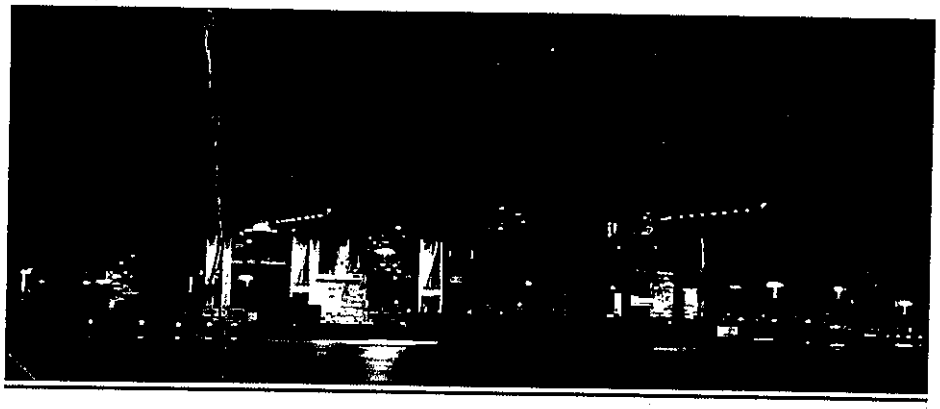

MUMBAI PORT TRUST

ENVIRONMENT IMPACT ASSESSMENT STUDY
&
ENVIRONMENT MANAGEMENT PLAN

Prepaired by

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Advisor Environment

PREFACE

Mumbai Port Trust is a major historical port established in 1873. Considering the harmonious coastline with back up of appropriate business, commercial facilities coupled by advance communication utilities have become a Gate Way of India.

It is a major port with essential navigation environ and utilities, has been achieving progress under the leadership of trustees by implementing several five year plans.

Ministry of Environment with a view to protect coastline had issued notifications under Environment Protection Act 1986 viz C.R.Z. rules 1992 with several amendments and Environment Impact Assessment notification 1994 duly amended in 2003.

Ministry of Environment had issued guidelines for Environment Impact Assessment Studies for Ports & Harbour activities and thus emphasized on existing and proposed ports to prepared Environment Impact Assessment and Environment Management Plan.

Mumbai Port Trust had prepared Environment Impact Assessment reports for several planned works by entrusting these to NEERI and WAPCOS etc. These reports were specifically prepared for improvement and additional works.

Mumbai Port Trust however desired to prepare Environment Management Plan with focus towards compliance of conditions of Environment Department and Pollution Control Boards regulations of water Act 1974, Air Act 1981, Hazardous Waste Management Rules, Hazardous Chemicals storage and Handling Rules and notifications of EP Act 1986.

This work was assigned to me in October 2003.Availing base line data reports of NEERI, WAPCOS and Mumbai Port Trust and the necessary compliance required for conditions of Consent and authorizations issued by Maharashtra Pollution Control Board and guideline prescribed by Ministry of Environment I have compiled this report. Environment Management Plan being a part of Environment Impact assessment it was desired to prepare EIA by using the base line data available with Mumbai Port Trust. Budget requirement for Environment Management Plan is also prepared emphasizing on Monitoring of Environment Attributes.

Commendable assistants was given to me by Mr. Bendale I/C Pollution Control Cell, Mr. Parera Harbour Master, Conservator of Port Chief Engineer Civil & Mechanical Departments and I also thank Hon'ble Chairman Mumbai Port Trust to complete this assignment.

26th January, 2009

D. R. Rasal
Advisor Environment

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CHAPTER NO-1

INTRODUCTION

CHAPTER-1

INTRODUCTION

General

1.1 Mumbai port has been the principal gateway to India and has played a pivotal role in the development of the national economy, trade and commerce and prosperity of Mumbai city in particular. The port has achieved this position through continuous endeavor to serve the changing needs of maritime trade. Though traditionally designed to handle general cargo, over the years, the port has adapted to changing shipping trends and cargo packaging from break bulk to unitization/palletisation and containerization. Besides, it has also developed specialized berths for handling POL and chemicals. For decades, Mumbai Port was India's premier port. Even today, with the development of other ports, it caters to 11.29% of the country's sea-borne trade handled by major ports of the country in terms of volume. It handles about 20.84% of POL Traffic and 2.53% of Container Traffic in terms of TEUs handled by Major Ports of India. Having weathered and survived many a change in maritime trade in its long history, Mumbai Port is today facing challenges posed by competition from adjoining ports and private ports, changing traffic patterns, inherent physical constraints and continuing labour intensive operations, etc. However, Mumbai Port is taking various measures to render cost effective and quality services to the trade.

1.2 Activities:

Mumbai Port is administered by statutory autonomous corporation known as Mumbai Port Trust (MBPT). The port is fully integrated multipurpose port handling container, dry bulk, liquid bulk and break bulk cargos. The port has extensive dry and wet accommodation to meet normal needs of ships using the port. MBPT has provided services to ships. In the year 2006-2007 to 6078 ships and in the year 2007 to 2008 to 6150. The cargo handled in the year 2006-2007 is 138201 thousand tons and in 2007-2008 is 117596 thousand tons.

1.3 Need of the report:

It is desired by MBPT to carry out fresh environmental baseline study of their areas. The study would include baseline data as per CPCB and MOEF regulation, to identify the areas of sensitivity from Environmental angle, and to prepare Environment Management Plan (EMP).

EMP would address the Environmental Impacts and to create facility to meet and confirm the standards in respect of environmental waters, discharge of emissions ,air quality and possible risks involved and to create and to operate infrastructure facilities along with trained personnel to manage the quality of environment.

Bombay was called as Mumbai consisted of seven islands. Towards extreme south was a small island. There was a small undeveloped part. Britishers have after considering the potential of passenger and goods traffic started excavation

rocks and constructed developed part in 1852 which facilitated transportation of goods consisting of rail required for constructing Victoria terminus which was commissioned in 1857. Earlier the private lands were given to process for developing small parts Mr Bhau Ajinky who developed the port which is named as Carnec Bunder and now well known as Bhaucha Dhakha.

1.4 Project Benefits:

Mumbai Port site is one of the most ideal sites as it has got suitable Coastline and the port is not directly exposed to marine hazards especially storms. Water transport is the cheapest mode of transport and benefits export and imports. It has been a centre of prosperity of the country.

- Spreads cultural and commercial ties with the countries.
- Aids defense strategies provide employment and opportunities of connected business ties.
- Promotes fishing and connected marine activities.
- Promotes tourism, industrial, commercial cultural activities.
- Creates all round development of adjacent areas state and country.
- Marine ecodevelopment.

1.5 Legislative requirements:

MBPT being an international port has to comply various legislative and follow international code. These are elaborated as below.

Water Act 1974, Air Act 1981, Environment Protection Act 1986 and several notifications issued under it like CRZ, import and export of hazardous substances including storage handling etc. Hospital waste management rules, Solid Waste Management rules etc.

Besides above it is required to comply

- Indian Ports Act 1907
- Forest Conservation Act 1980

India being signatory to international agreements conventions, the port management has to follow and comply.

I) International Maritime Dangerous Goods code(IMDG-Code)
Methods of state transport of dangerous cargos.

II) MARPOL- International convention for the prevention of pollution from ships. This is to prevent pollution of marine environment by the operational discharges of oil and other harmful liquids.

III) United Nations Convention on the law of the sea (UNCIOS) 1982
The main objective is to prevent pollution damage addressing specific sources of pollution, including those from land based activities, sea bed activities, dumping etc..

IV) Ramsar convention of wetlands:

This convention is to preserve wetlands to compensate for by creation of new habitat.

1.6 Stages in EIA study

The purpose of this section is to enumerate the steps involved in an Environmental Impact Assessment (EIA) study. The same are given in following paragraphs. (Figure No.1.1)

1.6.1 Scoping

An exhaustive list of all likely impacts likely to accrue as a result is prepared by drawing information from as many sources as possible. The next step is to select a manageable number of attributes which are likely to be affected as a result of the proposed project. The various criteria applied for selection of the important impacts are as follows:

Magnitude, extent, significance and special sensitivity.

1.6.2 Baseline study:

Before the start of the project, it is essential to ascertain the baseline levels of appropriate environmental parameters which could be significantly affected by the implementation of the project. The baseline study involves both field work and review of existing documents, which is necessary for identification of data which may already have been collected for other purposes.

1.6.3 Impact Prediction:

This is essentially a process to forecast the future environmental conditions of the project area that might be expected to occur as a result of the construction and operation of the proposed project. An attempt is generally made to forecast future environmental conditions quantitatively to the extent possible. But for certain parameters which cannot be quantified, the general approach is to discuss such intangible impacts to qualitative terms so that planners and decision makers are aware of their existence as well as their possible implications.

1.6.4 Environmental Management Plan:

The approach for formulation of an Environmental Management Plan (EMP) is to maximize the positive environmental impacts and minimize the negative ones. After selection of suitable environmental mitigation measures the cost required for implementation of various management measures is also estimated, to have an idea to have an idea of their cost-effectiveness.

1.6.5 Environmental monitoring programme:

A post-project environmental monitoring programme has been suggested to oversee the environmental safeguards, to ascertain the agreement between prediction and

reality and to suggest the remedial measures not forseen during planning stage but during the operation phase and to generate data for further use.

1.6.6 Scoping Matrix

At the beginning of the study after visiting the site of, Indira Dock and other areas a "Scoping Matrix" was prepared for identification of impacts from as many sources possible on the different environmental aspects.For these aspects, environmental baseline data has been collected from secondary as well as primary data sources as a part of EIA study. The scoping matrix derived for this study is given in

Table1.1.
Scoping Matrix for the EIA study for Mbpt

SR NO	ACTIVITY	LIKELY IMPACTS
A	Actions affecting coastal marine ecology	
1.	Oil spil/leakage within port area	Adverse impacts on marine ecology
2.	Dredging activities	Increased short term turbidity at dredging site resulting in decreased light penetration and in turn primary productivity. Alteration of bottom surface, which can affect the benetic biota.
B.	Actions affecting \Recreational/Resort/Breach along the coastal zone:	
1.	Escape of liquid and solid wastes from the harbour.	Silt deposition along the shore line.
C.	Actions affecting the physio-chemical aspects.	
1.	Dredging Activities	Partitioning of contaminants from sediments to the water column. Generation of turbidity plumes. Increase in turbidity level
2.	Construction activities	Noise pollution and adverse impacts on aquatic flora
3.	Ship movement	Increased ship movement could increase probability of oil spills.
D.	Factors affecting socio-economic environment	
1.	Increase in draft and berthing capacity	Improvement in employment potential Since mbpt will handle large/OD vessels in Basin berths of Indira Dock. Upgradation of infrastructure facilities.
2.	Traffic	Needs to improve existing roads to avoid traffic congestion due to increased cargo.

The above mentioned "Scoping Matrix" has been utilized as a guideline for collection/generation of data and for assessment of baseline assessment and identification of impacts to be covered as a part of the REIA study. The severity of the impacts depends upon its magnitude, duration and actual site conditions. Thus,

the above given Scoping Matrix has served as tool for line of action for the EIA study conducted.

1.7 Plan of Approach and Methodology

1.7.1 Environmental Baseline Status:

The environmental baseline status of the study area has been assessed by collecting/ generating data for physico-chemical, ecological and socio-economic aspects for the study area. The Study Area for the EIA has been considered as area within 10 km radius of the project site considering Indira Dock at centre. The data has been collected through field studies, literature review and interaction with concerned departments. The detailed baseline data collected as a part of EIA study is given as below:

Land use:

The present land use pattern has been established through literature review, satellite imageries and field studies with respect to urban land (settlement), barren stretches, water bodies etc. The digital satellite data has been procured from National Remote Sensing Agency (Hyderabad).

The following landuse/land cover category for the study area has been classified:

- Vegetation
- Mangroves
- Marshy land
- Barren land
- Water body
- Built-up/Exposed land

Demography and Socio-economics:

The socio-economic characteristic of the study area has been studied through the available secondary data. The information on population literacy, occupational profile etc for the study area has collected from secondary data sources. The main source of data was the Directorate of Economics and Statistics of the project area district.

Meteorology:

The meteorological data for last 5 years of the nearest Meteorological Department (IMD) station has been collected. The data on following aspects has been collected.

- Rainfall(mean annual)
- Humidity
- Maximum and minimum temperature
- Wind speed
- Ambient Air Quality:

A monitoring network for ambient air quality is generally designed to characterize ambient air quality with respect to SO2, NOx, Suspended Particulate Matter (SPM) and Respirable Particulate Matter (RPM) at various locations. However, in the

proposed project, the ambient air quality data as provided by the mbpt has been utilized in the EIA report.

Noise:

A noise monitoring survey has been conducted at various locations within the study area. Monitoring was done, once during the study period for 24 hours at each location. The equivalent noise levels (leq) have been determined.

ECOLOGY

Terrestrial Ecology:

The status of vegetation in the study area has been assessed through satellite imagery and data as available with various secondary sources.

Aquatic Ecology:

As a part of the EIA, Marine water and sediments samples were collected from various locations. The samples so collected were analysed for physcio-chemical and biological parameters. The list of parameters analysed is as given below:

a) Physico-chemical parameters to be analysed Marine Water:

- Temperature
- pH
- Salinity
- Electrical Conductivity
- Dissolved oxygen
- BOD
- TDS
- Oil and grease
- Calcium
- Magnesium
- Sodium
- Potassium
- Phosphates
- Nitrates
- Ammonical nitrogen
- Sulphates
- Chlorides
- Total nitrogen
- Zinc
- Nickel
- Cadmium
- Lead
- Mercury

Sediments:

- Grain size distribution
- pH
- Chlorides

- Phosphates
- Nitrates
- Sulphates
- Sodium
- Potassium
- Total Kjeldahl Nitrogen
- Organic matter
- Total Volatile Solids

As a part of the Marine Ecological Survey, Phytoplankton (density and diversity) Zooplankton (density and diversity), primary productivity, etc have been assessed. The sediment samples too were collected at the locations, from where marine water samples were collected. The sediments were analysed for various Physcio-chemical properties and biological parameters, e.g. macro and micro-fauna.

Marine water and sediment samples has been also analysed for the following biological parameters.

Biological Parameters
Marine Water

- ✓ Primary Productivity
- ✓ Chlorophyll 'a'
- ✓ Phaeophytin
- ✓ Oxidisable particular organic carbon,
- ✓ Phytoplanktons

- Abundance
- Number and name of groups, present
- Total number and name of species of each group, present
- Density(Total numbers of individual of each species/l)
- Total Biomass

Zooplanktons

- Abundance
- Number and name of groups, present
- Total number and name of species of each group, present
- Density(Total numbers of individual of each species/l)
- Total Biomass

Sediments
Benthic Organisms
Meio-benthos and Macros-benthos

- ❖ Abundance
- ❖ Number and name of groups, present
- ❖ Total number and name of species of each group, present

- Density
- Total Biomass

1.7.2 Impact Assessment

With knowledge of the baseline conditions, project characteristics, the intensity of various project activities and environmental baseline status, impact assessment has been carried out for the following aspects:

- Impacts on ambient air quality
- Deterioration of water quality due to disposal of effluents.
- Increase in the ambient noise levels
- Impacts on ecology of the area
- Changes in the socio-economic environment
- Risk analysis due to project related activities

1.7.3 Environmental Management Plan(EMP)

Environmental Management Plan (EMP) has been formulated to ameliorate the adverse impacts on various facets of environment due to the proposed project activities. It is recommended at various measures outlined as parts of EMP are integrated in the overall project planning. This will ensure their affective implementation.

1.7.4 Post-Project Environmental Monitoring Programme

A post-project Environmental Monitoring Programme to monitor critical parameters has been suggested. The consultant will also be identified for the equipment and manpower requirements for implementation of this programme and the costs involved.

1.8 OUTLINE OF THE REPORT

The main elements of the study are as follows:

Chapter-1 summarizes the need for the project and various legislative and regulatory requirements and a concise documentation of the methodology adopted for the proposed study.

Chapter-2 gives a brief description of the proposed project activities.

Chapter-3 describes the baseline environmental setting of the study area.

Chapter-4 covers the anticipated positive and negative impacts likely to accrue as a result of the proposed project.

Chapter-5 describes the Environmental Management Plan (EMP) for amelioration of anticipated adverse impacts on various aspects of environment.

Chapter-6 outlines the Disaster Management Plan (DMP)

Chapter-7 delineates Environmental Monitoring Programme for implementation during project operation phase.

