

MORMUGAO PORT TRUST



Environmental Impact Assessment Study for Re-development of Berth 8,9 & Barge Berth at MPT, Goa

EXECUTIVE SUMMARY



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EXECUTIVE SUMMARY

1. INTRODUCTION

The Mormugao Port Trust, Goa is a major port on the west coast of the country, located in the state of Goa. The coordinates of the port are 15°25'N and 73°47' E. The Mormugao Port was established in 1885. Once known as the premier iron-ore exporting port of India, today the port is set to diversify into other commodities as well as containers. Coal/Coke is a major commodity handled at the port. Iron ore exports which had drastically reduced post the Supreme Court ban which was later removed, have also been showing signs of revival

The proposed project envisages the redevelopment of Berths 8th, 9th and barge berth at Mormugao Port. The main activities include construction of berths, construction of Bund, reclamation in an area of about 11.4 ha, capital dredging of 2.44 Mm³ for deepening of turning circle from 14.40 up to -19.50 m near the Berth face up to 50 m distance. The existing capacity of berth 8th and 9th is 13 MMTPA which will increase to 19.20 MMTPA, with the redevelopment of 3 berths. The entire facility lies within existing port area. The existing structures will be modified and redeveloped for the proposed development. The proposed facility envisages handling a variety of cargo including iron ore, bauxite, limestone, gypsum, steel products, granite, wood chips, coal, containers etc. Coal will be handled in totally covered conditions including covered storage and conveying system.

The maximum quay length of the proposed 3 nos. berths will be 950 m, to facilitate handling of cape size vessels. However in case provision for barge berths are made, the length of the main berth will be about 950m. As stated above, the 3 berths put together will have a total capacity of 19.20 MTPA. Back-up area of about 27 ha which includes reclamation of 11.4 ha shall be utilized for the proposed facility. At least 2 berths will be fully mechanized for handling bulk cargo. One berth is meant mainly for handling break bulk cargo and therefore will be provided with wharf cranes. All berths will have dust suppression systems. Rail and road infrastructure as required will be provided. The total cost of the project will be Rs.1145.36 Crores. The project location is depicted in Figure-1. The Google image of Mormugao port is given in Figure-2.

2. PROJECT DESCRIPTION

2.1 Existing Port Facilities

The total cargo handling capacity of MoPT is 43.8 MMTPA. The berth wise details of the capacity of operational berths and type of cargo handled are shown in Table-1.

Table-1: Berth Wise Capacity and Cargo handled at MoPT

S. No.	Berth No.	Capacity (in MTPA)	Cargo
1	Berth No. 8	1.5	Liquid Bulk
2	Berth No. 9	11.5	Iron Ore
3	Mooring Dolphins	10.0	Iron Ore/Coal
4	Transshipper	6.0	Iron Ore
5	Berth No. 5 & 6	7.5	Coal, Coke, General Cargo
6	Berth No. 7	4.61	Coal/Coke
7	Berth No. 10 & 11	2.65	General Cargo
	Total	43.8	

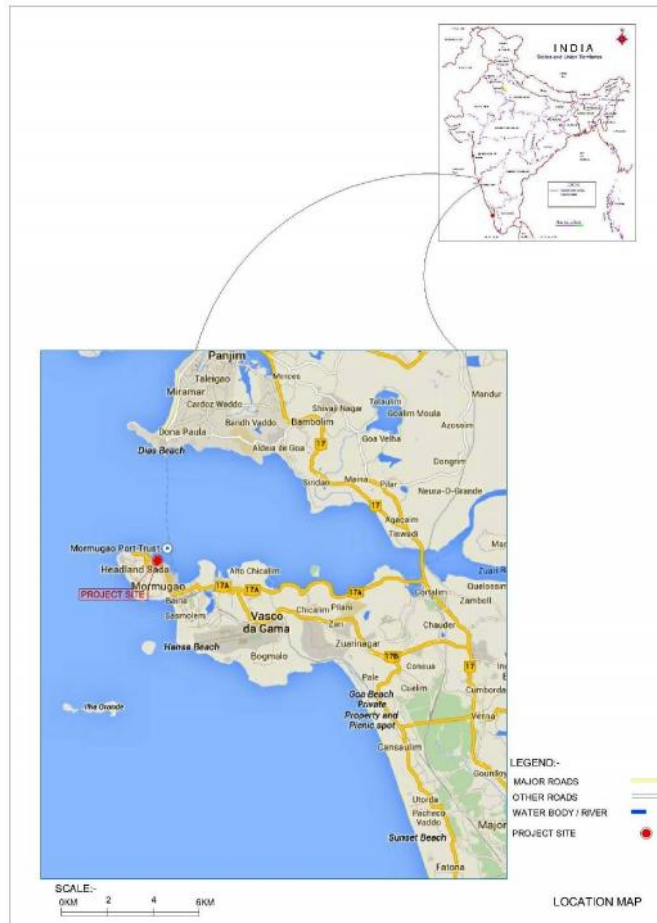


Figure-1: Location Map



Figure- 2 Google image of berth 8, 9 and barge berth

2.2 Need for the conversion of berth 8, 9 & barge berths

Mormugao Port is now focusing to position itself as a multi-commodity port and therefore needs to create handling facilities for capacity addition. Berth No.8 is a liquid cargo handling berth, however the berth utilization is low. Therefore, port plans to shift this operation to Berth No.10/Berth no.11. Berth No.9, which is a dedicated iron ore export berth and the barge berths along with the barge berths and the Mechanical Ore Handling Plant (MOHP) are also practically underutilized since most of the equipment have become old and needs replacement. Hence, it is proposed to redevelop berth 8, 9 and barge berths considering the future cargo potential.

