land area is vacant with scanty vegetation and no habitation.

iii. Road & Rail

No road network has been available. Balagarh Railway Station is 5.3 km from the project site in the South direction.

iv. Water

As per initial estimation, water demand of the proposed project is expected to be around 60 cum/day. Such water will be made available from the River Hooghly.

v. Power

As per estimation, about 817 KVA of electricity will be required during operational stage, which will be sourced from WBSEDCL.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C5 - 4
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B. Site – II (at Balagarh)

i. Location

The proposed project is situated at Village & PO - Balagarh, District - Hooghly, PIN - 712501, West Bengal. Its geo-graphical coordinates are Latitude 23°38'25.28"N and Longitude 87°17'10.17"E with Above Mean Sea Level 38 meters (125 ft.)

ii. Land & Terrain

Approx. 124.95 Hectares (308.75 Acres) of land is available for the proposed project. The terrain is flat.

iii. Road & Rail

The island can easily be connected to SH-6 through existing bridge (only the approaches to be constructed). Balagarh Railway Station is 5.1 km from the project site in the West direction.

iv. Water

As per initial estimation, water demand of the proposed project is expected to be around 60 cum/day. Such water will be made available from the River Hooghly.

v. Power

As per estimation, about 817 KVA of electricity will be required during operational stage, which will be sourced from WBSEDCL.

Further, the area is strategically well connected with Asansol and Durgapur and Jharkhand Industrial belt. Acquisition of land for road connectivity with SH-6 has already been completed by CESC and CESC agreed to share the acquired land with SMPK. So, R&R issue is not envisaged.

C. Site – III (at Jirat Char)

i. Location

The proposed project is situated at Village & PO - Balagarh, District - Hooghly, PIN - 712501, West Bengal. Its geo-graphical coordinates are Latitude 23°05'29.69"N and Longitude 88°29'14.61"E with Above Mean Sea Level 32 meters (105 ft.)

ii. Land & Terrain

Approx. 121 Hectares (300 acres) of land is available for the proposed project. The terrain is flat.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C5 - 5
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iii. Road & Rail

No road network has been available. Balagarh Railway Station is 5.1 km from the project site in the West direction.

iv. Water

As per initial estimation, water demand of the proposed project is expected to be around 60 cum/day. Such water will be made available from the River Hooghly.

v. Power

As per estimation, about 817 KVA of electricity will be required during operational stage, which will be sourced from WBSEDCL.

5.4 Conclusion/Recommendation

The facts presented in preceding paragraphs mandate that Site-II at Balagarh, Hooghly emerges as technically best suitable site w.r.t. land availability. It is substantially advantageous in terms of environmental and technical criteria. The Port of Kolkata felt the need of setting up additional cargo handling facilities at a new location upstream of Kolkata which would decongest the existing cargo handling facilities at KDS and eventually Balagarh was selected to be a suitable location for this purpose. Selection of project site of a port depends primarily on availability of desired draft, adequate back-up area, cargo evacuation connectivity (road, rail, river transport network), social and environmental impacts of the project and technical viability of commissioning the port. To minimize social impact, the number of project affected people and properties should be minimum. Similarly, degradation of natural environment and more particularly uprooting of trees should also be kept minimum. Keeping all these in mind, a site selection exercise was done with the inputs from the multi-disciplinary Team of experts (Engineers, Environment Specialist and Social Development Specialist etc). Adjudging the above mentioned issues, the area upstream 84 km upstream of present Kolkata port has been found to be the best location.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C6 - 1
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CHAPTER-6.0

ENVIRONMENTAL MONITORING PROGRAMME

6.1 INTRODUCTION

Environmental monitoring is the repetitive and systematic measurement of the characteristics of environmental components. The post project environmental monitoring program serves as the key tool to check the performance of mitigation measures implemented / adequacy of pollution control technologies installed.

6.2 ENVIRONMENTAL MONITORING PROGRAMME

Monitoring of the following aspects is important to keep a constant check on the environmental performance of the project and also the environmental quality of the area.

- Ambient Air Quality
- Stack Emission
- Work zone Air quality,
- Water Quality
- Wastewater Quality
- Drinking Water Quality
- Noise Level
- Plantation Condition
- Periodic Preventive Maintenance
- Occupational Health & Safety Monitoring
- Fire Safety Monitoring

Ambient Air Quality

Ambient air quality monitoring is being monitored at 4 locations inside the project site for the relevant parameters, as stipulated in NAAQS 2009, by NABL approved Laboratory.

Fugitive emissions of PM₁₀ will be monitored with a frequency of once in three months in the project area, where fugitive dust emissions are anticipated like the raw material handling area (unloading and storage), truck movement and parking areas, solid wastes storage area to ensure

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C6 - 2
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that air pollution control measures are working properly.

Table 6.1: Air Pollutant Measurement Technique

Sl. No.	Parameter	Technique	Technical Protocol Minimum Detectable
1	Respirable Particulate Matter (PM ₁₀)	Respirable Dust Sampler (Gravimetric Method)	IS 5182 (Part 23) : 2006 Reaffirmed 2012
2	PM _{2.5}	Fine Respirable Dust Sampler (Gravimetric Method)	CPCB method -
3	Sulphur Dioxide	Modified West & Gaeke method	IS 5182 (Part 2) : 2001 Reaffirmed 2012
4	Oxides of Nitrogen	Jacob & Hochheiser method	IS 5182 (Part-6): 2006 Reaffirmed 2012

Stack Emissions

Emissions from all stacks will be monitored manually using stack monitoring kit. Online Continuous Emission Monitoring System has already installed.

The flue gas from all the stacks will be monitored for PM and the Power Plant stack for PM, SO₂ and NO_x.

Table 6.2: Stack Measurement Technique

Sl. No.	Parameter	Technique	Technical Protocol Minimum Detectable
1	Particulate Matter	Gravimetric Method	IS 11255 (Part 1) : 1985 Reaff. 2014
2	Sulphur Dioxide	IPA – Thorin method	IS 11255 (Part 2) : 1985 Reaff. 2014
3	Oxides of Nitrogen	Phenol di-sulphonic acid method	IS 11255 (Part 7): 2005 Reaff. 2012

Ground Water Quality

Ground water will be monitored inside the project site, near solid wastes storage area by installing a piezometer. Groundwater quality monitoring will be also done at nearby villages (3 villages located along the boundary of plant). The monitoring will be carried out with a frequency of four times in a year.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C6 - 3
---	--	---------------

Wastewater Quality

Zero wastewater discharge has been planned for the project. There will be wastewater treatment plant and final treated wastewater after treatment will be reused. Yet the treated wastewater quality before use will be regularly monitored on monthly basis.

Meteorology

A meteorological station will be set-up at the project site for the record of meteorological parameters such as wind velocity and direction, ambient temperature, relative humidity, atmospheric pressure, rainfall etc.

Noise

Noise monitoring will be carried out inside the work area of each plant and near the high noise generating areas, at plant boundary and outside the project site at nearby villages twice in a year.

Plantation

The project proponent has trained people to look after and record the conditions of tree plantation and greening of the project area.

Periodic Preventive Maintenance

All instruments installed or used for monitoring and recording of working environment parameters will be regularly tested and calibrated, and the respective records maintained.

Occupational Health & Safety Monitoring

The occupational health and safety monitoring program shall include safety inspection, testing and calibration. Project proponent shall carry out inspection and testing of all safety features and hazard control measures for plant operation. This shall include regular inspection and testing of all safety features and hazard control measures focusing on engineering and personal protective features, work procedures, places of work, installations, equipment, and tools used. The inspection shall verify that issued personal protective equipment (PPE) continues to provide adequate protection and is being worn as required.

Conclusion

The post project monitoring programme, consisting of various disciplines, no. of locations, parameters, frequency of monitoring along with the fund provision for the expansion-cum-modification project has been presented in **Table-6.3**.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C6 - 4
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However, the monitoring programme w.r.t. the frequency and the sampling locations will be finally decided in consultation with the State Pollution Control Board and Regional Office of MOEF&CC.

TABLE-6.3
POST PROJECT MONITORING PROGRAMME

Discipline	Locations	Parameters	Frequency	Fund Provision (Annual Cost in Lakhs)
Meteorology (Met Station)	One	Temperature, Rainfall, Relative Humidity, Atmospheric Pressure, Wind Speed and Direction	Hourly	2 lakhs
Ambient Air Quality	3-4 relevant locations	PM ₁₀ , PM _{2.5} , SO ₂ & NO ₂	Quarterly	12 lakhs
Fugitive Emission	3-4 relevant locations	PM	Quarterly	1 lakh
STP	Process Effluent	pH, Total Suspended Solid, Temperature, Oil & Grease, Copper, Iron & COD	Yearly	1 lakh
Ground Water Quality	2-3 Locations	pH, Temperature, Conductivity, Turbidity, Alkalinity, Chlorine, Total Suspended Solid, Total Dissolved Solids, Total Hardness, Ca-hardness, Mg-hardness, Coliform, Fe, Cu, Cd, Cr ⁶⁺ , Pb, As, Hg, Zn	Yearly	1 lakh
Drinking Water Quality	1 Location	pH, Temperature, Conductivity, Turbidity, Alkalinity, Chlorine, Total Suspended Solid, Total Dissolved Solids, Total Hardness, Ca-hardness, Mg-hardness, Coliform, Fe, Cu, Cd, Cr ⁶⁺ , Pb, As, Hg, Zn	Yearly	1 lakh
Noise	Port Area and Nearby villages	Day-and Night-Time Noise Levels	Half-yearly	1 lakh
TOTAL				19 lakhs

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 1
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CHAPTER-7.0

ADDITIONAL STUDIES

(HAZARD IDENTIFICATION & RISK ASSESSMENT AND DISASTER MANAGEMENT PLAN)

7.1 INTRODUCTION

Considering the generic structure of the EIA/EMP report prescribed in EIA Notification dated 14.09.2006, this chapter comprises of public consultation, Risk Assessment, social impact assessment and R&R Action plan.

This chapter deals with identification of the potential hazards and disaster and preventive measures for disaster. The proposed Development of an Extended Port Gate System project may encounter with certain types of hazards which can disrupt normal activities suddenly and lead to disaster like fires, inundation, failure of machinery, electrocution etc. Disaster management plan has been formulated with an aim of taking precautionary step to control the hazard propagation and ward off disaster and also to take such action after the disaster which minimize the damage.

Industrial activities, involved in producing, treating, storing and handling of hazardous substances, have a high hazard potential to safety of man and environment at work place and outside. Recognizing the need to control and minimize the risks posed by such activities, the Ministry of Environment, Forest and Climate Change (MoEF&CC) has notified the “Hazardous and other wastes (Management and Transboundary Movement) Rules in the year 2016 (In super session of the Manufacture, Storage, Handling and Transboundary Movement and Hazardous Waste Rules, 2008). For effective implementation of the rule, Ministry of Environment Forest and Climate Change has provided a set of guidelines. The guidelines, in addition to other aspects, set out the responsibilities/duties needed to be performed by the occupier along with the procedure. The rule also lists out the industrial activities and chemicals, which are needed to be considered as hazardous.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 2
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The proposed activities are scrutinized in line with the above referred “Manufacture, storage and import of hazardous chemicals rules” and observations/findings are presented in this document.

Port activities involve hazardous processes, which can result in significant risk to the work environment and hence needs proper assessment.

7.2 RISK ASSESSMENT

Risk is the unwanted consequence of an event or series of events. Risk occurs when multiple risk causing factors occur at the same time causing an accident manifesting in an event like a fire or explosion. Risk Assessment (RA) is a method that has proven its value as an all-round tool for improving the safety standards prevalent in every hazardous industry. With advancements in in-built and inherent safety systems, accidents rates have come down, but still persist at unacceptable levels for newer technology, new plants and chemical handling facilities. RA is a structured safety assessment tools designed for high hazard industries such as chemical, petrochemical, pesticides, pharmaceuticals, sea ports, etc., supplementing other safety systems tools such as HAZOP, safety audit, and regular incident analysis to identify the potential for incidents (near-misses, unsafe conditions) and to evaluate the necessary control measures.

In order to cater up with projected increase in traffic and to overcome the problem of restricted cargo movement within the city limits, KPAL (wholly owned subsidiary of Kolkata Port) intends to shift part of its operation to Balagarh, a site 45 Nautical Miles upstream of Kolkata.

Two dedicated berths, one for container and one for coal have been planned commensurate with 85000 TEU (1.1 MTPA) container traffic and 1.6 MTPA coal traffic. The total capacity of the terminal works for two berths works out to be about 2.7 MTPA.

A major accident has the potential to cause serious injury or loss of life and extensive damage to environment or property or serious disruption outside the plant. It may require the assistance of outside emergency services to effectively handle the situation. Accidents are normally caused by a number of different factors, e.g. plant/system failure, human error, earthquake, vehicle crash or sabotage. An important element of risk mitigation is emergency preparedness, which is recognizing the potential situations & consequences and prepare on site emergency plan.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 3
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7.2.1 Hazard identification

Identification of hazards is of primary significance in the analysis, quantification and cost effective control of accidents. Potential Hazards identified in the proposed project have been broadly classified as below:

Hazards during Construction Phase:

- Mechanical Hazards
- Transportation Hazards
- Physical Hazards
- Storage and Handling of Hazardous Materials

Hazards during Operation Phase:

- Material Hazards
- Handling Hazards

Hazards due to:

- Natural Calamities Earthquake
- Tsunami
- Cyclone/Flood

Hazards during Construction Phase:

Potential hazards during the construction phase of the project could be due to the mechanical hazards, navigation/ transportation hazards, physical hazards and storage and handling of hazardous materials.

Mechanical Hazards: Mechanical hazards during the construction phase arise due to the moving parts in the machinery, especially the belts and bolts of the construction equipment, which are heavy and pose a threat to the work personnel. Other hazards include falling (during working at heights), falling objects like hand held tools, etc; failure of slips and traps created for scaffolding; and due to faulting of electrical equipment.

Navigation/ transportation Hazards: Planning of access/egress to construction site also plays significant role in minimizing the associated hazards such as vehicles/ barges collision.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 4
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Physical Hazards: The noise and vibrations generated during construction phase may affect the workers health, hinder effective communication and may jeopardise sensitive organs. In addition to noise and vibration, hot works also pose a considerable hazard to the workers.

Hazards during Operational phase:

The objective of hazard identification is to identify and evaluate the hazards and the unintended events, which could cause an accident. The first task usually is to identify the hazards that are inherent to the process and/or plant and then focus on the evaluation of the events, which could be associated with hazards. In hazard identification and quantification of probability of occurrence it is assumed that the extended port will perform as designed in the absence of unintended events (component and material failures, human errors, external event, process unknown), which may affect the port/process behaviour. The types of materials to be handled i.e. coal and container are non hazardous in nature.

Material Hazards: During operation, coal will be handled at the proposed facility. The cargo hazard classification can be made based on its Characteristics such as Flammability, explosiveness, toxicity or corrosivity etc. The ratings are given in NFPA (National Fire Protection Association) Codes and Material Safety Data Sheets (MSDS).

Handling Hazards: Proposed berths involves handling of coal cargo. The hazards related to coal transport and unloading may be due to accidents, breaking of unloading arms, failure in mechanical components, etc. The handling hazards include:

- Failure to use appropriate control measures and Personal Protective Equipment (PPE),
- Use of expired/worn Personal Protective Equipment's (PPE's),
- Failure of liquid delivery tool,
- Possible hazards during barge movements at the port are collision, grounding, etc.
- Likely hazards during loading and unloading of coal,
- During barge unloading operations, the possible hazard may arise due to collision by another vessel and others

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 5
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Cargo handling: A fully mechanized ship loading/unloading system (Pipelines) is planned at the berths. The major components of the mechanised ship loading/unloading system are Pumps and Pipelines.

Barge movements/Navigation Hazards: The possible navigation hazards during operation phase are grounding and collision of barges / vessels at proposed Balagarh extended port gate project. However, these would be controlled by suitable barge traffic management by Kolkata Port.

Barge unloading: During barge unloading operations, possible hazard may arise due to collision by another vessel and others.

Slip and Trip Hazards: Workers performing cleaning operations are exposed to slippery working surfaces and tripping hazards. This places workers at risk of:

- Slipping off oily and greasy ladders
- Tripping over equipment, hoses, and vessel structures

A Preliminary Hazard Analysis was carried out initially to identify the major hazards associated with handling and transport of bulk cargo. This was followed by consequence analysis to quantify these hazards. Finally the vulnerable zones were plotted for which risk reducing measures are deduced and implemented. The need for communicating acceptable risks is very important. Though setting acceptable criterion for use in Quantitative Risk Assessments may often lead to disagreement between parties, nevertheless sound techniques and methods have led to the definition of acceptable levels of risks taking into account the need of people to feel safe in their day-to-day activities.

A Risk Analysis should therefore, be seen as an important component of any or all on- going preventive actions aimed at minimizing and thus hopefully, avoiding accidents. Re-assessments should therefore follow at regular intervals, and/or after any changes that could alter the hazard, so contributing to the overall prevention programme and disaster management plan of the project.

7.2.2 Description of Cargo Handling Operation

The proposed extended port gate project comprises of two dedicated berths, one for container and one for coal have been planned to commensurate with 85000 TEU (1.1 MTPA) container traffic and 1.6 MTPA coal traffic

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 6
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Coking coal, thermal coal and other bulk cargo will be stored in a hard stranded area made with concrete pavement. The hard stranded area will have an impervious polythene sheet above the sand layer in order to stop percolation of leachate into the ground water. The entire hard stranded area where the storage of coal will be kept will have a peripheral drain of 600 mm wide and 1000 mm depth to collect the run off. Such runoff will be conveyed to a rain harvesting tank through a settling pit. The settled solids from the pit will be periodically removed.

7.3 RISK ANALYSIS

Risk is defined as the consequences of a particular activity in relation to the likelihood that this may occur. Risk measurement or analysis thus comprises of two variables:

- 1) Magnitude of consequences of certain accident and
- 2) Probability of occurrence of this accident

Probability of a certain accident depends on the probability of failure of a plant component including human error/failure and failure of designed counter measures.

Probability of a certain consequence depends on the probability of weather/stability class, probability of wind direction, probability of ignition in case of a fire or explosion, and finally probability of being injured or killed which depends on the damage criteria and escape factors.

7.3.1 Risk Analysis Methodology

The four normal components of a risk analysis study are:

- 1) Identification of hazards and accident scenarios
- 2) Calculation of physical effects and consequences
- 3) Estimation of the probabilities and frequencies
- 4) Risk assessment and calculation of risk levels

Major chemical hazards are generally considered to be of two types:

- Flammable (fire, explosion etc)
- Toxic (toxic gas cloud)

Where there is the potential for gas/vapour releases, there is also the potential for explosions. These often produce overpressures which can cause fatalities, both through direct action on the body or through plant and building damage.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 7
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Accidental release of flammable or toxic vapours can result in severe consequences. Delayed ignition of flammable vapours can result in blast over pressures covering large areas. This may lead to extensive loss of life and property. Toxic clouds may cover yet larger distances due to the lower threshold values in relation to those in case of explosive clouds (the lower explosive limits).

In contrast, fires have localized consequences. Fires can be put out or contained in most cases; there are few mitigating actions one can take once a vapour cloud gets released. Major hazards arise, therefore, consequent upon the release of flammable or toxic vapours or BLEVE in case of pressurized liquefied gases.

Various studies such as Hazard and operability studies, Event tree analysis, 'What-if' analysis etc are normally applied for the identification of potential hazards.

Inventory plays an important role in regard to the potential hazards. Larger the inventory of a vessel or a system, larger is the quantity of potential release. A practice commonly used to generate an incident list is to consider potential leaks and major releases from fractures of pipelines and vessels containing sizable inventories of flammable/toxic materials.

The range of possible releases for a given component covers a wide spectrum, from a pinhole leak upto a catastrophic rupture (of a vessel) or full bore rupture (of a pipe). It is both time consuming and necessary to consider every part of the range; instead, representative failure cases are generated. For a given component these should represent fully both the range of possible releases and their total frequency.

In general, the following typical types of failures are considered:

- Rupture for vessels
- Full bore rupture for pipes
- Large leaks (mainly connection failures), 100 mm equivalent diameter
- Small and Very small leaks (due to corrosion, impact and other such cases), 25 and 5 mm equivalent diameter leaks respectively.

For this type of analysis, a screening process is also implemented. This ensures that attention is focused on events with potential to cause fatalities. All events which do not have the potential to generate consequences are eliminated at this stage.

When the appropriate inputs are defined, the software calculates the source terms of each release, such as the release rate, release velocity,

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 8
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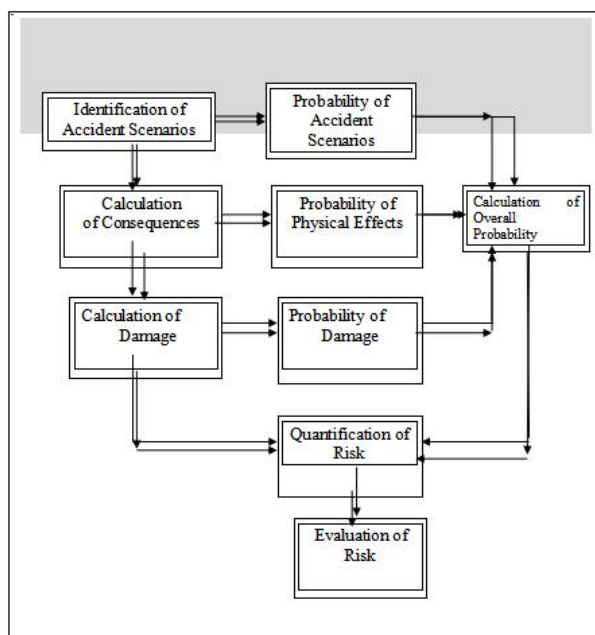
release phase and drop size. These source term parameters then become inputs to the consequence modelling.

Quantitative risk assessment (QRA)

Estimation of individual risk or consequence of a single accident scenario depends on a number of factors. Probability of a certain accident depends on probability of failure of a plant component including human error/ failure and failure of designed counter measures. Probability of a certain consequence depends on the probability of wind direction, probability of ignition case of a fire or explosion and finally probability of being injured or killed which depends on the damage criteria. Quantitative Risk Assessment (QRA) is a means of making a systematic analysis of the risks from hazardous activities, and forming a rational evaluation of their significance, in order to provide input to a decision-making process.

The first stage in a QRA is defined as system definition where the potential hazards associated with a facility or activities are to be analyzed. The hazard identification consists of a qualitative review of possible accidents that may occur.

In parallel with the frequency analysis, consequence modelling evaluates the resulting effects if the accidents occur, and their impact on people, equipment and structures, the environment or business, depending on the defined scope of the QRA study. Estimation of the consequences of each possible event often requires some form of computer modelling. Consequence analysis requires the modelling of a number of distinctive phases, i.e., discharge, dispersion, fires and explosions (for flammable materials).



Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 9
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The scenarios considered for release of flammable and toxic chemicals are:

- Fireball – Immediate ignition of a large amount of vapour gas
- Flash fire - Delayed ignition of zone of gas / vapour
- VCE – Vapour Cloud Explosion – Explosion of a dispersing cloud
- Jet flame – Immediate ignition of a continuous releasing vapour
- Pool fire – Liquefied pool catches fire
- BLEVE – Boiling Liquid Expanding Vapour Explosion – This occurs when a pressurised tank of flammable liquid is subjected to fire. First, it raises the internal pressure and then it weakens the tank shell. This can cause the tank burst catastrophically releasing a large quantity of boiling liquid which vaporises violently and then may ignite to form a fireball. The BLEVE will also produce large projectiles from the parts of ruptured vessel or from neighbouring equipment and cause significant damage.

Closely liaised with the consequence assessment is the impact assessment, i.e. how does the fire, explosion affect human beings. When the frequencies and consequences / impact of each modelled event have been estimated, they can be combined to produce risk results. Various forms of risk presentation may be used, commonly grouped as follows: - Individual risk - the risk experienced by an individual person

Thermal damage:

The hazards will cause different levels of damage and its area of concern will be also different. It is therefore useful to decide on the damage criteria relevant to each type of hazard. For the present study only thermal damages are being considered.

Pool fire, jet flame, flash fire will generate heat radiation. Following have been given as the heat flux levels important for hazard analysis.

TABLE 7.1
EFFECT OF HEAT RADIATION

Heat Radiation	Effect
37.5 kw/m ²	Damage to equipment
12.5 kw/m ²	Melting plastic
4.0 kw/m ²	Blistering
1.6 kw/m ²	Severe hot feeling

Thermal damage is a function of amount of heat flux as well as exposure time. This is true both for plant equipment and people.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 10
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TABLE 7.2
HEAT RADIATION AND FATALITY

Radiation Level (kw/m ²)	Exposure time in seconds for % fatality		
	1%	50%	99%
1.6	500	1300	3200
4.0	150	370	930
12.5	30	80	200
37.5	8	20	50

Total exposure is expressed by a quantity obtained by the following equation. (Radiation) E+1.333x Time. For 1% human fatality this value is about 1000.

Overpressure Damage

Explosion release a sudden amount of energy which travels as a shock wave or over pressure.

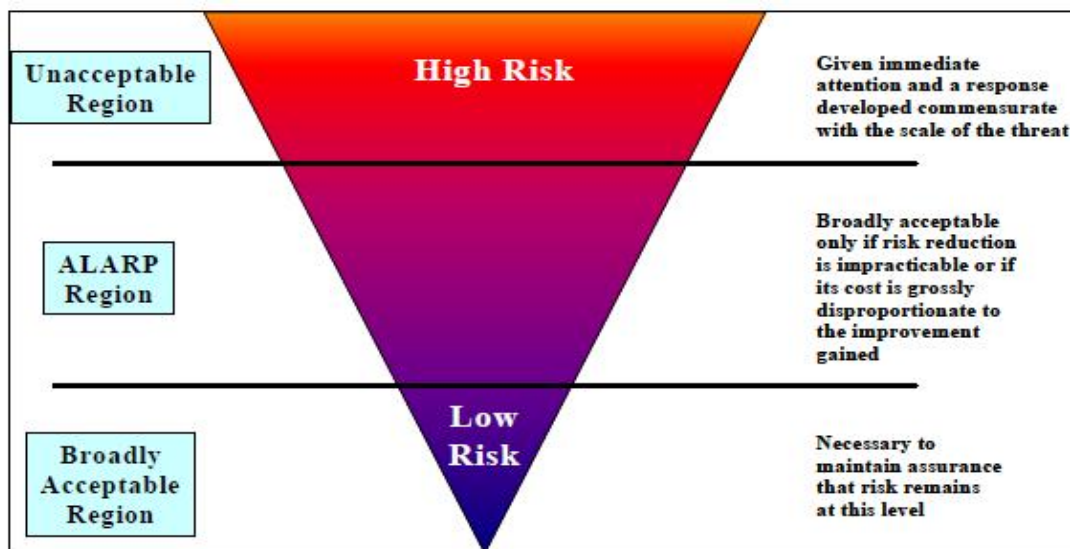
TABLE 7.3
OVERPRESSURE AND DAMAGE

Over pressure (milibar)	Damage type
345	Heavy Damage
140	Repairable Damage
70	Major Glass Damage
20	10 % Glass Damage

Risk Criteria

The next stage is to introduce criteria, which are yardsticks to indicate whether the risks are acceptable, or to make some other judgment about their significance. Risk assessment is the process of comparing the level of risk against a set of criteria as well as the identification of major risk contributors. The purpose of risk assessment is to develop mitigation measures for unacceptable generators of risk, as well as to reduce the overall level of risk to As Low as Reasonably Practical (ALARP).