Chapter-8 Environmental Monitoring Programme

Chapter-9 Estimation for Monitoring Programme

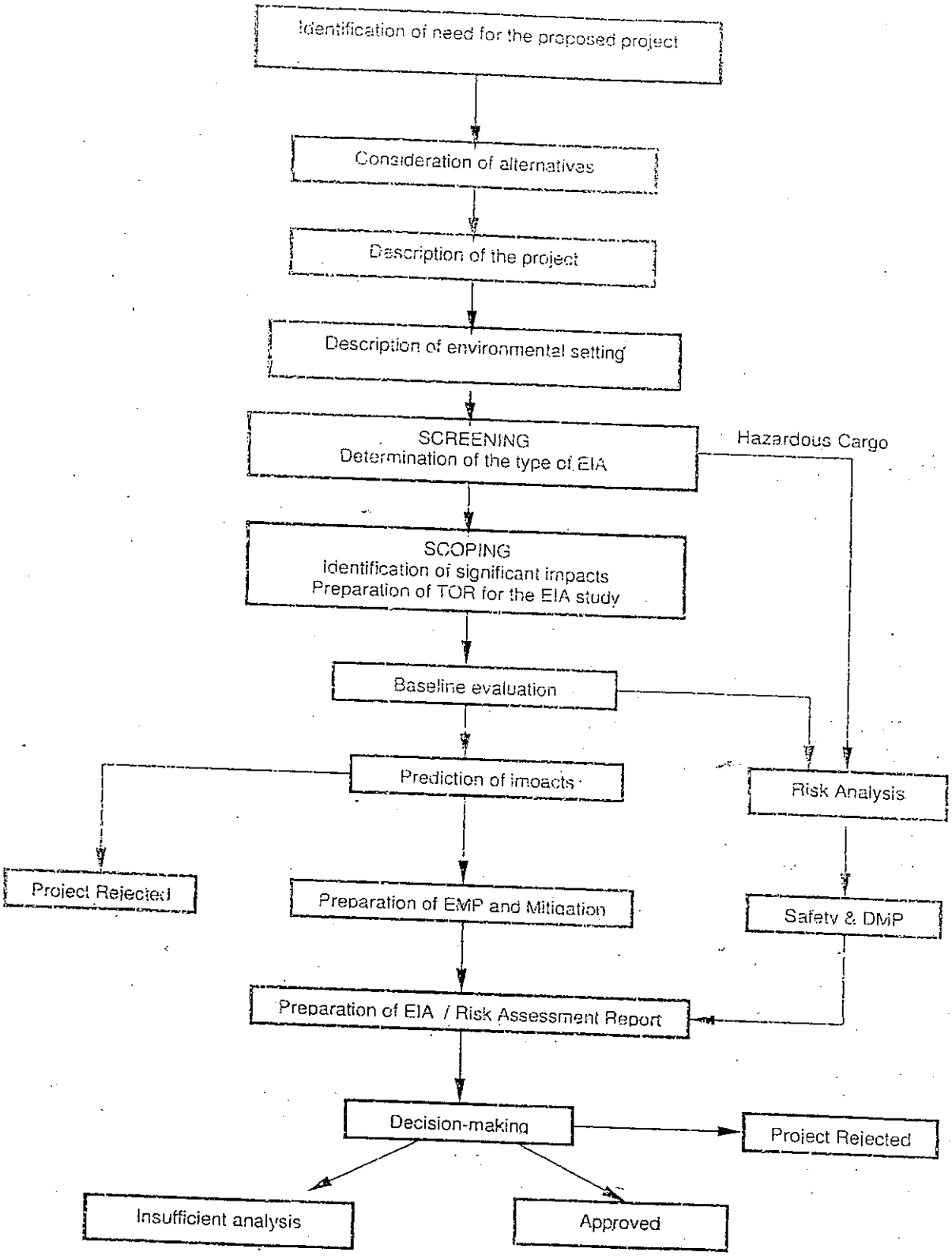

Figure 1.1 Components of E.I.A study

CHAPTER NO-2

LOCATION & PROJECT DETAILS

Chapter 2

LOCATION & PROJECT DETAILS

The port lies midway along with the west coast of India and is gifted with a natural deep water harbour of 400sqkm protected by main land of konkan on its east and island on Mumbai on west. Refer Figure (2.1)
Deep waters in the harbour provide secure and ample shelter for shipping throughout year. Configuration protects the port from heavy storms during rough weather.

2.0) Location:
Location of the port is almost midway (latitude) 18-54'N longitude 72'49'E. The approaches of the port are well lighted as details are as under
Prongs lighthouse (N)- 27 km (visibility)
Kenney lighthouse (S) - 29 km

2.1) Salient features of the project:
The main navigational Harbour channel is, for the great part, a natural deep-water fairway. The channel has been deepened to 11 metres. With a mean high water neap tide of 3.3 metres, the channel is adequate to meet the requirement of a large number of cargo vessels, passenger ships and deep drafted tankers. With good lighting arrangements navigation is allowed at the port round the clock.

There are three enclosed wet docks namely Indira, Prince's and Victoria dock having a total water area of 46.30 hectares and a quayage of 7776 metres. The Indira Dock has an Entrance Lock 228.6 metres long and 30,5 metres wide though which vessels can enter or leave the docks at any state of tide. There are 21 berths inside the basin and 5 berths along the harbour wall, with a designed depth of 9.14 metres and 7.5 metres respectively. The depth of berths inside the basin can be increased by 1.20 metres by impounding water by electric pumps. There are 14 berths with a designed draft of 6.4 metres at Princes Dock with a designed draft of 6.7 metres.
There are two berths on the Southward extension of East arm of the Indira Dock, namely Ballard Pier Station and Ballard Pier Extension. The Ballard Pier Extension berth is 244 metres long and has a modern passenger Terminal Building. It has a designed depth of 9.75 metres CD the Ballard Pier Station berth caters to container vessels and has a designed depth of 9.1 metres CD.

For handling Crude Oil and Petroleum products, there are four jetties at Jawahar Dweep. One of the jetties at Jawahar Dweep, which was commissioned in 1984, can handle tankers with the maximum loaded draft of 12.7 metres corresponding to 125,000 Displacement Tons. Two of the jetties can accommodate tankers upto 70,000 Displacement Tons and 228.6 m length and the third one can take tankers of 213.4 m length and upto 48,000 Displacement Tons. Chemical and POL products are handled

at two jetties at Pir Pau. Old Pir Pau jetty can accommodate tankers of 170.7 m length while the new one commissioned in December 1996 can handle tankers with a length of 197 m and a draft of 10.5 m. All the jetties are connected to Oil Refineries by a network of pipelines.

Besides the wet docks, there are along the harbour front a number of bunders and open wharves where the traffic carried by sailing vessels is handled.
The port has two dry docks, one inside Indira Dock, viz, Hughes Dry Dock which is 304 metres long and the other inside Prince's Dock, the Merewether Dry Dock which is 160 metres long.

There are transit sheds at most of the berths and a number of warehouses in the Port area for storage of uncleared cargo and pre-shipment storage of export cargo.

2.2 Planned Progress

Mbpt has planned various developmental as well as renovation, reconstruction renewal activities by planned process. They have actually five year plans and details regarding layout, main projects to be executed are as follows:

a) First two plans: The principle objective of the first two plans was to rehabilitate the war damage suffered by the port and provide maintainence and effective functioning of existing facilities.
b) Third plan: The third plan aimed at relieving chronic congestion in the docks by adding fresh facilities which included execution of dock expansion schemes, construction of Ballard Pier Extension berth and new ferry wharf of Princes Dock.
c) Fourth and Fifth plan: The fourth and fifth plan and the subsequent annual plans mainly aimed at maintenance of existing facilities. Construction of fourth oil berth at Jawahar Dweep was included in it along with upgrading of three marine oil terminal to receive tankers of 70000 displacement tons.
d) Sixth Plan: The greater emphasis was a container handling facilities modernization of Flotilla and completion of earlier schemes of fifth plan.
e) Seventh Plan: Seventh Plan laid emphasis in modernization of handling systems and container handling facilities. It also included new schemes, like purchase of new dredger, reconstruction of transit shed No. 6ID replacement of two tugs, one fine float and one dredging tug
f) Eighth five year plan: It included replacement and renewal modernization of port facilities schemes which help in increasing operational efficiency and welfare schemes.
g) Ninth Plan: Outlay of 1207 Crores which includes modernization of jetties 1, 2, 3 at Jawahar Dweep, Replacement and common user pipeline, revamping railway system. Construction of second berth at new Pir Pau Pier, development of Dock complex at Gamadia roads.
h) Tenth Plan: Proposed outlay of 880020 crores- It includes construction of deep drafted offshore berth, replacement of 2 RTGs and 2 Nos of QGC replacement of 4th oil berth, improvement to port connecting replacement of ELL Wharf cranes.

i) Eleventh Plan: Outlay of 2858.26 crores - It includes construction of two offshore container berths. Second liquid chemical, specialized grades of POL berth at new pir pau pier, Development of coastal shipping improvement of rail, road and port connectivity.

2.3. Privatisation: The liberalized economic policy of Government of India Envisages increased privatization in port sector. However, a significant level of private participation already exists at Mumbai Port.
Some of the areas where the outside agencies have been involved in port activities include:
1. Supply of equipments for handling containers (party)
2. Ship repair work at Dry Docks
3. Bunkering and supply of water to ships etc.
Major project for privatization are construction of two deep drafted offshore container berths and development of container terminal on BOT basis.

2.4 Infrastructure facilities:
I) Several Navigational Aids have been provided by Mbpt like light houses, three light buoys flashing green light every 5 secs, control station,etc. There are 63 anchorages at the port and pilotage is compulsory for 100 tons gross.
II) Cargo berths have been provided at Indira Dock Victoria Dock and Princess Dock. Berths have been provided for handling POL/ Chemicals at Jawahar Dweep, pir pau old and new.
III) Passengers Cargo berths have been provided at Ballard pier extension.
Berths for ferry ships are provided at New ferry Wharf.
Holiday berths- used as shelter for Mbpt Tugs and launches at Victoria Dock.

Besides the wet docks there are along the harbour front, a number of bunders with open wharves and basins to handle the traffic are available. The bunders have extensive facilities for loading, unloading storing the cargo to an aggregate quay age 12500 metres.

3. Storage Capacity Area in sq metres

	Covered Area	Open area
a. Indira Dock	76862	117827+1320 slots
b. Victoria Dock	14307	17678
c. Prince Dock	16612	10658
d. Container Freight station	46299	47500+5888 slots
e. Empty Container Yard		111180 sq metres
f. Warehouses	131721	81134+20 slots
Total	280702	385977 7228slots

IV. Cargo Handling Equipment:
There are electric wharf cranes, mobile cranes, Tower cranes, Floating cranes, Fork lift tractors.

V. Dry Dock:
Existing facilities provide all major services for repairs to the ships. There are two dry docks merewhether in princess dock and Hughesin Indira Dock. Hughes dry dock pumps have been electrified to raise the water level to extra height of 1.20 metres and in Indira dock it can be raised extra by 1.20 metres.

VI. Port Railway:
Mbpt owns and operates its own railway which is connected to broad guage lines of Central Railway and Western Railway at its interchange Railway yard at Wadala. Railway runs at 10 kms from Ballard Pier and Wadala but has extensive network of tracks of about 100m

VII.Roads:
Entire port area is served by an extensive network of 126 kms of roads of good quality.

VIII.Water Supply:
Adequate supply of drinking water to ships in stream at berth is provided. While water is supplied by alongside the berths, vessels in the charge receive supply from water boats.

IX. Bunkering:
Oil for bunkering can be obtained at all the berths.

X. Refer Points:
There are 133 Refer Points at selected berths have been provided for refrigerated cargo.

XI. Telecommunication:
Telecommunication system plays a vital role in effective functioning.
Telecommunication system which was in operation since 1990 has been replaced in March 2003 by statement of the Art. ISDN-EPABXS. Network system.

Website - Mumbai Port has hosted its own homepage on the internet at site http/www.mumbaiport.gov which provides all the details.
International Ship and Port Facility Security:

ISPS code is mandatory regulation promulgates by the international maritime organization to which India is a signatory. The code aims to enhance the security level for shipping and port industry.

XII. Vessel Traffic Management System:
State of the Art VTMS for control of ports operations, survelliance and harbour navigation having interface with port MIS was commissioned in September 1997. A GPS based marine survey system is also part of VTMS.

XIII. Details of Dredgers and TUGS

Flotilla -5 dredgers
TUGS
Dock Tugs -11Nos
HarbourTugs-4Nos
Other Tugs -5 Nos
Pilot vessel and container
Pilot launches -6 Nos
Other launches -12 Nos
Fire Floats -1 Nos
Survey Vessel -1 Nos

XIV. Establishment:

Three categories of warehouses are directly involved in handling of cargo viz Shore labour, Qua crane Drivers, and stevedores workmen including winchmen who work on board of the ship.
Details of Port workers and staff and Dock water is enumerated below.

As on	Port Workers and staff	Dock worker
31-3-2000	24284	7074
31-3-2010	18262	5529
31-3-2002	17341	5358
31-3-2003	17021	5209
31-3-2004	16138	4592
31-3-2010	15504	4196
31-3-2006	15185	4675
31-3-2007	14935	4351
31-3-2007	14481	4175

XV. Financial Results:

Financial Results of the working of port are given below:

YEAR	NET SURPLUS
2003-04	162.54 crores
2004-05	46.76 crores
2005-06	243.39 crores
2006-07	131.34 crores
2007-08	190.21 crores

XVI. Welfare Activities:

a. Medical facilities:

Port Authority has its own medical facilities and operates them with the help of own employees. A modern hospital complex is provided with latest sophisticated gadgets have been provided at Wadala for its own employees.
Mumbai Port trust hospital is also accredited as centre for diploma courses of college of physician and Surgeons of Mumbai and the specialists are in field of Anaeothesia, Opthalonology, ENT Orthopedic, Obst/Gynaecology, skin VD Pediaties.

b. Other facilities:

1. Quarters: Mumbai Port Trust provides residential accommodation to class I, II, III and IV Categories. A total of 4863 residential quarters has been provided so far. In addition there are 1129 ex-BDLB Quarters.
2. Welfare Centres: There are 8 welfare centres operating in Port Trust Residential colonies where indoor and outdoor games are organized and in addition social gatherings, celebrations of festivals, drama competition are arranged Radios and T.V. sets have also been provided. Two community halls have been at Nadkarni Park and Tejas Nagar. Small halls to 8 welfare centres are also given for small function.
3. Other-Canteen services subsidized to the extent of 5 crores.

Educational loan 1.5 crores (approx) at nominal interest is sanctioned for deserved candidates.

2.5 Port Organization and Administration:

The Port is administered by a statutory body constituted under the Major Port Trusts Act, 1963. It is composed of 21 Trustees headed by the Chairman who is appointed by the Government. The other members of the Board are officials and non-officials representing the principal chambers of commerce, customs, railways, civic body, labour employed in the Port, etc.

There are 16 departments which look after the day-to-day administration of the port. Port activities in brief are as detailed below:

Sr. no	Department	Responsible for
1.	Manager(Services, O& M)	Administrative Policy Matters.
2.	Secretary	Convening of meetings of the Board and Standing Committees and Coordination.
3.	Chief Personnel & Industrial Relations Manager	Matters pertaining to industrial Relations
4.	Accounts	Accounts and Finance
5.	Civil Engineering	All Civil Engineering works
6.	Mechanical Engineering	Mechanical and Electrical Works.
7.	Traffic	Dock & Railway
8.	Port	Marine Operations
9.	Stores	Purchase of Stores
10.	Estate	Management of Port Estate
11.	Medical	Management of Hospital and Medical Care of Port Employees.
12.	Labour	Staff Welfare and Dock Safety.
13.	Planning & Research	Maintenance of Port Statistics, Carrying out Research and investigations on problems relating to Port Working, Computerization of Port Activities and Providing Telecommunication Facilities, ISO- related activities.
14.	Vigilance	Vigilance Matters
15.	Legal	Advise on Legal Matters, Filing of Suits etc..
16.	Railway	Railway Operations.

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4.	Accounts	Accounts and Finance
5.	Civil Engineering	All Civil Engineering works
6.	Mechanical Engineering	Mechanical and Electrical Works.
7.	Traffic	Dock & Railway
8.	Port	Marine Operations
9.	Stores	Purchase of Stores
10.	Estate	Management of Port Estate
11.	Medical	Management of Hospital and Medical Care of Port Employees.
12.	Labour	Staff Welfare and Dock Safety.
13.	Planning & Research	Maintenance of Port Statistics, Carrying out Research and investigations on problems relating to Port Working, Computerization of Port Activities and Providing Telecommunication Facilities, ISO- related activities.
14.	Vigilance	Vigilance Matters
15.	Legal	Advise on Legal Matters, Filing of Suits etc..
16.	Railway	Railway Operations.

2.6 Project Description:

Project Description involves description of the project activities and infrastructure requirements. Annexure A gives a questionnaire for describing the project setting. For a typical port and harbour project, the harbour infrastructure requirements are breakwaters; tug boats; lighthouse, fire fighting equipments, facilities to combat oil slick(oil skimmers, booms), buoys and marine police. Dock requirements are dictated by the vessel types, cargo type and storage and handling requirements. General considerations for the overall layout of the facility depend on berth length, number of vessels, loading/unloading points, apron width, and short-term storage on the pier or wharf, cargo -handling equipment requirements, exposure to sea conditions, deck elevation and traffic movements. Port requirements can be classified as landside and waterside requirements. Figure 2.1 gives the facilities involved in the Port and Harbour project.

A broad list of activities (though not exhaustive) involved in a port and harbour construction and operation are given in table 2.1. All these activities involve a number of tasks or sub-activities.

- Ports and Harbours
- Roads, Railways and Crane Tracks
- Landside facilities waterside facilities
- Underwater
- Pipelines
  Storage and Stacking
- Water supply and waste water Sewage disposal Outfall Breakwater
- Dry-docks Pipeline for liquid cargo transfers Tank farm Berthing Facilities.