2.3 Existing Infrastructure At Berth 8, 9 & Barge Berths

Infrastructure facilities and cargo handling at Berth No. 8

Berth No. 8 is a dedicated berth for handling liquid cargo. Separate equipment and pipelines are installed at berth-8 for handling of liquid cargo and transportation up to the storage location/tanks. The details of the liquid cargo handled at Berth No. 8 during 2013-14 and 2014-15 are shown in Table-2.

Table-2: Liquid cargo handled at Berth-8 during 2013-14 and 2014-15

(Unit: 000 TPA)

Import Cargo	2013-14	2014-15
POL	428.95	371.59
Caustic Soda	39.37	45.63
Liquid Ammonia	62.20	87.35
Edible Oil (Palm Oil)		3.50
Total Import Liquid Cargo	530.52	508.07
Export Cargo		
POL	4.62	
Total Import + Export	535.14	508.07
Percentage (%)	62 %	48 %

Existing Infrastructure and cargo handling at Berth 9

Berth 9 is a dedicated iron ore export terminal operated by Port along-with Mechanical Ore Handling Plant (MOHP). The area behind Berth 9 is utilized for stacking of iron ore. The rated capacity of Berth 9 is 11.5 MTPA. However, most of the equipment are very old and cannot be put to safe operations. There are 5 barge berths which houses 8 grab barge unloaders and one continuous barge unloader.

2.4 Proposed facilities at berth no. 8, 9 and barge berths

The total berth front now available after shifting of liquid handling from berth No. 8 and dismantling Iron Ore handling from berth No. 9 and Barge berth area is 950 m. The total backup area after reclamation of entire barge berth area including stackyard for iron ore is around 27 ha. The future potential for general cargo, containers, coal for Mormugao Port is found to be in increasing trend in the traffic projection study. Iron ore exports have also shown vast improvements during the last one year.

It is proposed that berth no 8 will be converted in to a bulk berth for handling of coal with all required mechanization facilities and stackyard. The optimal capacity of the coal terminal proposed at berth 8 shall be about 7 MTPA. The traffic potential for the proposed

general cargo and container terminal proposed to be developed at Berth 9 & barge berths is given in Table 3. Layout of the proposed redevelopment of Berth 8, 9 and 9A are shown in Figure-3.

Table 3: Traffic Potential for Proposed GC & Container Berth 9 & 9A

Cargo	2019 (MTPA)	2020 (MTPA)	2025 (MTPA)	2030 (MTPA)
Fertilisers	0.36	0.37	0.43	0.74
Break Bulk Projection	5.98	6.44	9.12	12.39
Total GC and BB Cargo Potential	6.34	6.81	9.55	13.13
**Less, Capacity 10+11	2.65	2.65	2.65	2.65
Traffic Available for Berth 9 & 9A	3.69	4.16	6.90	10.48
Potential Container Traffic, (in TEU)	171	182	247	338

Utilities and support facilities

The following utilities and support facilities shall be provided

- Buildings
- Terminal internal roads
- Power supply
- Water demand
- Water supply system
- Storm Water Drainage
- Fire Fighting System
- Dust Suppression System

3. POLICY, LEGAL AND ADMINISTRATIVE FRAMEWORK

As per the list of projects or activities requiring prior environmental clearance given in the EIA Notification issued by MoEF on 14th September 2006, proposed project is listed on S.No. 7e and requires Environmental Clearance from Ministry of Environment, Forest and Climate Control. Since, the project is proposed in the coastal area, CRZ Clearance would also be required as per the CRZ Notification of January 2011. The approval for the Terms of Reference (TOR) for the EIA study was accorded by MoEF&CC, vide letter dated 16.02.2016.

4. ENVIRONMENTAL BASELINE STATUS

The study area for the EIA study has been considered as the area within radius of 10 km considering the proposed project site at the center. The major portion of the study area is under water. In such setting, impacts likely to accrue as a result of project construction and operation phases are expected to occur mainly on water front i.e. on marine environment. Thus, as a part of the EIA study, specific emphasis has been accorded to marine environment. As a part of the EIA study, the baseline status has been collected for various environmental parameters. The study area map is enclosed as Figure-4.