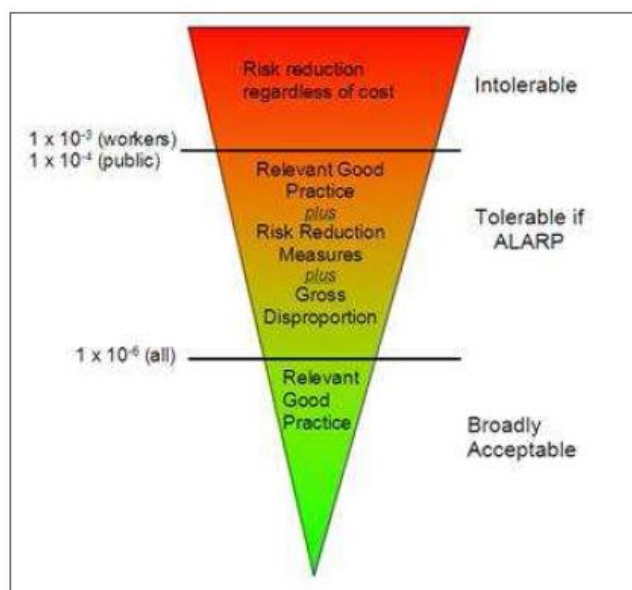
Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 11
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The UK HSE Individual Risk Criteria is generally considered to assess the risk for the proposed project.

Risk criteria for Individual Risk for on-site are as follows:

- Individual risk levels above 1×10^{-3} per year will be considered unacceptable and will be reduced, irrespective of cost
- Individual risk levels below 1×10^{-6} per year will be broadly acceptable
- Risk levels between 1×10^{-3} and 1×10^{-6} per year will be reduced to levels as low as reasonably practicable (ALARP). The risk within this region is tolerable only if further risk reduction is considered impracticable because of the cost required to reduce the risk is grossly disproportionate to the improvement achieved.



Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 12
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CONCLUSION & RECOMMENDATION

Based on the consequence analysis in the event of a fire, an effective emergency plan will have to be worked out and rehearsed for fire fighting and to evacuate the people safely.

Adequate number of fire and smoke detectors along with Alarms, Panel indications in control room should be provided in fire prone areas. Sufficient isolation valves must be installed.

In on-site emergency plan, provision should be made for adequate combination of fire fighting media located strategically along with crew of trained fire fighters so that fires as envisaged in this study could be quickly controlled.

The emergency response time for arresting release, fire fighting, safe evacuation of plant personnel and safety of stored inventory is critical to people's safety both on-site and off-site. Hence Regular Mock Drill to check preparedness level and resources' efficiency to be conducted.

Well defined standard operating procedures (SoPs) shall be followed. TPM i.e. Total Preventive Maintenance practices may be adopted to improve plant performance and safety.

The entire operating system should be designed, constructed and operated in accordance with the safe engineering practices and standards.

7.3.2 Handling and Storage

Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not breathe dust.

Storage:

Keep container dry. Keep in a cool place. Ground all equipment containing material. Keep container tightly closed. Keep in a cool, well-ventilated place. Combustible materials should be stored away from extreme heat and away from strong oxidizing agents

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 13
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7.3.4 Accidental Release Measure

Small Spill:

Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:

If the product is in its solid form: Use a shovel to put the material into a convenient waste disposal container. If the product is in its liquid form: Absorb with an inert material and put the spilled material in an appropriate waste disposal. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system.

Fire Fighting Media and Instructions:

SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Exposure Controls/Personal Protection Engineering Controls:

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Boots. Gloves. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits: Not available.

7.4 OIL SPILLS CONTINGENCY PLAN

INTRODUCTION

Oils spills has a serious environmental and economic threats on port activities as well as overall port activities. Generally, extent of damage due to oil spills is temporary and localized and it is caused primarily by the physical properties of oil creating nuisance and hazardous conditions.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 14
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Since, there is no proposal of handling oil in the proposed project at Balagarh, therefore, Oil Spills Contingency Plan is not applicable here.

7.5 RISK ASSESSMENT FOR HANDLING DRY CARGO

The proposed project has lower risk potential than those project dealing with toxic and flammable chemicals. Off-site people are not exposed to any dangers, hence the societal risk is insignificant.

For hazard identification, maximum credible accident (MCA) scenarios have been assessed. The maximum credible accident has been characterized as an accident with a maximum damage potential and the occurrence of which is most probable. Based on MCA scenario, the following hazards were identified for this project.

- (a) Fire in coal storage yard
- (b) Mechanical injury to body parts

(a) Fire in coal yard: This is the most common accident known to occur in any project, storing and handling coal. Since such incident takes sufficient time to get widespread, enough response time is available for plant personnel to get away to safer distance. Appropriate fire fighting systems will be installed to mitigate the accidental risk. Water for fire fighting is available in the cooling water pond.

(b) Mechanical injury to body parts: In such dock project, there are several places where workers are likely to be involved with accidents resulting in injury to body parts. The places are main dock area, workshop, during mechanical repair work in different part of the dock area, during construction work, road accidents due to vehicular movement, etc. All machinery comprises of standard engineering designs meeting all quality specifications. Since most accidents occur due to human error and improper work practice, safety awareness workshop for the plant personnel are organized on regular basis. Workers are encouraged to wear and use appropriate safety devices like boots, gloves, helmets, aprons, goggles and safety belts.

7.6 RISK ASSESSMENT DUE TO COAL STORAGE

In the proposed extended port gate at Balagarh, mainly coal will be stored, which may cause risk to the environment due to fire.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 15
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Coal is typically stored on an outside stockpile. As significant amount of coal is stored, the risk of fire will exist.

Coal is a combustible material, making it susceptible to a variety of ignition scenarios. Coal may be susceptible to spontaneous combustion; provided it is exposed to the required heat in the presence of the oxygen necessary for heating. Spontaneous combustion has long been recognized as a fire hazard in stored coal. Spontaneous combustion fires usually begin as "hot spots" deep within the reserve of coal. The hot spots appear when coal absorbs oxygen from the air. Heat generated by the oxidation then initiates the fire.

The heat requirements to complete the fire triangle or the explosion pentagon can be in the form of temperature or energy. The ignition temperature of a coal dust cloud decreases as the volatile content increases. At about 150-300°F, it begins to give off minute, but measurable, quantities of gas -aerosols, hydrogen, and CO₂, precursors of combustion. As the temperature increases further, at about 600-700°F, relatively, large, visible particulates are emitted. Soon, as the heating rate increases in intensity to about 750-800°F, incipient combustion, and ultimately self-ignition and flame, will occur. With dust layers on hot surfaces, the minimum ignition temperature decreases sharply as the thickness of the deposit is increased. This is due to the fact that thicker dust layers capture and hold heat more readily.

RECOMMENDATIONS

Preventing spontaneous combustion coal fires involves attention to many different factors. Among the most critical are the type, age, and composition of coal, the storage methods. Given the right kind of coal, oxygen, and a certain temperature and moisture content, coal will burn by itself.

Such fires can be very stubborn to extinguish because of the amount of coal involved (often hundreds of tons) and the difficulty of getting to the seat of the problem. Moreover, coal in either the smoldering or flaming stage may produce copious amounts of methane and carbon monoxide gases. In addition to their toxicity, these gases are highly explosive in certain concentrations, and can further complicate efforts to fight this type of coal fire.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 16
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Following recommendations may be followed:

- (i) Coal Storage Site Preparation: The coal storage site must be properly chosen and prepared. The ground should be cleared of any vegetation and refuse. A hard packed clay or sandy soil is ideal; if not available, a concrete pad can be installed to keep dirt out of the coal. The site should be dry, level and well drained. If it doesn't drain naturally, drains should be installed around the storage pile, not underneath it as this may produce upward air currents through the pile aiding spontaneous combustion. Make sure the site is away from any external heat sources as combustion liability increases with a rise in temperature.
- (ii) To know the type of coal: Anthracite (sometimes called eastern coal) has a high carbon content and is much less combustible than low oxygen content bituminous (or western) coal. Freshly mined coal absorbs oxygen more quickly than coal mined at an earlier time, and is more likely to head spontaneously.
- (iii) Storing coal with low sulphur content is helpful. Sulphur compounds in coal liberate considerable heat as they oxidize.
- (iv) Air circulating within a coal pile should be restricted as it contributes to heating; compacting helps seal air out.
- (v) Moisture in coal contributes to spontaneous heating because it assists the oxidation process. Coal having a high moisture content should be segregated as quickly as possible. Efforts should be made to keep stored coal from being exposed to moisture.
- (vi) Following the "first in, first out" rule of using stock reduces the chance for hot spots by helping preclude heat buildup for portions of stock which remain undisturbed for a long term. The design of coal storage is important in this regard.
- (vii) A high ambient temperature aids the spontaneous heating process.
- (viii) Remove coal as quickly as practicable. The longer large coal piles are allowed to sit, the more time the spontaneous process has to work.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 17
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(ix) The shape and composition of open stockpiles can help prevent fires. Dumping coal into a big pile can lead to problems. Rather, coal should be packed in horizontal layer. This method helps distribute the coal evenly and thus avoids breakage and segregation of fine coal. Segregation of coal particles by size should be strenuously avoided, as it may allow more air to enter the pile and subsequent heating of finer sizes.

(x) The height of the coal pile is also important. Limit unlayered, uncompacted high grade coal to a height of 15' (10' for low grade coal); maximum height is 26' for layered and packed coal.

(xi) Properly inspect, test and maintain installed fire protection equipment.

(xii) Maintain an updated pre-fire plan and encourage regular visits to coal facilities by the site or local emergency response force.

7.7 ON-SITE DISASTER MANAGEMENT PLAN

This chapter contains arrangements, which are general in nature and will apply to all types of accidents/disasters and highlight the duties and responsibility of all participants including the various divisions of proposed project Complex.

This Chapter contains the detailed action plans of various divisions like Marine, Shipping & Cargo Handling, P&E, I&CF, Medical, Finance, Administration etc. of the proposed project.

The following table describes the certain key terminology used in DMP.

Control Room/ Base Control	The control room will be set up in the Office/ Administrative building from which the Management Group will operate. If, however, any disaster broke out at the said building itself, alternate site for control room will be at the CISF & Internal Security building.
Forward Control	The Action Team, which is at the scene of incidence and engage in combating it. The control room will be set up in the vehicle of Port Fire Service, engaged in the operation.
Watch Room	The Main Office of Port Fire Service

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 18
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Fire Service	All Fire Service stations
Signal Station	The Port control station situated at Marine office.

The types of disaster as envisaged in this plan and areas that may become affected by each type of disaster are broadly classified as follows:

Fire/Explosion Hazard involving:

- Ships at the multipurpose jetties.
- Cargo storage area

Accidental Hazard involving:

- Collision and grounding of ships, lifting appliances, drowning of dockworkers, retrieval of transport equipment from dock basin, etc.
- Sinking of vessel.

Hazard due to Natural Calamities:

- Storm, Flood and Earthquake in Dock areas.

7.7.1 Raising the Alarm and Control of Operations

During the disaster or any incidence having potential to turn into disaster situation, it is vital that the alarm should be raised immediately. The initial responsibilities for raising the alarm have been detailed in each section of the plan in subsequent sections.

Every time an alarm is raised information flow should be as detailed earlier. Upon receiving the information about the disaster the Fire Service and Administration division will contact West Bengal Fire Service and local police for their assistance, if necessary.

Each division will designate an officer who should be informed whenever a disaster occurs whether during office hours or on holidays. The nominated officer will directly supervise his division's allotted activities. In case of non-availability of nominated officer, his responsibilities will automatically devolve on the next officer available.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 19
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Each division will also draw a list of important files that should be saved from destruction in a disaster occurring in that building. All reasonable steps will be taken by those on the spot to render whatever aid is immediately available. Subsequent actions will be coordinated through the control room.

The fire service or other disaster services may be mobilized before a disaster is declared, to deal with the minor incident on a ship or jetty or elsewhere. The Manager (MO), the GM (OPS) must always be informed immediately of any such incidence.

7.7.2 Control of Shipping

All decisions regarding movement of ships during a disaster will be made by the Manager (MO) in consultation with Manager (SH & CH) &/or Manager (P&E) and wherever necessary he will decide the order in which the ships are to be moved. However, in all such cases GM (OPS) will always be kept informed about the movement of ships. In this context and through out the plan, Dy. Manager (MO) will have authority to act on behalf of the Manager (MO) in the event of his non-availability.

The Regulation of shipping movement will normally be executed through the Port control station (signal station).

No seagoing or cargo carrying vessels or dredgers or private launches etc. are to be moved from the jetties, buoys, docks or anchorage after the receipt of an alarm without prior concurrence of the Manager (MO) unless such vessel is in immediate danger of being affected by the disaster.

If conditions permit, vessels not involved in a disaster but staying close to a berth or ship where disaster has occurred will be moved to sea or to an anchorage at the first opportunity.

Under no circumstances may any vessel in danger of sinking or in any way endangering the Port be moved without specific permission of Manager (MO) who will fix the area to which the vessel will be moved and the route thereto.

Vessels in danger of sinking will not use or cross the fairway (shipping channel) unless specifically directed to do so.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 20
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During disaster involving ships or shipping activities the Dy. Manager (MO) will be the leader of Forward Control and in such circumstances GM (OPS) along with Manager (MO) will be at the base control.

7.7.3 Fire Fighting Operations

7.7.3.1 Personnel at Scene

In all cases, initial fire-fighting will be undertaken by all personnel on the spot with whatever appropriate equipment is available.

For fires at berths and ships on berths, directions of all fire-fighting units, including tugs and other crafts will be exercised by JAM (Fire) in consultation with Dy. Manager (MO) and also with the Master of the ship concerned.

For fires on vessels moored or at anchorage direction of all fire-fighting units will be exercised by the Master of the ship concerned, until the arrival of the Dy. Manager (MO) or JAM (Fire).

Should any question concerning the safety or stability of a ship arise during the course of fighting the fire, the Manager (MO)/ Dy. Manager (MO) in-consultation with the Master of the vessel will take the steps necessary for the safety of the Port and the ship.

Where a fire occurs on a vessel alongside a berth, the vessel may, except in circumstances that threaten the Port and its installations, be kept alongside the berth to facilitate fire fighting operations and safety of the ship's crew and the fire-fighting personnel.

7.7.3.2 Port Fire Service

On receipt of an alarm, the Port Fire Service (PFS) will dispatch required number of fire-fighting units immediately to the place of the incident. If necessary, arrangement will simultaneously be made with the West Bengal Fire Service to avail their fire fighting units. If necessary, strengthening of fire-fighting fleet may also be made from outside industries.

Further reinforcements will be moved up in readiness, as circumstances dictate.

The tug designated for fire-fighting duties for the day will proceed directly to the fire, notifying the Signal Station.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 21
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The fire-fighting operations of these tugs will be controlled by a senior officer in the tug until the arrival of the Dy. Manager (MO).

JAM (Fire) should arrange for required training of his fleet of Officials and staffs to fight chemical fire.

7.8 EVACUATION PLAN

Evacuation of affected people or neighboring endangered area will be done on specific instruction from the control room.

If evacuation has to be done, on specific instruction from control room, the berth-in-charge or the concerned Traffic Officer with active co-operation from CISF personnel will co-ordinate the evacuation of persons from the affected area. Also Port Fire personnel will extend their participation during evacuation of persons.

The on-duty officer at the berth will first assess the damage to men and material that has occurred in the area. Subsequently, he will inform the Control room/CISF control/ Fire Service stations of his assessment of damage and will seek necessary help required. On-duty officer and his team will render first aid to the affected persons and collect them at a suitable place and await help.

The Management Group, which will be by now having an overview of the disaster situation, will make adequate arrangements in consultation with mutual-aid agencies, if necessary to evacuate the affected areas. People from that area will be evacuated to a safe place. Haldia Municipality & Haldia Development Authority may be consulted in such cases. Care should be taken to ensure that no person is entrapped/ left at the affected area. A head count/ attendance may be done in such cases.

Steps leading to contingency planning involving evacuation:

1. Identification of the disaster
2. Ascertaining the extent of damage
3. Assessing the number of affected people
4. Arranging for coordinating the assembly of the affected people
5. Arranging for transportation of the people from the assembly point of safe shelters.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 22
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6. Conducting transport for transporting the children first followed by women and old people in that order.
7. Should there be a toxic release and the wind direction being towards cargo berth jetty launches could be used for evacuating people in up wind direction or away from the source of release. Should such an eventuality (toxic release) occur the PA system is to be used to inform the people at large to assemble and move towards the safety zone, which should be clearly declared.
8. In the event of an impending natural disaster, the residents of Port colonies should be moved out, by moving them to the railway station/ bus terminus/ any other decided area for further evacuation by the rail-road.
9. The vehicle-carrying civilian should be given the first priority in traffic movement. Contractual labor at site should be given second priority and the Port officials the last priority.
10. Before undertaking evacuation of people by road a pilot survey should be undertaken by the security staff to ascertain that there is no road block or tankers parked blocking the road.
11. While on a survey for assessing the evacuation route, constant communication link should be maintained with the Main Emergency Control Room as well as with the individual assembly point station from where the evacuation is to be undertaken.
12. Assembly area should have a small room equipped with First aid box, Gas Mask, Wireless set, Stretchers, Oxygen Cylinders, Telephone / Alternative Communication equipment, Map of the area, List of telephone numbers, Staging area for food supplies.
13. Assembly area should be equipped with electricity and potable water.
14. Transportation should be primarily catered to by vehicles at disposal of the port – port owned and contracted. Manual Aid Agencies and local transporters may also be called in to supplement as per needs.
15. Management group may mobilize a vehicle pool during requirement. Database of Transporters, vehicles and drivers thereof for such vehicle pool would be mobilized shall be maintained.
16. Administration division should ensure the availability of the drivers and vehicles. All vehicles whether it is departmental or hired

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 23
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should be parked in the location as decided by Management group from where it can be taken for immediate use as soon as the people move into action.

7.9 CARGO OPERATIONS

The Manager (SH & CH)/ Manager (P&E) will ensure the following actions are taken by the concerned persons:

On receipt of an alarm regarding disaster at jetties, all landing/shipment of cargo will stop immediately on all vessels and barges. Loading or discharging will not be resumed without the specific consent of the Manager (SH & CH)/ Manager (P&E).

A consolidated list of dangerous goods, in packaged form and bulk should be prepared and given to the Management Group whenever such places are involved in a disaster.

Mobilization of available manpower and cargo handling equipment from C&F agents to segregate unaffected cargo in ships and storage shed and make arrangements to protect such cargo.

7.10 MARINE OPERATIONS

The Manager (M.O.) will ensure that the following actions are taken by the concerned persons:

On receipt of an alarm regarding disaster at jetties all loading, discharging and bunkering operations will cease. Hoses will be disconnected and all vessels prepared to go to anchorage. Operations will not be resumed without the specific approval of the Marine Officer. He will consult with Manager (MO) before issuing any directive in this regard.

Sufficient number of launches and tugs will be mobilized. All launches will be provided with a Talkie and will maintain listening watch to receive instructions from Signal Station.

Maintain continuous watch on VHF Channel on non marine VHF with fire service on walkie-talkie with tugs, launches and pilots and on telephones with other officers of the Marine.

The Dy. Manager (M.O.) being in charge of the Action Team will mobilize the action team and initiate actions to combat the incident. He will keep in touch with the Management Group.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 24
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Pilots, Berthing Masters may be informed for availing their services in short notice for shifting/sailing out operations.

Assistance of H.M.(R)/ S.D.D.S in the event of grounding/collision of ships and towing of ships/tankers etc. may become inevitable and those officials should be informed accordingly with specific request for help.

In the event of fire involving chemical, gas leakages, expert services of Safety Officer (under DMD)/ Safety Officer (JR), P&IR Division may be requisitioned.

The General Manager (Ops) being a member of the Management Group will, after assessing the initial reports of an incident activate the Management Group and the Control Room. He will also arrange to collect meteorological data/tidal information and will forward the same to Action Team.

Efforts will be coordinated with all owners/agents of ships in Port specially those carrying, chemicals and other dangerous goods to prepare them to vacate harbor.

Arrange and supply wires, ropes etc. of specific size for towing purposes.

Mobilize diving personnel and equipment.

7.11 MEDICAL SERVICES

On receiving the message regarding a disaster the Medical Superintendent or the senior most Medical Officer available will liaison with the mutual-aid hospitals and coordinate all medical services available.

The Medical division of the port Complex will be responsible for making arrangements to collect and transport all casualties from incident site and treat them at nearby Hospital (in consultation with Administration division for arranging transport logistics, if required ambulances are not at its disposal).

It will alert all its ambulances and keep them in running condition and will set up a Casualty Receiving Cell at the nearby Hospital.

Once ambulances are alerted, one with the first doctor available and paramedical staff will be sent direct to the site affected unless the fire service has advised that it will not be possible to handle casualties at the site of the fire, in which case the ambulance will be sent to a place as specified by the Management Group (Control Room).

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 25
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The first Doctor on the scene of incidence will become the Medical Officer-in-Charge until relieved and will act as liaison officer for all medical services employed by the mutual-aid services.

On arrival at the scene, the Medical Officer-in-Charge will Coordinate all medical services and also keep the police informed of casualties, if any. The Medical Officer-in-Charge will keep constant touch with Base Control and nearest Hospital.

7.12 P&E SERVICES

The Manager (P&E) will ensure that following actions are taken by the concerned officer of his division:

Portable lighting arrangement should be kept ready and be transported to the accident site. This arrangement will consist of at least one generator and six numbers lights on portable stands, each stand not less than six feet high and capable of adequately illuminating the area of incident.

It will be the responsibility of the P&E division to gear up its repair section and lock gate in good working order and well attended.

In case of fire due to electrical short circuit, one responsible officer will ensure that such places be isolated and all live electrical wires be suitably guarded.

Arrangements should be made for auxiliary cutting/ welding equipment which may be required for rescuing people from entrapped area.

Liaison is to be maintained with the Electricity Board for supply of power for running essential installations till disaster become over. Activate disaster generator in case of power cut/ failure so that the place of incident be supplied with continuous power.

Arrange for suitable equipment for removal of debris.

7.13 CIVIL ENGINEERING SERVICES

Depending on the type and extent of the disaster/accident, the I&CF Division of the Port will take the following actions:

Proper arrangements will be made to supply sufficient amount of water to fight any fire till it is extinguished.

Strengthening of shore line, buildings and other civil works, including housing colonies.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 26
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Ensure continuous supply of potable water to the incident site as well as evacuates camp.

Arrange for suitable equipment for removal of debris.

7.14 FINANCIAL SERVICES

Finance Division of Balagarh port will process agreements and/or arrange payments to all departments for all their requirements such as purchasing/leasing of equipment, hiring of specialist services, food, shelter and transport arrangements, as the situation demands.

It will depute a senior officer to each division involved in combating action to look after its needs. It will also monitor the expenditure and services rendered by outside agencies to the Port and vice versa to avoid disputes later and to facilitate smooth working of mutual aid.

A senior officer of this division assisted by an officer from the Admn. Dept. will be earmarked to document all events, damages and claims.

7.15 ADMINISTRATIVE SERVICES

The Administration division of the proposed port will be responsible for and will carry out the following actions:

One senior officer of the Administration division of the Kolkata Port will act as communication officer and will take charge of all communication systems of the Port either fixed or portable.

He will maintain and supply sufficient numbers of electronic communication equipment to the Signal Station, the Base Control, the watch-room and anywhere else as necessary.

Coordinate evacuation of Dock areas with the State bodies such as the Haldia Municipality, Haldia Development Authority, the Relief and Rehabilitation Department, Govt. of West Bengal, Police Authority etc.

Assist in rehabilitation of the affected port personnel by either restoring them to their homes or by arranging for their medi-care through the Medical Services of the Port.

In the event of large scale evacuation, assist Management Group to coordinate with District Authority and the Police Authority for evacuation of the neighbouring population.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 27
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Liaison with the local civic body / administration and the Civil Defense Organisation for arrangements of shelters for the evacuated persons, food for them and later for their rehabilitation.

Keep in close liaison with the evacuating authority and collect all details regarding the evacuated people. This will be necessary to settle claims, if any, at a later date.

Keep the Legal Adviser of the Dock informed of the situation at all times and obtain his advice for legalizing all the Dock's actions in collaboration with P&IR.

Mobilize all vehicles for the transportation needs of the Management Team, the action team and support services. Sufficient number of workshop personnel will be mobilized to keep all vehicles required to tackle a disaster in good condition during the course of disaster.

Draw lists of Port Personnel affected and involved in an incident, and keep their families in collaboration with P&IR informed correctly through Information Centre. Make proper arrangements for the Port's personnel engaged in combating a disaster for their food and rest.

Document all events and actions for future reference.

7.16 ON-SITE ACTION PLAN FOR MAJOR DISASTER

This section describes the detail on-site action plan for major disaster likely to occur in jetties viz. fire and explosion hazards in ships or cargo storage yards, pollution hazards due to the spillage of chemical into the river, collision and grounding of ships, sinking of vessels, collapse of lifting appliance, drowning of dock workers and natural calamities like storm, cyclone, floods etc.

7.16.1 Fire / Explosion Hazards at Barge

This plan applies to barges berthed at riverine jetties.

7.16.1.1 Raising of Alarm

All ship fires will be treated as potentially dangerous and this plan will be activated. The decision to declare a full disaster will rest with the Dy. Chairman.

Responsibility

The responsibility of raising the alarm in case of incidents, involving ships in riverine jetties rest with the Marine Officer, Balagarh and also

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 28
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with the Security personnel posted on duty there. In an incident occurring on board a ship, the ship master is also bound to raise an alarm.

To avoid either false alarms or duplication of an alarm with consequent overloading (jamming) of the telephones at the Trust's fire service headquarters, herein after called the Watch Room, it is desirable that the alarm is raised by only those designated to do so.

Persons other than those on the terminals or on the ships may also raise an alarm, if they have any doubt whether the alarm has been raised.

Method of Raising Alarm

- i) By personnel on terminal concerned, alarm should be raised by continuous sounding of disaster alarm.
- ii) Reporting to Watch Room on direct telephones or on non-marine VHF channel giving a short message stating where the fire is, and if possible, whether any casualties have occurred or are likely to occur.
- iii) If Watch Room cannot be contacted, the same message can be passed on to the Port Control by telephone or by VHF Channel.

By personnel on the ship, at the terminal concerned alarm should be raised by reporting the incident as follows:

- Informing responsible personnel on the jetty through public Address System or orally.
- Calling the Port Control or Watch Room on VHF Channel and giving a short and clear message.

Action by Personnel at Affected Jetty and Ship

The alarm having been raised, the responsibility for fighting the fire on the terminal will rest with the JAM (Fire)/ Dy. Manager (Marine Ops.) who shall be assisted by the Terminal-in-Charge.