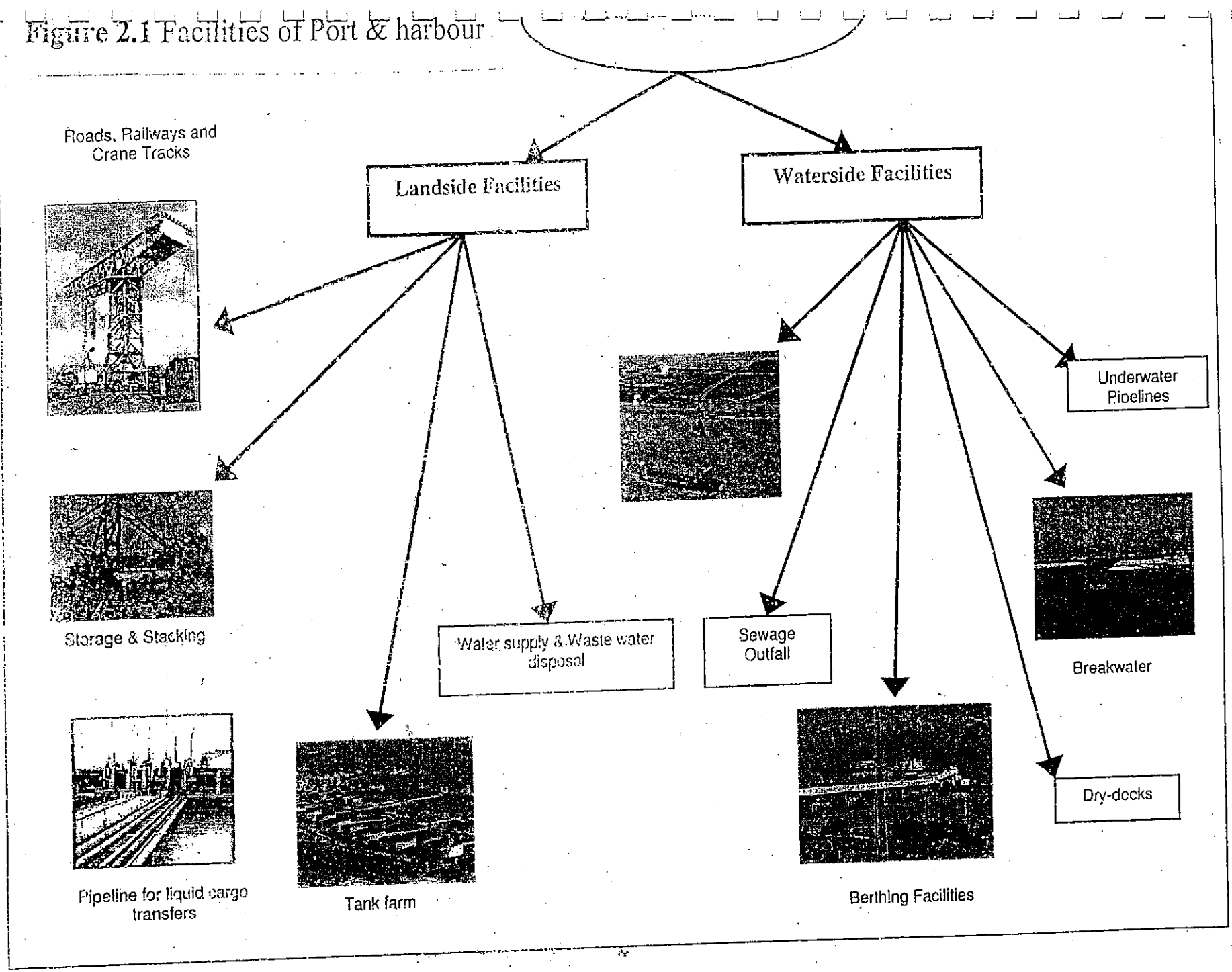
Table 2.1

Activities typical to ports and harbours

Phase	Landside Activity	Waterside Activity
Construction	▪ Siteclearing/deforestation ▪ Resettlement ▪ Rehabilitation ▪ Soilexcavation/Quarrying Transportation of raw materials* ▪ Construction/Precasting/ Fabrication/Welding Laying of roads/railways/crane tracks ▪ Land reclamation/disposal of dredged material on-shore ▪ Labour camps for all activities	▪ Capital dredging ▪ Disposal of dredged material into sea ▪ Berth/wharf/jetty/trestle construction(Piling operations/Construction of gravity foundation/diaphragm walls) ▪ Breakwater Construction* ▪ Single Point Mooring(SPM) ▪ Trenching the seabed for underwater pipeline/intake/outfalls/u nderwater blasting
▪ operation	▪ Afforestation Vehicular traffic(roads and railways) ▪ Storage of dry cargo ▪ Loading and unloading of dry cargo ▪ Loading and unloading of liquid cargo ▪ Storage of wet cargo/Tankfarm operation ▪ Pipeline operation ▪ Disposal of dredged material on land/ Land reclamation ▪ Waste management and discharge	▪ Maintainencedredging Disposal of dredged material into sea Maintenance of Breakwater/water-front structures ▪ Brine discharge from desalination plants ▪ Ship operations (bunkering, ballasting/deballasting/discha rges) ▪ Fishing activities.

- Phase Landside Activity Waterside activity
- Maintenance Infrastructure
- Desalination plants
- Captive power plants
- Induced development.

Figure 2.1 Facilities of Port & harbour



CHAPTER NO-3

ENVIRONMENT BASELINE STATUS

Chapter 3

ENVIRONMENTAL BASELINE STATUS

3.1 General

It is desirable to measure the levels of the appropriate environmental parameters which could be significantly affected by the operation of the proposed project. This Chapter outlines the information on baseline setting of the study area. The baseline data were collected through field investigations and collection of available secondary data, review of existing documents/ publications pertaining to this area. The base line data collection of different environmental components viz. meterology, airquality, noise, waterquality, landuse, ecology and socio-economics was conducted. The study area considered for EIA study is the area within 10km radius of the port site. The Study Area map is enclosed as Figure-3.1.

Most of the study area comes under urban area of Greater Mumbai whereas about upto 80-90% of the study area comes under Arabian sea. In such conditions, most of the impacts likely to accrue as a result of project construction and operation are expected to be occur on water front i.e. on marine environment. A detailed marine ecological survey has been conducted in the vicinity of harbour to assess the existing status of marine ecology. The data on other aspects has been collected from available reports and secondary data sources. The Baseline status has been categorized as below:

- Physico-chemical aspects
- Ecological aspects
- Socio-economic aspects

3.2 PHYSCIO-CHEMICAL ASPECTS

3.2.1 Meterology:

In the project area, due to its proximity to coastal environment, the diurnal and seasonal variations in temperature is not significant. The year may be divided into four seasons. The south-west monsoon season sets in June and lasts till the end of September. October and November are post-monsoon months, followed by a mild winter season lasting from December to February, which is followed by summer season which lasts upto the end of May.

Temperature:

The temperature starts increasing from March and generally May is the hottest month of the year with mean daily maximum temperature at 32.9 degree C. Due to high humidity, weather during summer months is oppressive. In the afternoons, sea breeze brings some relief from the heat. With the onset of south-west monsoons by about first week of June, there is an appreciable drop in temperature and the weather becomes pleasant. After November both day and night temperatures begin to decrease. The month of January, is the coolest month of the the year with mean daily maximum and minimum temperatures of 29.1 degree C and 19.3 degree C respectively.

Humidity:

The relative humidity is high throughout the year being particularly so during the south- west monsoon months when humidity goes as high as 85%. The relative humidity is comparatively lower (70-73%) during the period from November to May.

Rainfall:

The average rainfall in the study area is about 2.422 mm and annual mean numbers of rainy days are about 77.8. Majority (95%) of the rainfall is received in the months from June to September. The monthly variation in temperature, humidity and rainfall in the study area is given in Table-3.1.

TABLE-3.1

Details of temperature and rainfall in the study area

Month	Temperature (degree C)Maximum	Mini mum	Rainfall(mm)A verage	No. of rainy days	Relative Humidity (%)8.00 AM	5.00AM
January	30.6	16.4	0.6	0.3	71	
February	31.3	17.3	1.5	0.1	72	62
March	32.7	20.6	0.1	0.1	72	63
April	33.1	23.7	0.6	0.3	73	66
May	33.3	26.1	13.2	1.2	73	68
June	31.9	25.8	514.1	15.4	80	78
July	29.8	24.8	868.3	23.5	85	85
August	29.3	24.5	553.0	19.1	85	84
September	30.1	24.0	306.4	12.8	85	80
October	32.9	23.1	62.9	3.7	80	74
November	33.4	20.5 1	14.9	1.0	73	67
December	32.0	18.2	5.6	0.3	70	64
Total			2422	77.8		
Average	31.7	22.07				

Winds:

Winds are generally light to moderate with some increase in force in the summer and monsoon seasons. In the period from January to May winds strengthen in the afternoons. In the southwest monsoon season, winds are mainly westerly or north easterly. During rest of the year, winds are north-easterly to easterly in the mornings and blow from directions between south-west and north-west in the afternoons. Wind rose diagrams for the months of April, May and June are given in Figure-3.2 and the mean wind speed of Mumbai meteorological station is given in Table-3.2.

TABLE-3.2
Wind speed in the study area

Month	Mean Wind Speed(km/hr)
January	9.1
February	9.3
March	10.4
April	10.5
May	10.0
June	12.8
July	14.8
August	13.4
September	10.0
October	8.5
November	8.2
December	8.5
Annual Average	10.5

3.2.2 Tides

The tides in the Mumbai region are characterized by occurrence of two High and two Low Waters every day with marked diurnal inequality in the levels of the two waters. The important tidar datum planes at Mumbai Mumbai Port (Apollo Bunder, Mora and Trombay) are given in Table-3.3

TABLE -3.3
Important tidal datum places

Place	Tidal Level Above Chart Datum in m				
	MHWS	MHWN	MLWN	MLWS	MSL
Mumbai Port	4.42	3.30	1.85	0.76	2.51
Mumbai(Apollo Bunder)	4.4	3.3	1.9	0.8	2.5
Mora	4.4	3.4	1.8	0.9	2.6
Trombay	4.4	3.4	1.7	0.7	2.5

The highest level recorded is stated to be +5.38m C.D and lowest recorded was -0.44m.

3.2.3 Currents

The currents in the Mumbai harbour and in the near shore zone are tide induced with reversal at high and low waters. The current strength in the Mumbai ranges from 0.75m to 1.5m (1.5 to 3 knots)

3.2.4 Waves

During monsoons, the predominant wave direction is from south-west to west. During this period, waves of 4to 5m height normally occur, however, wave's upto 8.0m in height and period of 14 seconds have also been reported. At Mumbai port wave with maximum height of 3m has occurred for 10 sec. October and November are transition months during which the predominant wave direction changes to north to north-east. During December and January the waves mainly occur from north to north-east and from February to May waves predominantly come from the north-west quadrant.The wave climate described above pertains to deep sea. The amplitude and direction of waves get modified as they progress towards the shore due to effects of refraction, reflection, diffraction, shoaling etc. and thus become a more localized phenomenon. The project area being well within the Mumbai estuary is fairly well protected from waves, by the Mumbai headland.

3.2.5 Land use pattern:

Mumbai port trust area falls under south Mumbai area. The raw and classified satellite imagery is shown in figure 3.3 and 3.4 respectively. The landuse pattern as per satellite data is outlined in Table-3.4.

TABLE-3.4

SR NO	Category	Area (ha)
1.	Vegetation	1491(4.75)
2.	Mangroves	499 (1.59)
3.	Marshy land	110 (0.33)
4.	Barren land	155 (0.49)
5.	Water body	24173 (76.94)
6.	Built-up/Exposed land	4993 (15.89)
	TOTAL	31416(100.0)

The major landuse category in the study area is water body accounting for about 82.25% of total study area, followed built up area (11.24%).Vegetation accounts for about 4.11% of the study area. Mangroves account for about 0.93% of the total study area. However no mangroves are observed in the project area.

3.2.6 Air quality

EIA study was conducted by NEERI for Mumbai Port Trust (Mbpt) for the two off shore berths and a container terminal. As a part of EIA study five ambient air quality monitoring locations were established to assess the quality status for suspended particulate matter(SPM), sulphur dioxide (SO) and oxides of nitrogen (NO).The monitoring was carried out using a high volume sampler.The concentrations of SPM were estimated gravimetrically and the gaseous pollutants were estimated colorimetrically.

The SPM levels were found out to be higher at all locations whereas the gaseous pollutants were found out to be lower than thepCPCB stipulated standards at all five locations. The ambient air quality data for the five locations is presented in Table-3.5. The monitoring data showed that SO concentration ranges from 29.5

ug/m to 51.9 ug/m. The NO and SPM concentrations ranged from 11.25.5 ug/m and 273.7. 637.5 ug/m respectively. SPM concentrations are observed to be exceeding stipulated standards of Central Pollution Board (CPCB) for residential region. However, SO and NO concentrations are within the stipulated standards of CPCB at all locations.

Ambient Air Monitoring is done by Ashwamedh Engineers, a recognized agency on behalf of MbPt.The monitoring is done in order to asses the impact due to coal plant at Hazibunder.The Monitoring stations were established at main gate, pump house no.1,pump house no.2 & fire station. The monitoring is done on eight hourly basis for twenty four hours. RSPM, TSPM, Sulphur Dioxide, and Oxides of Nitrogen are monitored.

The maximum & minimum values of above mention parameters for the months of September & October are stated below

TABLE-3.4. (a)

Ambient Air Quality Monitoring Report:

MONTH	RSPM		TSPM		SO2		NOx	
	Min	Max	Min	Max	Min	Max	Min	Max
September-2008	63	99	370	542	11	16	10	19
October-2008	70	99	410	577	11	16	11	19
Values are in Micro gram per Cu/M								

Main source of emission is respect of operations of DG Sets in MbPT area

Sr.No.	Location	Nos	Capacity	Year of Installation
1.	MoT-JD	02	750 KVA	1997-1998
2.	Pir Pau Jetty	01	200 KVA	1996
3.	RES Project	06	160 KVA	1999
4.	ISPS Project	03	100 KVA	2004

TABLE-3.5

Ambient Air Quality Monitoring Results

SR NO	LOCATION	SPM	SO2	NOx	CO
1.	PD' Mello Road	577	51.9	22.3	ND
2.	Link Road	273.7	29.5	11	ND
3.	Cotton Green Station	1112	46.6	22.4	ND
4.	Wadala Flyover	588.7	36.1	15.4	ND
5.	Chembur (Near Priyadarshini)	637.5	51.2	25.5	ND

Out of five stations listed in Table-3.5, the monitoring station at Chembur is within the study area. In addition, ambient air quality stations of another station at Sewri was also collected from secondary sources. The results are shown in Table -3.6.

TABLE-3.6
Ambient air quality status

Parameter	Mean Concentration ug/cum
SPM	225
NO	31
SO	39

TABLE-3.6.1
AMBIENT AIR QUALITY FOR THE MONTH OF JANUARY 2007

SR NO	DATE	SITE OF SAMPLING	CONCENTRATION OF SO CONCENTR-ATION IN ug/m	CONCENTRATION OF NO CONCENT-RATION IN ug/m	CONCENTRATION OF NH CONCENTRATION IN ug/m
1.	10/10/07	FIRE STATION	17.50	3.38	4.17
2.	02/10/07	SAGAR DARSHAN	14.77	3.62	8.12
3.	03/10/07	M'SHED	15.04	4.21	6.77
4.	04/10/07	B.P.X	18.30	5.74	6.65
5.	07/10/07	B.P.X	15.53	2.80	8.35
6.	09/10/07	HAJI BUNDER	17.95	2.80	6.62
7.	10/10/07	M'SHED	15.95	4.48	4.83
8.	11/10/07	FIRE STATION	14.47	4.61	6.71
9.	15/10/07	B.P.X	18.56	3.83	8.09
10.	17/10/07	MBPT HOSPITAL	21.97	3.03	7.10
11.	18/10/07	M'SHED	13.07	1.23	8.27
12.	19/10/07	FIRE STATION	11.14	2.61	8.21
13.	21/10/07	SAGAR DARSHAN	16.48	3.26	4.30
14.	22/10/07	FIRE STATION	25.27	3.64	6.15
15.	23/10/07	SALVAGE	16.33	4.66	6.19
16.	24/10/07	B.P.X	13.07	4.03	8.09
17.	25/10/07	SALVAGE	21.97	3.27	6.29

21.	31/10/07	SALVAGE	17.27	6.61	9.28

TABLE-3.6.3
AMBIENT AIR QUALITY FOR THE MONTH OF OCTOBER 2007

SR NO	DATE	SITE OF SAMPLING	CONCENTRATIONOF SO_2 CONCENTRATION IN µg/m³	CONCENTRATION OF NO_X CONCENTRATION IN µg/m³	CONCENTRATION OF NH_3 CONCENTRATION IN µg/m³
1.	01/10/07	B.P.X	12.158	4.314	4.081
2.	03/10/07	M'SHED	7.612	3.869	1.668
3.	04/10/07	SALVAGE	10.416	5.876	6.663
4.	05/10/07	SAGAR DARSHAN	10.150	5.966	5.965
5.	06/10/07	B.P.X	15.530	6.030	7.418
6.	09/10/07	FIRE STATION	4.961	4.122	6.881
7.	10/10/07	SALVAGE	15.946	4.160	7.170
8.	11/10/07	MBPT HOSPITAL	21.326	4.583	6.652
9.	12/10/07	HAJI BUNDER	12.234	3.670	6.374
10.	15/10/07	SAGAR DARSHAN	10.870	3.617	5.151
11.	16/10/07	B.P.X	25.833	3.666	4.824
12	17/10/07	SALVAGE	21.363	5.217	5.725
13.	19/10/07	FIRE STATION	14.014	5.267	4.408
14.	20/10/07	B.P.X	14.166	3.324	9.879
15.	22/10/07	M'SHED	21.022	2.877	7.789
16.	23/10/07	HAJI BUNDER	21.174	5.642	7.466
17.	24/10/07	FIRE STATION	23.561	5.716	4.918
18.	25/10/07	B.P.X	19.886	6.073	5.331
19.	26/10/07	SALVAGE	19.166	6.088	3.807
20.	29/10/07	M'SHED	11.590	4.989	4.734
21.	30/10/07	MBPT HOSPITAL	20.833	7.542	5.624

It is observed from Table-3.6, that the concentration of SPM, SO, and NO are well within the permissible limits for industrial area (refer Annexure-I).
Ambient air quality is also assessed within the port area by establishing air quality stations. The following table-3.6.1 shown moving stations along with the observation during the three seasons i.e winter, post Monsoon, summer. The critical values observed for parameters of SO2-25.83ug, NOx-8.10ug/Nm3

Figure 3.5 shows the location of this monitoring station.

3.2.7 NOISE ENVIRONMENT:

The ambient noise levels were measured at the same locations where the ambient air quality monitoring was carried out. The noise level measurement was carried out for 24 hours using a portable sound level matter. Noise levels were recorded at 15 minutes interval. The results of noise levels are shown in Table-3.7.

Noise levels are also measured along with ambient air at three stations and the noise levels recorded are as per the table (3.7.1).

The equivalent noise levels ranged from 80 dB(A) to 94 dB(A). These are higher than the CPCB standard specified for commercial areas (Refer Annexure-II).

TABLE-3.7

Noise Level Monitoring Stations dB(A)

SR NO	LOCATIONS	Leq	Lmin	Lmax
1.	PD'Mello Road	82	73	87
2.	Link Road	80	64	87
3.	Cotton Green Station	90	60	96
4.	Wadala Flyover	87	60	100
5.	Chembur(Near Priyadarshini)	94	68	106

3.2.8. Marine Water Quality:

As a part of EIA study, a marine ecological survey was conducted at ten locations in and around the project site. The sampling locations are shown in Figure-3.5. The depth at various stations ranged from 3.6 to 12.4m. Light penetration ranged from 17 to 74m at various sampling locations. The physcio-chemical characteristics at various sampling locations are summarized in Tables-3.8 to 3.10.