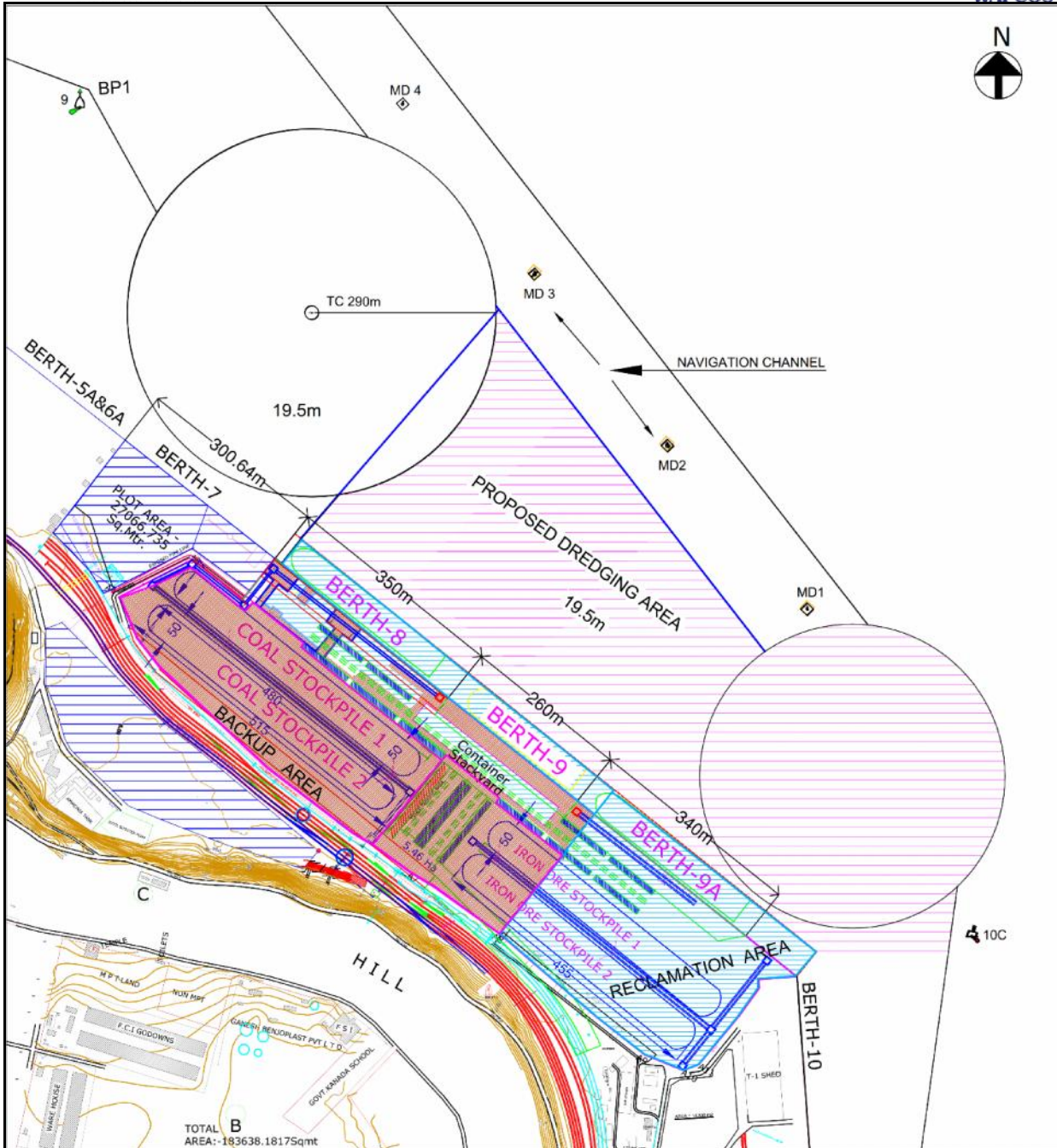


Figure-3 Layout of the redevelopment of Berth 8, 9 and 9A

4.1 Meteorology

Meteorological data regarding wind speed, wind direction, temperature, rainfall, relative humidity, Visibility etc was collected for Mormugao. The meteorological data was used to determine the ambient Air quality monitoring stations.

4.2 Landuse Pattern

The landuse pattern of the study area has been assessed using satellite data. The major landuse category is water body accounting for about 75.24% of the total study area. The

area under dense and open vegetation in the study area is 4.92% and 6.38 % respectively. The agricultural area accounts for about 2.53% of the Study Area, while built-up area accounts for 1.41% of the total Study Area.

4.3 Ambient Air Quality

As a part of field studies, ambient air quality was monitored at 6 locations in the study area from 4th March 2016 to 28th May 2016. The ambient air quality monitoring was carried out with a frequency of two samples per week for twelve consecutive weeks at six locations in the study period.

The average concentration of PM_{2.5} at various stations monitored ranged from 33.0 to 36.5 µg/m³. The highest PM_{2.5} value was recorded as 47.5 µg/m³ near Project Site and lowest values of 30.0 µg/m³ were recorded near MPT colony. The average concentration of PM₁₀ at various stations ranged from 71.5 to 84.1 µg/m³. The highest PM₁₀ value was recorded as 128 µg/m³ near project site and lowest values of 58.0 µg/m³ were recorded near MPT Guest House. PM_{2.5} and PM₁₀ concentrations recorded at various stations area within the limits prescribed for “Residential/Industrial” zone.

The average concentration of Sulphur dioxide at various stations monitored ranged from 26.52 to 29.4 µg/m³. The SO₂ values were below detectable limit at all the locations. The average Nitrogen dioxide concentration at various sampling stations ranged from 47.7 to 52.2 µg/m³. The highest Nitrogen dioxide value was recorded as 64.5 µg/m³ near Sub Jail, and lowest value of 32.3 µg/m³ was recorded near Vasco.

The average concentration of Carbon Monoxide at various stations monitored ranged from 0.6 to 0.7 mg/m³. The highest Carbon Monoxide value was recorded as 1 mg/m³ near MPT colony and lowest values of 0.4 mg/m³ were recorded near MPT Guest House. The average concentration of O₃ at various stations ranged from 45.9 to 51.6 µg/m³.