The Master of a ship at the terminal or senior most officer-on-board will be responsible for taking all immediate steps to safeguard his ship and fight a ship-board fire with all available resources. The personnel on the terminal will render him all assistance.

The JAM (Fire) or his deputy or Dy. Manager (M.O.) whoever arrives first on the scene will take overall control of the fire fighting operations from

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 29
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the personnel on the terminal and on the ship. A senior officer of the vessel at the terminal will remain with the JAM (Fire) and provide detailed information of the ship, cargo and her equipment (see also General Arrangements).

The personnel on the terminal with the active cooperation of the ship's personnel, will stop all cargo operations and disconnect hoses/unloading arm.

The Terminal-in-Charge in consultation with the vessel alongside will inform the Forward Control the details, type and quantities of cargo on-board the vessel.

7.16.2 Collisions and Grounding of Barges

The disasters that are envisaged under this section include collision at jetties, barge at anchorage, drifting and likely to run a ground.

Collision/grounding by itself will constitute a disaster. It is also foreseen that collision/grounding may lead to other disaster, such as fire, explosion and flooding of barges holds/engine rooms. All these eventualities will be dealt with by actions envisaged in this section. When a vessel's hold/ engine room is flooded with water such vessels shall be moved to a designated area for examination.

Raising of Alarm

The responsibility for raising the alarm in case of collision/grounding involving one or more barges lies with the ship's Master or Pilot on board. The same shall be communicated to the Signal Station. The Signal Station on hearing the alarm will inform the Director, Marine Deptt./Harbor Master (R) in case such collision takes place within fairway. For collision at jetties GM (Ops)/Manager (M.O.) shall be informed. Signal Station will also inform the owner or agents of the ship.

The official of the Marine Division on the vessel, which is involved in a collision/grounding, will be primarily responsible for raising an alarm.

Action by Marine Division

In addition to the actions as detailed earlier.

When a message is received, from a ship approaching port informing about damage to the vessel, which may lead to leaking/flooding, the vessel will be instructed to anchor in the designated area for inspection.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 30
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The Harbor Master (River) or Manager (M.O.) as the case may be, will proceed to the concerned vessel, investigate and report to the DMD and GM (Ops).

If the vessel is leaking, the DMD/GM (Ops) will assess and evaluate the extent of damage and formulate an attack plan for collision, grounding and/or pollution as situation requires.

The measures for tackling the disaster are to be agreed to between the ship's Master and the Harbor Master (R)/ Manager (M.O.). These agreed measures are to be recorded in the ship's logbook also.

The GM (Ops) will inform the ship's agent and will require them to mobilize immediately all assistance such workshop facilities, surveyors and salvage experts, if necessary.

If the investigation by the Harbor Master (R)/Manager (M.O.) shows that the vessel is not leaking and the GM (Ops) is satisfied that it is safe to berth the vessel in order to carry out a thorough inspection and to facilitate disaster repairs, the vessel may be advised for berthing.

Before such a vessel is brought into the harbor, she must indemnify the port against all losses and damages to fixed and floating objects of the Trustees. The vessel will also have to be brought under coverage by Insurance for hull, machinery and wreck removal.

As long as the disaster exists the DMD/GM (Ops) will keep the situation under constant review and amend the action plan as the situation warrants.

On board a vessel, which is under a disaster, no cargo work shall commence. If on board a vessel alongside a berth cargo-work is in progress when she is involved in as collision, all cargo work shall stop forthwith and shall be resumed only on the exclusive permission of the Manager (M.O.)/ Manager (Sh. & Ch.)/ Manager (P&E) as the case may be.

Apart from the responsibilities mentioned earlier, the Marine Ops. Division should mobilize workforce and cargo handling equipments in readiness to handle cargo on the affected vessel, if needed.

The department will mobilize its diving personnel, equipment and material as may be required for rescuing persons from the flooded compartments of the affected ship and from under water, if any.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 31
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Action by Ship's Master

The Dy. Dock Master described as "Duty Officer" in the General Arrangements, will establish and maintain constant contact with the ship's Master and will endeavour to ensure that the following actions are taken.

A vessel that falls into any one category listed above will immediately inform the Port through the Signal Station of such incident, on VHF Channel-16, and shall maintain continuous contact till the disaster is over.

In the case of a ship running aground, the vessel will indicate the geographical location or relative position and the extent of the ship grounded and suspected damage.

In the case of a ship drifting at anchorage she will indicate her geographical or relative position.

In the case of a ship approaching harbour for refuge. She shall give the following information to the Signal Station:

Extent of damage

Cause of damage

Likely effects of damage, and

Nature of assistance required at Port

The Master involved in a collision/ grounding shall check the following and inform the Signal Station of his findings and requirements:

- Tank and bilge soundings
- Suction for engine cooling
- The need of shore connection for lighting and machineries
- Preliminary survey to see where and how much of the hull is grounded.
- If double-bottom tanks (oil) are intact and cargo holds are open to sea, this may lead to a situation where the double bottom tanks will fill through broken/leaking sounding pipes. Such tanks may then overflow through air pipes, leading to oil pollution.
- Shoring facilities for bulkhead in engine room, if adjacent compartments are flooded.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 32
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- Condition of all water tight doors, and bulkheads.

The master will take all precautions as a prudent seaman against fire, explosion, pollution and sinking of the ship. He will bear in mind that mobilization of any type of assistance he may require from the shore is likely to take time. Therefore, he should assess the overall situation for safety at frequent intervals.

If a vessel is found impeding the navigation or is likely to impede navigation, the Port Authority may ask the vessel to shift from navigational channel to a designated area. Master of the vessel should carryout such order immediately.

Action by P&E Division

In addition to the actions as detailed earlier, to arrange to supply power to a stricken ship and to attend to quayside cranes which may be have been affected.

Apart from the responsibilities mentioned earlier, the P&E division should mobilize workforce and cargo handling equipments in readiness to handle cargo on the affected vessel, if needed.

Action by the SH & CH Division

Apart from the responsibilities given in an earlier section, the shipping cargo handling division mobilizes workforce and cargo handling equipments in readiness to handle cargo on the affected vessel, if needed.

Action by the Indian Navy and Coast Guard

Surveillance aircraft may me required to assist in assessing spillage amount as well as in order disaster duties such as air lifting personnel and equipment. Aircraft as required will be sent to the scene and a coordinating officer will join the management group.

In addition, the coast guard will assist in other anti-pollution actions with men and material at its command. The Indian coast guard being the overall in-charge of all contingency plans for dealing with spills, trough its regional head quarters rendered all assistants to the port.

Action by the West Bengal Pollution Control Board

The WBPCB will on a request from Kolkata Port, assist in inspection and cleaning of jetties if required. WBPCB will also assist in collection of spilled chemicals, testing of the same and recommend precautions and

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 33
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steps to recovery of disperse or otherwise deals with spilled commodities. Board will also assist with their anti-pollution machineries and personnel for abatement of pollution.

7.16.3 Sinking of Barge

This plan covers sinking of any vessels nearby the riverine jetties.

Raising of Alarm

In the event of sinking of a barge the Master of the ship of Pilot on board will raise the alarm. The Signal Station on hearing the alarm will inform the owner or agent of the ship. In case of KoPT vessel, the official of the Marine Department on the vessel will be primarily responsible for raising the alarm.

Method of Raising Alarm

First information should be given to the Signal Station through wireless and from there information should be given to the owner of the vessel and General Manager (Ops), GM (Ops) will then inform Manager (I&CF), Manager (P&E), Manager (Sh. & Ch.), Commandant CISF, JAM (Fire), Medical Superintendent, Manager (M.M.) and also to GM (M & S).

Action by Marine Division

On receiving the message of sinking of a vessel Marine division will mobilize sufficient number of launches and tugs equipped with Walkie Talkie and maintain listening watch to receive instructions from Signal Station. The Dy. Manager (M.O.) being in-charge of the Action Team will mobilize the action team and initiate actions to combat the incident. He will keep in touch with the Management Group.

The GM (Ops) being a member of the Core Group will, after assessing the initial reports of the incident activate the Core Group and the Control Room also inform Chairman & Dy. Chairman, MMOH will collect Meteorological data, tidal information and will forward the same to the Action Team.

If the incident takes place in the Dock, GM (Ops) will contact outside agencies seeking for salvage operation. MMOH will also make arrangement of safe rescue of the crew members of the vessel. On receiving the message of sinking of a vessel the Manager (Marine) will mobilize its Port Divers' Unit. The Manager (Marine) will mobilize the workshop staff for proper maintenance of the crafts engaged in salvage/ rescue operation.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 34
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Action by P&E Division

The Manager (P&E) will also ensure uninterrupted electric supply for adequate illumination at the place of crisis. If necessary he will make arrangement of Portable lighting.

7.16.4 Collapse of Lifting Appliances

Disaster related to Collapse of lifting appliance like shore cranes, mobile cranes, yard cranes etc. will come under the specific plan.

7.16.5 Drowning of Dock Workers

Raising of Alarm

In the event of drowning of a dock worker, the alarm will be raised by the Officer-in-Charge of the section under whom the dock worker is employed. The same will be communicated to the CJP Exchange for onward transmission to Watch Room.

Action by Marine Operation Division

Marine Division will immediately deploy port divers for locating and searching for the dockworker is drowned in dock water. Marine Division will deploy suitable launches for the purpose of assisting searching operation of the Dockworker drowned in dock water.

Action by P&IR Division

Manager (P&IR) will arrange to communicate the message of accident to the family of affected dockworker. If necessary he will also inform respective Labour Union to solicit their support during rescue operation.

Action by Medical Division

Immediately on receiving the message of the accident the Medical Superintendent will send a team of medical personnel along with a Doctor and an ambulance for the purpose of rendering medical aid to the person drowned in the water. He will immediately arrange to transport the injured person to the port Hospital for proper treatment.

Action by P&E Division

If the incident took place during afternoon or night the Manager (P&E) will arrange for uninterrupted supply of electricity to the crisis area. He

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 35
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will also arrange for adequate numbers of portable lighting appliances to facilitate rescue operation.

Port Fire Service

Port Fire Service will extend all possible help during rescue operation of the dockworker.

7.16.6 Natural Calamities

Type of disaster that have been covered under this action plan are:

- Severe Storm/ Cyclone, which may damage Port properties or personnel.
- Severe Floods which may disrupt normal functioning of Port
- Earthquake

Apart from southwest monsoon, which dominates Balagarh region as well as the West Bengal State from June to October, local storms of great intensity known as Norwesters are also experienced from February to May in this region. Alipore Observatory of Indian Meteorological Department issues weather forecast, storm-warning signals and maintain weather bulletins to ships, fishing boats and marine interests through wireless broadcasts by Kolkata Radio.

Raising of Alarm

Whenever Kolkata Radio the signal station has issued a storm signal would inform GM (Ops) & Manager (M.O.) and keep in close touch with the Alipore Observatory. In case of flood or earthquake restricted locally, the people working/ residing in the vicinity would inform the Fire Watch Room or Signal Station. In turn these stations will inform all concerned about the incident.

Action by Marine Division

In addition to the actions mentioned earlier, DMD or GM (Ops) will issue directives to both Harbour Master (R) and Manager (M.O.) regarding steps to be taken to ensure safety of shipping in the River/Port areas as also of KoPT's crafts, navigable channel/buoys etc. Tugs, Mooring Launches along with their crew will be kept ready day & night to tackle any eventualities. One tug engineer will also be on duty round the clock. Manager (M.O.)'s office would monitor round the clock till the disaster is over.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 36
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DMD or GM (Ops) will also issue special instructions to the Master of the ships, regarding extra precautions to be taken by ships during inclement weather. Keep all divers under his control ready to join the combating team whenever required. All floating crafts under his control should be properly secured and manned.

Actions by Ships at Port and at Anchorages

Every crew member should be on board and no shore leave to be granted.

Keep close watch on VHF marine channel for weather broadcast by Kolkata Radio and special instruction(s) issued by Port Authority. Mooring ropes should be doubled and all ship fenders should be put out.

Master of all ships should follow the instructions, during stormy weather as detailed in “Appendix-B” of “TIDE TABALES FOR HUGLI RIVER” for each type of storm signal.

Action by Port Fire Service

In addition to the actions given earlier.

Upon hearing the news of flood or earthquake, the Port JAM (Fire) will send his men for detail inspection.

Arrange for rescue of Port personnel from flood affected/quake hit areas to a safer place in consultation with Management Group.

Action by I&CF Division

In addition to the duties as mentioned earlier.

Arrange for Bulldozer from state authorities for clearing debris at quake hit areas.

Arrange for uninterrupted supply of potable water to evacuees camp.

After the disaster become over carryout in-depth inquiry to assess the damage caused by the flood/earthquake and report to Dy. Chairman.

For clearing debris formed due to earthquake and pumping out water from waterlogged areas he should seek the help of Haldia Municipality through Base Control.

Arrange for heavy-duty pumps for pumping out water from flood-hit areas from State authorities.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 37
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Action by P&E Division

To make sure that a team is always available to tackle failure of electricity and departmental vehicles during crisis hours.

All crane and other equipments should be firmly secured in their proper position.

Arrange for heavy-duty pumps for pumping out water from flood-hit areas from State authorities.

For clearing debris formed due to earthquake and pumping out water from waterlogged areas he should seek the help of local block / district administration through Base Control.

Arrange for Bulldozer from state authorities for clearing debris at quake hit areas.

The divisions will carryout a detail survey, after the disaster become over to assess the total damage caused to its properties and equipments and send a report to Dy. Chairman.

7.17 EDUCATION OF PUBLIC

In the emergency People living within the influence zone will be educated in a suitable manner. This can be achieved only through the Local and District Authorities. However, necessary information can be extended to the Authorities.

7.18 REHABILITATION AND RESETTLEMENT (R&R)

The Balagarh Island has a total land area of about 900 acres, The Port owns about 300 acres of land on this island, another 300 acres of adjacent land is owned by Calcutta Electric Supply Corporation and the remaining area is under the control of the State Government.

SMP, Kolkata is planning to use about 100 acres of land for the present project. Therefore, the proposed project shall be installed within the acquired land.

There is no human settlement in the proposed project site. So, R&R plan will not be applicable for this Project.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 38
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7.19 SOCIAL IMPACT ASSESSMENT STUDY

7.19.1 Background

M/s Syama Prasad Mookerjee Port (erstwhile Kolkata Port Trust) has proposed for Two dedicated berths, one for container and one for coal have been planned commensurate with 85000 TEU (1.1 MTPA) container traffic and 1.6 MTPA coal traffic. The total capacity of the terminal works for two berths works out to about 2.7 MTPA.

Its geo-graphical coordinates are Latitude 23°38'25.28"N and Longitude 87°17'10.17"E with Above Mean Sea Level 5 meters (16 ft.).

The proposed project will have various direct and indirect impacts on the existing socio-economic environment in the surrounding area. Besides being a potential employment generating source, the project will result in the creation of various infrastructural facilities, leading to the improvement in the existing lifestyle and the economic condition of the local people. The areas, which are close to the project site shall derive maximum benefit. Hence, a Social Impact Assessment was undertaken.

7.19.2 Objectives of the Study

The objectives of the study are:

- To assess the existing socio-economic scenario;
- To examine the impact of the project on the existing socio-economic scenario;
- To ascertain the areas, to be considered for addressing the existing challenges for the improvement of the existing socio-economic condition;
- To ultimately derive the need-based activities, to be considered for Corporate Environment Responsibility, based on the study;

7.19.3 Existing Socio-Economic Scenario

A 10 km radius around the project site has been considered as the study area for this project. The study area includes, either partly or entirely 13 villages and 2 CT Ward areas. The proposed project of **M/s SMPK** is situated at Village & PO - Balagarh, District - Hooghly, PIN - 712501, West Bengal.

The details of the existing demographic and socio-economic status of the study area is discussed in Chapter-3 of the EIA-EMP report.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 39
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7.19.4 Methodology Adopted for the Study

The methodology adopted for the study is based on the following process:

Review of Secondary Data

Data from the secondary sources, viz. the latest available District Statistical Handbook, 2011 Census data and various census updates based on the 2011 census, were explored / reviewed for getting the demographic profile, occupational structure, etc. of the population within the study area (10 km radius) of the project site. The secondary data supplemented the primary data, collected through direct field survey.

Field Survey

The 2011 census data have been supplemented and corroborated by a socio-economic sample survey, conducted in February, 2023, covering a sample population size of 5225 numbers covering 1298 number of Households, distributed over 13 villages and 2 Census Towns within the study area including the project site through structured questionnaires portraying demographic and socio-economic aspects of the study area population. The names of the villages, considered for the sample survey have been gathered in Chapter-3.0. The data of this socio-economic survey including demographic and socio-economic characteristics, income profiles, household amenities, educational status etc. have also been summarized in the Chapter-3.0. The salient findings of this sample survey are presented below:

Total Population	5225 (Male: 2664, Female: 2561)
No. of Households	1298 (Distributed over 13 Villages and 2 Census Towns)
Family Size	4.03
Sex ratio	961 females per 1000 males
Caste	SC & ST (41.19% w.r.t total Sampling population)
Literacy Level in Area	Total Literate 70.39%, Male Literate 71.81%, Female Literate, 68.92%

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 40
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Build of House of sample Households	Brick (55.16%), Multistoried Brick (36.44%), Thatched Roof Brick (8.01%), Mud (0.39%)
Lighting source of sample Households	Electricity (98.60%), Kerosene (1.4%), Others (0.00%)
Occupational Status of sample population	Workers (43.6%), Non-Workers (56.4%)
Source of Income	Agriculture (10.8%), Business / Trade (25.82%), Service (20.38%), Labour (27.93%), Forestry/ Plantation (5.18%), Livestock/ Fishery (7.33%), Others (2.55%)

Comparison of the findings of the socio-economic sample survey with the 2011 census data are presented in **Table-7.17**.

Table-7.17

Particulates	2011 Census	2020 Sample Survey
Family Size (persons per household)	4.14	4.03
Literacy Level in Area (% of total population)	75.0	70.39
Sex ratio in rural area	958 females per 1000 males	961 females per 1000 males
Occupational Status in area of the total worker population	Workers (37.0%), Non-Workers (63.0%)	Workers (43.6%), Non-Workers (56.4%)

Table-7.18 : List of Villages for Sample Survey

S.N	Name of Village / town	No. of Households	Population		
			T	M	F
1	Sripur (CT) WARD NO.-0001	181	723	360	363

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 41
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2	Jirat (CT) WARD NO.-0001	206	817	420	397
3	Baruipara	55	212	106	106
4	Bhabanipur	35	137	69	68
5	Bhabanipur Char	210	868	443	425
6	Arazi Bhabanipur	16	58	32	26
7	Balagarh	77	330	169	161
8	Tamlipara	44	184	96	88
9	Gournagar	16	69	37	32
10	Paschim Sambhupur	62	229	115	114
11	Par Niamatpur	94	373	192	181
12	Jagapur	70	309	153	156
13	Gosair Char	56	220	115	105
14	Balagari Char	138	532	272	260
15	Raninagar	38	164	85	79
TOTAL		1298	5225	2664	2561

It is evident from the above comparison that the family size has almost remain unchanged, there has been increase in the literacy rate and sex ratio and percentage of workers has decreased in the villages under sample survey.

In addition to the above, the survey was conducted to find out whether the following facilities are available in these in these 10 villages, 1 Municipality Town and 4 Census Towns:

1. Drinking Water Facility
2. Medical & Educational Facility
3. Garbage Collection & Disposal Facility
4. Facility for Skill Development

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 42
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5. Electrification including Solar Power

6. Sanitation

7. Rainwater Harvesting

8. Roads

9. Sewerage System

1. Drinking Water Facility:

It was observed that 2 Census Towns, all of them have Govt. made treated tap water supply facility all year round which is used for drinking purposes. Out of 13 villages, all of the surveyed villages have treated hand pump, tube well & well.

2. Medical & Educational Facility:

Most of the villages have primary health sub centre. All the 13 surveyed villages and 2 Census Towns have Govt. Pre-Primary and Primary schools. Only few villages have Govt. Middle schools and Govt. Secondary schools. None of the surveyed villages have colleges.

3. Garbage Collection & Disposal Facility:

The 2 Census Towns have proper garbage collection facility. But there is no proper garbage collection and waste disposal facility, available at any of these villages. Villagers throw their garbage in the open thereby creating an unhygienic condition in the surrounding areas.

4. Facility for Skill Development:

The educational system at all these villages is based on the traditional pattern and is not job-oriented. There is no proper facility for skill development in any village.

5. Electrification including Solar Power:

Electricity is available in all the surveyed villages and Census Towns. However, there is no facility for utilizing solar power.

6. Sanitation

In all the surveyed villages, there are houses, which do not have facility of the toilet.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 43
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7. Rainwater Harvesting

There is no concern of rain water harvesting in any of these 13 villages.

8. Roads

State Highway -6 is passing at 4.3 kms. Distance at West direction from the project site. The quality of existing roads are not so good.

9. Sewerage System

Only few villages and 2 CT Towns have covered drains. Rest of the villages have open kuccha drains. There is no proper sewerage system as such in any of the villages in the study area.

7.19.5 IMPACT OF THE PROJECT ON THE EXISTING SOCIO-ECONOMIC SCENARIO

The implementation of the proposed project of **M/s Syama Prasad Mookerjee Port (erstwhile Kolkata Port Trust)** will have both direct and indirect impact on the existing socio-economic scenario, which are highlighted as under:

- There will be generation of both direct and indirect employment due to the project. Around 300 persons will get employment (direct and indirect) during operation of the project. Mostly, local people will be benefited.
- A no. of business opportunities will be created for the local people to derive significant economic advantages.
- The company has identified various areas based on its survey in the above mentioned villages and the public hearing conducted. There will be development of various infrastructural facilities in the areas like roads, health and education, drinking water, street lights and in many other areas.

During operation of the proposed project, there will be generation of some pollutants, which may affect the surrounding villages. The EIA Report contains the detailed study in this regard. It is observed that there will be insignificant impact on the air quality of the surrounding areas due to the operation of the proposed project. The green belt development within the project area shall further mitigate it and shall improve the aesthetic look of the area. The project is designed, based on “zero waste water discharge concept”.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 44
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7.20 PUBLIC CONSULTATION

The Public Hearing shall be conducted by West Bengal Pollution Control Board (WBPCB). The point-wise compliance to the issues, raised during this meeting shall be kept in mind. An action plan shall be formulated along with budgetary provision and this shall be included in the Final EIA Report.

7.21 CONCLUSION

It can be concluded that there will be no major risk involved in the proposed expansion project. Suitable risk control measures and management with respect to Risk Assessment will be implemented to minimize any risk. Regular training, implementation of SOPs and use of relevant Personal Protective Equipment (PPE) shall help to minimize the health hazards and incidental casualties. The company will continue to work for development of the society in future. Thus, the proposed project will have a positive impact on society. It also does not involve discharge of any effluent and shall follow zero discharge concept; thus, the society will not be impacted. Therefore, it is safe to say that any risk involved due to the activities within the premises of proposed project will be controlled and managed by plant personnel.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C8 - 1
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CHAPTER-8.0

PROJECT BENEFITS

The traffic at Kolkata Dock System has followed a steady growth in the past 5 years. The Syama Prasad Mookerjee Port (erstwhile Kolkata Port Trust) expects rise in Container and General cargo volumes in near future.

In order to cater up with projected increase in traffic and to overcome the problem of restricted cargo movement within the city limits, Syama Prasad Mookerjee Port (erstwhile Kolkata Port Trust) intends to shift part of its operation to Balagarh, a site 45 Nautical Miles upstream of Kolkata.

The Balagarh Island has a total land area of about 900 acres - ownership shared by Kolkata Port Trust, State Government and Calcutta Electricity Supply Company. The Port owns about 308.75 acres of land in this Island.

This will be a boon to the region and will give various benefits to the society of the region.

The proposed project will result in improvement of infrastructure as well as upliftment of social structures in the area. The people residing in the nearby areas are benefited directly and indirectly as well. It is anticipated that the proposed project will provide benefits for the locals in two phases i.e., during construction phase as well as during operational phase.

8.1 Construction Phase

8.1.1 Employment:

Such project is expected to improve the living conditions by providing better employment opportunities and thereby result in further reduction of population below poverty line, which is one of the prime policy objectives of the Government. About 150 persons will be involved during the construction phase of the proposed expansion project. These construction workers will be taken from the study area to the extent possible. Hence, the proposed expansion project will benefit locals to a great extent. Trading of equipment and materials such as plates, pipe fittings, valves, pumps, compressors, electrical machinery and

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C8 - 2
---	--	--------

construction materials provide employment and income to a large number of people.

8.1.2 Community Services:

KOPT will employ local people to the maximum extent possible. In addition, KOPT will continue to provide the community services under existing CSR programs to the community, which will be beneficial to the local people, residing in the area.

8.1.3 Transportation:

Construction phase of proposed expansion project and other facilities will involve movement of material of great magnitude. The material to be transported includes earthwork, concrete, steel, equipment and other materials. The proposed expansion project will result in improving the additional infrastructure facilities of the area.

8.2 Operational Phase

8.2.1 Project Benefits Based on Natural Resources

Land: The entire region is likely to get benefited like creation of new avenues of employment generation, development of infrastructure, uplift of financial position of the local people which in turn leads to conversion of waste land in and around project into agricultural and non-agricultural purposes viz. development housing colonies, hotels, food centers, bazaar, etc. These activities generate precious revenue for the government.

Water: There is no proposal to extract ground water resources in the project. The water requirement of the proposed project will be met from Hooghly River. The proposed expansion project is designed to operate on zero discharge concept. Therefore, it will conserve fresh water resources for the region, which is a significant benefit of the proposed expansion project.

8.2.2 Social Benefits

Employment: The project will create the employment of around 150 Persons during operation. Skilled and unskilled people on daily average will be employed. KOPT will give preference to the local peoples during construction and operation phase of the project depending upon the skill, job requirement and capability. Several others indirect employment opportunities will be created in the surrounding areas by transport, business, vehicle drivers and attendants, workshops, grocery and retail

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C8 - 3
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etc.

So, this proposed expansion project is likely to generate direct and indirect job opportunities in the field of transportation of employees, transportation of product to nearest port, canteen services and greenbelt development work etc.

Transportation: There will be small increase in the vehicular traffic due to passenger / material transports. This increase in traffic is not to any major scale and of such consequence to warrant special mention. It is expected that the increased passenger/material load in the sector will prompt the state government to start new and frequent services to this area, bringing upliftment to the whole area.

8.2.3 Other Benefits

As part of the Corporate Social Responsibility (CSR), KOPT has taken/ will take steps directly in the following fields to share its success with the communities in areas where it operates:

- Employment of local people
- Minimization of Noise Pollution
- Development of new roads in the surroundings
- Safety measures to be taken for workers during the construction and also after commissioning of the proposed expansion project
- Control of pollution level strictly as per Govt. rules and regulation
- Tree plantation in and outside of the plant
- Improvement of lighting facility during night time

Further, the company has a long way to go in this area and is determined to make a difference in the lives of the less fortunate. The fields those which would be benefited by this project in addition to above are:

- New Ancillary industries / SSI set-up;
- Direct and indirect employment of the people particularly the downtrodden;
- Promotion of education;
- Infrastructure development;
- Hospitality Services development;
- Health care Service Development;
- Rural development;

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C8 - 4
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Since its establishment, KOPT has contributed towards increasing growth and progress in the rural society and touched the lives of numerous people.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C9 - 1
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CHAPTER-9.0 ENVIRONMENTAL COST BENEFIT ANALYSIS

The scope of the EIA/EMP has been prescribed vide the Terms of References (TOR) issued by State Environment Impact Assessment Authority (SEIAA), West Bengal, vide Ref. No. 444/EN/T-II-I/169/2021 dated 15th March, 2022 (Refer **Annexure-I**).