TABLE-3.8

Physical characteristics of marine water in the study area

Parameters	Location	1	2	3	4	5	6	7	8	9	10
Temperature (C)	SW	28.4	28.4	28.5	28.3	28.2	28.3	28.3	28.3	28.5	28.4
	BW	28.2	28.1	28.2	28.3	28.0	28.0	28.2	27.9	28.2	28.4
pH	SW	8.0	8.0	8.3	8.0	8.0	8.0	8.0	8.0	8.0	8.0
	BW	8.2	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
Salinity(ppt)	SW	18.5	18.9	19.4	19.7	19.0	18.2	17.8	17.1	16.6	16.1
	BW	18.8	19.5	19.4	19.8	19.4	19.1	18.0	19.2	17.0	16.0
Electricity Conductivity (mS/cm)	SW	31.89	32.59	33.32	33.79	32.61	31.36	30.78	29.74	28.94	28.14
	BW	32.29	33.37	33.27	33.82	33.11	32.67	31.04	33.62	29.42	27.98
Dissolved Oxygen (mg/l)	SW	6.6	6.66	6.48	7.0	6.3	6.6	6.35	6.78	6.4	6.5
	BW	6.0	6.1	6.2	6.5	5.3	5.6	6.3	6.2	5.6	5.59
BOD (mg/l)	SW	2.3	2.45	2.5	2.5	2.6	2.3	2.45	2.47	2.2	2.6
	BW	2.5	2.11	2.9	2.6	2.0	2.86	2.0	2.1	2.45	2.36
TDS (mg/l)	SW	22400	24200	21600	24800	23700	22800	22120	22100	21410	20900
	BW	24100	24200	24100	24800	24500	24500	22900	24800	22065	20920
Oil and grease (mg/l)	SW	0.08	0.06	0.09	0.05	0.05	0.12	0.09	0.04	0.05	0.08
	BW	0.014	0.012	0.018	0.03	0.04	0.08	0.07	0.03	0.05	0.06

TABLE-3.9

Nutrients characteristics of marine water in the study area

Parameters	Locations	1	2	3	4	5	6	7	8	9	10
Calcium (mg/l)	SW	340	300	390	350	360	410	320	360	380	380
	BW	320	340	360	360	340	380	300	340	350	350
Magnesium (mg/l)	SW	710	680	650	640	640	620	580	640	690	670
	BW	690	700	660	600	630	620	600	610	650	640
Sodium (mg/l)	SW	6200	6100	5800	6100	6400	6210	6240	6180	6120	6200
	BW	6240	5920	5700	5900	6170	5840	6100	5940	5800	6000
Potassium (mg/l)	SW	270	250	250	280	260	260	250	260	260	260
	BW	300	250	250	250	260	250	250	250	280	300
Phosphates (mg/l)	SW	8.0	8.0	8.3	8.2	8.0	8.1	7.9	7.8	7.9	7.9
	BW	8.0	8.2	8.1	8.2	8.0	7.9	7.6	7.8	8.0	7.5

Nitrates (mg/l)	SW	8.9	8.6	8.6	8.5	8.8	8.8	8.6	8.9	8.8	8.0
	BW	8.3	8.6	8.1	8.0	8.1	8.3	8.0	9.3	9.0	9.2
Ammonical (mg/l)	SW	3.1	3.0	2.8	2.9	3.2	3.1	2.8	2.6	2.6	2.8
	BW	3.3	3.8	3.5	3.3	3.3	3.7	3.4	3.0	3.2	3.0
Sulphates (mg/l)	SW	1250	1280	1300	1240	1280	1260	1200	1210	1180	1160
	BW	1200	1200	1300	1340	1400	1350	1360	1300	1200	1280
Chlorides (mg/l)	SW	9250	9400	9620	9400	9420	9020	8840	8510	8280	8010
	BW	9320	9600	9600	9450	9610	9940	8970	9280	8450	7980

TABLE -3.10

Heavy metal content of water samples on the study area

Parameters		1	2	3	4	5	6	7	8	9	10
Zinc(ug/l)	SW	0.986	1.06	1.008	0.96	0.323	0.098	0.425	0.988	0.88	1.0
	BW	1.01	1.06	0.88	0.98	0.86	1.0	0.88	1.1	1102	1.11
Nickel(ug/l)	SW	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
	BW	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL	BDL
Cadmium (ug/l)	SW	0.001	0.01	0.002	0.001	BDL	BDL	0.001	0.008	BDL	BDL
	BW	0.001	0.002	0.01	0.01	BDL	0.001	0.001	0.008	BDL	0.002
Lead (ug/l)	SW	1.0	0.08	0.098	0.689	1.03	0.983	0.997	0.732	0.056	BDL
	BW	1.1	1.01	1.0	0.89	0.9	1.002	0.997	0.858	0.565	0.003
Mercury(ug /l)	SW	0.001	BDL	BDL	BDL	0.001	0.002	BDL	BDL	0.002	0.013
	BW	0.001	BDL	0.001	BDL	0.001	0.002	BDL	BDL	0.001	0.003

pH:

The marine water in the project area is slightly alkaline. The pH values in surface water samples ranged from 8.0 to 8.3 (Refer Table-3.8). The pH values in bottom water samples ranged from 8.0 to 8.2. The pH values did not show any spatial variations.

Total Dissolved Solids:

The TDS levels in the surface water samples varied from 20,920 mg/I to 24800 mg/I. In the bottom water samples TDS values varies from 20900 mg/I to 24850 mg/I. As evident from the Table-3.8, the TDS level bottom water samples are slightly higher in the bottom water samples. The lowest value was recorded at both levels at station 10 whereas highest value was recorded at station 4. Similar trend was observed in salinity values of surface water and bottom water samples.

Dissolved Oxygen (DO):

The details of DO level in the marine water at various stations are given in Table-3.8. DO level in the surface water at different stations ranged between 6.3 mg/I to 6.88 mg/I. The highest DO level (6.88 mg/I) was observed at Station 8. In the bottom water samples DO values ranged from 5.3 mg/I to 6.5 mg/I. In general, DO levels in coastal water ranges from 6 to 8 mg/I. The DO levels in the project are within similar concentration, indicating the absence of sources of pollution.

Oil and grease:

In spite of anchoring, loading and unloading activities taking place in the Indira Dock, the values of oil and grease recorded for surface and bottom water samples were quite low, indicating the absence of sources of pollution.

Nutrients:

The presence of nutrients is significant for the primary productivity in the area. The main source of these nutrients is the rivers out falling in through the runoff mainly from agricultural runoff. The rivers thus transport these nutrients in to the sea. The presence of these nutrients stimulates the biological productivity of the area. The nutrient levels in surface and bottom water samples in the study area was monitored during the survey conducted in monsoon season. The results are discussed in foregoing paragraphs.

Cations and Anions:

The various cations analysed as part of the study included calcium, magnesium, sodium, and potassium.

Likewise amongst the anions, nitrates, phosphates and chlorides were monitored and the results are summarized in the following paragraphs.

Calcium:

Calcium concentration in the surface samples ranged between 300 mg/I to 410 mg/I (refer to Table-3.9). Marginal variation was observed in the calcium concentration at different stations. In the bottom water samples calcium values ranged from 300 mg/I to 360 mg/I.

Magnesium:

Magnesium concentration in surface water samples ranged from 580 mg/I to 710 mg/I. whereas in bottom water samples of ranged from 600 mg/I to 700 mg/I. No variation was observed in highest and lowest values of magnesium in surface and bottom water samples. (Refer Table-3.9). The magnesium levels indicate the fresh water influx.

Sodium:

Sodium concentration in water samples ranged between 5800 mg/I and 6400 mg/I in surface water samples, whereas it ranged from 5700 to 6240 mg/I in the bottom water samples (Refer Table-3.9). The concentration of sodium thus was observed to be much lower than the average levels as observed in marine waters.

Potassium:

Potassium concentration at different locations in surface water samples ranged between 250 and 280 mg/I and 250 to 300 mg/I (Refer Table-3.9) in bottom water samples. The concentration of potassium was observed to be within the average potassium level (400mg/I) observed in marine water.

Phosphates:
In the water samples, the phosphate content varied from 7.9 to 8.3 ug/I in surface water samples and 3.0 to 3.7 ug/I in bottom water samples . (Refer Table-3.9). The phosphate levels were much lower than the average levels observed for marine water sample (0.5 to 0.8 mg/I) indicating the dilution due to fresh water influx.

Nitrates:
The nitrates are ranged 8.0 to 8.9 mg/I and 8.0 to 9.2 mg/I in surface and bottom water samples respectively. There is no variation recorded in the samples taken at both levels (Refer Table-3.9).

Ammonical Nitrogen:
The Ammonia-nitrogen water samples in the project area ranged between 2.6 to 3.2 ug/I in surface water samples and 3.0 to 3.7 ug/I in bottom water samples (Refer Table-3.9). Unpolluted coastal waters are generally devoid of ammonia-nitrogen. The presence of ammonia-nitrogen in water samples indicates the inputs of nitrogen from sewage.

Sulphates:
The concentration of sulphates ranged from 1160 mg/I 1280 mg/I in surface water and 1200 to 1400 mg/I in bottom water samples. Sulphates levels as observed in the study area are much lower than that observed in marine waters.

Heavy metals:
The concentration of heavy metals in surface and bottom water samples concentration of copper, zinc, cadmium, nickel, lead and mercury observed in the surface and sub-surface water samples is summarized in Table-3.10.
The investigation of the heavy metals, both in the water column and sediments, exhibited station-wise variations, giving fairly high concentration. However, the Zinc and Lead in both compartments were found to be higher compared to the other metals. The water samples collected from project area showed the values of 0.056 to 1.06 ug/I for Zinc in surface water and 0.86 ug/I to 1.1 ug/I in bottom water. The values of bottom water are slightly higher than the surface water. Zinc 0.001 to 0.002 ug/I for Cadmium 0.098 to 1.03 ug/I for Lead in surface water and 0.03 ug/I to 1.1 ug/I for bottom water and 0.01 to 0.013 ug/I for Mercury.
It must be mentioned that most of the heavy metals have shown negligible concentration or the concentration was below detectable limits. Nickel was below detectable limits in the samples collected.

3.2.9. Sediment characteristics:
Sediment samples were collected from same locations as that of water samples. The texture of the sediments in the area to be dredged was silty marine clay. The results are summarized in Table -3.11 to 3.13.

Grain Size Distribution:

The grain size distribution of the all the sediment samples were carried out. The results are summarized in Table-3.11. The proportion of sand , silt and clay in various sediment samples indicates that the texture is mainly clayey.

TABLE-3.11

Sieve size analysis of sediment samples.

Parameters	Stn 1	Stn 2	Stn 3	Stn 4	Stn 5	Stn 6	Stn 7	Stn 8	Stn 9	Stn 10
Sand (%)	10	9	10	8	10	10	10	12	15	20
Silt (%)	20	33.0	30.0	25.0	15.0	20.0	20.0	20.0	25.0	20
Clay (%)	70	58.0	60.0	67.0	75.0	68.0	70.0	68.0	60.0	60

Physio-chemical characteristics:

Physio-chemical characteristics of the sediments are sumaarised in Table-3.12.

TABLE-3.12

Physio-chemical characteristics of sediment samples

Parameters	Stn 1	Stn 2	Stn 3	Stn 4	Stn 5	Stn 6	Stn 7	Stn 8	Stn 9	Stn 10
pH	7.80	8.0	7.9	7.8	7.8	8.0	8.1	8.1	8.0	7.6
Chlorides(mg/g dry wt)	16.6	16.0	18.0	18.6	15.9	17.9	18.3	16.8	16.0	17.4
Phosphates (mg/g dry wt)	4.0	3.8	4.6	4.8	4.9	5.3	4.8	5.4	4.0	5.1
Nitrates (mg/g dry wt)	4.1	4.6	4.6	5.0	4.8	5.1	5.0	4.6	4.8	4.8
Sulphates (mg/g dry wt)	7.4	7.0	7.2	7.1	7.8	7.0	7.5	7.1	7.4	7.6
Sodium (mg/g dry wt)	8.8	8.1	7.4	7.2	7.2	6.9	8.0	8.1	8.2	8.0
Potassium (mg/g dry wt)	1.3	1.1	2.0	2.2	1.8	1.4	2.0	1.9	1.6	1.7
Total Kjeldal (mg/g dry wt)	2.0	1.6	1.8	1.3	1.8	1.6	1.6	1.8	0.9	1.1
Organic matter (mg/g dry wt)	231	223	214	208	212	203	214	224	243	221
Total volatile solids (mg/g dry wt)	32.0	33.0	31.0	36.8	38.5	42.8	44.8	44.2	44.6	48.2
Oil and grease(mg/g dry wt)	0.21	0.09	0.4	0.25	0.28	0.98	0.4	0.2	0.21	0.09

Heavy metals:

The heavy metals concentration recorded at all 10 (ten) sampling stations is in Table-3.13.

TABLE-3.13

Heavy metal contents of sediments from harbour wall berth areas

Sr no	Parameters	Stn 1	Stn 2	Stn 3	Stn 4	Stn 5	Stn 6	Stn 7	Stn 8	Stn 9	Stn 10
1.	Zinc (ug/g dry wt)	1.3	1.34	1.2	1.12	1.0	0.9	0.89	0.8	0.6	0.8
2.	Nickel (ug/g dry wt)	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
3.	Cadmium (ug/g dry wt)	0.2	0.09	0.3	0.6	0.09	0.1	0.2	0.14	0.13	0.13
4.	Copper (ug/g dry wt)	2.2	2.3	2.1	2.0	2.4	2.3	2.4	2.2	2.0	1.98
5.	Lead (ug/g dry wt)	1.1	1.2	1.09	1.3	0.31	1.0	0.98	1.0	0.8	1.0
6.	Mercury (ug/g dry wt)	0.001	0.002	0.001	0.001	0.021	0.003	ND	0.001	ND	ND

3.3 ECOLOGY:

Ecology is the science of inter-relationships of all organisms with their environment. The biotic environment is organized in to natural groupings with dependence among their members and show varied responses and sensitivities to external influences. Even if one link is broken, the whole system is disturbed. The developmental activities are one such external influence which might affect the ecology of an area, if proper management measures are not taken during construction and operation phases. The following paragraphs describe the terrestrial and aquatic ecology of the study area.

3.3.1 Terrestrial Ecology:

Major portion of the study area comes under water body i.e Arabian Sea. Land portion of the study area is partly industrial area. Since the site is in the Mumbai Port Trust area, therefore, there will not be any loss of forest or land with vegetable cover.

The project area is totally devoid of any forest at present. In the adjoining area too, no forest is observed. Within the Mumbai port area, no vegetation barring a few trees along the boundary walls of the structures and roads are observed. This is also reflected in the land use pattern as derived from satellite imagery data where forest area under vegetation was very less. However, patches of trees are observed in the

project area and its surroundings. These include Mango, Ain, Jambhal, Pipal, gulmohar, Wad, etc...

The list of major floral species observed in the project area and its surroundings is shown in Table-3.14.

TABLE-3.14

Major floral species reported in the project area and its surroundings

Scientific Name	Local Name
Trees	
Azadirachta indica	Kaduneem
Mangifera indica	Amba
Ficus religiosa	Pipal
Borassus flabellifer	Tad
Acacia arabica	Kanak Champa
Ficus hispida	Kharoti, Kala Umbar
Shrubs	
Anona squamosa	Sitaphal
Thespesia populnea	Ranbhendi
Zizyphus xylopyra	Ghout, Ghatbori
Zizyphus mauritiana	Bor
Lawsonia inermis	Mendi
Grasses	
Tridax spp	Dagadipala
Cynadon dactylon	Durva

3.3.2 Marine Ecology:

Biological parameters are very important in the aquatic eco-system since they determine the productivity of a water body. Primary productivity is an important indicator of pollution level in any aquatic ecosystem. Presence of fish is dependent on zooplankton productivity which in turn is dependent on the phytoplankton productivity or primary productivity. All these are related to physico-chemical characteristics of the water. Detailed marine ecological survey was conducted in the study area to understand the existing status of marine ecology in this area. The biological parameters like abundance and density of zooplanktons and phytoplanktons, chlorophyll, phaeophytin, primary productivity, abundance and density of benthic organisms are presented in the following sections.

Chlorophyll 'a' and Phaeophytin:

Chlorophyll 'a' is an indicator of algal biomass in any water body. The chlorophyll 'a' and phaeophytin content in marine water samples ranged from 0.9 to 1.2 mg/m 0.4 to 0.65 mg/m respectively. The values of chlorophyll 'a' and phaeophytin indicate that the area has moderate productivity.

TABLE-3.15

Primary productivity and pigment content of the area

Parameters	Stn 1	Stn 2	Stn 3	Stn 4	Stn 5	Stn 6	Stn 7	Stn 8	Stn 9	Stn 10
Gross primary productivity (mgC/m3d)	6.4	7.1	6.2	6.0	6.8	6.0	6.0	6.2	6.4	6.1
Net primary productivity (mgC/m3d)	4.6	5.8	4.7	4.4	5.6	4.8	4.6	5.1	5.4	5.0
Community respiration (mg/m)	1.8	1.3	1.5	1.6	1.2	1.2				1.1
Chlorophyll 'a' (mg/m)	1.1	0.9	1.1	1.2	1.0	1.0	0.95	1.1	1.2	1.1
Phaeophytin (mg/m)	0.61	0.58	0.6	0.74	0.65	0.45	0.61	0.4	0.4	0.5
Oxidisable particulate organic carbon (mg/m)	1835	1865	1792	1856	1954	1821	1539	1685	1755	1800

Primary Productivity:

Primary productivity is the rate at which new organic matter is added to the existing Phytoplankton standing crop. Primary productivity depends on the chlorophyll pigments, which absorbs the light and produces the energy through the process of photosynthesis. Therefore, the estimation of these pigments is important to ascertain the productivity of aquatic environment. The Gross Primary Productivity (GPP) and Net Primary Productivity (NPP) in the area ranged from 6.0 to 7.1 mg/C/m/day and 4.4 to 5.8 mg/C/m/ day respectively. The productivity levels indicate that the project area has moderate biological productivity.