The average concentration of Ammonia at various stations monitored ranged from 12.5 to 14.4 µg/m³. The highest Ammonia value was recorded as 22.6 µg/m³ near Sub Jail, Headland Sada and lowest values of 9.5 g/m³ were recorded near Vasco area. The average concentration of Benzene at various stations ranged from 0.4 to 0.5 µg/m³. The concentrations of various gaseous pollutants in the ambient air, as described above are also found to be within the prescribed norms for Industrial area.

4.4 Ambient Noise Levels

Ambient Noise Levels were monitored at various locations in the study area. The day time equivalent noise level ranged from a minimum of 50.40 dB (A) to a maximum of 52.88 dB (A). The night time equivalent noise level ranged from a minimum of 38.36 dB (A) to a maximum of 44.90 dB (A). The Ambient noise levels are within the prescribed norms for Industrial/Residential area.

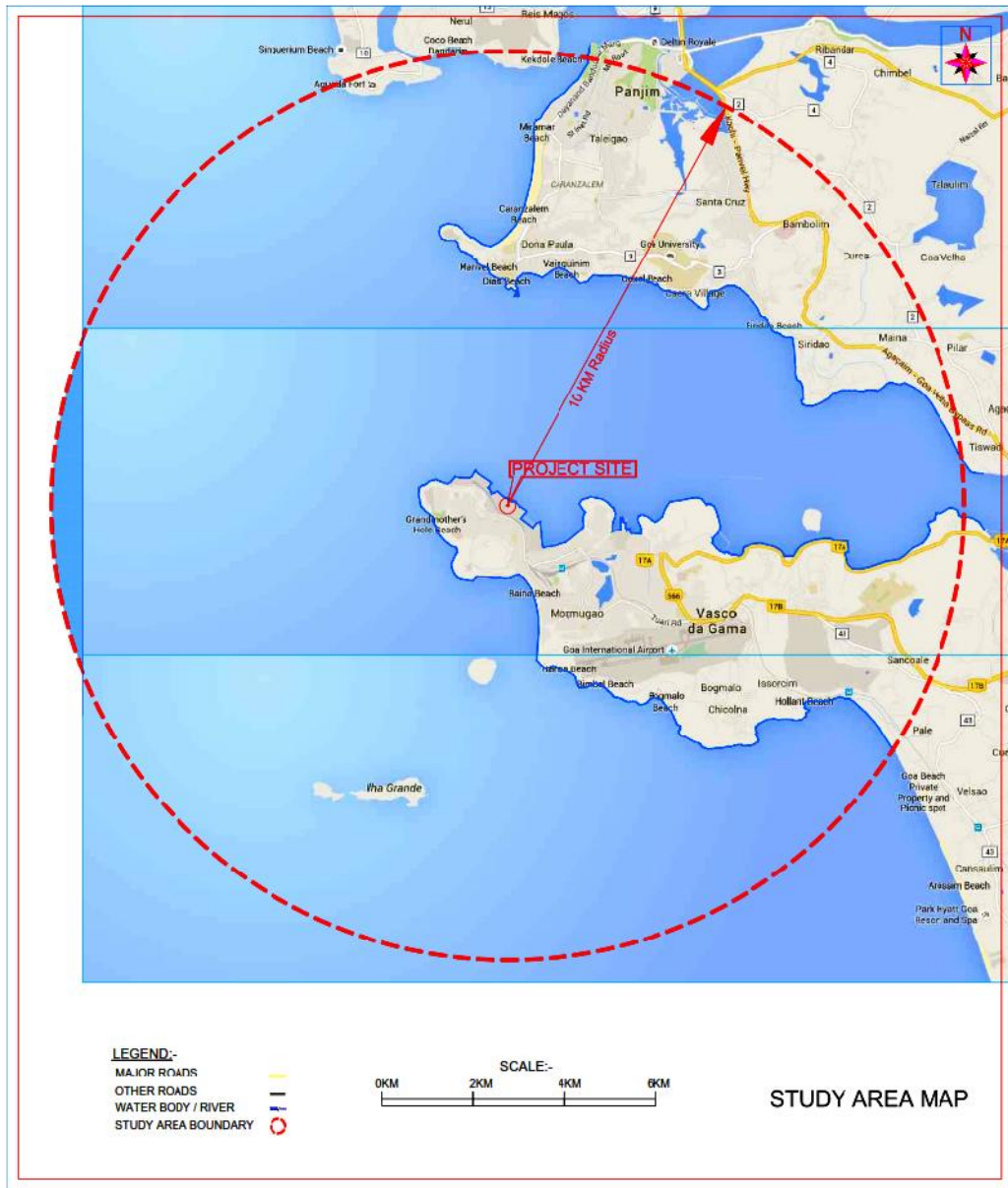


Figure-4 Study Area Map

4.5 Marine Ecological Survey

Marine Ecological Survey was carried out along with the Experts from the Centre of Advanced Study (CAS) in Marine Biology, Annamalai University, Tamilnadu in May 2016. During survey, marine water and sediment samples were collected to assess physicochemical and biological parameters i.e. phytoplankton, zooplankton, macro-benthos, meio-benthos and microbial samples besides sea weeds, sea grasses, and fishery resources etc.

a) Physicochemical parameters of marine water

Surface water temperature ranged from 27.1 °C to 31.9°C at various sampling stations. The salinity values varied from 31.2 to 39.8 PSU at various sampling locations in the study area. The pH value ranged from 7.8 to 8.7 at all the stations, which indicates that the marine water is marginally alkaline in the study area. The Total Suspended Solids values ranged between 13.9 and 29.2 ppm at various sampling locations. The Dissolved Oxygen level in the water samples ranged from 3.7 to 6.4 mg/l at various sampling locations.