As per S.O. 1533 dated 14th September 2006, this chapter is to be prepared if prescribed at scoping stage.

The prescribed scope does not require environmental cost benefit analysis.

CHAPTER-10.0

ENVIRONMENTAL MANAGEMENT PLAN

10.1 ENVIRONMENTAL MANAGEMENT PLAN

Environmental Management Plan is the key to ensure a safe and clean environment. Various pollutants' generation, their control & disposal for the proposed units have been discussed in **Chapter-2.0**. In this chapter, various management measures taken by M/s Syama Prasad Mookerjee Port (erstwhile Kolkata Port Trust) to check, monitor and manage the performance of various pollution control equipment and improvement of environment is discussed.

The key benefits of the EMP are that it provides the organization with means of managing its environmental performance thereby allowing it to contribute to improve environmental quality.

10.2 CONSTRUCTION PHASE

During construction phase, the following activities are important towards development of impact.

The features of environment of the project area suggest that the different types of impacts on the project should be expected as follows:

- Site preparation
- Excavation and hydraulic filling
- Hauling of earth material
- Pilling, cutting, and drilling
- Mixing of concrete and mortar
- Concrete construction
- Erection of structural steelwork
- Painting and finishing
- Clean up operation
- Construction of infrastructural facilities
- Landscaping and afforestation

Construction phase activities would have major impacts on land use, demography, socio economy, on site soils and on-site noise. It could also develop minor impacts on water use, air and water quality and ecology.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 2
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10.2.1 Air Quality

- All machineries of ships, tugs, barges, launches etc. used for jetty construction are to be maintained properly for optimum consumption of fuel and to mitigate air pollution. The boilers in the ship should be maintained properly.
- It is recommended to use low sulphur diesel oil in DG sets as well as other equipment used at construction site that are run on fuel.
- Vehicles like trucks, trailers, tankers etc. having valid Pollution Under Control (PUC) certificates will only be used at the construction site.
- Water will be used for dust suppression in the construction site.
- Suitable plant species should be planted in and around the proposed project site.
- Deliberate emissions of ozone depleting substances, which include halons and chlorofluorocarbons (CFCs) are to be avoided by ships used for construction purposes.
- The workers would be advised to prevent open fires within the work site.

10.2.2 Noise Environment

- Vehicles and construction equipment with internal combustion engines without proper silencer will not be allowed to operate at the construction site.
- Loading and unloading operation would be done in such a manner to ensure minimum noise generation.
- Construction equipment will be maintained properly to ensure minimum noise generation.
- Noise pollution attenuating green belt all along the boundary of the project site would be developed to reduce noise impacts.

10.2.3 Water resources

Surface Water Quality

- Vessels used for construction purposes will not discharge their bilge or ballast into the river.
- No vessels will be allowed to discharge their garbage in the river. Such garbage should be disposed of in the shore bins available at jetties.
- No ships should discharge sewage within four miles of the nearest land, unless they have in operation an approved treatment plant.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 3
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Between four and 12 miles from land, sewage must be disinfected before discharge.

- No construction wastes like rubbish, food wastes, oil or chemicals etc. will be disposed off into the river.
- High standards of waste management shall be observed on the works vessels and barges to ensure that no waste arising or fuel/diesel oils are disposed to the surrounding marine waters.
- Oil waste water generated in ships/launches shall be handed over to registered re-refiners for disposal.

Ground Water Quality

- No ground water will be used for construction purposes. However required drinking water will be hired from mobile tanker.

10.2.4 Land Environment

- Excavated material will be properly collected and stored within the project area.
- Unwanted material will be properly disposed of in designated areas in consultation with the local civic authority.
- All wastes, unused construction materials and construction equipment shall be removed from the construction site after completion of the construction activities.
- Hazardous wastes, generated during the construction phase will be segregated in two categories viz. usable and un-usable. Usable fractions will be handed over to the registered waste recyclers and the un-usable fractions will be disposed of in consultation with the -West Bengal waste management facility.
- The contractor should prepare a Waste Management Plan for the construction site and the same shall be submitted to the Port authority for approval.
- Proper storage and site practices would be encouraged to minimise the potential for damage or contamination of construction materials.
- Training of site personnel in proper waste management procedures would be undertaken.

10.2.5 Biological Environment

- As discussed under water environment, oily wastes and garbage will not be discharged into the surface water.
- Every attempt will be made to minimize the effects of construction of the berth on the water quality of the area to avoid impact on the marine resources.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 4
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- Before dredging, if it comes unavoidable, an exclusion zone of 500 m radius will be scanned around the work area for at least 10 minutes prior to the start of dredging.
- Temporary work sites/disturbed areas would be reinstated immediately after completion of the construction.

10.2.6 Socio-economic Environment

- Maximum utilization of the local population in the construction activities will be made.
- Potable water will be made available to the construction workers by mobile tanker.
- Outstation workers will be provided with proper shelter to be set-up within the project site. Accommodation with potable water and proper sanitation facilities shall be provided to the workers. Proper drainage systems will also be provided to ensure efficient drainage of surface run-off.
- Garbage bins will be provided near the temporary shelter of workers for collection of domestic solid waste. Garbage will be removed regularly from the bins and will be disposed off in consultation with the local civic authority.
- Detail Plan & design for Water Harvesting to be incorporated in EIA report.

10.3 OPERATIONAL PHASE

Activities during operation phase may have impacts that are minor or major, positive or negative, on environmental disciplines such as soils, surface and ground water hydrology, land-use, water use, water and air quality, terrestrial and aquatic ecology, socio economy and noise. The important activities contributing to environmental impacts are as follows.

- Container handling i.e., loading and unloading
- Bulk cargo handling
- Water consumption
- Liquid effluent discharge
- Emission of air pollutant
- Solid waste disposal
- Operation of cranes

10.3.1 Air Environment

- Good housekeeping will be maintained in the port premises. Dust accumulation will be avoided.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 5
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- Vessels moored at the berth will be insisted to switch off their engines.
- All internal roads will be paved.
- A speed limit of 20 kmph will be maintained within the Port.
- Informative signboards will be provided within the port towards vehicle maintenance, safe drinking and adherence of the emission standards.
- Adequate traffic controllers will be provided to ensure free traffic movement within the port.
- Best possible care will be taken to ensure minimum queuing of trucks outside the port.
- Suitable preventive measures shall be taken to protect workers against dust originating from port operations.
- Dust suppression systems like water sprinklers and windscreens will be provided at all dust prone areas / stackyards to limit residual dust in the discharge area.
- Stack yard will be provided with water spraying system.
- For wind generated dust generation, a windshield with a wire mesh fencing with fast growing creepers up to a height of 10 m around the coal/other bulk stack yard has been proposed.
- In-motion wagon loading system, if in operation, would be complying with the zero emission standards.
- One highly efficient road sweeping machine will be in place for sweeping the roads and paved area to mitigate any dust emissions through vehicular movements.
- The transport vehicles having valid Pollution under Control (PUC) Certificate will only be allowed to ply within the dock area.
- Low sulphur fuel will be used by the cargo handling equipments.
- Economically unviable old tugs /high fuel consuming cargo handling equipment will be replaced by new equipments.
- Along the boundary and roads, offices, building etc. of the proposed project site, trees should be planted to mitigate/prevent the effect of air pollution. In addition, trees, herbs, shrubs will be planted to enhance the aesthetic value of the area. Selection of plant species should be made on the basis of air pollution tolerance index of tree species along with micrometeorological and soil condition of the area. Local plant shall get preference over other species. Selection of plant species should also be made based on the following criteria
 - i. The plants should be fast growing and attaining a height of 5 m or more.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 6
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- ii. The plants should be preferably perennial and evergreen.
- iii. The plants should have large leaf area index.
- iv. The plants should be resistant to air pollutions.

10.3.2 Noise Environment

- Regular activities will be planned in such a manner that similar activities will be carried out regularly at a fixed time.
- The equipment/machines will be maintained properly with particular attention to the silencers and mufflers.
- Old noise producing economically unviable cargo handling equipment will be replaced by new low noise producing equipment.
- Ear muffs/plugs or other protective devices will be provided to the workers working in noise prone areas.
- A well designed green belt will be established within the dock complex to control noise pollution.

10.3.3 Water Environment

To prevent water pollution, following measures will in general be adopted:

- Best possible care will be taken to protect the surface water resources in the area.
- All wastewater generated in the dock area -will be treated. Treated water will be used for gardening as well as dust suppression within port premises.
- All steps will be taken to avoid spillage of bulk cargo, oil and other materials into the river.

The surface may get polluted in terms of suspended solids, heavy metals etc. as these pollutants may enter these water systems through diffused locations on bulk cargo stack yards. The following measures will be taken for prevention and control of water pollution.

- The slope of the bulk cargo storage facility will be towards landward side to avoid storm water draining into the river.
- Run off will be collected in a sump and allowed to settle. An oil separator will be installed prior to the sump to arrest oil and grease from entering into the sump. Clear water from the sump will be allowed to overflow to the trunk storm water drain for ultimate disposal. In addition, to prevent or minimize storm water pollution

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 7
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appropriate storm water pollution prevention plan (SWPPP) will be developed. SWPPP will be specific, because every unit is unique with source, type and volume of contaminated storm water discharge.

- The bulk cargo area will be paved and made impermeable for any leachate to percolate to the subsurface water table.

10.3.4 Land Environment

- Waste reduction is best achieved at the planning and design stage, as well as by ensuring the implementation of good site practices.
- To minimize the impact on land environment, the solid wastes likely to be generated will be properly collected and disposed off to maintain hygienic situation in and around the proposed project site.
- Shore bins near the berths will be provided, such shore bins will have four equal compartments to receive biodegradable waste, oily waste, non-biodegradable waste and recyclable waste. .
- Garbage generated in the dock area will be removed regularly outside port premises.
- One non recyclable hazardous shore bin will also be provided near berth to receive hazardous wastes from ships as well as from berths and office areas. Hazardous waste will be handed over to WBPCB approved facility holders at Balagarh.

10.3.5 Biological Environment

Greenbelt Development

Extensive plantation programme will be taken in the project site. This plantation programme will be taken up to upgrade the ecological status of the area and to improve the aesthetic quality of area. The greening programme, particularly the green belt will help in reducing pollution due to vehicular activities and other port operations. While selecting plant species, following criteria will be kept in view:

- Native plant species will be preferred
- Fast growing plants will be planted
- Plants having thick canopy cover will be used
- Preferably perennial and evergreen species will be selected
- Plants having large leaf area index will be considered
- Shoreline / marshy area will be planted with mangrove vegetation
- Road sides will be planted with local vegetations

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 8
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M/s Syama Prasad Mookerjee Port (erstwhile Kolkata Port Trust) has earmarked total 41.23 hectares (101.9 acres) land (33% of 124.95 hectares (308.75 acres)) within its proposed site at Village: Balagarh, Dist.-Hooghly, West Bengal. Total 61,845 number of trees will come under greenbelt.

Plant species that would be considered for the plantation programme outside port area will include the following.

<i>Dalbergia sissoo</i>	Sissoo
<i>Acacia arabica</i>	Babul
<i>Acacia auriculefermes</i>	Akashmoni
<i>Acacia nilotica</i>	Krishnachura
<i>Anthocephalus chinensis</i>	Kadam
<i>Cocos nucifera</i>	Coconut
<i>Azadirachta indica</i>	Neem
<i>Butea monosperma</i>	Palas
<i>Cassia fistula</i>	Amaltas
<i>Casuarina equisetifolia</i>	Jhau
<i>Delonix regia</i>	Gulmuhar
<i>Eugenia jambosa</i>	Jam
<i>Lagerstroemia speciosa</i>	Jarul
<i>Mangifera indica</i>	Mango
<i>Peltandra ferruginea</i>	Radha chura
<i>Polyalthia longifolia</i>	Debdaru
<i>Pongamia pinnata</i>	Karanja
<i>Swietenia mahagoni</i>	Mahoguni
<i>Syzygium cumini</i>	Jamun
<i>Terminalia arjuna</i>	Arjun

Pits for plantation will be opened measuring 30 x 30 cm and be kept exposed to sun for at least one day. Recommended dose of fertilizers shall be added and sapling shall be planted during peak monsoon season to obtain higher survival rate. On completion of plantation, maintenance of the above sapling shall be carried out for at least 3 (three) years from the date of plantation for getting effective result.

Mangrove species grows in the inter-tidal zones and acts as a very good soil binder and attracts different varieties of aquatic flora & fauna.

Different types of selected mangrove species may be planted in the inter-tidal zones, where influence of saline water is the most common during high tides. During mangrove plantation, attention will be given for good survival rate of mangrove species. Plantation programmes are to be undertaken to see that it can harbor different types of marine fauna. The following mangrove species are recommended for plantation at the inter-tidal zone:

<i>Sonneratia apetala</i>	Keora
<i>Bruguiera gymnorhyza</i>	Kakra
<i>Rhizophora apiculata</i>	Garjan
<i>Ceriops spp</i>	Garan
<i>Aegiceras corniculatum</i>	Khasi
<i>Avicennia spp</i>	Bain
<i>Excoecaria agallocha</i>	Gnewa
<i>Pongamia pinnata</i>	Karanja

10.3.6 Socio-Economic Environment

Following measures will be adopted to improve socio-economic environment:

- The workers/staff will be provided toilet and bathroom facilities.
- The workers/staff will be paid as per the minimum wage Act.
- Roads will be properly maintained.
- The local people will be given preference in providing employment for unskilled and semi-skilled category.
- Workers will be provided with personal protective equipment.

Feasible and cost-effective measures that may reduce environmental impact should be identified. These should be prioritized according to their relative importance, capital and recurring costs, as well as their institutional, training, and monitoring requirement. Potential impacts and their possible mitigation measures.

About 3% of the Capital Cost, has been provisioned for Environment Mitigation Measures. This will include STP, Windscreen all around the coal stack yard and provision of Dump Pond for collection of coal sludge. Provision of Green belt in between clean cargo stackyard and coal stackyard has also been considered. Regular sprinkling of water in Coal stackyard and cleaning of roads from spilled over coal cargo will be considered. Possibility of Rain Water harvesting will also be considered

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 10
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in the adjacent vacant area of the terminal along with gradual development of the terminal. Effluent from STP will be used for plantation and development of green belt.

10.4 FIRE AND SAFETY MANAGEMENT

Three types of cargos (General Cargo, Containers and Coal) will be handled at the port. Stripping / stuffing of containers will not be carried out at the terminal generally. Therefore, elaborate arrangement of firefighting may not be required at the container handling area. There will be a Reefer zone for storage of refrigerated containers, where there is possibility of electrical fire. Hence all arrangements to fight electrical fire will be made. There will be machines like Tractor-Trailers, Reach Stackers, MHCs etc. which themselves are self-contained with portable fire extinguishers. All buildings including the substations are required to be covered as per National building Code of India.

Firefighting system will be required at Coal, Container and General Cargo stackyards and the same also has to be dealt as per the provisions of National Building Code.

Generally, the new terminal will have the following two firefighting system:

- Internal firefighting System
- External Fire Fighting System

10.4.1 Internal Fire Fighting System

Internal fire Fighting system has been proposed as per the provision of National Building Code (NBC) and TAC. Features of the system are as below:

- Terrace water tank of adequate capacity on top of Administrative to generate required pressure.
- Down Comer of pipe size 100 mm dia. as single outlet landing valve
- Fire Extinguishers - As per TAC rules
- Hose Reel - As per TAC rules
- Manually Operated Electric Fire Alarm System - As per TAC rules

10.4.2 External Fire Fighting System

The external firefighting fixed system has been considered in line with the requirement of the TAC and considering the yard area. System will comprise of the following:

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 11
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- River Water intake system with pumping arrangement (1- electric pump + 1- Diesel pump and jockey pump of desired capacity) to maintain pressure within the entire fire water network and to feed the fire hydrants. Pumping capacity will be decided based on the layout of the pipe drain vis-à-vis the pressure requirement of 3.5 Kg/ sq. cm at the remotest hydrant point. The system will be designed to withstand a working pressure 10.5 Kg/sq. cm.
- Peripheral pressure pipeline of Ductile Iron of adequate size
- Double out let Fire hydrants (63 mm dia. hose outlet) valve shall be proposed for every 45 m of the periphery of the terminal.

10.5 ENVIRONMENTAL AWARENESS CAMPAIGN

In addition to training of employees in various aspects of pollution control activities of the port, programmes like celebration of World Environment Day, World Safety Day, screening of films on environment, tree plantation, participate Swachh Bharat Ahiyan etc. will be regularly carried out in order to create greater awareness towards environment protection amongst employees and the people in the neighbouring areas.

10.6 LEGAL AND STATUTORY COMPLIANCE

All the environmental standards/stipulations will be fully maintained by port. Port will obtain consent to establish & consent to operate from West Bengal Pollution Control Board.

The port will obtain yearly clearance from the State Pollution Control Board for hazardous waste handling & disposal. Specific information in prescribed forms will be submitted as per and when required.

10.7 DOCUMENTATION

All the monitoring data, environmental and health related shall be stored in systematic manner so that the specific records will be easily available as required.

10.8 INFORMATION DISSEMINATION AND PUBLIC RELATIONS

Everybody nowadays is concerned about environmental pollution. People should be provided with environmental data related to the port so that wrong apprehensions can be removed. This requires a well-planned public relation and information dissemination process so that unnecessary public intervention is avoided. In this connection, KoPT will organize different programmes with participation from local bodies, encouraging local community in environmental projects (like tree plantation) etc.

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 12
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10.9 OCCUPATIONAL HEALTH & SAFETY

Introduction

The Occupational Health and Safety Management System is a vital part in Industrial Sectors. So, in this project, Occupational Health and Safety has been taken into consideration. The purpose of the Occupational Health and Safety Management System is as follows:

- Minimize risk to employees and others
- Improve business performance
- Assist the organization to establish a responsible image for health and safety.

Approach

The basic approach for the establishment and implementation of the occupational health and safety management system will involve the following steps:

- ❖ Identify the hazards involvement in the activities of the organization.
- ❖ Evaluate the risks which are involved in the performance of these activities.
- ❖ Control these risks to an acceptable level.

All contractors' personnel and temporary staff will also be advised to use safety equipment. Even the visitors will be advised to use helmet, nose mask & other personal protective equipment as per the requirement.

Occupational Health and Safety Improvement Measures

Following are some of the occupational health and safety improvement measures prepared to be implemented at the port:

- Provision of personal protective equipment (PPE) that is fit for the task to prevent injury and maintain hygiene standards
- PPE should be inspected regularly and maintained or replaced as and when necessary
- Training of workers for correct use of machinery and safety devices
- Installation of mechanical lifting aids where possible and rotate work tasks to reduce repetitive activities
- Separation of people from moving equipment
- Installation of walkways to separate people from vehicles or moving parts to reduce risk of collision

10.10 ENERGY CONSERVATION PLAN

Various energy conservation measures are proposed and shall be adopted as outlined below:

Syama Prasad Mookerjee Port, Kolkata	Environmental Impact Assessment for Development of an Extended Port Gate System at Balagarh, Dist : Hooghly, West Bengal	C7 - 13
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- Control of unnecessary illumination at unmanned area using switching, delamping, etc.
- Reduce Illumination level to standard levels by using lower wattage lamps (400W HPSV to 250W HPSV), changing lamp types (2x40W Fluorescent lamp to 70W Metal halide & 400W Mercury Vapour to 250W Metal Halide) etc. for street lighting as well as building inside lighting.
- Control lighting with clock timers, photocells, and/or occupancy sensors.
- Control of Electrical utilities like Air Conditioner beyond working hours.
- Installation of LED lamps in place of Incandescent lamp for panel indication, decorative lamps, exit lamps, etc.
- Continuous improvement of building area fluorescent lamps by using Electronic ballasts and low wattage fluorescent lamps in place of copper ballasts and high wattage fluorescent lamps.
- Reduction in Illumination lamp usage by day lighting in Workshop areas.

M/s Bengal Energy Limited	Environmental Impact Assessment for Proposed Expansion cum Modification of the existing Steel Plant of M/s Bengal Energy Limited at Village: Dauka, P.O- Tentulmuri, PS-Narayangarh, Dist.-Paschim Medinipur, West Bengal, Pin-721437	C11 - 1
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CHAPTER-11.0

SUMMARY & CONCLUSION

11.1 INTRODUCTION

The traffic at Kolkata Dock System has followed a steady growth in the past 5 years. The Syama Prasad Mookerjee Port (erstwhile Kolkata Port Trust) expects rise in Container and General cargo volumes in near future.

In order to cater up with projected increase in traffic and to overcome the problem of restricted cargo movement within the city limits, SMPK intends to shift part of its operation to Balagarh, a site 45 Nautical Miles upstream of Kolkata.

Two dedicated berths, one for container and one for coal have been planned commensurate with 85000 TEU (1.1 MTPA) container traffic and 1.6 MTPA coal traffic. The total capacity of the terminal works for two berths works out to about 2.7 MTPA.

The berths are planned as open pile structure each having length 120m and width 30 m. The Berths will be connected to the shore through Approach Trestles (also founded on piles) of 50 m length and 15 m width. As stated above, one dedicated coal berth and one dedicated berth for handling container have been considered.

Container, peas and pulses, and coal are key cargo types currently handled at KDS. At the initial stage the port anticipate shifting of part of these cargo to the chosen complementary location at Balagarh. Coal is looked upon as an alternative commodity which can be partly moved, while, peas and pulses is only considered in one of the scenarios developed for forecasted traffic.

The overall project scenario is presented in **Table - 2.1**.

TABLE - 2.1
OVERALL PROJECT SCENARIO

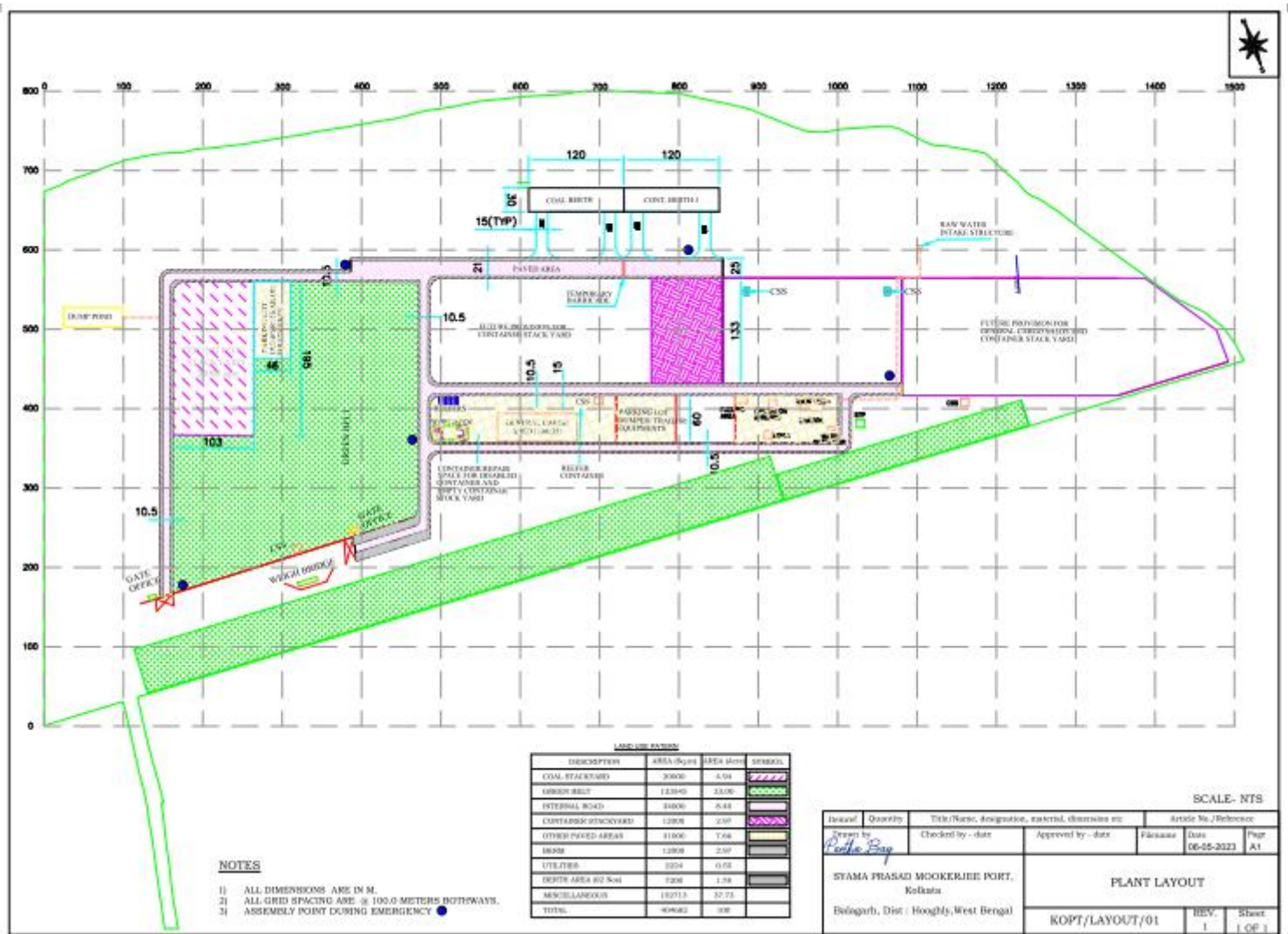
M/s Bengal Energy Limited	Environmental Impact Assessment for Proposed Expansion cum Modification of the existing Steel Plant of M/s Bengal Energy Limited at Village: Dauka, P.O- Tentulmuri, PS-Narayangarh, Dist.-Paschim Medinipur, West Bengal, Pin-721437		C11 - 2
Design Vessel		3000 DWT	
Approach Channel	Width	75 m	
	Length	1200 m	
Turning Circle Diameter		190 m	
Length of Bank Protection		1000 m	
Types Of Cargo Handled		Container/ Coal	
Total Cargo Handling Capacity		2.7 MTPA	
		Container: 1.1 MTPA	
		Coal: 1.6 MTPA	
No. of Berths		2 (two) - 1 (one), dedicated for Container Traffic & 1 (one), dedicated for Coal Traffic	
Size of each berth		120m Length x 30m Width	
Storage Area		Total : 3.2 Hectares	
		Container : 1.2 Hectares	
		Coal : 2.0 Hectares	
Capital Dredging		a) Berth Pocket: 1.5 lakhs cubic meter (approx.) b) Reclamation / Hydraulic Filling: 4.3 lakh cubic meter (approx..)	

M/s Envirotech East Pvt. Ltd. have conducted an Environmental Impact Assessment (EIA) for the proposed expansion project and formulated an appropriate Environmental Management Plan (EMP) for such project.