Phytoplanktons:

Phytoplankton have long been used as indicators of water quality. Some species flourish in highly eutrophic waters while others are very sensitive to organic and/or chemical wastes. Phytoplanktons from the pastures of the sea. These organisms are autotrophic in nature. The growth and multiplication of phytoplanktons primarily depends on solar illumination, temperature and also on the availability of certain essential nutrients such as nitrates, phosphates, silicates, trace elements, etc. Phytoplanktons are suspended in the euphoric zone and they draft along with the ocean currents. They vary from place to place and from season to season and this variation is responsible for the organic production.

The productivity of phytoplanktons is directly responsible for the growth of zooplanktons in the water. Usually when phytoplanktons reach the maximum intensity of growth, zooplanktons start growing.

The productivity of phytoplanktons declines attaining maximum growth because of the depletion of nutrients and grazing by zooplanktons. Thus, in the inter-relationship or food chain of the phytoplanktons abundance is important as this is

the first step of any food chain or food web. The benthic organisms and fishes are also dependent on planktons for their food. A total of 15 phytoplankton groups were observed at various sampling locations. The abundance of phytoplanktons at various locations in the study area is given in Table-3.16.

TABLE-3.16

Abundance of major phytoplankton groups

Phytoplankton groupS	Stn 1	Stn 2	Stn 3	Stn 4	Stn 5	Stn 6	Stn 7	Stn 8	Stn 9	Stn 10
Anabaena	2	8	2	2	2	4	0	2	6	6
Asterionella	16	28	36	44	40	22	20	14	10	12
Bidlphia	8	8	12	0	12	0	8	14	22	20
Chaetoceros	4	12	8	8	8	12	10	0	8	12
Coscinodiscus	60	84	88	126	182	300	282	246	228	280
Euglena	4	12	8	0	0	12	4	0	23	22
Fragillaria	228	314	320	268	340	210	186	180	208	240
Navicula	8	12	16	12	22	14	10	8	2	8
Nitzchia	0	0	0	2	8	0	0	2	11	10
Oscilatoria	0	2	4	8	2	0	0	8	14	22
Peridinium	2	8	12	12	20	8	8	0	8	0
Pleurosigma	28	88	108	160	182	86	428	168	120	180
Rhizosolenia	14	0	8	24	22	0	24	8	4	12
Skeletonema	85	88	104	108	90	140	86	88	68	28
Thalassionema	2	8	4	0	0	6	12	16	34	33
Total density(No)	462	674	730	778	935	820	1078	76	775	885

It is observed from the Table-3.16, that the highest density of phytoplankton was recorded at Station-7 (1078 No/l) and lowest was recorded at Station-1 (462 No/l). The phytoplankton density indicated low primary of the area which can be attributed that the project is located in an operational Fragillaria was the dominant phytoplankton group most of the sampling stations. The other dominant group was coscinodism.

Zooplanktons:

Zooplanktons are microscopic free floating organisms which constitute an important link between primary producer and consumer of higher order in the aquatic food chain. Therefore, the population dynamics of zooplankton represent the physico-chemical and biological conditions of water. A total of 10 zooplankton group were recorded at various sampling locations. The abundance and density of zooplankton recorded during the survey conducted in July 2006 is given in Table-3.17.

TABLE-3.17

Abundance of major zooplankton group

Zooplankton groups	Stn 1	Stn 2	Stn 3	Stn 4	Stn 5	Stn 6	Stn 7	Stn 8	Stn 9	Stn 10
Cladocera	12	0	0	2	4	6	2	0	0	4
Copepoda	46	44	62	60	48	40	80	88	68	120
Decapoda	2	4	16	0	0	2	8	4	8	2
Fish eggs	2	0	1	1	1	0	2	0	0	0
Fish Larvae	2	2	4	8	2	6	12	16	14	8
Gastropod Larvae	44	80	60	44	28	63	22	28	26	32
Globigerina	0	8	0	0	8	12	12	0	0	2
Lamellibranchiata	8	12	18	28	26	22	20	8	14	13
Nauplius larvae	40	48	52	86	66	48	40	12	46	32
Polychaeta	1	0	0	0	2	1	0	2	2	0
Total density (No)	157	198	223	229	185	200	198	158	178	213

It is revealed from the Table-3.17 that the dominant species of zooplanktons in the study area were Copepoda and Gastropod larva. The highest density of zooplanktons was observed at station 4 (229 No) and density was observed at station 1 (157 No). Overall, the zooplankton density indicates low primary productivity of the area.

Benthic fauna:

Benthic fauna denotes the whole assemblage of organism dwelling at the bottom. They show marked diversity with depth and sediment properties. The benthic fauna cover both meio-fauna and macro fauna. The benthic fauna was studied at all the locations near the Indira Dock Wall berths. The meio-faunal and macro-faunal recorded at various sampling stations are given in Table-3.18 and 3.19 respectively.

TABLE-3.18

Abundance of meio-fauna

Meio-faunal groups	Stn 1	Stn 2	Stn 3	Stn 4	Stn 5	Stn 6	Stn 7	Stn 8	Stn 9	Stn 10
Archiannelida	0	0	1	2	2	4	6	4	12	10
Decapod larvae	8	16	10	18	26	22	24	54	62	66
Harpaticoidea	8	2	0	3	12	10	12	16	28	32
Nematoda	160	120	98	110	210	256	321	358	360	450
Oligochacta	18	8	4	4	86	88	120	196	250	298
Unidentified groups	6	12	14	8	18	6	28	22	18	16
Total density(No 10cm)	200	158	127	150	354	386	514	660	730	882

It is observed from Table-3.18 that the density was highest at station 10 (882 No cm) and it was lowest at station-1 (200 No cm). The density of Nematoda group was highest at various stations covered as a part of marine ecological survey. The other

groups observed were at various sampling stations were Decapod Larvae, Hapaticoidea, Oligochaeta, etc.

TABLE-3.19

Abundance of macro-fauna

Sr no	Macro-faunal groups (Nos cm)	Stn 1	Stn 2	Stn 3	Stn 4	Stn 5	Stn 6	Stn 7	Stn 8	Stn 9	Stn 10
1.	Amphipoda	8	4	0	2	18	22	20	8	8	12
2.	Bivalves	0	0	2	2	18	16	22	28	20	32
3.	Decapods	0	0	0	2	8	4	12	6	8	12
4.	Gastropoda	6	4	2	2	8	10	12	12	18	20
5.	Oilgochaeta	12	14	8	11	18	22	20	26	24	32
6.	Shrimps	0	0	0	1	3	4	8	6	2	0
	Total density	26	22	12	20	73	78	88	86	80	108

It is observed from Table-3.19, that about 6 groups of macro-fauna were recorded at ten locations covered as a part of the marine ecological survey in the study area. The highest density was recorded at station-10 (108 N cm) and lowest was recorded at station at station 3 (12 N cm). The density was higher at stations which are away from shore. The Oligarchies, Gastropoda and Bivalves were the dominant species.

Mangroves:

Mangroves are an inter-tidal, salt tolerant ecosystem. The ecosystem is dominated by the influence of water. Mangroves constitute a bridge between terrestrial and aquatic ecosystems. The flora and fauna are interdependent and would not survive in isolation, if any component is disturbed, thereby exhibiting its fragile nature. Therefore mangroves are highly productive ecosystems, and serve as an excellent reservoir of nutrients providing nursery and feeding grounds for a widowee array of organisms. Mangroves account for about 0.93% of total study area.

However, no mangroves are observed in the project area.

Based on the secondary information, the mangroves present in the study area as follows:

- Acanthius the
- Aegiceras carnculatum
- Avicennia marina
- Avicennia officianales
- Avicennia alba
- Rhizophora apiculata
- Rhizophora mucronata

Fisheries:

More than 50% of the study area of the proposed project comes under water bodies, which comprises mainly the Mumbai harbour region. Maharastra is the one of the major maritime states in India with a coastline of 720 km. There are five maritime districts viz. Thane, Greater Mumbai, Raigad, Ratnagiri and Sindhudurg from where

fishing vessels operate. The major fish landing of the state comprises Bombay duck, croakers, ribbon fish, cat fishes, carangids, mackerel, pomfrets, penaeid and non-penaeid prawns and cephalopods. During the peak fishing season, the operative gear from the Sassoon docks are mainly trawls, purse seiners, dol nets, and hooks and line. During the fishing season the trawlers undertake 4-5 days trips and each vessel lands around 3 to 4 tonnes of fish including 800 kg of head on shrimps. The major fish species reported in the study area are listed in Table-3.20.

TABLE-3.20

Common fishes reported in the study area

Name of species	Common name	Local name
Chiloscyllium griseum	Dogs fish	Baravla
Scoliodon palasorrah	Grey dog shark	Mori
Scoliodon sorrakosi	Yellow dog shark	Sonmushi
Scoliodon ceylonensis	Setna Shark	Mushi
Galeocredo arcticus	Tiger shark	Waqhbeer
Sphyrna blochii	Hammer-head shark	Kanar
Pristis cuspidatus	Saw fish	Hali
Dasyatis bleckeri	Whiptail stingray	Chamli
Narcine indica	Electric Ray	Zinzina
Megalops cyprinodes	Indian Tarpon	Chirai
Sardinella funbriata	White sardine	Pedwa
Hilsa ilisha	Indian Shad	Palla
Thrissocles malabaricus	Malabar anchoviella	Kati
Hamodon nehereus	Bombay duck	Bombil
Tachysurus sumatranus	Cat fish	Shingla
Muraenesox talabon	Common eel	Vam
Strongylura crocodilus	Fork-tail-gar-fish	Tol
Brenaceris atruoubbus	Kuttke eid	Khada
Therapon pula	Glass fish	Kachki
Therapon theraps	Large scaled perch	Dadadada
Atropus	Horsemackered	Katbanqada
Alectis Indicus	Thread fish	Bhagat
Lutianus argentimaculatus	Red snapper	Tamb
Sciaena russelli	Jew fish	Dhoma
Otolithoides brunneus	Dore	Koth
Monodactylus arggenteus	Silverangel fish	Chandluk
Trichiurus lepturus	Ribbon fish	Bala
Lepturacanthus savala	Ribbon fish	Wagti
Scomberromorus commerson	Seer Fish	Surmal
Pampus argenteus	Silver pomfret	Saranga
Pampus chinensis	Grey pomfret	Khalwad
Baleopthalmus dussumieri	Mud skipper	Nivti
Abalistis stellaris	Trigger fish	Nivti

However, within the project site, fisheries are not well developed as a result of continuous ship movement. As a result within the project area there are no fishing activities.

3.4. SOCIO-ECONOMIC ENVIRONMENT:

The project area comes under Greater Mumbai. The area belongs to South Mumbai district. This area is mainly urban area, and major portion is under the jurisdiction of Mumbai Port Trust. The demographic profile of the study area is given in Table-3.21.

TABLE-3.21

Demographic profile of the study area

Parameter	Value
Households	443946
Population	
▪ Total	2231631
▪ Male	1263478
▪ Female	968153
Scheduled Caste Population	109327
▪ Number	4.90
▪ Percentage to total population %	
Scheduled Tribe Population	
▪ Number	13927
▪ Percentage to total population %	0.62
Literates	
▪ Total	1760093
▪ Male	1043547
▪ Female	716546

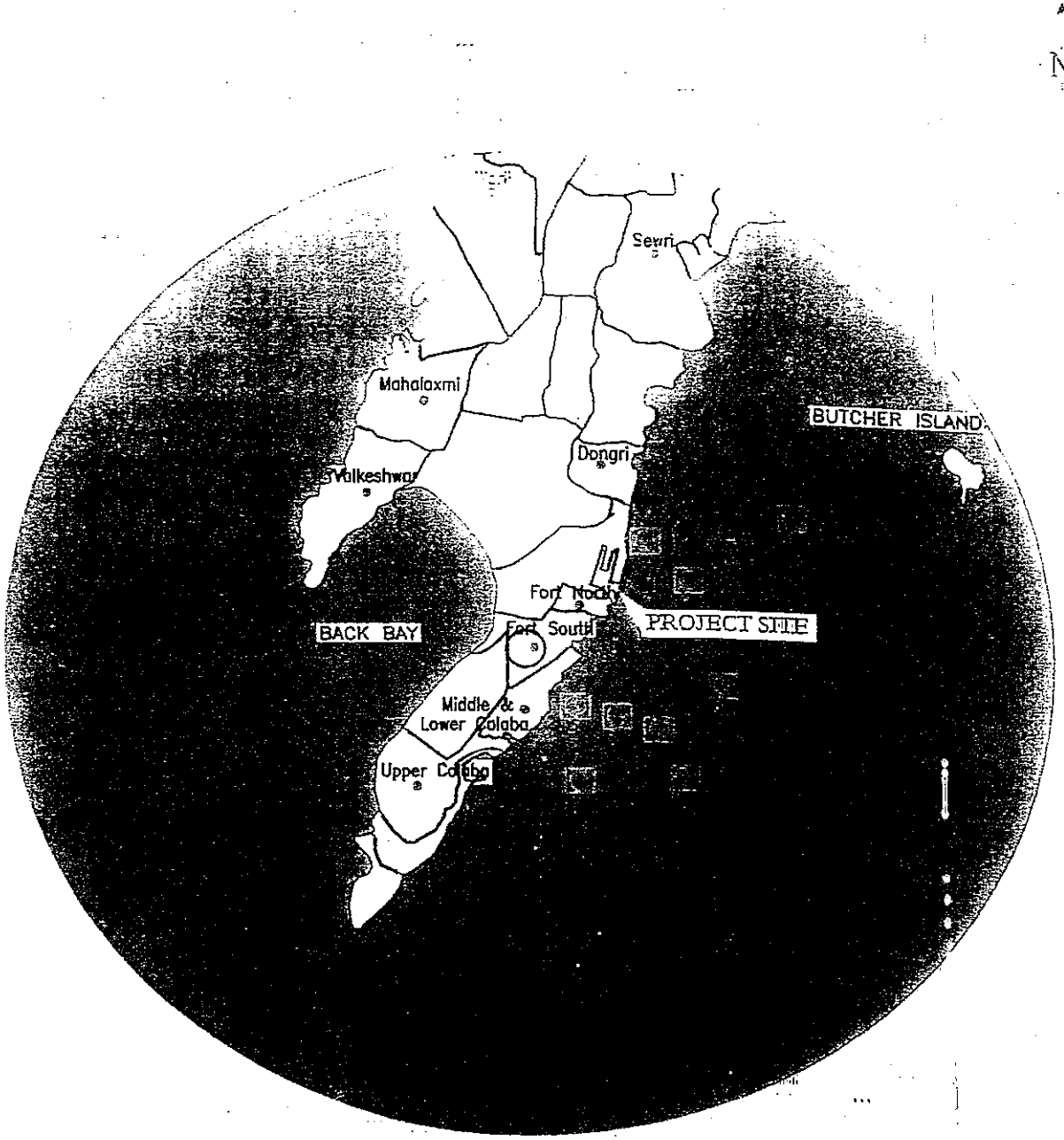
The total population of the study area is 2.23 million. The number of females per thousand males is 766. The percentage SC and ST population is 4.9% and 0.62% respectively. The overall literacy rate is 78.8 %. The male and female literacy rates are 82.6% and 74.0% respectively.

ABBREVIATIONS

MbPT	Mumbai Port Trust
CPCB	Central Pollution Control Board
MPCB	Maharashtra Pollution Control Board
MOEF	Ministry of Environment & Forest
EIA	Environment Impact Assessment
EMP	Environment Management Plan
E.P. ACT	Environment Protection Act
CRZ	Coastal Regulation Zone
REIA	Regional Environment Impact Assessment
IMD	Indian Meteorological Department
BOD	Biochemical Oxygen Demand
RSPM	Respirable Suspended Particulate Material
SPM	Suspended Particulate material
NOx	Nitrogen Oxide
H2S	Hydrogen Sulphide
NH3	Ammonia

Source: Standard methods for the examination pf water and wastewater (20th Edition)
(APHA) American Public Heath Association
(AWWA) American Water Works Association

Figure 3.1 Study Area of E.I.A.