The nitrite level varied from 0.74 to 1.65 $\mu\text{mol/l}$. Nitrate concentration ranged between 2.27 and 5.21 $\mu\text{mol/l}$. The Total nitrogen values ranged from 15.16 to 37.89 $\mu\text{mol/l}$ in surface and sub-surface water samples collected at various sampling locations.

The heavy metal concentration was found to be within permissible limits. The concentration of iron and zinc in the sample varied from 15.71 to 25.56 $\mu\text{g/g}$ and 15.78 to 23.89 $\mu\text{g/g}$ respectively. The concentration of manganese in the sediment sample ranged from 23.89 to 36.72 $\mu\text{g/g}$ in surface water. Chromium concentration in various surface and sub-surface samples varied between 1.63 and 3.47 $\mu\text{g/g}$. Copper values varied from 3.39 to 6.86 $\mu\text{g/g}$. The concentration of mercury in various water samples ranged from 0.28 to 0.47 $\mu\text{g/g}$.

b) Sediment characteristics

The pH values in sediment samples ranged from 8.8 to 8.1. The percentage of sand content varied from 13.18 to 82.32%, silt content ranged from 12.5 to 66.7% clay content varied from 1.61 to 20.13%. The total organic carbon ranged between 4.59 and 8.10 mgC/g in sediment samples collected from various stations.

The concentration of iron in various sediment samples varied from 4230 to 6784 $\mu\text{g/g}$. The concentration of zinc in various sediment samples varied from 14.57 to 30.29 $\mu\text{g/g}$. The concentration of manganese in various sediment samples ranged from 24.89 to 52.78 $\mu\text{g/g}$. The concentration of chromium in various sediment samples varied between 4.30 and 8.18 $\mu\text{g/g}$. The concentration of lead in various sediment samples ranged from 4.34 to 8.37 $\mu\text{g/g}$. The concentration of copper in various sediment samples ranged from 13.89 to 28.31 $\mu\text{g/g}$.

c) Biological Characteristics

Chlorophyll-a, Phaeopigments and Total biomass

In the present study, the chlorophyll 'a' in water sample varied from 0.425 to 2.546 mg/m^3 . The Phaeopigments content varied from 0.332 to 1.718 mg/m^3 and the total biomass values varied from 17.88 to 42.67.

Phytoplanktons

In the present study period, species belonging to three groups namely diatoms, dinoflagellates and blue greens were recorded. Of these, diatoms were found to be the dominant group with 40 species.

Zooplanktons

During the study period, three groups of macro zooplankton namely, calanoida, cyclopoida, and harpacticoida and 2 groups of micro zooplankton namely, spirotricha and larval forms and group "others" of zooplankton were recorded. Among these, calanoida were found to be the dominant group with 11 species. Larval forms came as next dominant group with 7 species.

d) Benthos

During the present investigation, four groups of benthic organisms namely polychaetes, crustaceans, bivalves and gastropods were recorded. Of these, polychaetes constituted the dominant group followed by crustaceans, gastropods and bivalves. Altogether 44 species of macro fauna were recorded. Of these, polychaetes topped the list with 25 species. Benthos population density, percentage composition and diversity values

of this study are found to be similar to the report submitted by Dredging Corporation of India Ltd (DCI) at Mormugao Port during March to May 2016

4.6 Terrestrial Ecology

The vegetation composition at the proposed project area, especially along the coastal stretch includes the coconut Ambo ,Moi, Kudo, Onwal, Jamun and Zamba etc. Wild animals reported in the area includes Monkey, Languor and Squirrel, Mouse and Bats etc. The faunal species amongst mammals were common Jackal, Langur and Bonnet macaque are found all over the region inhabiting groves, coastal belt and woodlands. The common Mongoose, Indian hare are also commonly observed in the area. Amongst reptiles, Monitor Lizard, Garden Lizard, Common skink and Rat Snake are common. As per the IUCN status of threatened animals it was found that all the species falls under the least concern. No threatened, rare and endangered faunal species (mammals, reptiles) were present in the IUCN Red List of threatened animals.

4.7 Fisheries

The study area has a total 1540 fishermen population. A total of 405 fishermen families are registered in the study area. Three fish landing centers Kariwada, Baina beach landing facility, Bogmalo beach landing facility.

4.8 Socio-Economic Aspects

The information on socio-economic aspects has been mainly extracted from Primary Census Abstract 2011. The study area comprises of about 19 villages. The total population in the study area villages is of the order of 267477 persons residing in 63,423 households as per Census of India 2011.

5. ASSESSMENT OF IMPACTS

Based on the project details and the baseline environmental status, potential impacts that are expected to accrue as a result of the construction and operation of the proposed project have been identified.