Total Land area is 124.95 Hectares (308.75 Acres). The proposed land area is vacant with scanty vegetation and no habitation.

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The plant layout showing the proposed facilities with Greenbelt area has been shown as **Figure-11.1**.



11.2 SITE LOCATION

Ranaghat is located 7.5 km from project site in North-east direction from the project site. Chuchura is situated 29 km from the project site in SSW direction from the project site. Balagarh Railway Station is 5.1 km from the project site in the West direction. Jirat Railway station is 4.7 km from the project site in the SW directions. NSCBI Airport, Kolkata is 49.2 km from the project site in South East Direction. Hooghly River is flowing at close vicinity [The Balagarh Island is surrounded by Hooghly River] from the project site. There is no National Park, Reserve Forest & Wildlife Sanctuary within 10 km radius of the Project Site.

The location of the proposed project site on Google Map are presented in **Figure-11.3**.

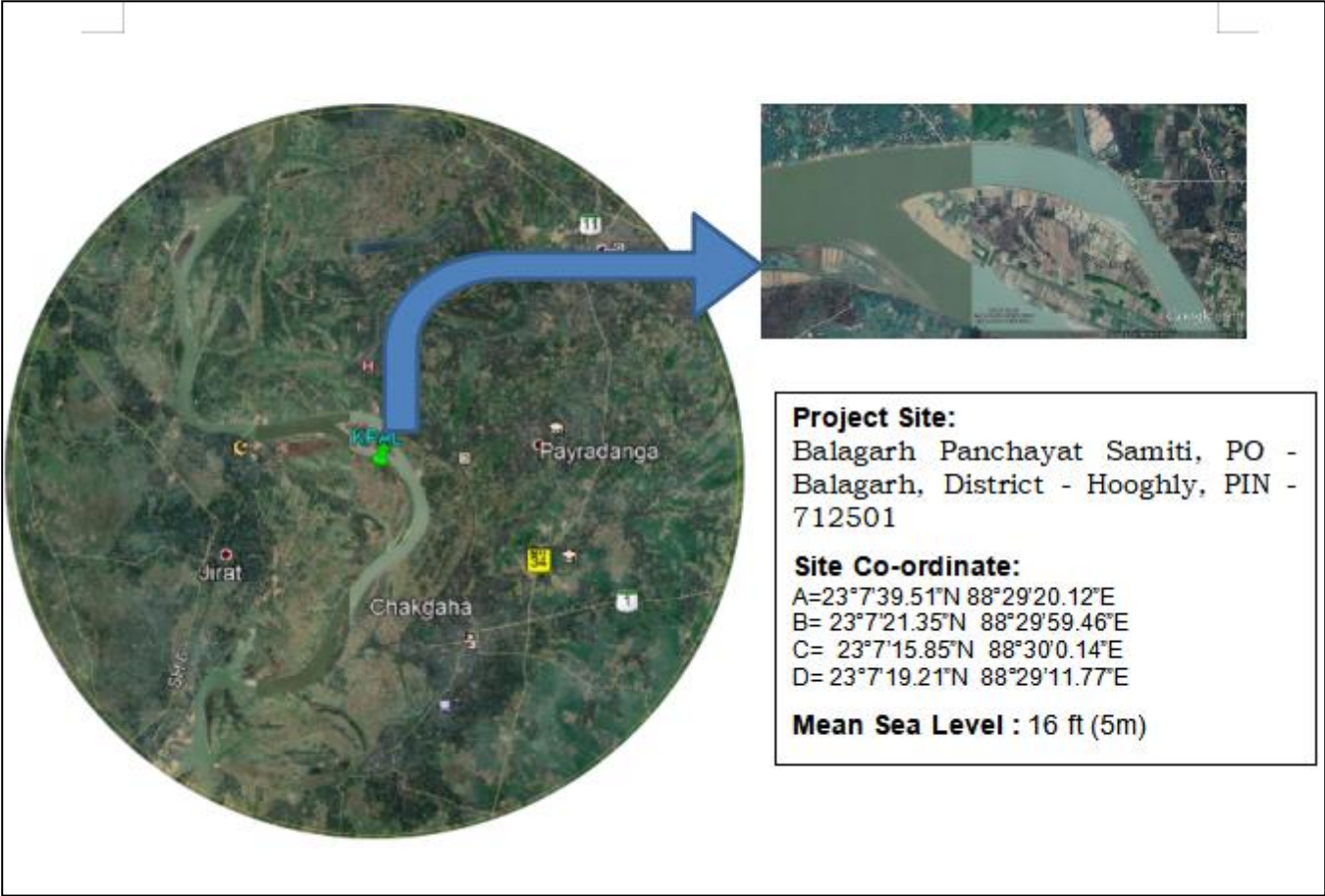


FIGURE-11.3: GOOGLE MAP PROJECT SITE & ITS SURROUNDING AREA
GEOGRAPHICAL CO-ORDINATES
Latitude: 22°14'17.96"N to 22°15'39.25"N &
Longitude: 87°22'51.39"E to 87°23'35.82"E
ELEVATION OF THE PROJECT SITE
30m above Mean Sea Level (AMSL)

11.3 PROJECT HIGHLIGHTS

The principal features or highlights of the proposed expansion of existing steel plant of **M/s Syama Prasad Mookerjee Port (erstwhile Kolkata Port Trust)** , under study are as follows:

PROPOSED PROJECT HIGHLIGHTS	
Location	Village & PO - Balagarh, District - Hooghly, PIN - 712501, West Bengal. Its geographical co-ordinates are as follows C B B D A A ↑
	A=23°7'39.51"N88°29'20.12"E N B= 23°7'21.35"N 88°29'59.46"E C= 23°7'15.85"N 88°30'0.14"E

M/s Bengal Energy Limited	Environmental Impact Assessment for Proposed Expansion cum Modification of the existing Steel Plant of M/s Bengal Energy Limited at Village: Dauka, P.O- Tentulmuri, PS-Narayangarh, Dist.-Paschim Medinipur, West Bengal, Pin-721437		C11 - 6
	D= 23°7'19.21"N 88°29'11.77"E Mean Sea Level : 16 ft (5m)		
Land requirement	Total Land area is 124.95 Hectares (308.75 Acres). The proposed land area is vacant with scanty vegetation and no habitation.		
Raw water requirement & source	As per initial estimation, water demand of the proposed project is expected to be around 60 cum/day. Such water will be made available from the River Hooghly.		
Power requirement	As per estimation, about 817 KVA of electricity will be required during operational stage, which will be sourced from WBSEDCL.		
Effluent generation & disposal	The proposed project will be designed based on zero discharge concept. Entire treated effluent meeting the CPCB/SPCB standard will be used in plantation, development of green belt, suppression of dust and other non critical purposes within the Port area. Domestic wastewater will be treated in Sewage Treatment Plant (STP).		
Air pollution control	Dust will be generated during construction phase from earthworks, movement of vehicles. Appropriate fugitive dust control measures, like water sprinkling of exposed areas and dust covers for trucks, would be employed to minimize the impact. No significant impacts to air quality from fugitive dust emissions are anticipated during construction and during operation phases of the proposed project.		
Solid Waste Management	➤ Dust generated during dry bulk handling will be stacked separately for further disposal / re-handling. ➤ Solid waste of domestic / commercial origin that would be generated in the proposed port project will be disposed off suitably in consultation with the concerned local body.		
Manpower	150 persons - During Construction Phase 150 persons - During Operation Phase		
Project cost	Rs. 445.50 Crores		

11.4 BASELINE ENVIRONMENTAL SCENARIO

The area falling within the radius of 10 km around the project site at Village & PO - Balagarh, District - Hooghly, PIN - 712501 in West Bengal. has been considered as study area. On-site environmental quality monitoring was carried out from **01st January, 2023 – 31st March, 2023**.

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11.4.1 Meteorology

The monthly maximum and minimum temperatures recorded on-site during the aforesaid monitoring period varied between (27.5 - 38.0)°C and (9.5 - 17.0)°C respectively with overall maximum and minimum temperatures being 38.0°C and 9.5°C respectively.

The monthly minimum and maximum relative humidity recorded on-site during the said monitoring period varied between (72 - 74)% and (46 - 59)% respectively, the overall maximum and minimum being 74.0% and 46.0% respectively.

The overall mean wind speed during the monitoring period was 3.9Km/hr. The predominant wind direction is North & North-East.

11.4.2 Ambient Air Quality

Ambient air quality was monitored at eight (8) locations in and around the project site.

The overall mean values of PM₁₀, PM_{2.5}, SO₂, NO₂ and CO in the area (mean of all the 8 locations) were 60.1 µg/m³, 26.1 µg/m³, 8.0 µg/m³, 19.9 µg/m³ and 0.377 mg/m³ respectively.

11.4.3 Water Quality

Water samples were collected and analyzed at ten (10) locations to assess the surface water quality in the study area. Water samples were collected from eight (8) locations to assess the baseline status of the ground water quality of the study area.

The pH values of the collected two water samples (**SW1, SW2 and SW10**) from the river water were found pH 7.25 - 7.34. Value of Dissolved Oxygen were observed (7.1- 7.3) mg/lit. Total Dissolved Solids were found (157 - 198) mg/lit while value of total Hardness (as CaCO₃) & total Alkalinity (as CaCO₃) were found (103 - 124) mg/lit & (99 - 116) mg/lit respectively. Calcium (as Ca) & Magnesium (as Mg) were found (25 - 30) mg/lit and (10 - 21) mg/lit respectively. Oil and grease was below detection limit (<1.4 mg/lit) in these sample. Sulphate (as SO₄), Nitrate (as NO₃) and Chloride (as Cl) were observed (12 - 23) mg/lit, (1.2 - 2.8) mg/lit and (27 - 32) mg/lit respectively. Iron (as Fe) contents were found (0.11 - 0.14) mg/lit and BOD were found (2 - 3) mg/lit respectively.

The pH values of the collected pond water samples were found in the range of (7.16 - 7.47). Dissolved Oxygen was observed in the ranges of

M/s Bengal Energy Limited	Environmental Impact Assessment for Proposed Expansion cum Modification of the existing Steel Plant of M/s Bengal Energy Limited at Village: Dauka, P.O- Tentulmuri, PS-Narayangarh, Dist.-Paschim Medinipur, West Bengal, Pin-721437	C11 - 8
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(6.1 – 6.8) mg/lit. Total Dissolved Solids were found in the ranges of (250 – 389) mg/lit while total Hardness (as CaCO₃) & total Alkalinity (as CaCO₃) were found (132 - 153) mg/lit & (127 - 160) mg/lit respectively. Calcium (as Ca) & Magnesium (as Mg) were found varying in the ranges of (31 – 47) mg/lit and (9 – 14) mg/lit respectively. Oil and grease was below detection limit (<1.4 mg/lit) in these samples. Sulphate (as SO₄), Nitrate (as NO₃) and Chloride (as Cl) were observed varying in the ranges of (21 – 59) mg/lit, (2.2 – 5.5) mg/lit and (51 – 91) mg/lit respectively. Values of Iron (as Fe) were found in the ranges of (0.13 – 0.21) mg/lit.

The pH values of collected ground water samples were found in the range of (6.85 – 7.34) with an average of 7.09. Total Dissolved Solids (TDS) was found in the range of (295 – 467) mg/lit with an average of 381 mg/l, while Total Hardness (as CaCO₃) was found in the ranges of (167 – 237) mg/lit with an average of 202 mg/l. Alkalinity (as CaCO₃) was found in the ranges of (162 – 228) mg/lit with an average of 195 mg/l. Calcium (as Ca) and Magnesium (as Mg) were found varying in the ranges of (48 – 71) mg/lit and (7 – 16) mg/lit respectively. Sulphate (as SO₄), Nitrate (as NO₃) and Chloride (as Cl) were observed in the ranges of (15 – 57) mg/lit, (2.8 – 4.5) mg/lit and (59 – 119) mg/lit respectively. Iron (as Fe) content was found in the range of (0.22 – 0.72) mg/lit with an average of 0.32 mg/l and Zinc (as Zn) content was found (0.06 – 0.18) mg/lit.

11.4.4 Noise

A total of 10 locations around the proposed project were selected for the measurement of ambient noise levels.

During the day time, the equivalent noise levels were found to vary in the range of (50.8 - 60.8) dB(A) while in the night time, the equivalent noise levels were observed to be varying in the ranges of (39.5 - 44.7) dB(A).

11.4.5 Ecology

The study area is found to have a good vegetation cover due to helpful climatic conditions and good soil quality in the area. There are naturally growing plants, vegetation and grasses. The overall floral composition in the whole study area is quite rich.

11.4.6 Demography and Socio-economy

The study area is rural in nature and Moderate populated with the total population of 6,41,514 (as per 2011 Census). The sex ratio is about 958 females per 1000 males. The overall literacy rate is about 75.0%. Male literacy rate is 78.7% (w.r.t. the total male population) and female literacy

M/s Bengal Energy Limited	Environmental Impact Assessment for Proposed Expansion cum Modification of the existing Steel Plant of M/s Bengal Energy Limited at Village: Dauka, P.O- Tentulmuri, PS-Narayangarh, Dist.-Paschim Medinipur, West Bengal, Pin-721437	C11 - 9
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rate is 71.1% (w.r.t. the total female population). The principal staple food is rice.

11.5 ENVIRONMENTAL IMPACTS OF PROPOSED PROJECT

11.5.1 Impacts on Air Quality

Operation of ships, operation of different cargo handling equipment, handling of bulk cargo, movement of automobiles etc. are likely to generate air emissions, which may affect the air quality in the neighborhood. The main pollutants of concern include:

Particulate Matters (PM)

Suspended as well as respirable particulates are expected to be generated from cargo handling, operation of different plants and equipment, operation of ship engines as well as generators, vehicular movement, stack yard etc.

Sulphur dioxide (SO₂)

Operation of ships and other plants & equipment and different transportation activities are the probable causes of SO₂ emission.

Nitrogen oxides (NO_x)

Operation of ships and automobiles are the primary sources of NO_x emission.

Carbon mono-oxide (CO)

CO emissions are directly related to incomplete combustion of fossil fuel by ships, automobiles and other cargo handling equipment.

11.5.2 Impacts on Water Quality

Company will follow “the zero wastewater discharge concept” and the entire wastewater will be recycled to the plant for various uses. As no wastewater will be discharged into any outside water body, there will be no impact on the water quality of any surface water bodies of the area.

11.5.3 Impacts on Soil

There will be solid waste generation, but will be managed in the proper manner. This will ensure that there will not be any impact on soil quality due to the disposal or deposition of solid waste.

11.5.4 Impacts on Land Use

The project area is a piece of vacant land which is owned by SMPK having no human settlement. Setting up of the project will change the land use pattern of the land. However, the change in the land use will have beneficial impact due to the conversion of the unused vacant land into a needful use in the regional context.

M/s Bengal Energy Limited	Environmental Impact Assessment for Proposed Expansion cum Modification of the existing Steel Plant of M/s Bengal Energy Limited at Village: Dauka, P.O- Tentulmuri, PS-Narayangarh, Dist.-Paschim Medinipur, West Bengal, Pin-721437	C11 - 10
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11.5.5 Impacts on Biological Environment

As discussed earlier, the proposed project is not going to generate wastes of concern except some fugitive dust emissions, thus impact of such wastes on the biological environment of the area would be minimum. In addition, a green belt would be developed which will not only improve the aesthetic value of the area, but also act as a very good sink for absorption of air pollutants, attenuation of noise pollution and provide avenue for reusing/recycling of wastewater. In addition, it will create a good habitat for the birds and other terrestrial fauna.

The storm water will undergo proper treatment before discharge into the river. Hence, there will be insignificant impact on the aquatic environment of the river. Waste water generated from the office will be treated as per CPCB standards & the same will be used for gardening/dust suppression. Hence, no negative impact is expected. Proper greenbelt along with landscape garden will be developed within port premises, which is expected to improve aesthetic value of the project area.

11.5.6 Impacts on Socio-Economic Environment

The economic condition along with employment opportunities of unskilled and semi-skilled workers are likely to improve. In addition, this proposed project will be a catalyst to growth of supporting industries, transport and communication system in the region. Thus, a significant positive impact on the socio-economy of the study area is expected due to the proposed project.

Due to the construction, the industries of entire hinterland of this port will be benefited. Thus, this will not only improve the economy of the port but also the economy of the entire region as a whole.

M/s Syama Prasad Mookerjee Port (erstwhile Kolkata Port Trust) fully understands and acknowledges that better education and health care facilities, road infrastructure and drinking water facilities are basic social amenities for better living standard of any human being. The above activities shall be initiated either by providing or by improving the facilities in the area, which will help in uplifting the living standards of local communities.

11.6 ENVIRONMENTAL MONITORING

PROGRAMME:

Details of the environmental monitoring schedule / frequency, which will be undertaken for various environmental components, as per are given in **Table 11.4**.

M/s Bengal Energy Limited	Environmental Impact Assessment for Proposed Expansion cum Modification of the existing Steel Plant of M/s Bengal Energy Limited at Village: Dauka, P.O- Tentulmuri, PS-Narayangarh, Dist.-Paschim Medinipur, West Bengal, Pin-721437	C11 - 11
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Table 11.4

POST PROJECT MONITORING PROGRAMME

Discipline	Locations	Parameters	Frequency	Fund Provision (Annual Cost in Lakhs)
Meteorology (Met Station)	One	Temperature, Rainfall, Relative Humidity, Atmospheric Pressure, Wind Speed and Direction	Hourly	2 lakhs
Ambient Air Quality	3-4 relevant locations	PM ₁₀ , PM _{2.5} , SO ₂ & NO ₂	Quarterly	12 lakhs
Fugitive Emission	3-4 relevant locations	PM	Quarterly	1 lakh
STP	Process Effluent	pH, Total Suspended Solid, Temperature, Oil & Grease, Copper, Iron & COD	Yearly	1 lakh
Ground Water Quality	2-3 Locations	pH, Temperature, Conductivity, Turbidity, Alkalinity, Chlorine, Total Suspended Solid, Total Dissolved Solids, Total Hardness, Ca-hardness, Mg-hardness, Coliform, Fe, Cu, Cd, Cr ⁶⁺ , Pb, As, Hg, Zn	Yearly	1 lakh
Drinking Water Quality	1 Location	pH, Temperature, Conductivity, Turbidity, Alkalinity, Chlorine, Total Suspended Solid, Total Dissolved Solids, Total Hardness, Ca-hardness, Mg-hardness, Coliform, Fe, Cu, Cd, Cr ⁶⁺ , Pb, As, Hg, Zn	Yearly	1 lakh
Noise	Port Area and Nearby	Day-and Night-Time Noise Levels	Half-yearly	1 lakh

M/s Bengal Energy Limited	Environmental Impact Assessment for Proposed Expansion cum Modification of the existing Steel Plant of M/s Bengal Energy Limited at Village: Dauka, P.O- Tentulmuri, PS-Narayangarh, Dist.-Paschim Medinipur, West Bengal, Pin-721437				C11 - 12
	villages				
TOTAL					19 lakhs
Discipline	Locations	Parameters	Frequency	Fund Provision (Annual Cost in Lakhs)	
Meteorology (Met Station)	One	Temperature, Rainfall, Relative Humidity, Atmospheric Pressure, Wind Speed and Direction	Hourly	2 lakhs	
Ambient Air Quality	3-4 relevant locations	PM ₁₀ , PM _{2.5} , SO ₂ & NO ₂	Quarterly	12 lakhs	

11.7 ENVIRONMENTAL MANAGEMENT PLAN

M/s Syama Prasad Mookerjee Port (erstwhile Kolkata Port Trust), will develop various management activities for the Environmental Management Programme which will meet all statutory requirements and help to improve environmental quality.

In order to improve the aesthetic look of the area and enhance the land use as well as to compensate for any loss in ecology during construction, adequate plantation programmes around the project site have been planned and will be adopted. Development of green belt will include plantation of trees along boundary of the factory, roads, raw material yard and other available spaces. 33% of total area of port will be covered under green cover.

A detailed monitoring for different environmental parameters will be carried out as per direction of State Pollution Control Board. An environmental management group will be established to implement the management plan.

M/s SMPK has earmarked total 13 hectares (33 acres) land (33% of 40 hectares (100 acres)) within its proposed site at Village: Balagarh, Dist.-Hooghly, West Bengal. Total 19,500 number of trees (@1500 nos. of trees per hectares) will come under greenbelt.

11.8 OVERALL CONCLUSION OF THE PROJECT

All the impacts likely to have an effect on the environment have been identified and efficient / adequate mitigation measures have been proposed for Sustainable Environment.

M/s Bengal Energy Limited	Environmental Impact Assessment for Proposed Expansion cum Modification of the existing Steel Plant of M/s Bengal Energy Limited at Village: Dauka, P.O- Tentulmuri, PS-Narayangarh, Dist.-Paschim Medinipur, West Bengal, Pin-721437	C11 - 13
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Considering the probability of likely impacts, the proponent has planned adequate mitigation measures and Environmental Management Plan. Further, the proponent has been undertaking various activities which have beneficial impacts on the socioeconomic environment. Measures like 100% rainwater harvesting, energy conservation and greenbelt development are also commendable for mention. Looking to the overall project scenario, employment potential and allied development plans will be a great impetus to the development of the society and the economy.

The best environment savvy technology including all safety aspects shall be adopted in the proposed project. All the above safe guards and the respective mitigation measures shall ensure sustainable environment.

CHAPTER-12.0 DISCLOSURE OF CONSULTANT ENGAGED

Brief Profile of M/S. Envirotech East Pvt. Ltd.

M/s. Envirotech East Pvt. Ltd., Kolkata has acquired the status of one of the Prime organizations of the country in undertaking various assignments in the areas like Environmental Impact Assessment, Environment Management Plan, Risk Analysis, Detailed Project Report, Environmental Audit / Statement, Geo-Technical Statement etc., since it was formed in 1988 by Prof. G. D. Agarwal, former Dean, IIT Kanpur and Member Secretary, Central Pollution Control Board.

In order to cater up with projected increase in traffic and to overcome the problem of restricted cargo movement within the city limits, SMPK intends to shift part of its operation to Balagarh, a site 45 Nautical Miles upstream of Kolkata.

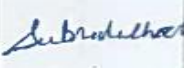
Two dedicated berths, one for container and one for coal have been planned commensurate with 85000 TEU (1.1 MTPA) container traffic and 1.6 MTPA coal traffic. The total capacity of the terminal works for two berths works out to about 2.7 MTPA.

The berths are planned as open pile structure each having length 120m and width 30 m. The Berths will be connected to the shore through Approach Trestles (also founded on piles) of 50 m length and 15 m width. As stated above, one dedicated coal berth and one dedicated berth for handling container have been considered.

Total Land area is 124.95 Hectares (308.75 Acres). The proposed land area is vacant with scanty vegetation and no habitation.

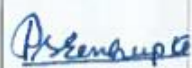
The company has a well-equipped laboratory, which is recognized by West Bengal Pollution Control Board and Ministry of Environment, Forest & Climate Change, Govt. of India.

TABLE-12.1
MANPOWER ENGAGED FOR EIA STUDY FOR EXTENDED PORT GATE
SYSTEM AT BALAGARH, DIST: HOOGHLY, WEST BENGAL

Discipline	Name of Expert	Key Qualifications indicating area of specialization relevant to the respective discipline	Involvement (Period & Task)	Signature
EIA Coordinator : Mr. Subrata Ghosh		Bachelor of Engineering (Electrical)	November, 2021 to till date Assessment & identification of the overall project, co-ordination with respective functional area experts, finalisation of action plans for the overall preparation of EIA/EMP report	
Functional Area Experts involved:				
Air Pollution	Mr. T. Kundu	Bachelor of Technology (Chemical Engineering)	November, 2021 to till date Finalization of monitoring locations for Ambient Air Quality Monitoring, evaluation of Ambient Air Quality results, suggestions & finalization of air pollution control measures, with client and contribution to overall EIA/EMP report preparation.	
Meteorology	Mr. A K. Sinha	P.G. Diploma in Environmental Science and Technology	November, 2021 to till date Identification of air emission sources and their inventerisation, prediction of cumulative impacts on ambient air quality due to all identified point & mobile sources, suggestions & finalization of mitigation measures with project proponent and contribution to overall EIA/EMP report preparation.	

Water Pollution Control	Mr. Asoke Kumar Banerjee	M.Sc. (Chem.)	November, 2021 to till date Finalization of sampling locations for surface water and ground water quality monitoring, evaluation of water quality results, analysis of water balance, identification of sources for wastewater generation and give suggestions on suitable water pollution control, exploring the ways for conservation of water, identification & assessment of impacts, finalization of mitigation measures with project proponent and contribution to overall EIA/EMP report preparation.	<i>Asok Banerjee</i>
Geology Hydrology	Dr. Somenath Bhattacharya	Ph.D in Geology	November, 2021 to till date Assessment of existing Geology and hydrology of the area, Understanding and representing groundwater conditions, finalization of groundwater sampling locations, finalization of survey findings, identification of probable impact due to proposed industrial activity, suggestion of mitigation measures and contribution to overall EIA/EMP report preparation.	<i>Somenath Bhattacharya</i>
Ecology & Bio-diversity	Dr. (Mrs.) Anupam Sinha	Ph.D in Botany	November, 2021 to till date Assessment of the existing Ecology & Bio-diversity with proper emphasis on eco-sensitive locations, assessment of possible impacts to the biological	<i>Anupam Sinha</i>
	Ms. Puja Ghosh (TM)	M.Sc in Environmental Science		<i>Puja Ghosh</i>

			and ecological environment of the area due to the proposed industrial activity and EIA/EMP report preparation.	
Noise & Vibration	Mr. R.K. Dasgupta	Bachelor of Engineering (Mechanical)	November, 2021 to till date Finalization of noise sampling location and analysis of data, identification of impacts, suggestions & finalization of suitable mitigation measures with client and contribution to overall EIA/EMP report preparation.	
Land Use	Dr. Somenath Bhattacharya	Ph.D in Geology	November, 2021 to till date Site visit, supervising development of land use maps of study area using GIS tools, finalization of landuse maps, based on ground truth verification, identification of any probable changes due to the proposed industrial activity and contribution to EIA/EMP report preparation.	
Solid & Hazardous Waste	Mr. Asoke Kumar Banerjee	M.Sc. (Chem.)	November, 2021 to till date Identification of potential solid & hazardous waste generating sources and their inventorisation, finalization of waste management strategies, identification of impacts, finalization of mitigation measures with project proponent and contribution to overall EIA/EMP report preparation.	
Soil Conservation	Mr. Asoke Kumar Banerjee	M.Sc. (Chem.)	November, 2021 to till date	

			Finalization of soil sampling locations, identification of potential sources of impacts due to project, finalization of suitable mitigation measures with project proponent and contribution to overall EIA/EMP report preparation.	
Risk & Hazard	Mr. T. Kundu	Bachelor of Technology (Chemical Engineering)	November, 2021 to till date Identification of major hazards, assessment of risks associated with the proposed project, quantification of the identified risks with the help of the standard software. preparation of on-site and off-site emergency plan and contribution to overall EIA/EMP report preparation.	
Socio-economics	Prof. Pabitra Sengupta	M.Sc. (Economics)	November, 2021 to till date Field survey, assessment of the existing socio-economic scenario of the area, assessment of possible changes to socio-economics of the area due to the proposed project and contribution to overall EIA/EMP report preparation.	