LEGEND :-

STUDY AREA BOUNDRY

WATER BODY

MARINE WATER AND SEDIMENT SAMPLING LOCATIONS

SCALE

1 0 1 2 3 4 Km

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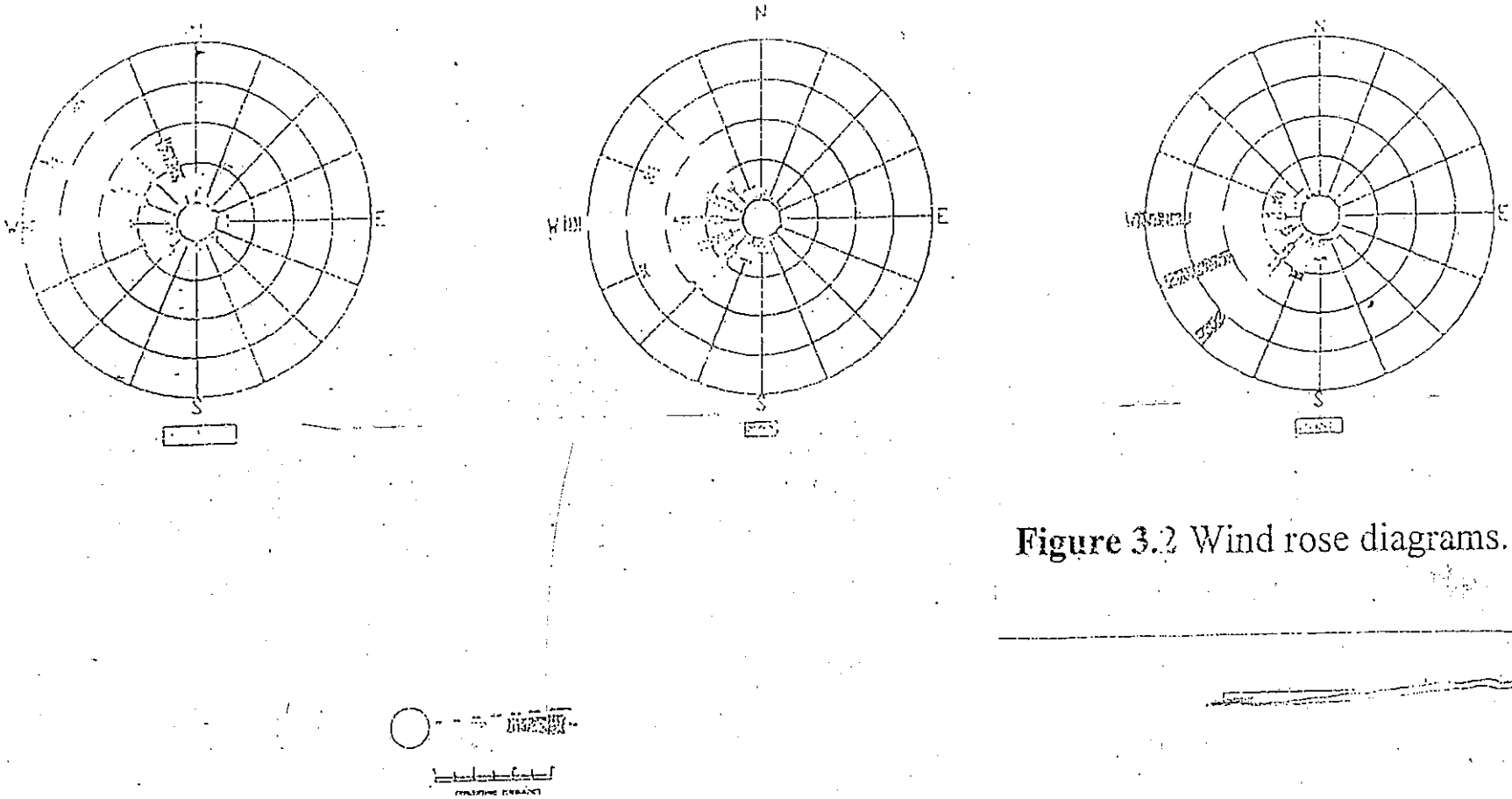
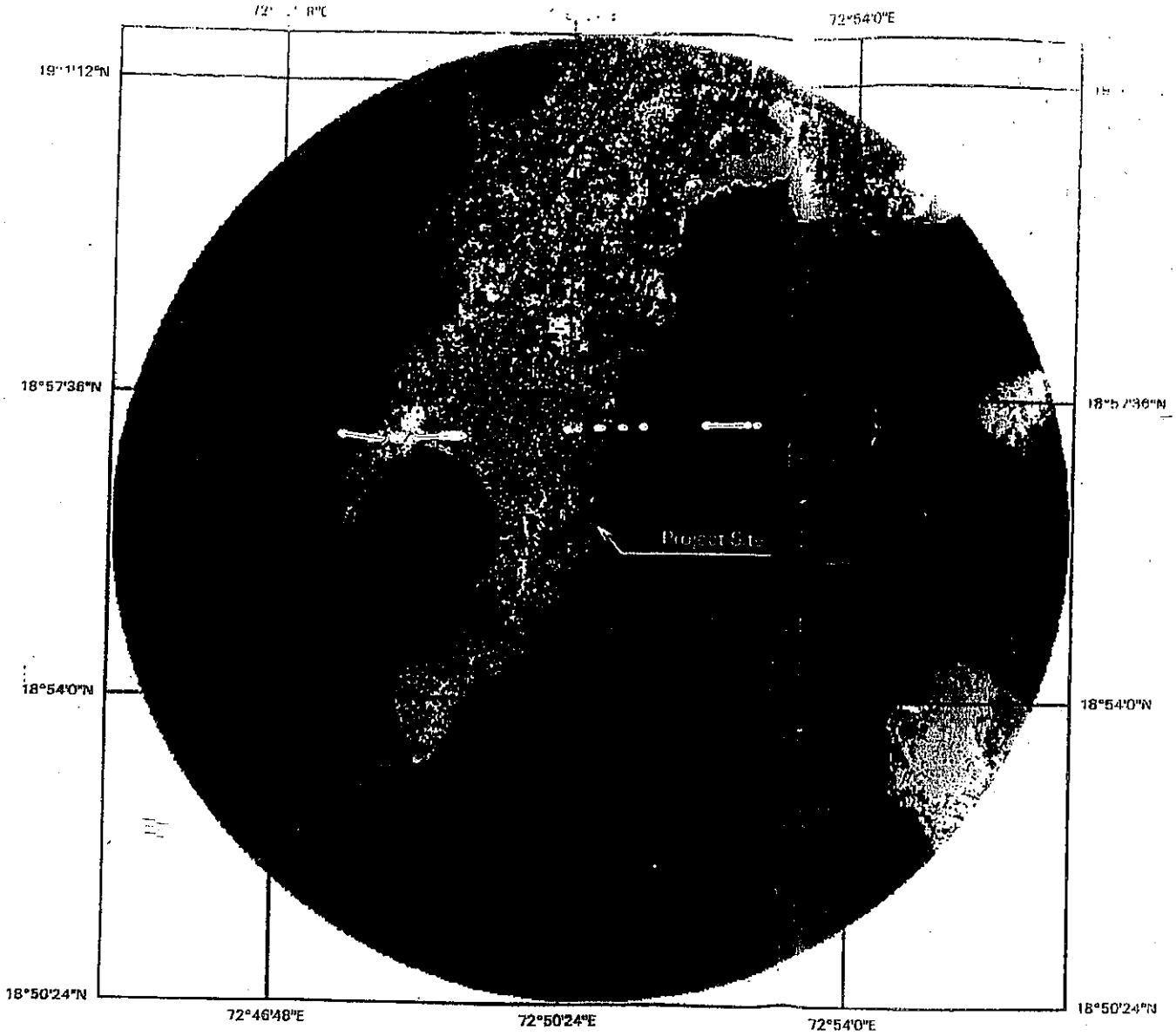


Figure 3.2 Wind rose diagrams.

Figure-3.2



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LANDUSE CLASSIFICATION OF THE STUDY AREA

Figure 3.4

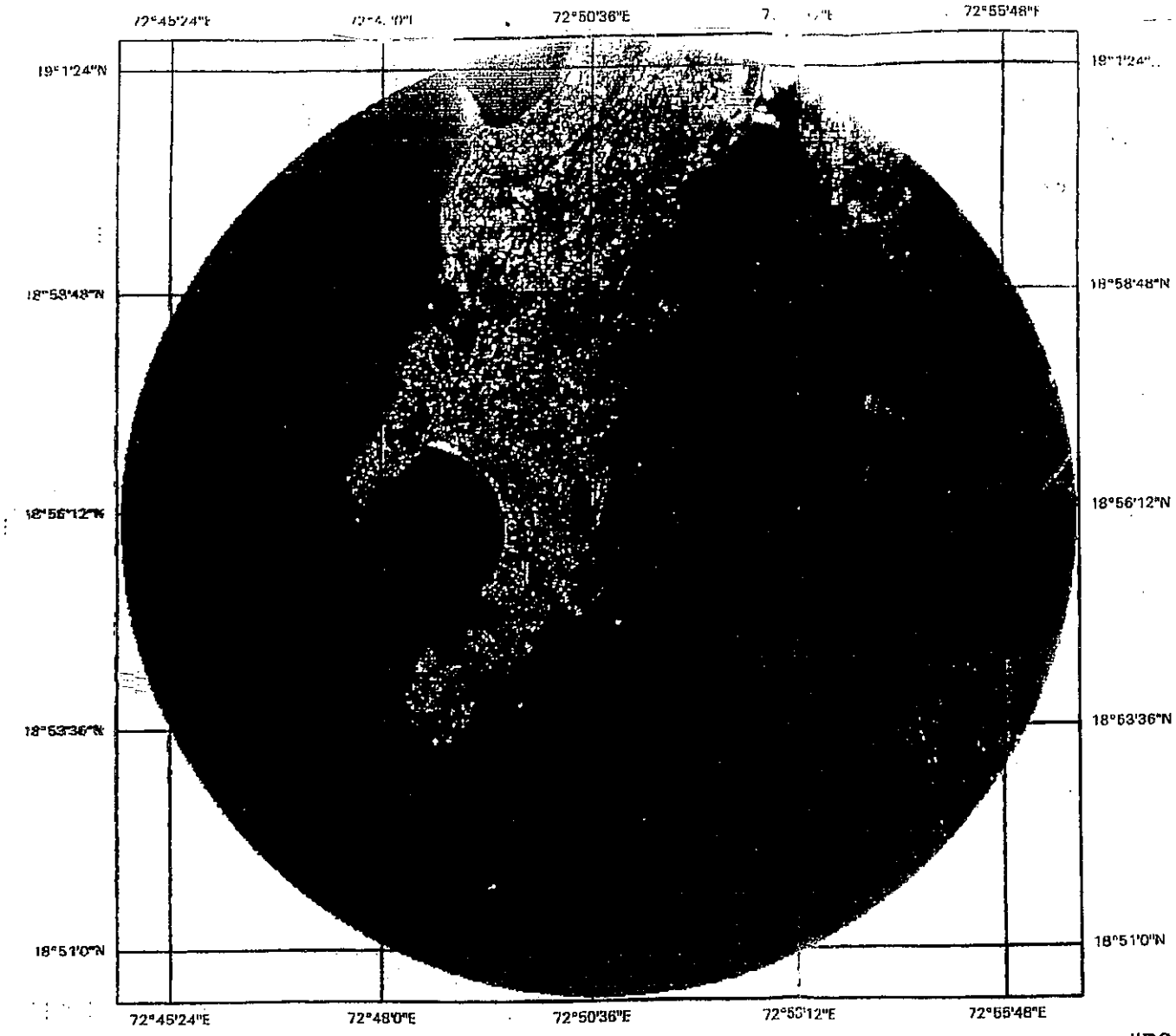

Figure 3.3

RAW SATELLITE IMAGERY
(IRS,P-6, LISS-III SENSOR) OF THE STUDY AREA

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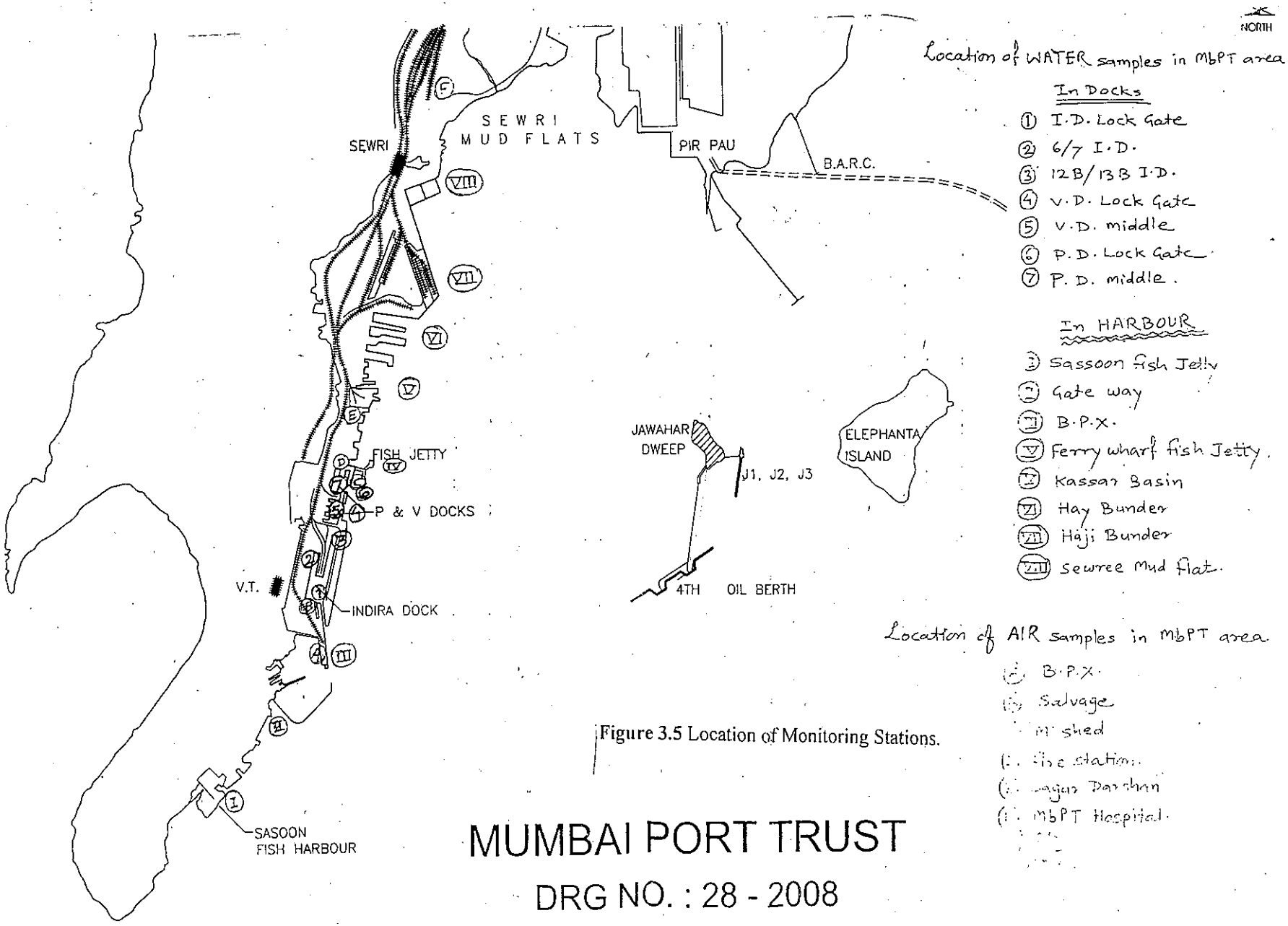

Location of WATER samples in MbPT area.

In Docks

1. I.D. Lock Gate
2. 6/7 I.D.
3. 12B/13B I.D.
4. V.D. Lock Gate
5. V.D. middle
6. P.D. Lock Gate
7. P.D. middle.

In HARBOUR

1. Sassoon fish Jetty
2. Gate way
3. B.P.X.
4. Ferry wharf fish Jetty.
5. Kassar Basin
6. Hay Bunder
7. Haji Bunder
8. Sewree Mud flat.

Location of AIR samples in MbPT area.

2. B.P.X.
3. Salvage
4. M shed
5. Fire station
6. Sagar Darshan
7. MbPT Hospital.

Figure 3.5 Location of Monitoring Stations.

MUMBAI PORT TRUST

DRG NO. : 28 - 2008

CHAPTER NO-4

PREDICTION OF IMPACTS

Chapter 4

PREDICTION OF IMPACTS

4.1 Estimation of impacts is called prediction. It gives an estimate of magnitude and special distribution of impact. Prediction can be quantitative and qualitative. Quantitative methods give an estimate of impact using mathematical expression computer models and or physical models.

Qualitative methods are based on professional judgment and are supported by examples of similar occurrences/ events in other locations/ projects or cited in literature.

Impacts are estimated for most probable case scenario and worst case scenario.

Most probable case scenario- It is characterized by combination of discharges/emission and hydro dynamic/ atmosphere interactions that produce most frequently encountered impact i.e. discharges of routine spillage during cargo transfers. Ship vehicular discharges, during normal climatologically conditions.
Worst case scenario: It is characterized by the combination of discharges/ emission and hydrodynamic/ atmosphere interaction that produce maximum adverse impacts .Examples- Accidental discharges from tanks, vessels, pipeline leakages, DG set emission with stable to strongly stable atmosphere. Phase wise Environmental Attributes to be considered are elaborated in Table 4.1.

TABLE- 4.1 Environmental Attributes

Parameter	Attribute
▪ Air	▪ Diffusion factor- atmosphere (wind speed and direction, temperature, temperature gradient, humidity, rainfall, frequency of inversion, stability) and topographic (hills, valleys, buildings) factors and climatology. Quality factors- Particulates, Sulphur oxides, Hydrocarbons, Oxides of Nitrogen Carbon monoxide.
▪ Noise	▪ Attenuation factors-atmospheric and topographic factors ▪ Noise levels
• Marine environment	▪ Diffusion factor-hydrodynamics (tides ranges, waves, current velocity) ▪ Marine soil characteristics ▪ Water quality factors-physical (pH, salinity, temperature, oil and grease, TSS, turbidity), chemical (DO/BOD, nutrients, heavy metals/toxic compounds), biological(faecal coliforms,)

	▪ Sediment quality (Benthos, toxicity, SOD, phytoplankton, Zooplankton)
▪ Land	▪ Soil characteristics, hydrology, land- use patterns, waste management practice, topography including geomorphology, coastal stability, archaelogical monuments etc..
▪ Ecology	▪ Natural vegetation including forest, endangered species, marine organisms including fisheries, ecologically sensitive species (eg. Mangroves, sea grass, corals etc.)
▪ Socio-Economics	▪ Regional economic stability,population statistics, per-capita consumption, standard of living, resettlement and rehabilitation issues, marine resources like fisheries etc.
▪ Resources	▪ Fuel resources, non-fuel resources, aesthetics, water supply etc..

4.2 Marine Water Environment:

The typical significant water environment impacts a port and harbour project are those of sediment transport and water quality. These are influenced by the oceanographic parameters like waves, tides, currents and bathymetry. The sediment transport issues are related to the physical alterations of the coastline such as a presence of breakwater, seawall or reclamation, the water quality issues are related to the pollutants generated from dredging activities, oil spills, wastewater discharges and runoff from land areas.

Sediment transport:

Waves arriving at an angle to a shoreline generate long shore currents parallel to the shore in the near shore zone. The current flows in this zone have the highest velocities and turbulence, transporting sand in suspension along the bottom surface. Long-shore currents for a stretch of coastline have certain capacity to carry sediment, depending on the long-shore current velocity, wave climate and sediment characteristics. When coastal structures obstruct this along-shore transport, it causes deposition behind the obstruction .As a result; the sediment in down drift side of the obstruction is considerably reduced. To fulfill the requirement of the sediment carrying capacity, the upstream shoreline supplies sediment, resulting in erosion. The impact of coastal structures on the shoreline can be simulated using physical models or mathematical models. Mathematical models require the long-shore current component, which is typically generated from wave radiation models. The long-shore sediment transport is calculated using the continuity equation for sediment volumes. The primary inputs for the computation are the wave climate, cross-shore profile, sediment properties and the coastline orientation.