5.1 Impacts on Land Environment

a) Impacts due to pre-construction activities

Pre-construction activities generally involve the construction of approach roads, clearing of the project site, siting of labour camps and construction of storage sheds, etc. However, as the propose project envisages the redevelopment of Berths 8th and 9th at the Mormugao Port, which is well connected by rail and road. There is no need of the construction of new roads and land acquisition for the proposed development.

b) Impacts on land use pattern of the area

The proposed project site is located within Mormugao Port area and all the activities are within Mormugao Port. Hence, no major impact is anticipated on land use pattern except reclamation in an area of 11.40 ha.

c) Impacts due to quarrying operation

The proposed project envisages the reclamation of 11.4 ha. No dedicated quarry is proposed for the extraction of filling material for the redevelopment works. Required

material will be obtained from nearest approved quarry. Hence, adverse impacts due to quarrying operations are not anticipated.

d) Impacts due to generation of garbage at port

No labour camps are proposed as a part of the project, therefore quantity of domestic solid waste will be negligible. The garbage generated during construction phase could comprise of packaging material, used tyres, plastic, metal items at the time of erection of material handling equipment etc. Such items shall be collected and sold to scrap dealers. Hence, no major impacts are anticipated on this account.

5.2 Impacts on Water Environment

Construction Phase

a) Impacts due to effluents from construction site

The average and peak labour strength likely to be deployed at the proposed modernization are will be about 100. Total water requirement for domestic purposes during construction phase has been estimated as 4500 litre/day @ 45 lpcd and the quantity of domestic sewage likely to be generated during construction phase will be about 3600 litre/day. There is existing sewage handling facilities in operation at Mormugao Port, which can handle the additional inputs due to the proposed redevelopment activities in the port.

Apart from the domestic water requirements, fresh water will be required for construction purpose as well. The total fresh water requirement during construction phase has been estimated as 60 m³, will be met from existing sources of Mormugao port. Fresh water requirement operation phase has been estimated as 40 cum/day. The water will be taken from Public Works Department (PWD), Goa.

b) Impacts on marine water quality

In the present survey pH varied between 7.8 and 8.7 and dissolved oxygen was ranged between 3.7 to 6.4 mg/l which is ideal for a marine ecosystem. Moreover, sediment samples collected from all the sites were not contaminated. As such no adverse impact due to dredging or dumping on the chemical characteristics of water or sediment is expected.

Operation Phase

No staff colony is proposed as a part of the project. Total water requirement for domestic purposes during operations phase has been estimated as 60 cum/day and the quantity of domestic sewage likely to be generated during construction phase will be about 48 cum/day. The total manpower required during the construction phase would be of the order of 100. Hence, the no separate canteen, toilets and drinking water facilities are envisaged and the construction staff will use the existing sanitation and canteen facilities of Mormugaon Port.

5.3 Impacts on Noise Environment

(a) Construction phase

Modelling studies were conducted to assess the increase in noise level due to operation of various construction equipment. It is clear from modeling study, that at a distance of 1 km from the construction site, increase in noise levels will be only 1 dB(A). The nearest residential areas are at a distance of more than 1 km from the proposed project site.

Hence, no major adverse impacts are anticipated on ambient noise levels during construction phase of the proposed project.

b) Operation phase

During project operation phase, major source of noise could be due to operation of various equipment. As a part of the environment protection activities, trees includes ornamental trees and shrubs have been developed around the project area, which also attenuate noise levels. It is recommended that workers shall be provided with ear plugs.

5.4 Impacts on Air Environment

Impacts due to fugitive emissions

The major pollutant in the construction phase is SPM being air-borne due to various construction activities. The vehicular movement generates pollutants such as NO₂, CO and HC. However, the vehicular pollution is not expected to lead to any major impacts. The fugitive emissions due to vehicular movement will be 8 to 12 kg/km travelled by the vehicle. The fugitive emissions generated due to vehicular movement are not expected to travel beyond a distance of 200 to 300 m. The windblown dust is also likely to be substantial, especially during the summer months. Since, there is no habitation in the vicinity of the site, major impacts on air environment during construction phase is not expected to be significant as far as air pollution is concerned.

Impacts due to construction equipment

The combustion of diesel in various construction equipment could be one of the possible sources of incremental air pollution during the construction phase. The maximum short-term increase in SO₂ is observed as 0.0214 µg/m³, which is at a distance of 100 m from the emission source. The incremental concentration is quite low and does not require any specific control measure.

Operation Phase

Impacts due to dust during handling of Cargo

Dust will be released during handling of coal, limestone and Iron ore. This will lead to increased level of dust in the port area. The dust thus emitted can be carried off to the adjacent area if not controlled properly. However Mormugoa Port trust has been handling cargo using dust suppression methodologies to keep the dust under control. The upgradation of the berth number 8,9 and the Barge Berth will further lead to reduction in the fugitive dust emission due to the advanced handling methods and new dust suppression techniques.

5.5 Impacts on Ecology

a) Impacts on terrestrial flora

The direct impact of construction activity for any project is generally limited in the vicinity of the construction sites only. The proposed project envisages redevelopment of Berths 8th and 9th at the Mormugao Port. The Entire facility will come within existing Port area. There is no need of the construction of new roads and additional land acquisition for the proposed development. Hence, no significant impact is anticipated due to the proposed project. The site of the proposed berth does not have major tree cover, flora, fauna etc. as the project site is at the existing berth. Thus, no impact on terrestrial ecology is anticipated

b) Impacts on marine Environment

Impacts due to dredging and disposal of dredged material

The existing depth of the channel in front of berth 8, 9 and 9A is (-) 14.1 m CD. Mormugao port proposes to use capsized vessels after the redevelopment of berth 8 and 9. The required depths to cater the capsized vessels in the inner channel is (-) 19.5 m CD. Hence dredging has to be carried out in front of the proposed berth up to 50 m distance. The quantity of the dredging has been as estimated as 2.44 Mm³.