QUALITY COUNCIL
OF INDIA
Creating an Ecosystem for Quality



National Accreditation Board for Education and Training



Certificate of Accreditation

Envirotech East Pvt. Ltd., Kolkata

Bengal Ambuja Coml. Complex, UN-F-13, 1050/1, Survey Park, Kolkata -700075

The organization is accredited as **Category-A** under the QCI-NABET Scheme for Accreditation of EIA Consultant Organization, Version 3: for preparing EIA-EMP reports in the following Sectors –

S.No	Sector Description	Sector (as per)		Cat.
		NABET	MoEFCC	
1	Thermal power plants	4	1 (d)	A
2	Metallurgical industries (ferrous & non-ferrous)	8	3 (a)	A
3	Cement plants	9	3 (b)	A
4	Petroleum refining industry	10	4 (a)	A
5	Coke oven plants	11	4 (b)	A
6	Petrochemical based processing	20	5 (e)	A
7	Synthetic organic chemicals industry	21	5 (f)	A
8	Distilleries	22	5 (g)	A
9	Pulp & paper industry excluding manufacturing of paper from wastepaper and manufacture of paper from ready pulp without bleaching	24	5 (i)	A
10	Ports, harbours, break waters and dredging	33	7 (e)	A
11	Building and construction projects	38	8 (a)	B
13	Townships and Area Development projects	39	8 (b)	B

Note: Names of approved EIA Coordinators and Functional Area Experts are mentioned in RAAC minutes dated Feb 24, 2023 and posted on QCI-NABET website.

The Accreditation shall remain in force subject to continued compliance to the terms and conditions mentioned in QCI-NABET's letter of accreditation bearing no QCI/NABET/ENV/ACO/23/2722 dated March 31, 2023. The accreditation needs to be renewed before the expiry date by Envirotech East Private Limited, Kolkata following due process of assessment.

Sr. Director, NABET
Dated: March 31, 2023

Certificate No.
NABET/EIA/2225/RA 0279

Valid up to
Sept 12, 2025

For the updated List of Accredited EIA Consultant Organizations with approved Sectors please refer to the QCI-NABET website.





WEST BENGAL POLLUTION CONTROL BOARD

(Department of Environment, Government of West Bengal)

Paribesh Bhawan

Bldg. No. 10A, Block – LA, Sector – III, Bidhannagar, Kolkata – 700 106

Tel: 2335-9088 / 5076 / 5079 / 8861 / 7428 / 8211

Fax: (0091) (033) 2335-2813 / 8073 / 5272

Website: www.wbpcb.gov.in

Memo No: 0920 -5/WPB-S/99 (Part-VI)
[E-File: WBPCB-15012(14)/1/2021-SEC(WBPCB)-WBPCB]

Date: 29.03.2022

ORDER

In exercise of the power conferred under section 17(2) of the Water (Prevention and Control of Pollution) Act 1974 and under section 17(2) of the Air (Prevention and Control of Pollution) Act 1981, the West Bengal Pollution Control Board (hereinafter referred as the "State Board") recognizes Private/Government Laboratories for the purposes of environmental monitoring within the State of West Bengal.

The validity of recognition of the Private/Government Laboratories would expire on 31.03.2022. The State Board has decided to **extend the validity of recognition up to 30.06.2022** i.e. for another three (3) months.

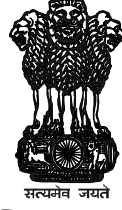
Sl. No.	Name & address of the Laboratory	Reference order(s) of WBPCB	Processing fees payable
1.	M/s. Asansol Mines Board of Health, Court Compound, Katchari Road, P.O.- Asansol Court, Dist- Paschim Bardhaman	147-5/WPB-S/99 (Part-V) dated 31.12.2019 2600-5/WPB-S/99 (Part-VI) dated 15.12.2021	Rs. 2000/-
2.	M/s. Bharat Foundation 25/11A, K. P. Roy Lane, Kolkata- 700031	147-5/WPB-S/99 (Part-V) dated 31.12.2019 2600-5/WPB-S/99 (Part-VI) dated 15.12.2021	Rs. 3000/-
3.	CSIR- Central Mechanical Engineering Research Institute Mahatma Gandhi Avenue, Durapur-713209, Paschim Bardhaman	147-5/WPB-S/99 (Part-V) dated 31.12.2019 2600-5/WPB-S/99 (Part-VI) dated 15.12.2021	Rs. 2000/-
4.	M/s. Eco Care Manoj Talkies Basement, Asansol, Burdwan	147-5/WPB-S/99 (Part-V) dated 31.12.2019 2600-5/WPB-S/99 (Part-VI) dated 15.12.2021	Rs. 3000/-
5.	M/s. Edward Food Research and Analysis Centre Limited Subhash Nagar, PO-Nilgunj Bazar, Barasat, Kolkata -700121	147-5/WPB-S/99 (Part-V) dated 31.12.2019 0989-5/WPB-S/99 (Part-V) dated 27.05.2020 2342-5/WPB-S/99 (Part-V) dated 28.12.2020 0922-5/WPB-S/99 (Part-VI) dated 13.04.2021 2600-5/WPB-S/99 (Part-VI) dated 15.12.2021	Rs. 3000/-
6.	M/s. Envirocheck 189 & 190, 192 & 63B, Rastraguru Avenue, Kolkata- 700028	147-5/WPB-S/99 (Part-V) dated 31.12.2019 2600-5/WPB-S/99 (Part-VI) dated 15.12.2021	Rs. 3000/-
7.	M/s. Envirotech East (P) Ltd. 100, Kalikapur, Madurdaha, Kolkata- 700107	147-5/WPB-S/99 (Part-V) dated 31.12.2019 2600-5/WPB-S/99 (Part-VI) dated 15.12.2021	Rs. 3000/-
8.	M/s. Fresh Environment Consultancy 123, R. N. Tagore Road, Berhampore, Murshidabad Pin-742101	147-5/WPB-S/99 (Part-V) dated 31.12.2019 2600-5/WPB-S/99 (Part-VI) dated 15.12.2021	Rs. 2000/-
9.	M/s. Good Earth Enviro Care S. D. Park, Kusumba, P.O.- Narendrapur, Kolkata-700103	147-5/WPB-S/99 (Part-V) dated 31.12.2019 2600-5/WPB-S/99 (Part-VI) dated 15.12.2021	Rs. 3000/-
10.	M/s. Green Vision Urvashi Malhar, Phase II, MEAV-25, Bengal Ambuja Housing Complex, City Centre, Durgapur-713216	147-5/WPB-S/99 (Part-V) dated 31.12.2019 2600-5/WPB-S/99 (Part-VI) dated 15.12.2021	Rs. 3000/-
11.	M/s. Indicative Consultant India HPL Link Road, Basudevpur, Khanjanchak, Haldia, Dist- Purba Medinipur, Pin-721602	147-5/WPB-S/99 (Part-V) dated 31.12.2019 0868-5/WPB-S/99 (Part-V) dated 13.03.2020 1220-5/WPB-S/99 (Part-V) dated 21.09.2020 0697-5/WPB-S/99 (Part-VI) dated 08.03.2021 1680-5/WPB-S/99 (Part-VI) dated 01.09.2021 2600-5/WPB-S/99 (Part-VI) dated 15.12.2021	Rs. 3000/-

Sl. No.	Name & address of the Laboratory	Reference order(s) of WBPCB	Processing fees payable
12.	M/s. J. M. Biotech (Pvt) Ltd. Sipta, P.O.- Amila, PS. Raina, Purba Bardhaman-713423	147-5/WPB-S/99 (Part-V) dated 31.12.2019 2600-5/WPB-S/99 (Part-VI) dated 15.12.2021	Rs. 3000/-
13.	M/s. Mitra S. K. Pvt. Ltd. Udyan Industrial Estate, P-48, 3- Pagla Danga Road, Kolkata- 700015	147-5/WPB-S/99 (Part-V) dated 31.12.2019 2600-5/WPB-S/99 (Part-VI) dated 15.12.2021	Rs. 3000/-
14.	M/s. N. D. International 107B, Block-F, New Alipore Kolkata- 700053	147-5/WPB-S/99 (Part-V) dated 31.12.2019 2600-5/WPB-S/99 (Part-VI) dated 15.12.2021	Rs. 3000/-
15.	M/s. Pollution Analyzer Consultant 10, Sourin Roy Road, (2 nd & 3 rd Floor) Behala Kolkata-700034	147-5/WPB-S/99 (Part-V) dated 31.12.2019 2600-5/WPB-S/99 (Part-VI) dated 15.12.2021	Rs. 3000/-
16.	M/s. Pollution and Project Consultants P- 145, Bangur Avenue Block A, Kolkata- 700055	147-5/WPB-S/99 (Part-V) dated 31.12.2019 2600-5/WPB-S/99 (Part-VI) dated 15.12.2021	Rs. 3000/-
17.	M/s. Qualissure Laboratory Services 361, Prantik Pally, 45/361, Bose Pukur Road, Kolkata- 700107	147-5/WPB-S/99 (Part-V) dated 31.12.2019 0623-5/WPB-S/99 (Part-VI) dated 26.02.2021 1021-5/WPB-S/99 (Part-VI) dated 04.05.2021 2600-5/WPB-S/99 (Part-VI) dated 15.12.2021	Rs. 3000/-
18.	M/s. Quality Control Laboratory, PO: Haldia Oil Refinery, Dist: Purba Medinipur, Pin- 721606	147-5/WPB-S/99 (Part-V) dated 31.12.2019 2600-5/WPB-S/99 (Part-VI) dated 15.12.2021	Rs. 2000/-
19.	M/s. R.V. Briggs & Co. Pvt Ltd. 9, Bentinck Street, 1 st Floor, Taher Mansion, Kolkata- 700001	147-5/WPB-S/99 (Part-V) dated 31.12.2019 2600-5/WPB-S/99 (Part-VI) dated 15.12.2021	Rs. 3000/-
20.	M/s. S. M. Scientific Service 486, Dum Dum Park, Kolkata-700055	147-5/WPB-S/99 (Part-V) dated 31.12.2019 2600-5/WPB-S/99 (Part-VI) dated 15.12.2021	Rs. 3000/-
21.	M/s. Scientific Research Laboratory 90, Lake East (4 th Road), Santoshpur, Jadavpur, Kolkata - 700075	147-5/WPB-S/99 (Part-V) dated 31.12.2019 2600-5/WPB-S/99 (Part-VI) dated 15.12.2021	Rs. 3000/-
22.	M/s. SGS India Pvt. Ltd. CS Plot No.- 512(P), Mauza - Hanspukuria, Diamond Harbour Road, P.O. - Joka, Dist.- South 24 Paraganas, Kolkata- 700104	147-5/WPB-S/99 (Part-V) dated 31.12.2019 2600-5/WPB-S/99 (Part-VI) dated 15.12.2021	Rs. 3000/-
23.	M/s. Superintendence Co. of India Pvt Ltd Plot- y-23, Block-EP, Sector-V, Salt Lake City, Kolkata- 700091	147-5/WPB-S/99 (Part-V) dated 31.12.2019 2600-5/WPB-S/99 (Part-VI) dated 15.12.2021	Rs. 3000/-
24.	M/s. Unitech Environmental Services Pvt. Ltd. 52D/12/1A, Babu Bagan Lane, Kolkata- 700031	147-5/WPB-S/99 (Part-V) dated 31.12.2019 2600-5/WPB-S/99 (Part-VI) dated 15.12.2021	Rs. 2000/-
25.	M/s West Bengal Waste Management Limited (A division of Ramky Enviro Engineers Ltd) J. L. No. -103, Mouza - Purba Srikrishnapur, P.S.- Sutahata, Haldia, Dist. -Purba Midnapur, Pin- 721635	147-5/WPB-S/99 (Part-V) dated 31.12.2019 2600-5/WPB-S/99 (Part-VI) dated 15.12.2021	Rs. 3000/-

The terms and conditions and the recommended parameters as mentioned in the above referred respective order(s) of the State Board will remain same and unaltered.

The Laboratories are requested to deposit the requisite processing fees mentioned against respective laboratory, to the State Board, within 30.04.2022.


Member Secretary, WBPCB



भारत का राजपत्र The Gazette of India

असाधारण

EXTRAORDINARY

भाग II—खण्ड 3—उप-खण्ड (ii)

PART II—Section 3—Sub-section (ii)

प्राधिकार से प्रकाशित

PUBLISHED BY AUTHORITY

सं. 4549]

नई दिल्ली, शुक्रवार, नवम्बर 16, 2018/कार्तिक 25, 1940

No. 4549]

NEW DELHI, FRIDAY, NOVEMBER 16, 2018/KARTIKA 25, 1940

पर्यावरण, वन और जलवायु परिवर्तन मंत्रालय

अधिसूचना

नई दिल्ली, 15 नवम्बर, 2018

का.आ. 5768(अ).—केन्द्रीय सरकार, पर्यावरण (संरक्षण) नियम, 1986 के नियम 10 के साथ पठित, पर्यावरण (संरक्षण) अधिनियम, 1986 (1986 का 29) की धारा 12 की उपधारा (1) के खंड (ख) और धारा 13 द्वारा प्रदत्त शक्तियों का प्रयोग करते हुए भारत सरकार के तत्कालीन पर्यावरण और वन मंत्रालय की अधिसूचना सं. का.आ. 1174 (अ), तारीख 18 जुलाई, 2007 में निम्नलिखित और संशोधन करती है, अर्थात् :-

2. उक्त अधिसूचना से संलग्न सारणी में,

(i) क्रम संख्यांक 29, 31, 38, 54 और 73 तथा उससे संबंधित प्रविष्टियों के स्थान पर, निम्नलिखित क्रम संख्यांक और प्रविष्टियां रखी जाएंगी, अर्थात् :-

(1)	(2)	(3)	(4)
"29	मैसर्स महाबल ईनवायरो इंजीनीयरस प्राइवेट लिमिटेड, प्लॉट नं. 13, 17, 18, ग्रामपंचायत बोखारा, नागपुर शहर से 8 कि.मी. की दूरी पर, पटेल पैट्रोल पंप के सामने छिंदवाड़ा रोड, पोस्ट कोराडी, जिला नागपुर-441111, महाराष्ट्र	(i) श्री हरीश प्रभाकर मेंधी (ii) श्री किशोर चंद्रभान जी येओल (iii) श्री सचिन सुभाष गोरे	15 नवंबर, 2018 से 14 नवंबर, 2023
31	मैसर्स ईनवायरो ईस्ट प्राइवेट लिमिटेड, बंगाल अंबूजा कमर्शियल कम्प्लेक्स, यू एन-एफ-13, 1050/1, सर्वे पार्क, कोलकाता-700075	(i) श्री असोक कुमार बंदोपाध्याय (ii) श्री तापस कुंडु (iii) डा.शिवम मित्रा	15 नवंबर, 2018 से 14 नवंबर, 2023
38	मैसर्स ईनवायरोकेयर लैब्स प्राइवेट लिमिटेड, ईनवायरो हाउस, ए-7, एम आई डी सी, वागले	(i) डा.प्रीती एन अमृतकर (ii) कुमारी स्नेहा औंकार मेथर	15 नवंबर, 2018 से 14 नवंबर, 2023

	इंडस्ट्रीयल ईस्टेट, मेन रोड, थाने -400604, महाराष्ट्र	(iii) कुमारी मनीषा खराडे	
54	मैसर्स इको प्रो ईजीनीयर्स प्राइवेट लिमिटेड, 32/41, जी टी रोड से पश्चिम की ओर, यू पीएस आई डी सी इंडस्ट्रीयल एरिया, गाजियाबाद-201009, उत्तर प्रदेश	(i) श्री अमित सक्सेना (ii) सुश्री दिव्या सक्सेना (iii) सुश्री पूर्णिमा चौहान	15 नवंबर, 2018 से 14 नवंबर, 2023
73	मैसर्स के के बी माइक्रो टेस्टिंग लैब्स प्राइवेट लिमिटेड, तरुण प्लाजा, 3-5-244, दूसरा तल, एन एफ सी मेन रोड, कृष्णा नगर कालोनी, मौला अली, हैदराबाद-500040	(i) श्री चौ रामाकृष्णा (ii) श्रीमती पी. राजेश्वरी (iii) श्रीमती अमृता नलिनी	15 नवंबर, 2018 से 14 नवंबर, 2023"

(ii) क्रम सं. 168 उससे संबंधित प्रविष्टियों के पश्चात्, निम्नलिखित क्रम सं. और प्रविष्टियां रखी जाएंगी, अर्थात् :-

"169	मैसर्स ईकोसिस्टम रिसोर्स मैनेजमेंट प्राइवेट लिमिटेड, ए-अशोका पैविलियन, कपाड़िया हेल्थ क्लब के सामने न्यू सिविल रोड, सूरत-295001, गुजरात	(i) श्री सुनील कुमार पांडे (ii) श्री पटेल नीरव कुमार भागवत प्रसाद (iii) श्री पटेल शिरीश धीरुभाई	15 नवंबर, 2018 से 14 नवंबर, 2023
170	मैसर्स एस सी एसईनवायरो सर्विस प्राइवेट लिमिटेड, 7 केसरविहार, खाटू श्यामजी मंदिर के सामने रामन्नागरिया रोड, जगतपुरा, जयपुर-302017, राजस्थान	(i) डा. डी एस परीहार (ii) श्री जितेन्द्र दीक्षित (iii) श्री अभिषेक गौतम	15 नवंबर, 2018 से 14 नवंबर, 2023
171	मैसर्स एपेक्स इनवायरो लेबोरेटरी, 3-डेवर कालोनी, आई टी आई के पास, प्रताप नगर, उदयपुर, राजस्थान	(i) डा. वाई एल मेहता (ii) श्री अमित सक्सेना (iii) श्री किशनलाल अग्रवाल	15 नवंबर, 2018 से 14 नवंबर, 2023
172	मैसर्स पोलीटेस्ट लेबोरेटरीज, 22 सोनी इंडस्ट्रीयल ईस्टेट, पीरानगुट, पुणे-412115, महाराष्ट्र	(i) श्रीमती स्मिता अजय कपाडने (ii) श्री सचिन हरि कापडे (iii) श्रीमती स्वाती महेन्द्र उमरानी	15 नवंबर, 2018 से 14 नवंबर, 2023
173	मैसर्स इंडस्ट्रीयल रिसर्च एंड डेवलपमेंट हाउस प्राइवेट लिमिटेड, सी-10, सेक्टर-6, नौएडा-201306, उत्तर प्रदेश	(i) डा. एस एन ए रिजवी (ii) सुश्री वंदना गुप्ता (iii) सुश्री कविता शर्मा	15 नवंबर, 2018 से 14 नवंबर, 2023
174	मैसर्स विनमैट टेक्नोलोजीस प्राइवेट लिमिटेड, प्लॉट नं. आ-65, साईट-यूपी एस आई डी सी, ग्रेटर नौएडा-201306, उत्तर प्रदेश	(i) श्री कुलदीप सिंह तेवतिया (ii) श्रीमती उपासना (iii) श्री सुनील कुमार बंसल	15 नवंबर, 2018 से 14 नवंबर, 2023
175	मैसर्स नेक्सस टेस्ट लैब्स प्राइवेट लिमिटेड 29, दूसरा तल, तीसरा मेन सींगेहनापलाया, महादेवपुरा, बेंगलोर-560048	(i) श्रीविजया सिंहा रेड्डी पीआर (ii) श्रीमती के कृष्णावेनी (iii) श्रीमती एस मल्लेस्वरी	15 नवंबर, 2018 से 14 नवंबर, 2023
176	मैसर्स इको टैक लैब्स प्राइवेट लिमिटेड, 48 ए, दूसरी मेन रोड, रामनगर, साउथ एक्सटेंशन, पालीकरनई, चेन्नई-600100	(i) श्री ए. दामोदरन (ii) सुश्री एस कोकिला (iii) डा. आर रेणुका	15 नवंबर, 2018 से 14 नवंबर, 2023
177	मैसर्स एलकेटी रिसर्च लेबोर्ट्रीज इंडिया प्राइवेट लिमिटेड, प्लॉट नं. 1652, एम आई ई, पार्ट-बी, बहादुरगढ़-124507, हरियाणा	(i) डा. राजेश कुमार शर्मा (ii) श्री संजय कुमार पांडे	15 नवंबर, 2018 से 14 नवंबर, 2023

178	मैसर्स रोबस्ट मैटीरियल टेक्नोलोजी प्राइवेट लिमिटेड, सं. 94, दूसरा तल, थिरूमाला कमपलेक्स, एन जी ई एफ लेआउट, नागराभावी, बेंगलूर-560072	(i) डा. के. आर रवीकुमार (ii) डा. ममता एस एन (iii) श्री संदेश के एस	15 नवंबर, 2018 से 14 नवंबर, 2023"
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[फा. सं. क्यू 15018/21/2017-सीपीडब्ल्यू]

बृजेश सिक्का, सलाहकार

टिप्पण : मूल अधिसूचना भारत के राजपत्र, असाधारण, में अधिसूचना संख्यांक का. आ. 1174(अ), तारीख 18 जुलाई, 2007 द्वारा प्रकाशित की गई थी और अधिसूचना संख्यांक का.आ.1539(अ), तारीख 13 सितम्बर, 2007, का.आ. 1811(अ), तारीख 24 अक्तूबर, 2007, का.आ. 55(अ), तारीख 9 जनवरी, 2008, का.आ. 428(अ) तारीख 4 मार्च, 2008, का.आ. 865(अ), तारीख 11 अप्रैल, 2008, का.आ. 1894 (अ) तारीख 31 जुलाई, 2008, का.आ. 2728(अ) 25 नवम्बर, 2008, का.आ. 1356 (अ) तारीख 27 मई, 2009, का.आ.1802(अ) तारीख 22 जुलाई, 2009, का.आ.2399 (अ) तारीख 18 सितम्बर, 2009, का.आ.3122(अ) तारीख 7 दिसम्बर, 2009, का.आ. 3123(अ), 7 दिसम्बर, 2009, का.आ. 142(अ) तारीख 21 जनवरी, 2010, का.आ.619(अ) तारीख 19 मार्च, 2010, का.आ. 1662(अ) तारीख 13 जुलाई, 2010, का.आ. 2390(अ) तारीख 30 सितम्बर, 2010, का.आ. 2904(अ) तारीख 8 दिसम्बर, 2010, का.आ.181(अ) तारीख 28 जनवरी, 2011, का.आ. 692(अ) तारीख 5 अप्रैल, 2011, का.आ. 1537(अ) तारीख 6 जुलाई, 2011, का.आ.1754(अ) तारीख 28 जुलाई, 2011, का.आ. 2609(अ) तारीख 22 नवम्बर, 2011, का.आ. 264(अ) तारीख 13 फरवरी, 2012, का.आ. 1150(अ) तारीख 22 मई, 2012, का.आ. 1295(अ), 6 जून, 2012 का.आ.2039(अ) तारीख 5 सितम्बर, 2012, का.आ. 2850(अ) तारीख 7 दिसम्बर, 2012, का.आ.592(अ) तारीख 8 मार्च, 2013, का.आ. 945(अ) तारीख 8 अप्रैल, 2013, का.आ. 2287(अ) तारीख 27 जुलाई, 2013, का.आ. 3489(अ) तारीख 26 नवम्बर, 2013, का.आ.21(अ) तारीख 3 जनवरी, 2014, का.आ. 561(अ) तारीख 26 फरवरी, 2014, का.आ. 1190(अ) तारीख 2 जून, 2014, का.आ. 2003(अ) तारीख 9 अगस्त, 2014, का.आ.137 (अ) तारीख 12 जनवरी, 2015, का.आ. 1783(अ) तारीख 30 जून, 2015, का.आ. 2453(अ) तारीख 7 सितम्बर, 2015 का.आ. 1953(अ), तारीख 2 जून, 2016 और का.आ.388(अ) तारीख 10 फरवरी, 2017 और का.आ.सं. 857(अ) तारीख 26 फरवरी, 2018 द्वारा उनका अन्तिम संशोधन किया गया।

MINISTRY OF ENVIRONMENT, FOREST AND CLIMATE CHANGE

NOTIFICATION

New Delhi, 15th November, 2018

S.O. 5768 (E).— In exercise of the powers conferred by clause (b) of sub-section (1) of section 12 and section 13 of the Environment (Protection) Act, 1986 (29 of 1986), read with rule 10 of the Environment (Protection) Rules, 1986, the Central Government hereby makes the following further amendments in the notification of the Government of India in the erstwhile Ministry of Environment and Forests, vide number S.O. 1174(E), dated the 18th July, 2007, namely: -

in the said notification, in the table, -

(i) for serial numbers 29, 31, 38, 54 and 73 the entries relating thereto, the following serial numbers and entries shall be substituted, namely: -

(1)	(2)	(3)	(4)
“29	M/s. Mahabal Enviro Engineers Pvt. Ltd. Plot No. 13,17,18, Grampanchayat Bokhara, 8 KM from Nagpur City, Opp. Patel Petrol Pump, Chhindwara Road, Post Koradi, Distt. Nagpur-441111, Maharashtra	(i) Mr. Harish Prabhakar Mendhi (ii) Mr. Kishor Chandrabhanji Yeole (iii) Mr. Sachin Subhash Gore	15 th November, 2018 to 14 th November, 2023
31	M/s. Envirotech East Pvt. Ltd. Bengal Ambuja Commercial Complex, UN-F-13, 1050/1, Survey Park, Kolkata-700075	(i) Mr. Asoke Kumar Bandyopadhyay (ii) Mr. Tapas Kundu (iii) Dr. Shibam Mitra	15 th November, 2018 to 14 th November, 2023
38	M/s. Envirocare Labs Pvt. Ltd. Enviro House, A-7, MIDC, Wagle Industrial Estate, Main Road, Thane-400604, Maharashtra	(i) Dr. Priti N. Amritkar (ii) Ms. Sneha Omkar Methar (iii) Ms. Manisha Kharade	15 th November, 2018 to 14 th November, 2023
54	M/s. Eko Pro Engineers Pvt. Ltd., 32/41, South Side of G.T. Road, UPSIDC Industrial Area, Ghaziabad-201009, Uttar Pradesh	(i) Mr. Amit Saxena (ii) Ms. Divya Saxena (iii) Ms. Purnima Chauhan	15 th November, 2018 to 14 th November, 2023
73	M/s. KKB Micro Testing Labs Pvt. Ltd. Tarun plaza, #3-5-244, 2 nd Floor, NFC Main Road, Krishna Nagar Colony, Moula Ali, Hyderabad-500040	(i) Mr. Ch. Ramakrishna (ii) Mrs. P. Rajeswari (iii) Mrs. Amrutha Nalini	15 th November, 2018 to 14 th November, 2023

(ii) after serial number 168 and the entries relating thereto, the following serial numbers and entries shall be inserted, namely: -