Table 4.2.
Water Quality attributes to be considered one elaborated below:

Water quality attribute		Activities that require assessment
Physical	pH, salinity temperature, TSS, turbidity, oil and grease	pH, salinity, temperature etc.. need to be measured for waste discharge from labour camps, dredging dumping, breakwater construction, discharge of brine from desalination plants. Oil and grease need to be measured for petrochemical and petroleum handling operations, ship operations and pipeline transfer operations involving oil.
	Turbidity and TSS	Site clearing, quarrying, soil excavation, construction activities, waste discharge from labour camps, dredging, dumping breakwater construction, ship operations, trenching for pipelines
Chemical	DO/BOD, Nutrients	Waste discharge from labour camps and port buildings, dredging, dumping of dredged materials into sea,trenching and underwater blasting, ship operations, breakwater construction.
	Heavy metals and toxic compounds	Dredging, dumping of dredged materials into the sea, trenching and underwater blasting, cargo storage and handling operations, pipeline operations etc. ▪ However assessment of heavy metals is also characterized by the industrial discharges and geological features in the region
Biological	Faecal coliforms	Waste discharges from labour camps, port buildings and ships
	Phytoplankton, zooplankton, benthic organisms	Dredging, dumping of dredged materials into sea, trenching, underwater blasting, ship operations, breakwater construction, accidental spillage of cargo, discharge of brine from desalination plants etc..
	Species diversity	Introduction of non-indegenoius species during deballasting, thermal discharges, brine discharges
Groundwater quality	TSS/salinity, organic chemicals and heavy metals	Cargo handling/storage operations, dump sites, seepage

When a pollutant is discharged into a water body, the water quality in the surrounding area is a function of the currents, mixing, water chemistry and biological processes of the natural water body. The simplest method available for predicting concentrations is for a continuous discharge into a receiving water body will transport the pollutant downstream; spreading the waste by molecular and turbulent diffusion processes and for some pollutants, transforms the pollutant by chemical and biological processes.

The concentration of some pollutants such as pathogenic bacteria and BOD may be modeled by simple 'first order' decay equations, where the mass of the pollutant decreases with time. Dredge spoils may also be simulated using the first-order equations when the grain size is fairly uniform.

Behaviour of trace metals and organic chemicals are more complex to predict, requiring sediment concentrations in water to estimate the partitioning of the pollutant in its dissolved and particulate phases.
Dissolved Oxygen is an important water quality and ecosystem health indicator. DO models include many complex ecosystem components such as nutrient uptake, algal photosynthesis, primary productivity, benthic processes, etc. Oil spill models use the advection-dispersion model base and include processes such as volatilization, settling of tars and wind dispersion. Temperature models for thermal discharges have modules to define the heat exchange with the atmosphere, which is a function of evaporation, solar radiation and convective losses.

4.3 Air Environment:

In a port and harbour project, the typical air quality problems arise due to emissions from DG sets, ships, transportation of raw materials, vehicular traffic, leakage during cargo handling and quarrying, construction activities, evaporation of oil spilled on water etc..
Particulate emissions from soil excavation, site clearing, and quarrying, dry cargo storage/transfers are area sources. Even evaporation from oil spills on water from an area source.

Table 4.3
Air Quality attribute have been elaborated below:

Air quality attribute	Activities that require assessment
TSPM, RSPM	Site clearing, soil excavation, construction activities, transportation of raw material, captive power generation, dry cargo handling, port based industry etc.
CO, NOx, SO2	Vehicular traffic, emissions from construction equipment, ship operations, and captive power generation
Hydrocarbons	Handling of petrochemicals, captive power generation, diesel operated construction equipment and vehicular traffic
Hazardous toxicants	Spillage or leakage of hazardous cargo. ▪ The type of toxicants to be measured is characterized by the cargo proposed to be handled.

4.4 Noise Environment:

In a port and harbour project, the typical noise problems arise from DG sets, ships, transportation of raw materials, vehicular traffic, site clearing, soil excavation, quarrying, dredging, pile driving, and construction activities.

Sound or noise is a disturbance, which propagates away from the source through an elastic medium, namely air, water or solids, until it reaches a receiver. Models to predict noise estimate the noise level (dB) at the receiver's location and are a function of the characteristics of the sound source (power, intensity and frequency spectra), the properties of the transmission medium and the presence of objects or barriers.
The prediction of noise should address the type of source, type of environmental conditions at the site and the receptors.

Type of source:

Impulsive or sudden: e.g. Blasting for quarrying/soil excavation

Intermittent- unstead y: e.g. vehicular traffic

Continuous- steady noise: e.g. pile driving, dredging, dredging, DG sets

Types of environment or attenuating factors:
Atmospheric conditions like humidity, wind direction, wind speed, trees, vegetation, barriers such as walls form the attenuating factor. For example site clearing can remove trees/vegetation and hence reduce attenuation. Green belt development can result in greater attenuation.

Type of receptors:
nsensitive, sensitive zones. For example hospitals, bird sanctuaries, aquatic species are sensitive noise receptors while industrial, commercial areas are insensitive.

4.5 Biological Environment:
Ship operations, dredging, pile driving, breakwater construction, underwater blasting , pipeline trenching, disposal of wastes from labour camps, brine discharge from desalination plants, oil spills, hazardous cargo spills are some of the activities of a port that have an impact on the aquatic biology.

The most common method of prediction is the qualitative approach by an expert. Prediction is based on baseline ecology, knowledge of the plant and animal life and their habitat requirements. By utilizing the changes predicted for air, noise, water and land environment, an estimate of the ability of the biological community to tolerate the changes can be assessed. This is best performed when the data on the biological environment is available for different tropics levels. Tools to assist the expert in the prediction of impacts are:
Statistical estimates of bio-diversity such as the Shannon-Weiver Diversity Index of species richness indices from the rarefaction method or Jack-Knife estimates. These

statistical estimates should be compared with other values for similar environments only.

4.6 Land Environment:

Land Environment attributes to be considered as in Table 4.4.

TABLE-4.4 Land attributes

Land attribute	Activities that require assessment
Land-use patterns and Geomorphologic features	Site clearing, quarrying, labour camps, land reclamation, and induced development(major industries in the area)
Topography	Site clearing, quarrying, activities generating noise, hazardous cargo handling operations, and pipeline operations
	Site clearing, quarrying, storage of cargo, and pipeline operations.
Ground water hydrology	Water supply for construction activities, water supply for labour camps, land reclamation, and storage of dry and wet cargo.

A port and harbour project usually involves acquisition of significant areas of land and also attracts industries leading to rapid growth of the region. In this perspective the most significant elements of land have been broadly classified into the following.

Soil Erosion: Site clearing, soil excavation, quarrying, and construction wastes lead to soil erosion. Methods like Universal Soil Loss Equation (USLE) are useful to make estimations of soil erosion.

Soil Permeability: Land disposal of effluents and solid waste/hazardous wastes may lead to ground leaching. The permeability characteristic is essential to design the lining of the soil for disposal of wastes.

Land-use patterns: Induced development, land reclamation, resettlement etc lead to changes in land use patterns in and around the project site. Evaluation or interpretation of whether a proposed use of certain parcels of land conforms or conflicts with the existing or proposed land use plans needs to be done in order to assess landuse compatibility.

Hydrology: Groundwater may be a source of water for labour camps and construction activities. Alternative sources for water must be identified to protect against depletion of resource and saltwater intrusion. Land-use pattern may significantly increase the surface runoff and reduce the groundwater recharge. Leaching of pollutants into the groundwater can also be of serious concern.

4.7. Socio-Economic Environment:

Acquisitions of land, resettlement/rehabilitation, loss of commercial fishing grounds, restriction on fishing activities, infrastructure requirements, induced

development etc. are activities that affect the socio-economic environment . Predicting socio-economic impacts can best be done by means of scientifically planned surveys with questionnaires to the public. This survey can help quantifying many of the likely responses of the community to the project .It is possible to make estimates on the changes to the socio-economic environment with a detailed description of the project. The starting point for these estimates is human population and economic models. Population forecasts can involve simple forecasts of historical trends to complex cohort analysis. Econometric models relate the population and economic characteristics of the study areas with interrelationships of the change of economics and population. Table 4.5 gives a list of social and economic impacts that require prediction (as applicable to the project)

TABLE-4.5
Socio-economic attributes

Socioeconomic attributes	Activities that require assessment
Regional economic stability	Existing infrastructure Cargo handling operations that result in employment and induced development
Population statistics	Quarrying operations, hazardous cargo handling operations to study population
Per-capita consumption of valuable attributes	Labour camps, requirements during operational phase of the project, induced development etc
Standard of living	Beneficial aspects of the project in terms of increased employment opportunities, water supply and sanitation, power supply, medical facilities, educational institutions, recreational facilities.
Resettlement and rehabilitation	Land acquisition

Prediction for Socio-Economic Impacts
Social impacts Economic impacts
Resettlement of coastal population and loss of fishing rounds livelihood
New jobs created from the project
Increased risk of accidents to adjacent
General growth in commercial and industrial neighbourhood activity in the area
Increase in traffic flow and congestion
Potential loss of taxable property due to around the project location acquisition of private lands
Disruption in area due to construction activities
Increased cost for public services such as police and fire protection
Increase in population/transient population change in adjacent property values
Area increased energy consumption of port facilities
Health and life style impairment because of noise
Increase in local sales tax revenues and other
Effects tourist oriented revenues

Increased housing requirements.

4.8 Significance of impacts:

Determination of significance of impacts is to check whether the impacts are acceptable, require mitigation or unacceptable to the community. Significance of impact is determined by the consideration of the impact characteristic and the importance (value) attached to them. Impact characteristic Impact importance Significance. The predicted impacts need to be superimposed on the existing background concentrations and compared with standards. There may, however, be no appropriate technical standard for a social or a visual impact and resources that require sustainability. Significance in such cases must be derived from community preferences and can be discovered through public involvement or other special methods.(E.g. Delphi techniques).

4.9 Evaluation of Total Environmental Impact

The identified environmental impacts earlier in the chapter have been to the different components of the environment. All these impacts need to be aggregated to get a total score of the environmental impact of the proposed developmental activity. Such aggregation, it may be noted, may involve considerable subjectivity. However, with logical and rationalized procedure it is possible to reduce the subjectivity. In the following chapter, procedure of "modified matrix" is followed as it is simple and most reliable.

The modified matrix method involves following steps:

I) Identifying cause and effect relationship between activities and environmental components (Table 4.8).

II) Assigning degree of importance (rank) to each environment component, and normalizing ranks (4.9).

III) Distributing total Environmental Impact Units (EIU) to component to estimate Maximum Component Environmental Impact Units (MCEIU) by multiplying normalized rank with maximum EIUs as 1000 (Table 4.9)

IV) Deciding scale for Environmental Impact Index (Table 4.6 & 4.7)

V) Assigning Activity Importance Units (AIU) to each environmental component considering total importance of all activities on that component as 1.

VI) Assigning Environmental Impact Index (EII) to each project activity based on adverse/ beneficial nature of impact and magnitude of impact, assuming that project proponent does not desire to implement any environmental management plan. (Table 4.10)

VII) Estimating Environmental Impacts Units (EIU) for each project activity by multiplying AIU, EII, and MCEIU.

VIII) Adding parameter EIU to estimate total EIU. (Table 4.10).

Based on evaluation of impacts it is estimated that if Mbpt

Operates without any pollution control measures total environmental impact score will be reduced.

TABLE-4.6

(A) Environmental Impact Index (EII) for Adverse Environmental Impacts

Impact Magnitude	EII
No change	0.0
Insignificantly Adverse	-0.1
Slightly Adverse	-0.2
Moderately Adverse	-0.3
Significantly Adverse	-0.6
Highly Adverse	-1.0

TABLE-4.7

(A) Environmental Impact Index for Beneficial Environmental Impact

Impact Magnitude	EII
No change	0.00
Insignificantly Beneficial	0.1
Slightly Beneficial	0.2
Moderately Beneficial	0.3
Significantly Beneficial	0.6
Highly Beneficial	1.0

TABLE-4.8

List of Project Activities and Impacts

SR NO	PROJECT ACTIVITY	MARINE ENVIR-ONMENT	AIR QULA-LITY	WATER QUALITY	NOISE ENVIRON MENT	HEALTH	PUBLIC AMENITIES	ECO DEVELOPMENT	SOIL QUALITY	FLORA AND FAUNA
1	Wet docks Dry docks jetties loading, unloading ,pipeline storages	x	x	x	x	x		x	x	x
2	Disposal of effluents (ships, colonies, Amenities ,brine solution cooling water	x		x			x		x	x
3	Disposal ofsolid		x	x		x	x		x	x

	waste (Domestic ,hospital and commercial									
4	Transportation rail, road, transportationin port area		x		x	x		x		x
5	Support Activities DG Sets Storages(dry dock, wet dock) Light house Road and railways Recreation hall, Library, hospital, schools.		x		x	x		x	x	x

TABLE-4.9

Determination of Parameter Importance Values

Sr no	Impact Component	Degree of Importance-Rank					Total	Weighing	Maximum Component impact(units)
		1	2	3	4	5			
1.	Economic Environment				x		4	0.1538462	154
2.	Marine water Environment				x		4	0.1538462	154
3.	Noise Environment	x					1	0.0384615	39
4.	Public Amenities		x				2	0.0769231	77
5.	Water Environment			x			3	0.1153846	115
6.	Soil Environment			x			3	0.1153846	115
7.	Health			x			3	0.1153846	115

8.	Air environment				x		4	0.1538462	154
9.	Flora and Fauna		x				2	0.0769231	77
							26		1000

TABLE-4.10

Sr no	Environmental Component	Project Activity	Activity Importance Units(AIU)	Envisaged Impact without EMP	Environmental impact index EII without EMP	Weighted EII without EMP	MCEIU	EIU without EMP
1.	Marine Environment	▪ Sediment Transportation	0.3	Moderately Adverse	-0.3	-0.09		
		▪ Oceanography Parameter	0.2	Slightly Adverse	-0.2	-0.04		
		▪ Oil spills	0.5					
		▪ Dredging		Highly Adverse	-1.00	-0.50		
		▪ Waste water discharge from land and sea				-0.63	154	-92.4
			1.0					
2.	Air Quality	▪ DG sets, Boilers, thermos	0.2	Significantly Adverse	-0.6	-0.12		
		▪ Pipelines, storages	0.3		-0.2	-0.06		
		▪ Roads and railways vehicular traffic	0.3	Slightly Adverse	-0.3	-0.09		
		▪ Construction Activity	0.2	Moderately Adverse	-0.2	-0.04		
			1.0			-0.31	154	-47.74
				Slightly Adverse				
3.	Water Quality	▪ Domestic Effluents	0.3	Slightly Adverse	-0.2	-0.06		
		▪ Commercial Effluents, brine solution, cooling waters	0.4	Moderately Adverse	-0.3	-0.12		
		▪ Oil spills	0.3	Moderately Adverse	-0.3	-0.09		
		▪ Solid waste activities	1.0			-0.27	115	-31.05

4.	Noise Environment	▪ Rail and Road transport ▪ Lodging, unloading ▪ Support Activity dredging ▪ Construction dredging	0.4 0.2 0.3 0.1 1.00	Significantly Adverse Slightly Adverse Moderately Adverse Slightly Adverse	-0.6 -0.2 -0.3 -0.2	-0.24 -0.04 -0.09 -0.02 -0.39	39	-15.21
5.	Health	▪ Changes in biophysical environment ▪ Accident, Fire disaster ▪ Secondary Effect on air, noise and water pollution	-0.2 0.4 0.4 1.00	Slightly Adverse Significantly Adverse Significantly Adverse	-0.2 -0.6 -0.6	-0.04 -0.24 -0.24 -0.52	115	-60.03
6.	Public Ameniti es	▪ Public transport ▪ Muncipal solid waste ▪ Power, water supply required	0.2 0.3 0.5	Moderately Adverse Moderately Adverse Moderately Adverse	-0.3 -0.3 -0.3	-0.06 -0.09 -0.15 -0.30	77	-23.1
7.	Economic Activity	▪ Increase in sales tax, excise custom duty ▪ Employment opportunities ▪ Transport and raw material and products ▪ Health and life impairment	0.3 0.3 0.2 0.2 1.00		1 1 1 -0.2	0.3 0.3 0.2 -0.04 0.76	154	117.04

8.	Soil Environment	▪ Air emission ▪ Liquid waste disposal ▪ Solid waste disposal ▪ Hazardous waste disposal	0.2 0.3 0.4 0.1 1.00	Slightly Adverse Slightly Adverse Slightly Adverse Slightly Adverse	-0.2 -0.2 -0.2 -0.2	-0.04 -0.06 -0.08 -0.02 -0.20	115	-23.60
9.	Flora and Fauna	▪ Air emission ▪ Liquid waste disposal ▪ Solid waste disposal ▪ Hazardous waste disposal	0.1 0.3 0.4 0.2	Slightly Adverse Slightly Adverse Slightly Adverse Slightly Adverse	0.2 -0.2 -0.2 -0.2	-0.02 -0.06 -0.08 -0.04 -0.20	77	-15.04
							Total	-190.89

Total units (-190.89)

CHAPTER NO-5

ENVIRONMENT MANAGEMENT PLAN

Chapter 5

ENVIRONMENT MANAGEMENT PLAN

5.0

An EMP is an implementation plan to mitigate and offset the adverse environmental impacts of the project and to protect and where possible, enhance the environment. Based on the potential impacts identified, it sets out in detail, the process of implementing mitigation and compensatory measures, the timing of these measures and indicative costs. EMP should be viewed as a legal commitment on heart of the proponent to minimize environmental impacts.