The dredged materials will be dumped in the designated dumping site identified by the CWPRS. The proposed dumping area identified for capital dredging has a depth of 27m CD at 356000E and 1705000N.

c) Impacts on marine ecology

As stated above the entire project activity is well within the Mormugao port area and the area is subjected to continuous maintenance dredging for several years. Disruption of bottom sediments like increase in turbidity, depletion of oxygen and loss of benthic population is anticipated during dredging operations. Disposal of dredged material will be done at designated dumping sites away from the port area. Further no ecologically sensitive species are observed in and around the proposed site. However, the dredged stretches are likely to get recolonized after some time. Hence no major impacts are anticipated on marine ecology.

5.6 Impacts on Socio-Economic Environment

In the construction stage the peak labour force, or skilled and unskilled labourers, is estimated at about 100 labour population are likely to come from nearby sites. Since the laborers will be coming from nearby areas. No labour camp is proposed in the project. The proposed project lies within the existing port area, hence no additional land acquisition is required. The issues pertaining to resettlement and rehabilitation are not applicable to the project.

6. ENVIRONMENTAL MANAGEMENT PLAN

6.1 Environmental Management During Construction Phase

Land Environment

The proposed project will be constructed within the existing Mormugao Port. Hence, no land acquisition is envisaged in the proposed project. However, construction activities like use of existing access road, construction of storage sheds, etc. Therefore, it shall be made mandatory for the contractor to ameliorate all signs of haul roads, storage areas, temporary structures, etc on completion of construction activities.

Water Environment

The total water requirement for labour population during construction phase has been estimated as 4500 litre/day @ 45 lpcd and the quantity of domestic sewage likely to be generated during construction phase will be about 3600 litre/day. Safe drinking water and toilet facilities shall be provided at dredgers and barges. The toilets shall be equipped with bio digesters. Since the total number of work force proposed to be deployed for the proposed re-development of Berth No. 8, 9 and Barge Berth and quantity of sewage is

very small, it is proposed to provide 5 community toilets with septic tank are proposed to be constructed.

Effluent from workshops, oil storage etc.

The effluent from workshops, oil storage, etc. will contain oil and grease particles which shall be treated in an oil skimmer and suitably disposed after treatment or will be sold to registered recyclers. The collected oily matter is stored in cans, etc. and disposed at landfill sites designated by the district administration.

Environmental Management Plan for dredging operation

Proposed project envisages the deepening of turning circle and berth face from 14.4 m up to -19.50 m. The total quantity of dredged material has been estimated as 2.44 Mm³. Since, sediments comprises of sand and silt, the dredged material is likely to get dispersed in surrounding water and will not have long term adverse impacts. However, short term impacts are anticipated due to increase in turbidity, removal of benthic organisms, dispersion of sediments etc. within the operational area of the port.

Air Environment

Suggested Environmental Management measures recommended for the control of air pollution includes the following:

- The contractor will be responsible for maintaining properly functioning construction equipment to minimize exhaust.
- Construction equipment and vehicles will be turned off when not used for extended periods of time.
- Unnecessary idling of construction vehicles to be prohibited.
- Effective traffic management to be undertaken to avoid significant delays in and around the project area.
- Road damage caused by sub-project activities will be promptly attended to with proper road repair and maintenance work.

Dust Control Measures

The following measures have been suggested to control entrainment of dust:

- Identification of construction limits (minimal area required for construction activities).
- Contractor will be required to cover stockpiled fine aggregate and trucks hauling, sand, and other loose materials (or require trucks to maintain at least two feet of freeboard).
- Contractor shall ensure that there is effective traffic management at site. The number of trucks/vehicles to move at various construction sites to be fixed.
- Construction area and vicinity (access roads, and working areas) shall be swept with water sweepers on a daily basis or as necessary to ensure there is no visible dust.

Most dust control methods are inexpensive, easy to install, and simple to maintain. There are many categories of dust sources. In the cargo handling areas of the berth 8, 9 both dust prevention and dust suppression may be required. The type of system will depend on the dust source and the stage in the processing operation.

Solid waste Management

During construction phase, about 100 Nos. of labour are likely to congregate during the day time. No labour camp is envisaged and all the workers will come from nearby areas. Construction workers will use the existing canteen facility. In Mormugao Port Trust, solid wastes generated are collected and handed over to the Goa Municipal Corporation at their dumping yard. The same facility is proposed to be used for the solid waste generated by the proposed by barge jetty.

6.2 EMP for Implementation During Operation Phase

Water Environment

During construction phase, about 100 workers per shift are likely to be engaged. Since the total number of work force proposed to be deployed for the construction of Barge jetty is very small, and considering the location of the project, it is proposed that the labourers may be allowed to use the existing drinking water and toilet facilities of Mormugaon Port, located near to the site. Hence, no measures are required for maintaining the water quality.

Effluent Treatment Plant

A settling pond shall be provided to suitably treat the coal pile run-off water prior to disposal. The treatment plant will be of recycling type where the treated water will be again used for dust suppression.

Control of Water Pollution from oil spill and Marine Transport

The oil spills which may occur during bunkering operations or marine transportation could also be a major source of water pollution. To combat oil pollution near the jetty, portable oil skimmers should be available at the berth. A clean sweep oil recovery unit consisting of a power pack and the recovery unit mounted on a system can be utilized for this purpose.