(1)	(2)	(3)	(4)
“169	M/s. Ecosystem Resource Management Pvt. Ltd. A`-Ashoka Pavillion, Opp. Kapadia Health Club, New-Civil Road, Surat-395001, Gujarat	(i) Mr. Sunil Kumar Pandey (ii) Mr. Patel Niravkumar BhagvatPrasad (iii) Mr. Patel Shirish Dhirubhai	15 th November, 2018 to 14 th November, 2023
170	M/s. SCS Enviro Services Pvt. Ltd. 7 Kesar Vihar, Opposite Khatu Shyamji Temple, Ramnagariya Road, Jagatpura, Jaipur-302017, Rajasthan	(i) Dr. D.S Parihar (ii) Mr. Jitendra Dixit (iii) Mr. Abhishek Gautam	15 th November, 2018 to 14 th November, 2023
171	M/s. Apex Enviro Laboratory 3-Dhebar Colony, Near I.T.I Pratapnagar, Udaipur, Rajasthan	(i) Dr. Y.L. Mehta (ii) Mr. Amit Saxena (iii) Mr. Kishan Lal Agrawal	15 th November, 2018 to 14 th November, 2023
172	M/s. Polytest Laboratories 22 Sonaee Industrial Estates, Pirangut, Pune-412115, Maharashtra	(i) Mrs. Smita Ajay Kapadne (ii) Mr. Sachin Hari Kapade (iii) Mrs. Swati Mahendra Umarani	15 th November, 2018 to 14 th November, 2023
173	M/s. Ind Research & Development House Pvt. Ltd. C-10, Sector-6, Noida-201301, Uttar Pradesh	(i) Dr. SNA Rizvi (ii) Ms. Vandana Gupta (iii) Ms. Kavita Sharma	15 th November, 2018 to 14 th November, 2023
174	M/s. Winmet Technologies Private Ltd. Plot No. E-65, Site-IV, UPSIDC, Greater Noida-201306, Uttar Pradesh	(i) Mr. Kuldeep Singh Teotia (ii) Mrs. Upasna (iii) Mr. Sunil Kumar Bansal	15 th November, 2018 to 14 th November, 2023
175	M/s. Nexus Test Labs Pvt. Ltd. #29, Second Floor, 3 rd Main,	(i) Mr. Vijaya Simha Reddy P.R (ii) Mrs. K. Krishnaveni	15 th November, 2018 to

	Singaihanaplaya, Mahadevapura, Bangalore-560048	(iii) Mrs. S. Malleswari	14 th November, 2023
176	M/s. Eco Tech Labs Pvt. Ltd. 48A, 2 nd Main Road, Ram Nagar , South Extension, Pallikaranai, Chennai-600100	(i) Mr. A. Dhamodharan (ii) Ms. S. Kokila (iii) Dr. R. Renuka	15 th November, 2018 to 14 th November, 2023
177	M/s. Alcatec Research Laboratories India Pvt. Ltd. Plot No. 1652, M.I.E , Part-B, Bahadurgarh-124507, Haryana	(i) Dr. Rajesh Kumar Sharma (ii) Sh. Sanjay Kumar Pandey	15 th November, 2018 to 14 th November, 2023
178	M/s. Robust Materials Technology Pvt. Ltd. No. 94, 2 nd Floor, Thirumala Complex, NGEF Layout, Nagarabhavi, Bangalore-560072	(i) Dr. K.R. Ravikumar (ii) Dr. Mamatha S.N. (iii) Mr. Sandesha K.S	15 th November, 2018 to 14 th November, 2023"

[F. No. Q. 15018/21/2017-CPW]

BRIJESH SIKKA, Advisor

Note.- The principal notification was published in the Gazette of India, Extraordinary vide number S.O. 1174 (E), dated the 18th July, 2007 and subsequently amended vide notification numbers S.O. 1539 (E), dated the 13th September, 2007, S.O.1811(E), dated the 24th October, 2007, S.O.55(E), dated the 9th January, 2008, S.O. 428(E), dated the 4th March, 2008, S.O. No. 865(E), dated the 11th April, 2008, S.O.No.1894(E), dated the 31st July,2008, S.O. No. 2728(E), dated the 25th November, 2008, S.O.1356(E), dated the 27th May, 2009, S.O.No.1802(E), dated the 22nd July, 2009, S.O.No. 2399(E), dated the 18th September, 2009, S.O.No. 3122(E), dated the 7th December, 2009, S.O.No. 3123(E), dated the 7th December, 2009, S.O.No. 142(E), dated the 21st January, 2010, S.O. 619 (E), dated the 19th March, 2010, S.O.No. 1662(E), dated the 13th July, 2010, S.O.No. 2390(E), dated the 30th September, 2010, S.O.No. 2904 (E), dated the 8th December, 2010, S.O.No. 181(E), dated the 28th January, 2011, S.O.No. 692(E) dated the 5th April, 2011, S.O No. 1754 (E), dated the 28th July, 2011, S.O. No. 2609, dated the 22nd November, 2011, S.O No. 264(E) , dated the 13th February, 2012, S.O No. 1150 (E) dated the 22nd May, 2012, S.O No. 1295(E), dated the 6th June, 2012, S.O. No. 2039 (E), dated the 5th September, 2012, S.O No. 2850 (E), dated the 7th December, 2012, S.O. No. 592 (E), dated the 8th March, 2013, S.O. No. 945(E), dated the 8th April, 2013, S.O. No. 2287 (E), dated the 26th July, 2013, S.O No. 3489(E) dated the 26th November, 2013, S.O No. 21(E), dated the 3rd January, 2014, S.O No. 561 (E), dated the 26th February, 2014, S.O. No. 1190(E), dated the 1st June, 2014, S.O. No. 2003(E), dated the 9th August, 2014, S.O. No. 137 (E), dated the 12th January, 2015, S.O. No. 1783(E), dated the 30th June, 2015, S.O. No. 2453(E), dated the 7th September, 2015, S.O. No. 1953(E), dated the 2nd June, 2016, S.O. No. 388(E), dated the 10th February, 2017, S.O No. 2836 (E), dated the 30th August, 2017 and S.O. 857(E) dated the 26th February, 2018

STATE LEVEL ENVIRONMENT IMPACT ASSESSMENT AUTHORITY

Pranisampad Bhawan, 5th floor, LB 2, Sector-III, Salt Lake, Kolkata – 700 106

e-mail: environmentwb@gmail.com

Web Portal: www.environmentwb.gov.in

No. 444 / EN / T – II – 1/ 169/ 2021

Date: 15th March, 2022

To
M/s Syama Prasad Mookerjee Port,
15 Strand Road,
Kolkata-700001

Sub: ToR for doing EIA for the proposed development of an extended port gate system at vill & PO-Balagarh, Dist – Hooghly, PIN- 712501 West Bengal (proposal no. SIA/WB/NCP/69947/2021)

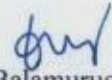
Sir,

This is to inform you that SEIAA in its meeting on 08.03.2022 considered your online application (vide Proposal No.SIA/WB/NCP/69947/2021) as well as the recommendations of SEAC for issuance of ToR and agreed with the recommendation including the additional conditions.

The ToR for conducting EIA study is attached herewith (annexure 1).

The ToR is valid for a period of 3 (three) years from the date of issue. EIA/EMP to be submitted before the expiry of the ToR for consideration of EC application or otherwise.

Encl: Annexure 1

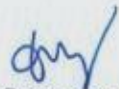

(K Balamurugan)
Member Secretary, SEIAA

No. 444 / EN/T-II-1/169/2021

Date: 15th March, 2022

Copy forwarded for the information to:

The Secretary, State Level Expert Appraisal Committee, 'Paribesh Bhavan', LA, Salt Lake Sector III,
Kolkata- 700106


Member Secretary, SEIAA

STANDARD TERMS OF REFERENCE

- 1) **Executive Summary – Annexure-A**
- 2) Reasons for selecting the site with details of alternate sites examined/rejected/selected on merit with comparative statement and reason/basis for selection. The examination should justify site suitability in terms of environmental angle, resources sustainability associated with selected site as compared to rejected sites. The analysis should include parameters considered along with weightage criteria for short-listing selected site.
- 3) Details of the land use break-up for the proposed project. Details of land use around 10 km radius of the project site. Examine and submit detail of land use around 10 km radius of the project site and map of the project area and 10 km area from boundary of the proposed/existing project area, delineating project areas notified under the wild life (Protection) Act, 1972/critically polluted areas as identified by the CPCB from time to time/notified eco-sensitive areas/interstate boundaries and international boundaries. Analysis should be made based on latest satellite imagery for land use with raw images.
- 4) Submit the present land use and permission required for any conversion such as forest, agriculture etc. land acquisition status, rehabilitation of communities/ villages and present status of such activities.
- 5) Examine and submit the water bodies including the seasonal ones within the corridor of impacts along with their status, volumetric capacity, quality likely impacts on them due to the project.
- 6) Submit a copy of the contour plan with slopes, drainage pattern of the site and surrounding area.
- 7) Submit the details of terrain, level with respect to MSL, filling required, source of filling materials and transportation details etc.
- 8) Examine road/rail connectivity to the project site and impact on the existing traffic network due to the proposed project/activities. A detailed traffic and transportation study should be made for existing and projected passenger and cargo traffic.
- 9) Submit details regarding R&R involved in the project
- 10) Submit a copy of layout superimposed on the HTL/LTL map demarcated by an authorized agency on 1:4000 scale along with the recommendation of the SCZMA.
- 11) Submit the status of shore line change at the project site
- 12) Details of the layout plan including details of channel, breakwaters, dredging, disposal and reclamation.
- 13) Details of handling of each cargo, storage, transport along with spillage control, dust preventive measures. In case of coal, mineral cargo, details of storage and closed conveyance, dust suppression and prevention filters.
- 14) Submit the details of fishing activity and likely impacts on the fishing activity due to the project. Specific study on effects of construction activity and pile driving on marine life.
- 15) Details of oil spill contingency plan.
- 16) Details of bathymetry study.
- 17) Details of ship tranquillity study.

- 18) Examine the details of water requirement, impact on competitive user, treatment details, use of treated waste water. Prepare a water balance chart.
- 19) Details of rainwater harvesting and utilization of rain water.
- 20) Examine details of Solid waste generation treatment and its disposal.
- 21) Details of desalination plant and the study for outfall and intake.
- 22) Examine baseline environmental quality along with projected incremental load due to the proposed project/activities.
- 23) The air quality monitoring should be carried out according to the notification issued on 16th November, 2009.
- 24) Examine separately the details for construction and operation phases both for Environmental Management Plan and Environmental Monitoring Plan with cost and parameters.
- 25) Submit details of a comprehensive Risk Assessment and Disaster Management Plan including emergency evacuation during natural and man-made disasters.
- 26) Submit details of the trees to be cut including their species and whether it also involves any protected or endangered species. Measures taken to reduce the number of the trees to be removed should be explained in detail. Submit the details of compensatory plantation. Explore the possibilities of relocating the existing trees.
- 27) Examine the details of afforestation measures indicating land and financial outlay. Landscape plan, green belts and open spaces may be described. A thick green belt should be planned all around the nearest settlement to mitigate noise and vibrations. The identification of species/ plants should be made based on the botanical studies.
- 28) The Public Hearing should be conducted for the project in accordance with provisions of Environmental Impact Assessment Notification, 2006 and the issues raised by the public should be addressed in the Environmental Management Plan. The Public Hearing should be conducted based on the ToR letter issued by the Ministry and not on the basis of Minutes of the Meeting available on the web-site.
- 29) A detailed draft EIA/EMP report should be prepared in accordance with the above additional TOR and should be submitted to the Ministry in accordance with the Notification.
- 30) Details of litigation pending against the project, if any, with direction /order passed by any Court of Law against the Project should be given.
- 31) The cost of the Project (capital cost and recurring cost) as well as the cost towards implementation of EMP should be clearly spelt out.
- 32) Any further clarification on carrying out the above studies including anticipated impacts due to the project and mitigative measure, project proponent can refer to the model ToR available on Ministry website "<http://moef.nic.in/Manual/Port and harbour>".

Executive Summary

The Executive summary of the EIA/EMP report in about 8-10 pages should be prepared incorporating the information on following points:

- 1) Project name and location (Village, District, State, Industrial Estate (if applicable).
- 2) Products and capacities. If expansion proposal, then existing products with capacities and reference to earlier EC.
- 3) Requirement of land, raw material, water, power, fuel, with source of supply (Quantitative).
- 4) Process description in brief, specifically indicating the gaseous emission, liquid effluent and solid and hazardous wastes.
- 5) Measures for mitigating the impact on the environment and mode of discharge or disposal.
- 6) Capital cost of the project, estimated time of completion.
- 7) Site selected for the project - Nature of land - Agricultural (single/double crop), barren, Govt./private land, status of acquisition, nearby (in 2-3 km.) water body, population, within 10km. other industries, forest, eco-sensitive zones, accessibility, (note - in case of industrial estate this information may not be necessary).
- 8) Baseline environmental data - air quality, surface and ground water quality, soil characteristic, flora and fauna, socio-economic condition of the nearby population.
- 9) Identification of hazards in handling, processing and storage of hazardous material and safety system provided to mitigate the risk.
- 10) Likely impact of the project on air, water, land, flora-fauna and nearby population.
- 11) Emergency preparedness plan in case of natural or in plant emergencies.
- 12) Issues raised during public hearing (if applicable) and response given.
- 13) Environment Management Plan (EMP) as per Office Memorandum issued by the MoEF & CC vide F. No. 22-65/2017-IA.III dated 30.09.2020 with proposed expenditure.
- 14) Occupational Health Measures.
- 15) Post project monitoring plan.

Table-1
Tolerance Limits for Inland Surface Waters (as per IS:2296)

SN	Parameter and Unit	Class-A	Class-B	Class-C	Class-D	Class-E
1	Colour (Hazen Units)	10	300	300	-	-
2	Odour	Unobject	-	-	-	-
3	Taste	Tasteless	-	-	-	-
4	pH (max) (min:6.5)	8.5	8.5	8.5	8.5	8.5
5	Conductivity (25°C) (µmhos/cm)	-	-	-	1000	2250
6	DO (mg/L)(min)	6	5	4	4	-
7	BOD (3 days at 27°C) (mg/L)	2	3	3	-	-
8	Total Coliforms (MPN/100 mL)	50	500	5000	-	-
9	TDS (mg/L)	500	-	1500	-	2100
10	Oil and Grease (mg/L)	-	-	0.1	0.1	-
11	Mineral Oil (mg/L)	0.01	-	-	-	-
12	Free Carbon Dioxide (mg/L CO ₂)	-	-	-	6	-
13	Free Ammonia (mg/L as N)	-	-	-	1.2	-
14	Cyanide (mg/L as CN)	0.05	0.05	0.05	-	-
15	Phenol (mg/L C ₆ H ₅ OH)	0.002	0.005	0.005	-	-
16	Total Hardness (mg/L as CaCO ₃)	300	-	-	-	-
17	Chloride (mg/L as Cl)	250	-	600	-	600
18	Sulphate (mg/L as SO ₄)	400	-	400	-	1000
19	Nitrate (mg/L as NO ₃)	20	-	50	-	-
20	Fluoride (mg/L as F)	1.5	1.5	1.5	-	-
21	Calcium (mg/L as Ca)	80	-	-	-	-
22	Magnesium (mg/L as Mg)	24.4	-	-	-	-
23	Copper (mg/L as Cu)	1.5	-	1.5	-	-
24	Iron (mg/L as Fe)	0.3	-	50	-	-
25	Manganese (mg/L as Mn)	0.5	-	-	-	-
26	Zinc (mg/L as Zn)	15	-	15	-	-
27	Boron (mg/L as B)	-	-	-	-	2
28	Barium (mg/L as Ba)	1	-	-	-	-
29	Silver (mg/L as Ag)	0.05	-	-	-	-
30	Arsenic (mg/L as As)	0.05	0.2	0.2	-	-
31	Mercury (mg/L as Hg)	0.001	-	-	-	-
32	Lead (mg/L as Pb)	0.1	-	0.1	-	-
33	Cadmium (mg/L as Cd)	0.01	-	0.01	-	-
34	Chromium (VI) (mg/L as Cr)	0.05	0.05	0.05	-	-
35	Selenium (mg/L as Se)	0.01	-	0.05	-	-
36	Anionic Detergents (mg/L MBAS)	0.2	1	1	-	-
37	PAH (mg/L)	0.2	-	-	-	-
38	Pesticides (µg/L)	Absent	-	-	-	-
39	Insecticides (mg/L)	-	-	Absent	-	-
40	Alpha Emitters (10 ⁻⁶ µc/mL)	0.001	0.001	0.001	0.001	0.001
41	Beta Emitters (10 ⁻⁶ µc/mL)	0.01	0.01	0.01	0.01	0.01
42	Percent Sodium (%)	-	-	-	-	60
43	Sodium Absorption Ratio	-	-	-	-	26

Class-A: Drinking water source without conventional treatment but after disinfection.
Class-B: Outdoor bathing.
Class-C: Drinking water source with conventional treatment followed by disinfection.
Class-D: Fish culture and wild life propagation.
Class-E: Irrigation, industrial cooling and controlled waste disposal.

Table-2
Drinking Water Quality Standards (as per IS:10500)

Sl No	Parameter and Unit	Desirable Limit	Permissible Limit in Absence of Alternate Source
1	Colour (Hazen units)	5	25
2	Odour	Unobjectionable	-
3	Taste	Agreeable	-
4	Turbidity (NTU)	5	10
5	PH	5-8.5	No relaxation
6	Total Coliforms (MPN/100 mL)	nil	-
7	Pathogenic Organisms or Virus	nil	-
8	TDS (mg/L)	500	2000
9	Mineral Oil (mg/L)	0.01	0.03
10	Free Residual Chlorine (mg/L)	0.2	-
11	Cyanide (mg/L as CN)	0.05	No relaxation
12	Phenol (mg/L C ₆ H ₅ OH)	0.001	0.002
13	Total Hardness (mg/L as CaCO ₃)	300	600
14	Total Alkalinity (mg/L as CaCO ₃)	200	600
15	Chloride (mg/L as Cl)	250	1000
16	Sulphate (mg/L as SO ₄)	200	400
17	Nitrate (mg/L as NO ₃)	45	100
18	Fluoride (mg/L as F)	1	1.5
19	Calcium (mg/L as Ca)	75	200
20	Magnesium (mg/L as Mg)	30	100
21	Copper (mg/L as Cu)	0.05	1.5
22	Iron (mg/L as Fe)	0.3	1
23	Manganese (mg/L as Mn)	0.1	0.3
24	Zinc (mg/L as Zn)	5	15
25	Boron (mg/L as B)	1	5
26	Aluminium (mg/L as AL)	0.03	0.2
27	Arsenic (mg/L as As)	0.05	No relaxation
28	Mercury (mg/L as Hg)	0.001	No relaxation
29	Lead (mg/L as Pb)	0.05	No relaxation
30	Cadmium (mg/L as Cd)	0.01	No relaxation
31	Chromium (VI) (mg/L as Cr)	0.05	No relaxation
32	Selenium (mg/L as Se)	0.01	No relaxation
33	Anionic Detergents (mg/L MBAS)	0.2	1
34	PAH (mg/L)	nil	-
35	Pesticides (µg/L)	Absent	0.001
36	Alpha Emitters (10 ⁻⁶ µc/mL)	nil	0.0001
37	Beta Emitters (10 ⁻⁶ µc/mL)	nil	0.001

Table-3
General Standards for Discharge of Effluents
[as per Environment (Protection) Rules, 1986]

Sl No	Parameter and Unit	Inland Surface Water	Public Sewers	Land for Irrigation	Marine Coastal Water
1	Temperature (°C)	#	-	-	#
2	Colour and Odour	\$	-	\$	\$
3	PH	5.5-9.0	5.5-9.0	5.5-9.0	5.5-9.0
4	BOD (3 days at 27°C) (mg/L)	30	350	100	100
5	COD (mg/L)	250	-	-	250
6	Bio-assay (% 96-hrs Survival)	@	@	@	@
7	TSS (mg/L)	100	600	200	100*
8	SS Particle size(pass IS Sieve)	850	-	-	&
9	Oil and Grease (mg/L)	10	20	10	20
10	Total Residual Chlorine (mg/L)	1	-	-	1
11	Nitrate Nitrogen (mg/L as N)	10	-	-	20
12	Ammonia Nitrogen (mg/L N)	50	50	-	50
13	Kjeldahl Nitrogen (mg/L as N)	100	-	-	100
14	Free Ammonia (mg/L as N)	5	-	-	5
15	Cyanide (mg/L as CN)	0.2	2	0.2	0.2
16	Phenol (mg/L C ₆ H ₅ OH)	1	5	-	5
17	Fluoride (mg/L as F)	2	15	-	15
18	Sulphide (mg/L as S)	2	-	-	5
19	Dissolved Phosphate (mg/L P)	5	-	-	-
20	Copper (mg/L as Cu)	3	3	-	3
21	Iron (mg/L as Fe)	3	3	-	3
22	Manganese (mg/L as Mn)	2	2	-	2
23	Zinc (mg/L as Zn)	5	15	-	15
24	Nickel (mg/L as Ni)	3	3	-	5
25	Vanadium (mg/L as V)	0.2	0.2	-	0.2
26	Arsenic (mg/L as As)	0.2	0.2	0.2	0.2
27	Mercury (mg/L as Hg)	0.01	0.01	-	0.01
28	Lead (mg/L as Pb)	0.1	1	-	1
29	Cadmium (mg/L as Cd)	2	1	-	2
30	Chromium (VI) (mg/L as Cr)	0.1	2	-	1
31	Chromium (Total) (mg/L as Cr)	2	2	-	2
32	Selenium (mg/L as Se)	0.05	0.05	-	0.05
33	Alpha Emitters (10 ⁻⁶ µc/mL)	0.1	0.1	0.01	0.1
34	Beta Emitters (10 ⁻⁶ µc/mL)	1	1	0.1	1

Shall not exceed 5°C above the receiving water temperature.

\$ All efforts should be made to remove colour and unpleasant odour as far as practicable.

@ 90% survival of fish after 96 hours in 100% effluent.

* For cooling water effluent 10% above TSS of influent.

& (a) Floatable solids 3 mm, (b) Settleable solids 850 micron.

Table-4
National Ambient Air Quality Standards

S. No.	Pollutant	Time Weighted Average	Concentration in Ambient Air		
			Industrial, Residential, Rural and Other Area	Ecologically Sensitive Area (notified by Central Government)	Methods of Measurement
(1)	(2)	(3)	(4)	(5)	(6)
1	Sulphur Dioxide (SO ₂), µg/m ³	Annual* 24 hours**	50 80	20 80	- Improved West and Gaeke -Ultraviolet fluorescence
2	Nitrogen Dioxide (NO ₂), µg/m ³	Annual* 24 hours**	40 80	30 80	- Modified Jacob & Hochheiser (Na-Arsenite) - Chemiluminescence
3	Particulate Matter (size less than 10µm) or PM ₁₀ µg/m ³	Annual* 24 hours**	60 100	60 100	- Gravimetric - TOEM - Beta attenuation
4	Particulate Matter (size less than 2.5µm) or PM _{2.5} µg/m ³	Annual* 24 hours**	40 60	40 60	- Gravimetric - TOEM - Beta attenuation
5	Ozone (O ₃) µg/m ³	8 hours** 1 hour**	100 180	100 180	- UV photometric - Chemiluminescence - Chemical Method
6	Lead (Pb) µg/m ³	Annual* 24 hours**	0.50 1.0	0.50 1.0	- AAS /ICP method after sampling on EPM 2000 or equivalent filter paper - ED-XRF using Teflon filter
7	Carbon Monoxide (CO) mg/m ³	8 hours** 1 hour**	02 04	02 04	- Non Dispersive Infra Red (NDIR) spectroscopy
8	Ammonia (NH ₃) µg/m ³	Annual* 24 hours**	100 400	100 400	-Chemiluminescence -Indophenol blue method

(1)	(2)	(3)	(4)	(5)	(6)
9	Benzene (C ₆ H ₆) µg/m ³	Annual*	05	05	- Gas chromatography based continuous analyzer - Adsorption and Desorption followed by GC analysis
10	Benzo(a)Pyrene (BaP) - particulate phase only, ng/m ³	Annual*	01	01	- Solvent extraction followed by HPLC/GC analysis
11	Arsenic (As), ng/m ³	Annual*	06	06	- AAS /ICP method after sampling on EPM 2000 or equivalent filter paper
12	Nickel (Ni), ng/m ³	Annual*	20	20	- AAS /ICP method after sampling on EPM 2000 or equivalent filter paper

* Annual arithmetic mean of minimum 104 measurements in a year at a particular site taken twice a week 24 hourly at uniform intervals.

** 24 hourly or 08 hourly or 01 hourly monitored values, as applicable, shall be complied with 98% of the time in a year. 2% of the time, they may exceed the limits but not on two consecutive days of monitoring.

Note. — Whenever and wherever monitoring results on two consecutive days of monitoring exceed the limits specified above for the respective category, it shall be considered adequate reason to institute regular or continuous monitoring and further investigation.

SANT PRASAD GAUTAM, Chairman
[ADVT-III/4/184/09/Exty.]

Note: The notifications on National Ambient Air Quality Standards were published by the Central Pollution Control Board in the Gazette of India, Extraordinary vide notification No(s). S.O. 384(E), dated 11th April, 1994 and S.O. 935(E), dated 14th October, 1998.

[as per Noise Pollution (Regulation and Control) Rules, 2000]

Area Code	Category of Area	Limits in dB(A) L _{eq} *	
		Day Time	Night Time
A	Industrial Area	75	70
B	Commercial Area	65	55
C	Residential Area	55	45
D	Silence Zone	50	40

- Notes: 1. Day time shall mean from 6.00 a.m. to 10.00 p.m.
2. Night time shall mean from 10.00 p.m. to 6.00 a.m.
3. Silence zone is defined as an area comprising not less than 100 metres around hospitals, educational institutions and courts. The silence zones are zones which are declared as such by the competent authority.
4. Mixed categories of areas may be declared as one of the four above mentioned categories by the competent authority.

* dB(A) L_{eq} denotes the time weighted average of the level of sound in decibels on scale A which is relatable to human hearing.