Jetty related wastes

The wastes generated at jetty in normal operations include domestic effluent, garbage and solid wastes (debris, leftover plastic items, boxes, containers etc). A site in the vicinity of berths will be cordoned and mark as solid waste collection site. Solid and hazardous wastes will be segregated at this site and stored separately. Biodegradable waste will be disposed as municipal sewage while hazardous waste will be given to the recyclers approved by State Pollution Control Board.

Green Belt Development

The greenbelt development plan has been evolved to reduce the pollution levels to the maximum possible extent. The project proponents will also do the maintenance of the plantation area. The cost of plantation per hectare is estimated at Rs.100,000/ha. About 5 ha of land is proposed to be afforested as a part of Greenbelt Development Plan in either of the project alternatives.

7. DISASTER MANAGEMENT PLAN

Propose project envisages the redevelopment of Berths 8th and 9th at the Port of Mormugao, Goa. Entire facility will come within existing Port area. Existing structures will be dismantled for the proposed development. The proposed project involves covered storage for coal cargo and open storage for general cargo are proposed, construction of bund, extension of Berth face, reclamation in an area of 11.4 ha capital dredging of 2.44

Mm³ for deepening of turning circle from 14.40 up to -19.50 m near the Berth face up to 50 m distance. Cargo composition for the proposed facility will include coal / coke / gypsum / limestone / dolomite / iron ore / container, etc. The existing capacity of berth 8th and 9th is 13 MMTPA which will increase to 19.22 MMTPA, with the redevelopment. The hazard identification, risk assessment and Disaster Management Plan to control the spread of incident effectively has been detailed in the EIA Report.

8. ENVIRONMENTAL MONITORING PROGRAMME

The summary of Environmental Monitoring Programme for implementation during project construction and operation phases is given in Tables-4 and 5 respectively.

Table-4: Summary of Environmental Monitoring Programme for implementation during project construction phase

S. No.	Aspects	Parameters to be monitored	Frequency of monitoring	Location
1.	Marine water			
	Physico-chemical parameters	pH, Salinity, EC, TDS, Turbidity, Phosphates, Nitrates, Sulphates, Chlorides.	Once in three months	3 to 4 sites
	Biological parameters	Light penetration, Chlorophyll, Primary Productivity, Phytoplanktons, Zooplanktons	Once in three months	3 to 4 sites
2.	Sediments			
	Physico-chemical parameters	Texture, pH, Sodium, Potassium, Phosphate, Chlorides, Sulphates	Once in three months	3 to 4 sites
	Biological parameters	Benthic Meio-fauna, Benthic Macro-fauna	Once in three months	3 to 4 sites
3.	Ambient air quality	PM ₁₀ , PM _{2.5} , SO ₂ & NO ₂	- Summer, Post-monsoon and Winter seasons. - Twice a week for four consecutive weeks per season.	Close to construction site(s)
4.	Noise	Equivalent Noise Level	During peak construction activities	Construction Site(s)

* Amongst the locations selected for baseline studies of this EIA.

Table-5: Summary of Environmental Monitoring Programme for implementation during project operation phase

S. No.	Aspects	Parameters to be monitored	Frequency of monitoring	Location
1.	Marine water			
	Physico-chemical parameters	pH, Salinity, EC, TDS, Turbidity, Phosphates, Nitrates, Sulphates,	Once in three months	3 to 4 sites

S. No.	Aspects	Parameters to be monitored	Frequency of monitoring	Location
		Chlorides.		
	Biological parameters	Light penetration, Chlorophyll, Primary Productivity, Phytoplanktons, Zooplanktons	Once in three months	3 to 4 sites
2.	Sediments			
	Physico-chemical parameters	Texture, pH, Sodium, Potassium, Phosphate, Chlorides, Sulphates	Once in three months	3 to 4 sites
	Biological parameters	Benthic Meio-fauna, Benthic Macro-fauna	Once in three months	3 to 4 sites
3.	Ambient air quality	PM ₁₀ , PM _{2.5} , SO ₂ & NO ₂	- Summer, Post-monsoon & Winter seasons. - Twice a week for four consecutive weeks per season.	Villages
5.	Noise	Equivalent Noise Level	Once per month	Project area and sites within 1 km of the project area
6.	Greenbelt Development	Rate of survival and growth of various species	Once per month	Various plantation sites.

9. COST ESTIMATES

The cost estimates for implementing Environmental Management Plan shall be **Rs. 3.27 crore**. The details are given in Table-6.

Table-6: Summary of cost estimate for implementing Environmental Management Plan (EMP)

S. No.	Parameter	Cost (Rs. lakh)
1	Solid waste management	10.0
2	Community toilets and Sewage network from community toilets to existing STP	12.5
3	settling tank	5.0
4	Effluent collection and disposal from workshops	10.0
5	Dust suppression, water supply and fire fighting equipment	200.0
6	Construction of effluent treatment plant	5.0
7	Green belt development	2.0
8	Implementation of Environmental Monitoring Programme during construction phase	82.75
	Total	327.25

The cost estimate for implementation of Environmental Monitoring Programme during construction phase is given in Table-7.

Table-7: Cost estimate for implementation of Environmental Monitoring Programme during construction phase

S.No.	Item	Cost (Rs. lakh)
1	Marine water and sediment quality	66.20
2	Ambient Air Quality	16.55
	Total	82.75