TABLE: - I Onsite Ambient Air Quality Monitoring Results Location Near Project Site (Gournagar) Period: 1st January,2023 to 31st March,2023				
DATE	PM₁₀	PM_{2.5}	SO₂	NO₂
	(µg/m³)	(µg/m³)	(µg/m³)	(µg/m³)
02.01.2023	53	23	7	12
05.01.2023	47	17	6	16
09.01.2023	56	25	8	18
12.01.2023	53	22	4	14
16.01.2023	48	19	6	20
19.01.2023	61	27	9	13
24.01.2023	56	24	5	18
27.01.2023	62	28	8	16
30.01.2023	55	25	6	15
02.02.2023	49	18	5	12
06.02.2023	52	20	6	19
09.02.2023	47	17	7	12
13.02.2023	60	26	5	16
16.02.2023	56	25	8	23
20.02.2023	63	28	9	13
23.02.2023	52	22	7	19
27.02.2023	48	18	8	15
02.03.2023	55	25	4	12
06.03.2023	61	27	6	16
09.03.2023	53	22	7	12
13.03.2023	47	17	9	17
16.03.2023	58	27	6	14
20.03.2023	52	20	7	19
23.03.2023	48	17	8	15
27.03.2023	60	26	5	21
30.03.2023	55	22	6	17

TABLE: - 2
Onsite Ambient Air Quality Monitoring Results
Location
West Sambhupur Netaji Vidyaniketan (H.S.)
Period: 1st January,2023 to 31st March,2023

DATE	PM₁₀ (µg/m³)	PM_{2.5} (µg/m³)	SO₂ (µg/m³)	NO₂ (µg/m³)
02.01.2023	61	29	9	16
05.01.2023	57	23	7	24
09.01.2023	62	27	5	15
12.01.2023	58	22	8	17
16.01.2023	65	29	6	28
19.01.2023	53	21	10	23
24.01.2023	61	25	9	21
27.01.2023	55	21	8	18
30.01.2023	63	28	9	19
02.02.2023	58	23	6	25
06.02.2023	52	19	5	20
09.02.2023	64	29	7	26
13.02.2023	57	24	10	18
16.02.2023	54	21	6	23
20.02.2023	61	28	9	16
23.02.2023	58	24	6	25
27.02.2023	66	30	8	18
02.03.2023	52	20	5	17
06.03.2023	64	28	7	21
09.03.2023	50	18	6	14
13.03.2023	63	26	9	19
16.03.2023	58	23	6	25
20.03.2023	53	19	10	20
23.03.2023	68	30	7	26
27.03.2023	57	21	6	18
30.03.2023	61	26	9	21

TABLE: - 3 Onsite Ambient Air Quality Monitoring Results Location Kayet Para Period: 1st January,2023 to 31st March,2023				
DATE	PM₁₀ (µg/m³)	PM_{2.5} (µg/m³)	SO₂ (µg/m³)	NO₂ (µg/m³)
02.01.2023	65	31	8	22
05.01.2023	59	27	10	15
09.01.2023	67	31	7	25
12.01.2023	58	27	8	15
16.01.2023	69	32	10	18
19.01.2023	57	25	6	24
24.01.2023	64	29	8	30
27.01.2023	61	26	11	21
30.01.2023	70	31	9	26
02.02.2023	66	30	11	20
06.02.2023	70	34	7	17
09.02.2023	64	31	6	15
13.02.2023	62	29	9	32
16.02.2023	55	23	7	18
20.02.2023	72	35	8	22
23.02.2023	59	27	10	15
27.02.2023	71	33	8	29
02.03.2023	64	29	12	21
06.03.2023	60	25	8	16
09.03.2023	67	30	6	20
13.03.2023	57	26	13	17
16.03.2023	64	31	10	15
20.03.2023	71	34	8	19
23.03.2023	62	29	9	27
27.03.2023	55	23	7	18
30.03.2023	69	32	10	32

TABLE: - 4 Onsite Ambient Air Quality Monitoring Results Location Payradanga Period: 1st January,2023 to 31st March,2023				
DATE	PM₁₀ (µg/m³)	PM_{2.5} (µg/m³)	SO₂ (µg/m³)	NO₂ (µg/m³)
02.01.2023	62	30	7	18
05.01.2023	59	27	5	23
09.01.2023	67	31	6	13
12.01.2023	56	25	10	21
16.01.2023	60	29	8	19
19.01.2023	55	25	10	14
24.01.2023	60	29	7	17
27.01.2023	53	22	12	22
30.01.2023	62	29	8	16
02.02.2023	70	32	6	19
06.02.2023	54	24	8	24
09.02.2023	62	30	7	18
13.02.2023	68	31	11	14
16.02.2023	52	21	9	16
20.02.2023	63	30	7	22
23.02.2023	59	27	5	23
27.02.2023	67	31	6	17
02.03.2023	68	31	12	25
06.03.2023	52	21	9	16
09.03.2023	63	30	7	22
13.03.2023	53	25	10	17
16.03.2023	58	27	8	15
20.03.2023	63	30	9	20
23.03.2023	70	32	6	13
27.03.2023	54	25	11	24
30.03.2023	62	30	7	16

TABLE: - 5 Onsite Ambient Air Quality Monitoring Results Location Chakda Narendra Pally Period: 1st January,2023 to 31st March,2023				
DATE	PM₁₀ (µg/m³)	PM_{2.5} (µg/m³)	SO₂ (µg/m³)	NO₂ (µg/m³)
03.01.2023	63	25	14	17
06.01.2023	74	34	10	34
10.01.2023	66	30	8	22
13.01.2023	63	28	13	28
17.01.2023	80	38	11	35
20.01.2023	68	30	9	23
25.01.2023	76	35	15	32
28.01.2023	70	32	8	19
31.01.2023	64	27	12	24
03.02.2023	75	36	8	22
07.02.2023	63	26	13	28
10.02.2023	64	29	11	37
14.02.2023	63	25	14	24
17.02.2023	80	38	17	26
21.02.2023	68	30	9	22
24.02.2023	76	35	15	32
28.02.2023	64	27	12	25
03.03.2023	67	28	12	33
07.03.2023	70	32	8	22
10.03.2023	63	26	13	28
14.03.2023	64	29	11	21
17.03.2023	68	32	14	17
21.03.2023	67	29	9	30
24.03.2023	67	31	12	25
28.03.2023	73	34	8	34
31.03.2023	63	27	14	23

TABLE: - 6 Onsite Ambient Air Quality Monitoring Results Location Uttar Gopalpur Jirat Period: 1st January,2023 to 31st March,2023				
DATE	PM₁₀ (µg/m³)	PM_{2.5} (µg/m³)	SO₂ (µg/m³)	NO₂ (µg/m³)
03.01.2023	60	26	8	21
06.01.2023	71	32	7	16
10.01.2023	63	28	10	19
13.01.2023	76	35	8	27
17.01.2023	60	24	7	18
20.01.2023	58	21	9	31
25.01.2023	64	28	12	20
28.01.2023	73	34	7	33
31.01.2023	62	29	8	22
03.02.2023	65	31	14	20
07.02.2023	61	27	9	17
10.02.2023	58	23	7	23
14.02.2023	67	30	9	16
17.02.2023	60	25	8	21
21.02.2023	71	33	12	28
24.02.2023	63	27	7	19
28.02.2023	57	21	10	25
03.03.2023	71	32	8	21
07.03.2023	59	22	14	32
10.03.2023	65	31	8	24
14.03.2023	62	27	9	18
17.03.2023	58	20	7	27
21.03.2023	65	29	11	16
24.03.2023	74	35	8	25
28.03.2023	67	30	9	20
31.03.2023	59	24	7	30

TABLE: - 7
Onsite Ambient Air Quality Monitoring Results
Location | Balagarghat Habibpur
Period: 1st January,2023 to 31st March,2023

DATE	PM ₁₀ (µg/m ³)	PM _{2.5} (µg/m ³)	SO ₂ (µg/m ³)	NO ₂ (µg/m ³)
03.01.2023	59	24	8	13
06.01.2023	54	21	5	19
10.01.2023	48	17	6	16
13.01.2023	52	22	4	20
17.01.2023	45	15	7	18
20.01.2023	56	24	6	11
25.01.2023	53	21	8	17
28.01.2023	50	19	5	19
31.01.2023	62	26	7	12
03.02.2023	55	21	4	18
07.02.2023	63	27	5	14
10.02.2023	52	21	6	21
14.02.2023	45	16	8	18
17.02.2023	54	23	4	20
21.02.2023	49	19	7	18
24.02.2023	58	26	6	11
28.02.2023	53	21	5	17
03.03.2023	45	16	6	15
07.03.2023	59	25	8	10
10.03.2023	55	22	4	18
14.03.2023	62	27	7	14
17.03.2023	60	23	6	21
21.03.2023	48	19	8	18
24.03.2023	53	23	4	12
28.03.2023	60	27	6	20
31.03.2023	49	17	5	18

TABLE: - 8
Onsite Ambient Air Quality Monitoring Results
Location | Sanyalchar
Period: 1st January,2023 to 31st March,2023

DATE	PM ₁₀ (µg/m ³)	PM _{2.5} (µg/m ³)	SO ₂ (µg/m ³)	NO ₂ (µg/m ³)
03.01.2023	61	27	5	20
06.01.2023	48	19	6	15
10.01.2023	56	26	11	12
13.01.2023	52	23	5	18
17.01.2023	63	30	6	15
20.01.2023	50	20	9	22
25.01.2023	56	24	5	12
28.01.2023	67	31	7	19
31.01.2023	53	21	5	24
03.02.2023	59	27	8	18
07.02.2023	66	30	9	25
10.02.2023	55	23	6	13
14.02.2023	60	27	5	20
17.02.2023	53	22	7	12
21.02.2023	50	20	10	16
24.02.2023	62	28	5	20
28.02.2023	66	30	7	19
03.03.2023	56	24	8	21
07.03.2023	52	20	5	14
10.03.2023	59	25	7	18
14.03.2023	66	30	9	25
17.03.2023	56	22	6	13
21.03.2023	60	27	5	17
24.03.2023	54	21	6	12
28.03.2023	50	19	10	16
31.03.2023	60	27	5	20

TABLE: - I
Onsite Ambient Air Quality Monitoring Results
Location | Near Project Site (Gournagar)
Period: 1st January,2023 to 31st March,2023

DATE	Shit - 1	Shit - 2	Shift-III
	(mg/m3)	(mg/m3)	(mg/m3)
02.01.2023	0.154	0.331	0.506
05.01.2023	0.574	0.234	0.335
09.01.2023	0.099	0.412	0.115
12.01.2023	0.460	0.442	0.407
16.01.2023	0.244	0.327	0.189
19.01.2023	0.148	0.218	0.509
24.01.2023	0.383	0.563	0.223
27.01.2023	0.107	0.609	0.274
30.01.2023	0.452	0.229	0.483
02.02.2023	0.235	0.560	0.218
06.02.2023	0.483	0.171	0.423
09.02.2023	0.327	0.394	0.214
13.02.2023	0.152	0.550	0.493
16.02.2023	0.223	0.322	0.143
20.02.2023	0.582	0.439	0.330
23.02.2023	0.326	0.242	0.295
27.02.2023	0.250	0.552	0.544
02.03.2023	0.139	0.212	0.115
06.03.2023	0.460	0.442	0.407
09.03.2023	0.244	0.327	0.189
13.03.2023	0.148	0.218	0.509
16.03.2023	0.383	0.301	0.223
20.03.2023	0.152	0.550	0.493
23.03.2023	0.223	0.322	0.143
27.03.2023	0.483	0.171	0.423
30.03.2023	0.182	0.439	0.230

TABLE: - 2
Onsite Ambient Air Quality Monitoring Results
Location
West Sambhupur Netaji Vidyaniketan (H.S.)
Period: 1st January,2023 to 31st March,2023

DATE	Shit - 1	Shit - 2	Shift-III
	(mg/m3)	(mg/m3)	(mg/m3)
02.01.2023	0.311	0.354	0.324
05.01.2023	0.148	0.117	0.140
09.01.2023	0.424	0.390	0.360
12.01.2023	0.217	0.297	0.267
16.01.2023	0.358	0.256	0.226
19.01.2023	0.104	0.585	0.412
24.01.2023	0.402	0.503	0.273
27.01.2023	0.144	0.458	0.428
30.01.2023	0.217	0.497	0.167
02.02.2023	0.458	0.356	0.326
06.02.2023	0.196	0.301	0.271
09.02.2023	0.238	0.403	0.423
13.02.2023	0.352	0.271	0.241
16.02.2023	0.297	0.398	0.268
20.02.2023	0.523	0.369	0.339
23.02.2023	0.198	0.541	0.311
27.02.2023	0.313	0.431	0.101
02.03.2023	0.217	0.297	0.267
06.03.2023	0.358	0.256	0.326
09.03.2023	0.414	0.458	0.421
13.03.2023	0.402	0.503	0.273
16.03.2023	0.144	0.458	0.428
20.03.2023	0.458	0.356	0.326
23.03.2023	0.196	0.301	0.271
27.03.2023	0.234	0.250	0.520
30.03.2023	0.238	0.553	0.423

TABLE: - 3
Onsite Ambient Air Quality Monitoring Results
Location Kayet Para
Period: 1st January,2023 to 31st March,2023

DATE	Shit - 1	Shit - 2	Shift-III
	(mg/m3)	(mg/m3)	(mg/m3)
02.01.2023	0.351	0.396	0.366
05.01.2023	0.188	0.212	0.179
09.01.2023	0.464	0.432	0.402
12.01.2023	0.257	0.339	0.309
16.01.2023	0.398	0.298	0.265
19.01.2023	0.640	0.443	0.473
24.01.2023	0.442	0.545	0.515
27.01.2023	0.184	0.338	0.415
30.01.2023	0.257	0.439	0.209
02.02.2023	0.408	0.398	0.628
06.02.2023	0.236	0.343	0.313
09.02.2023	0.278	0.695	0.565
13.02.2023	0.392	0.313	0.283
16.02.2023	0.337	0.240	0.310
20.02.2023	0.563	0.411	0.453
23.02.2023	0.438	0.383	0.249
27.02.2023	0.353	0.473	0.443
02.03.2023	0.257	0.339	0.309
06.03.2023	0.398	0.298	0.268
09.03.2023	0.640	0.443	0.473
13.03.2023	0.442	0.545	0.315
16.03.2023	0.398	0.398	0.268
20.03.2023	0.236	0.343	0.313
23.03.2023	0.278	0.195	0.565
27.03.2023	0.189	0.562	0.625
30.03.2023	0.392	0.313	0.283

TABLE: - 4
Onsite Ambient Air Quality Monitoring Results
Location Payradanga
Period: 1st January,2023 to 31st March,2023

DATE	Shit - 1	Shit - 2	Shift-III
	(mg/m3)	(mg/m3)	(mg/m3)
02.01.2023	0.257	0.393	0.431
05.01.2023	0.304	0.523	0.378
09.01.2023	0.233	0.365	0.532
12.01.2023	0.331	0.442	0.271
16.01.2023	0.405	0.341	0.379
19.01.2023	0.176	0.495	0.450
24.01.2023	0.327	0.291	0.218
27.01.2023	0.545	0.606	0.335
30.01.2023	0.143	0.386	0.424
02.02.2023	0.306	0.453	0.572
06.02.2023	0.195	0.323	0.385
09.02.2023	0.167	0.391	0.258
13.02.2023	0.445	0.606	0.435
16.02.2023	0.318	0.552	0.581
20.02.2023	0.250	0.386	0.174
23.02.2023	0.326	0.521	0.388
27.02.2023	0.217	0.278	0.507
02.03.2023	0.233	0.365	0.332
06.03.2023	0.331	0.442	0.271
09.03.2023	0.405	0.341	0.379
13.03.2023	0.143	0.386	0.424
16.03.2023	0.306	0.453	0.472
20.03.2023	0.195	0.323	0.385
23.03.2023	0.167	0.391	0.258
27.03.2023	0.414	0.542	0.445
30.03.2023	0.545	0.206	0.335

TABLE: - 5
Onsite Ambient Air Quality Monitoring Results
Location Chakda Narendra Pally
Period: 1st January,2023 to 31st March,2023

DATE	Shit - 1	Shit - 2	Shift-III
	(mg/m3)	(mg/m3)	(mg/m3)
03.01.2023	0.606	0.541	0.284
06.01.2023	0.211	0.431	0.574
10.01.2023	0.638	1.015	0.958
13.01.2023	1.053	0.505	0.448
17.01.2023	0.597	0.827	0.850
20.01.2023	0.287	1.001	0.644
25.01.2023	0.438	0.315	0.968
28.01.2023	0.253	0.505	0.448
31.01.2023	0.597	0.806	0.149
03.02.2023	0.191	0.740	0.187
07.02.2023	0.814	1.025	0.368
10.02.2023	0.453	0.330	1.022
14.02.2023	0.223	1.102	0.691
17.02.2023	0.620	0.355	0.298
21.02.2023	0.547	0.486	1.029
24.02.2023	0.453	0.281	0.245
28.02.2023	0.648	0.401	0.344
03.03.2023	0.287	1.001	0.644
07.03.2023	0.438	0.315	0.968
10.03.2023	0.253	0.505	0.448
14.03.2023	0.606	0.541	0.284
17.03.2023	0.211	0.431	0.574
21.03.2023	0.638	1.015	0.958
24.03.2023	1.053	0.505	0.448
28.03.2023	0.814	0.483	0.385
31.03.2023	0.597	0.827	0.850

TABLE: - 6
Onsite Ambient Air Quality Monitoring Results
Location Uttar Gopalpur Jirat
Period: 1st January,2023 to 31st March,2023

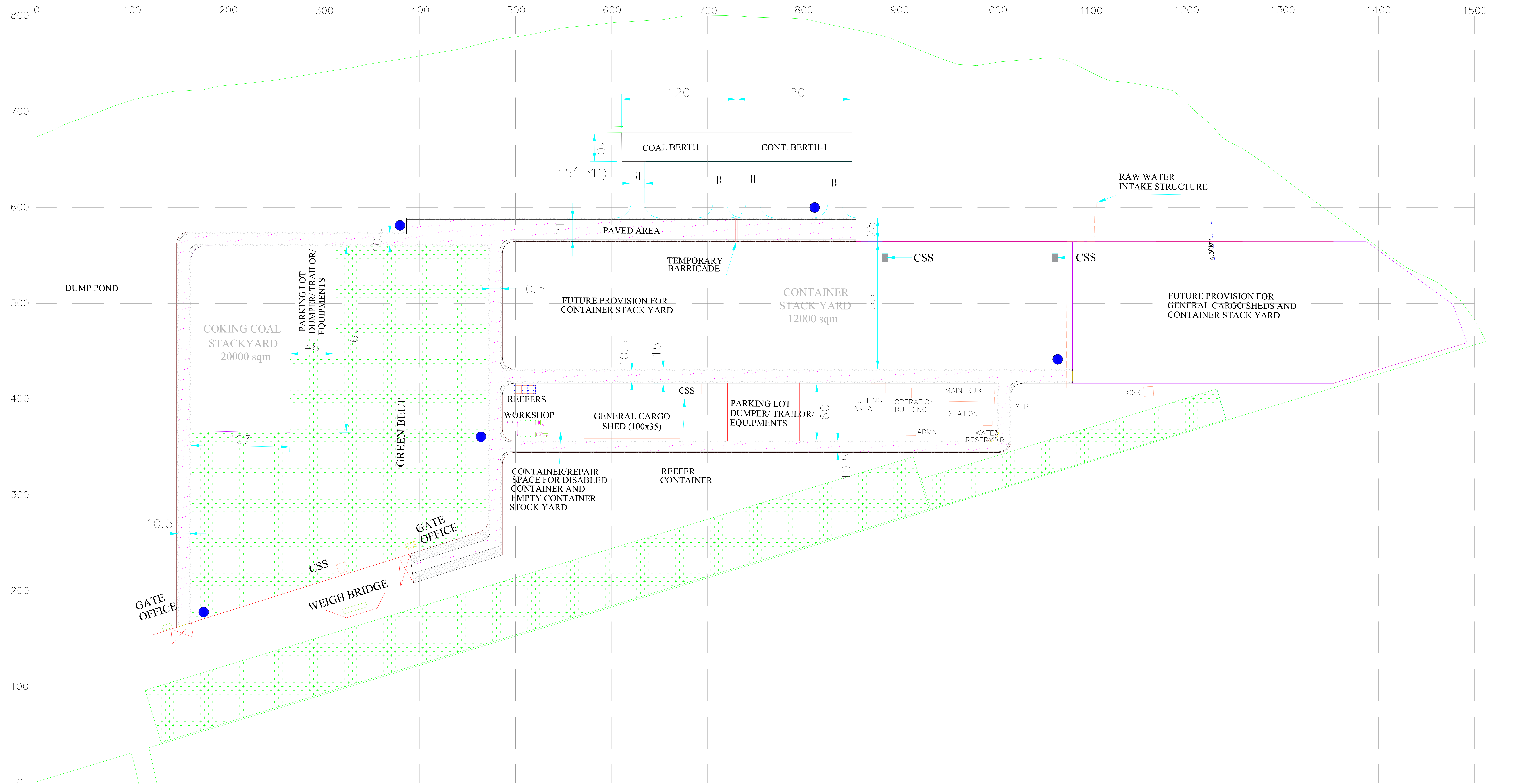
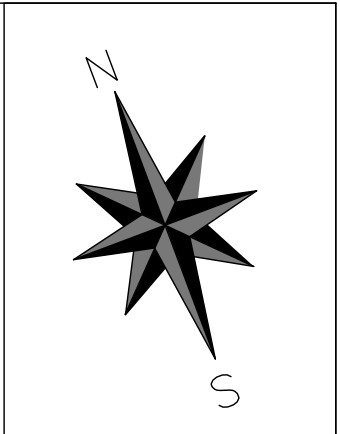
DATE	Shit - 1	Shit - 2	Shift-III
	(mg/m3)	(mg/m3)	(mg/m3)
03.01.2023	0.302	0.320	0.314
06.01.2023	0.639	0.736	0.630
10.01.2023	0.415	0.356	0.350
13.01.2023	0.208	0.263	0.257
17.01.2023	0.349	0.222	0.216
20.01.2023	0.191	0.467	0.321
25.01.2023	0.393	0.469	0.463
28.01.2023	0.735	0.424	0.418
31.01.2023	0.208	0.663	0.557
03.02.2023	0.449	0.322	0.416
07.02.2023	0.187	0.267	0.261
10.02.2023	0.229	0.789	0.513
14.02.2023	0.343	0.237	0.231
17.02.2023	0.288	0.464	0.758
21.02.2023	0.514	0.335	0.329
24.02.2023	0.389	0.407	0.401
28.02.2023	0.304	0.397	0.182
03.03.2023	0.208	0.193	0.257
07.03.2023	0.349	0.722	0.216
10.03.2023	0.191	0.467	0.321
14.03.2023	0.393	0.469	0.463
17.03.2023	0.229	0.619	0.513
21.03.2023	0.343	0.237	0.231
24.03.2023	0.288	0.464	0.258
28.03.2023	0.445	0.625	0.558
31.03.2023	0.514	0.335	0.329

TABLE: - 7
Onsite Ambient Air Quality Monitoring Results
Location Balagarghat Habibpur
Period: 1st January,2023 to 31st March,2023

DATE	Shit - 1	Shit - 2	Shift-III
	(mg/m3)	(mg/m3)	(mg/m3)
03.01.2023	0.099	0.416	0.231
06.01.2023	0.316	0.258	0.327
10.01.2023	0.238	0.382	0.101
13.01.2023	0.125	0.113	0.431
17.01.2023	0.347	0.286	0.168
20.01.2023	0.420	0.382	0.452
25.01.2023	0.123	0.188	0.278
28.01.2023	0.446	0.138	0.331
31.01.2023	0.116	0.458	0.427
03.02.2023	0.478	0.382	0.131
07.02.2023	0.281	0.212	0.326
10.02.2023	0.416	0.322	0.327
14.02.2023	0.095	0.225	0.189
17.02.2023	0.430	0.408	0.284
21.02.2023	0.210	0.470	0.401
24.02.2023	0.399	0.361	0.431
28.02.2023	0.142	0.112	0.278
03.03.2023	0.420	0.382	0.452
07.03.2023	0.123	0.508	0.278
10.03.2023	0.446	0.138	0.331
14.03.2023	0.116	0.458	0.127
17.03.2023	0.281	0.512	0.326
21.03.2023	0.416	0.322	0.327
24.03.2023	0.119	0.225	0.189
28.03.2023	0.267	0.198	0.225
31.03.2023	0.430	0.408	0.284

TABLE: - 8
Onsite Ambient Air Quality Monitoring Results
Location Sanyalchar
Period: 1st January,2023 to 31st March,2023

DATE	Shit - 1	Shit - 2	Shift-III
	(mg/m3)	(mg/m3)	(mg/m3)
03.01.2023	0.438	0.287	0.440
06.01.2023	0.295	0.627	0.397
10.01.2023	0.377	0.254	0.536
13.01.2023	0.162	0.406	0.384
17.01.2023	0.590	0.239	0.192
20.01.2023	0.367	0.399	0.469
25.01.2023	0.334	0.211	0.213
28.01.2023	0.484	0.573	0.517
31.01.2023	0.377	0.126	0.379
03.02.2023	0.108	0.206	0.136
07.02.2023	0.334	0.411	0.293
10.02.2023	0.199	0.678	0.528
14.02.2023	0.449	0.138	0.229
17.02.2023	0.530	0.362	0.132
21.02.2023	0.552	0.429	0.511
24.02.2023	0.297	0.671	0.185
28.02.2023	0.335	0.264	0.348
03.03.2023	0.162	0.406	0.184
07.03.2023	0.590	0.239	0.392
10.03.2023	0.367	0.399	0.469
14.03.2023	0.334	0.211	0.213
17.03.2023	0.108	0.606	0.336
21.03.2023	0.334	0.411	0.293
24.03.2023	0.199	0.678	0.617
28.03.2023	0.332	0.255	0.385
31.03.2023	0.449	0.138	0.229



NOTES

- 1) ALL DIMENSIONS ARE IN M.
- 2) ALL GRID SPACING ARE @ 100.0 METERS BOTHWAYS.
- 3) ASSEMBLY POINT DURING EMERGENCY ●

EXISTING GREENBELT

SCHEDULE & BOQ OF ORNAMENTAL FLOWERING TREES						
SR. NO.	TREE SPECIES	COMMON NAME	SPACING (MM.)	QUANTITY (Nos.)	PLANT HEIGHT(M)	SYMBOL
1.	Conocarpus erectus	Button wood	2500	1000	10M	☐
2.	Mimusops elengi	Bakul	3500	1150	12M	⊗
3.	Butea monosperma	Palash	3500	1100	10M	●
4.	Casseea fistula	Amaltas	3000	1000	12M	⊗
5.	Dalbergia sissoo	Sissoo	3000	1150	10M	⊗
6.	Ficus Bengalensis	Banyan	3000	1080	20M	⊗
7.	Ficus Religiosa	Peepal	2500	965	20M	⊗
8.	Purging Cassia	Sonajhuri	3000	1040	16M	⊗
9.	Terminalia Arjuna	Arjun	3500	1300	15M	⊗
10.	Azadirachta Indica	Neem	3000	800	20M	●
11.	Mangifera Indica	Mango	2000	1200	15M	⊗
12.	Albizia Lebbbeck	Siris	3000	1100	30M	⊗
13.	Artocarpus Heterophyllum	Jackfruit	4000	1365	10M	⊗
14.	Polyathia longifolia	Ashoka	4000	1250	15M	⊗
15.	Astinia scholaris	Saptaparni	3000	1500	15M	⊗
16.	Peltophorum pterocarpum	Radhachura	3500	1250	10M	⊗
17.	Borringtonia ocutongulo	Indian Oak	3200	1250	9-12M	⊗
		TOTAL		19500		

SCALE- NTS

Itemref	Quantity	Title/Name, designation, material, dimension etc			Article No./Reference		
Drawn by <i>Partha Bag</i>		Checked by - date	Approved by - date	Filename	Date 06-05-2023	Page A1	
SYAMA PRASAD MOOKERJEE PORT, Kolkata Balagarh, Dist : Hooghly,West Bengal			TREE PLANTATION PROGRAMME				
			KOPT/LAYOUT/02		REV. 0	Sheet 1 OF 1	