Ports that successfully integrate full consideration of environmental resources, including mitigation of unavoidable adverse impacts, into the planning and construction of port development projects stand to benefit from:

Reduced uncertainty with respect to approval of projects.
Reduced permit delays and associated costs.
Increased public support for port development projects.
Reduced operational and insurance costs.
In many instances, it has been found that successful implementation of EMP has resulted in reduction in project costs in the long run. This is because the EMP contains.
Proposals for optimum usage of available resources.
Plans to address minor faults at the initial stage (spills, leakage etc can be minimized using components like safety valves, pressure relief valves) is aster management plans to respond to accidents.
Countermeasures and measures and recovery plans for spills
Since communities rely on the marine resources for their livelihood, it becomes absolutely necessary to maintain a clean and usable waterfront. Environmental management is essential for sustainable use of the coastal ecosystem to preserve its rich diversity.

5.1 Environmental Management Process:

The environmental management process consists of
Defining an environmental policy
Developing plans for environmental management
Implementation of the EMP
Monitoring the EMP and incorporating corrective action
Review of the policy, EMP and improvement
Environmental auditing and lifecycle assessments may also be incorporated as an integral component of the EMP.

5.2 Environment policy:

Mumbai Port Trust has already decided on this issue of the environment policy is included in management strategy laid down under ISO 9000. It reads as "We at Mumbai Port Trust are committed to provide customer friendly reliable and cost efficient services by meeting environmental norms, through the teamwork of total employees involvement by training and effective review system."

The ideal Environmental policy suggested by MOEF for ports is as follows:

Environmental policy (An example)

To develop projects, in a manner that provides for sustainable use of the marine ecosystem and design infrastructure in such a way as to minimize their environmental impacts.

To minimize significant adverse environmental impacts through the preparation and implementation of comprehensive environmental management plans

To develop indicators of environmental performance by the authority concerned, and include statistics on these indicators in annual reports to government.

To run maintenance operations in ways that adhere to environmental regulations, prevent pollution and reduce EMP waste, recover and recycle materials wherever possible.

5.3 Inputs for developing EMP

I. Significant environmental impacts that have been identified.

II. Regulatory Requirements

III. Implementation of Environmental Policy

For Implementation following steps are involved in EMP

Step 1: Develop an organizational structure for EMP implementation as per developing plans and proposals to mitigate impacts and maintain Environmental policy.

Step 2: Assign Responsibilities for implementation

Step 3: Define timing for implementation

Step 4: Define Monitoring responsibilitie

5.4 Compliance of laws

For Evolving EMP, Mumbai Port Trust has to comply following legal responsibilities.

Table 5.1:

List of Regulatory Requirements Identified for Compliance by Mbpt

Sr no	Name of act/rule/order	Activity	Frequency
1.	The Water (Prevention and Control of pollution) Act - 194 and rules there under.	To obtain Consent to operate by using Form No. 'C'	As per form C
		To monitor the Effluent treatment plant to meet consent to operate condition and discharge and effluent	Daily
2.	The Air (Prevention and	To maintain and monitor the	Monthly

	Control of Pollution) Act - 1981 and rules thereunder	pollution control equipment's so as to meet following parameters as per consent to operate Stipulated parameters for monitoring of emission discharge to Air from each Chimney	
3.	The Water (Prevention and Control of Pollution) Cess Act -1977 and rules there under.	Furnishing of Cess Returns	Monthly
		Paying Cesss as per assessment order	As and when assessment order is received
4.	The Environment (Protection) Act -1986 and Amendment rules 2000.	Every financial year annual Environmental statement report is to be submitted to MPCB, before 15th of sept and commiance of CRZ rules	Every year
5.	The Hazardous Wastes (Management and Handling) Rules -1989. Amendment in Jan 2000.	To obtain authorization from MPCB for handling and disposal of Hazardous wastes.	As per form C
6.	Manufacture, Storage and Import of Hazardous Chemicals 1989 and amendment in 2000.	To identify the hazardous chemicals, which can cause major accidents. To procure MSDS for identified Hazardous chemicals and to take safety precautions. To prepare the emergency plans and keep it up to date.	Continuous
		To carry out safety Audit through competent person once in a year.	Once in a year
7.	Public Liability Insurance Act -1991, Rules there under	To obtain public liability insurance policy	Once in a year
		To test safety valves of pressure vessels and vaporizers	Once in a year
8.	The Petroleum Act-1934 and rules there under	To ensure that the vessels should be painted and maintained in good conditions.	Continuous and at the time of installations and monitoring there after.
		To ensure that the storage vessel pipelines are efficiently earthern and effectively	Continuous and at the time of installations

		bonded.	and monitoring there after.
9.	Central Motor Vehicle Act-1988 and rules there under.	To verify and set 'CO' emission at Idiling RPM as per Bas Table And CMVR 115 (B) (C).	100% Vehicle
		Compliance of emission norms from motor vehicles of Transport Dept/Vehicles owned by MbPT	As and when required
10.	The Gas Cylinder rules -1981	To obtain license whenever applicable	As and when required
		To renew license whenever applicable	As and when required
11.	The Prevention of food adulteration act-1954 and rules there under	To obtain the consent to run the Canteen	As per defined frequency
12.	Battery (Management and Handling) rules , 2001	To ensure that used lead acid batteries and disposed of only with the dealers inexchange for new batteries, or sold to registered recyclers	As and when it is required
13.	Noise Pollution Regulation and control rules, 2000	To ensure that ambient noise levels in the factory premises are maintained below the prescribed limits.	Monthly
14.	Solvent (Acquisition, Storage and use of automobile) Order 2000	To obtain license to store petrol, kerosene,diesel,CNG,LPG and all varieties of thinners or there equivalent products from state Government or district magistrate or any other officer authorized by central and state government.	As defined in license
15.	Bio-Medical waste(Management and Handling rules 1998	Disposal of all waste to be carried out.	As and when required
16.	Chemical Accidents(Emergency Planning and preparedness)Rules 1996	To identify and comply for storage of hazardous chemicals as per provision under the rules.	As and when required
17.	Noise limit of electricity generator sets run with diesel (under Environment Protection Act)	To comply with the Environment (Protection) second Amendment Rules,2002, Sub section 94	As and when required
18.	Municipal Solid Waste Management Rules 2000	To comply requirements of household solid waste	As and when required
19.	Emission Limit for electricity generator sets run with	To comply with the Environment (Protection)	Once in every two years.

	diesel (Under Evvironment (Protection) second Amendment Rules, 2002)	second Amendment Rules, 2002, Sub section 95	

Ports are also required to comply international convention and Indian Port Act.
International Treaties: Shipping is an international activity and hence national specifications and regulation relating to loading and safety at sea are largely based on international agreements and conventions. International regulations relevant to port and harbours are given herein. India is a signatory to these International agreements/conventions.

a. Shipping

International Maritime Dangerous Goods Code (IMDG- code)
The IMDG code relates to methods of safe transport of dangerous cargoes and related activities. It sets out procedures for documentation, storage, segregation, packing, marking and labeling of dangerous goods.
International Convention for the Prevention of Pollution from ships.
The main objectives of this convention are to prevent the pollution of the marine environment by the operational discharges of oil and other harmful substances and the minimization of the accidental discharges of such substances
United Nations Convention on the law of the sea (UNCLOS), 1982.
The main objective is the obligation to prevent pollution damage by addressing particular sources of pollution, including those from land based activities, seabed activities, dumping, vessels and from or through the atmosphere.

b. Others

The Convention requires states to designate at least one wetland site on the basis of ecology, botany, zoology, limnology or hydrology and requires the conservation of all wetland by establishing nature reserves. There is also a requirement that any loss of a wetland should be compensated for by creation of new habitat. For details, the reader is advised to refer to "Wetlands, biodiversity and Ramsar convention-The role of convention on wetland in the conservation and wise use of bio-diversity", edited by A.J.Hails, Ramsar convention Bureau, MoEF, 1996(1997).

5.5 Mitigative Measures to reduce Impacts:

i. Marine Environment -Sediment transport are influenced by oceanographic features damaging coast line and deposition of sand. This can be minimized by providing structures according to mathematical models to determine the long shore currents having adequate sediment carrying capacity.
Dynamic regime of the port area with compatible oceanographic parameters does not pose any serious problem.
Disposal of maintenance dredge spoil will be undertaken according to modeling simulations so that the impact on sediment quality is minimal.
Disposal of capital dredge spoil will be carried out in accordance with the dredged disposal scheme planned according to modeling simulation so that impact is minimized.

According to Marpol 1973/78 release of oily waste directly to marine environment by ships is prohibited. Ships generally accumulate the garbage and incentive it in ship itself. The sewage generated is also treated disposed off.
The major quantity of liquid waste that would be generated during in normal day to day operations at the site included domestic effluents, berth washing run off during monsoon etc. these wastes have potential to pollute marine water if disposed in untreated way.
This has been taken care by effective drainage system connected to Municipal services and by effectively implementing Marpol 1973/78.

Fisheries

Impact on fisheries

The impact on fisheries may be either due to physical impact of suspended solids or due to changes caused in the food chain. As the fishes are capable of free movement in water, they avoid areas with higher turbidity. They return to the area once the turbidity reduces after the cessation of construction activities. The excess amount of sediments entrained as a result of placement of construction material in water column results in fish suffocation as gill chambers become coated or clogged with material. Many researchers have concluded that extremely turbid that is formed briefly during construction phase can be detrimental to fish, but the impacts are not very alarming. Test organisms exposed at 50.100 and 400m from these sites showed no unusual mortalities. Hence, no major impact on fisheries is anticipated. In any case the project is part of an existing port area, where fisheries are not well developed and not allowed within the vicinity of the port area. Thus, no impacts on fisheries are anticipated.

ii.Air Environment

There are point sources & Area sources which contribute air pollution.

1. Emission from ship, DG sets; pinhole leakage from pipe line is point sources.
2. Emission from vehicular traffic during peak hours is line sources.
3. Particulate emission from soil excavation, site clearing, quarrying, dry cargo, storage transfer sources are area sources. Even evaporation from oil spills on water form an area source.

Mitigate measures

1. For D.G sets adequate stack height for dispersion and clean fuel can reduce the impacts use of low nox burners are recommended.
2. Vehicles shall confirm Central motor vehicle rules to achieve. The emission standards road surfaces should be of high quality coupled with better traffic management shall be planned. Burning of waste in open will be prohibited. Leak detection system will be introduced to identify pinhole leakages.
3. Particulate emissions can be controlled by adopting ,
   - Cordoning the area of excavation of construction
   - By spraying water in the area
   - Controlled blasting
   - Use of hydraulic drills for excavation
   - Use of protect structural members

iii. Water Environment

Measures regarding the mitigate measures to protect marine water has been covered in marine environment as site (i) above

iv. Terrestrial waters

To ensure that the terrestrial groundwater or surface water bodies are not impacted by the operations.

The operations will ensure that there will be no impact on surface on groundwater quality in the region due to disposal of untreated waste. The run-offs from stack yard will be disposed off, to avoid the impact on terrestrial water quality. The sewage from ships will be treated within the ships, in the absence of such facilities (e.g. in older vessels, barges), the sewage will be brought to treatment plant on land. Therefore it is not likely that there would be any risks of contamination of surface or groundwater as a result of the effluent or waste discharge

From the ships when within the port area. Oily wastes from the ships will also not affect any surface or groundwater as ships will not be allowed to release any oily bilge waste or ballast water within port limits. Regular monitoring of water quality will be carried out at the port site and in nearby surface bodies to keep track of adverse environmental changes.

V. Noise Environment :

Mitigation Measures for the Proposed Impacts on Ambient Noise Quality Construction Phase

Considering the impact scenario on ambient noise levels due to operation of transport vehicles and construction equipments, some of the mitigation measures proposed for noise environment protection during the construction phase are the following:

- Noise from DG set shall be controlled by providing acoustic enclosure to DG sets area. The enclosure shall be designed for minimum 25db (A) insertion loss. The performance of acoustic enclosure shall be checked by measuring noise levels in different direction at 0.5 m from the enclosure.
- Each item of powered machinery used on site will be properly maintained and serviced so as to prevent unnecessary noise emissions. All items to plant operating on site in intermittent use will be shut down in the intervening periods between uses.
- Any item of equipment found to be emitting excessive noise levels due to a faulty silencer, broken or ill-fitting engine covers or other reasons, will immediately be taken out of service and be adequately serviced, repaired or replaced.

Operations phase:

The design of the port will be such that the sound pressure level in the work area will not exceed 85 dB(A). Restricted areas will be those locations where it is not reasonably practicable to reduce the noise level below the work area limit. Wherever

practicable, attempts shall be made to reduce the noise level below 90 dB (A). The noise levels will not exceed 60 dB (A) at the perimeter of the port area. The equipment will be chosen in such a way that the above noise limit should not be exceeded. The post-project noise levels at the nearest habitation will be less than the stipulated standards of MPCB. However, as a good operational procedure the following generic measures will be implemented:

- Similar measures as proposed in the construction phase for DG sets and other noise making machinery, to ensure practicably low noise levels within the work environment. The major areas of concern for noise generation will be adequately addressed by considering it during procurement of machinery from vendors, project implementation stage. Further feedback from the monitored noise levels at sensitive locations will be taken to ensure that the impact due to high noise levels is practically minimized.
- Monitor job and location specific levels for compliance with HSE regulations by verifying acceptability of noise levels caused by the project activities and comparison with noise criteria.
- Conduct periodic audiometric tests for employees working close to high noise levels, such as the loading and unloading sections
- Provision of PPE's will be done and their proper usage will be ensured for eardrum protection of the workers as well as visitors.

Vi. Health Environment:

The movement of heavy equipment will be done will proper precaution to prevent any accidents on the road. Occupational risk would be minimized at the port site through safety measures.

Safety training will be provided to all construction workers on operation of equipment.

All workers will be given medical examination prior to recruitment. The contractor shall also be vigilant to detect worker showing symptoms of communicable diseases. All illness and incidents will be reported and recorded.

If mitigative measures suggest to protect Marine, Terrestrial and marine waters Air quality and noise levels are adopted there will be minimum impact on workers.

Prediction of health impacts have been elaborated in Table 5.2

TABLE-5.2 HEALTH IMPACTS

Parameters Affected	Cause (Primary attribute)	Effect	Type of Impact
Human health Vegetation Materials Risk to humans	Air attributes Particulate matter sulphur oxides Hydrocarbons Nitrogen oxides Lead carbon monoxide Photo-chemical	▪ Increased mortality and morbidity in exposed population ▪ Aggravates bronchitis, respiratory diseases, emphysema, cardiovascular diseases, eye irritation	Long-term

	oxidants	▪ Chronic plant injury, excessive leaf dropping, reduced productivity in plants and trees ▪ Soil clothes and structures ▪ Deter ioration, corrosion of stee and other metal structures ▪ Visibility problems, increased accidents	
Human Health	Noise Attributes Physiological effects Physiological effects Communicating effects	▪ Increased tension and fatigue ▪ Increased pulse and respiration rates ▪ Dizziness and loss of balance ▪ Anger, irritation and nervousness ▪ Partial hair loss ▪ Sleep loss ▪ Degradation/effect on structures ▪ Detrimental effects on worker performance	Long-term
Health Aquatic life Aesthetics Socio-economics	Water Attributes Water quantity Suspended solids BOD DO Oil Dissolved solids Nutrients Faecal coli form	▪ Coating of free oil on algae and plankton causing destruction ▪ Interference with re-aeration and photosynthesis ▪ Water soluble fractions of oil likely to cause direct toxic action ▪ Destruction of benthic organisms ▪ Direct deleterious effect on fish due to coating on gills and blanketing bottom	Long-term

		organisms by suspended solids ▪ Interference with fish spawning areas and loss of fish production ▪ Reduced recreational and economic benefits	

vii. Public Amenities:

Mumbai Port Trust has got very large area required for port functions and associated large residential complex spread over in different plots.

The port authorities have already provided several welfare activities such as library, dispensary, hospital, community hall, schools and have also promoted sports complex, entertainment and shopping facilities, canteen, restaurants etc..

These facilities keep the workers, officers and their families free from associated complex issues.

Public amenities also include school, buses for workers, sport competitions, gathering, educational rewards for eligible children of staff have been also arranged by post Authority on the whole public amenities are adequate. The land acquisition problem does not exist. There are almost no issues of compensation.

Viii. Socio-Economic Environment

As most of the new development will be within the existing port area, the developmental project will not have any visible impact on the population in the surrounding area and also there is no issue of compensation with regards to land acquisition. Opportunities like supply of material may however develop in the adjoining area along with associated services like transportation, construction, workers etc...

The development will also restrict encroachments on the coastline of the port area. Construction activities in the port area to some extent affect the fisheries and compensation for damages with respect to fish catch will have to be watched and a mechanism in this respect will be required.

Ports definitely increase the employment opportunities in all cadres and classes of workers and thus will have multiplied effect in enhancement of associated activities like housing, shopping, educational etc. Thus the port is highly positive effect on the economic environment.

The port has been established long back and has not only developed its are but also contributed in developing the adjoining properties in a positive direction and helped human beings by promoting commercial activities.

Mumbai port site regime is compactable to port activities coupled with rapid progress in commercial and economic activity brought Mumbai to the status of economic capital of the country. Table 5.3 states the prediction of socio-economic impact.

Dr. D.R. Rasal

TABLE-5.3

Prediction for Socio-economic Impacts

Social impacts	Economic impacts
▪ Resettlement of coastal population and loss of livelihood ▪ Increased risk of accidents to adjacent neighbourhood ▪ Increase in traffic flow and congestion at and around the project location ▪ Disruption in area due to construction activities ▪ Increase in population/transient population in area ▪ Health and lifestyle impairment because of noise effects ▪ Increased housing requirements	▪ Loss of fishing grounds ▪ New jobs created from the project ▪ General growth in commercial and industrial activity in area ▪ Potential loss of taxable property due to acquisition of private lands ▪ Increased cost for public services such as police and fire protection ▪ Change in adjacent property values ▪ Increased energy consumption of port facilities ▪ Increase in local sales tax revenues and other tourist oriented revenues

ix. Soil Environment :

It is generally atleast due to dumping of construction debris, disposal of untreated waste effluents, solid waste generated during commercial and domestic activities. This has been controlled by laying down the procedure under various provisions of laws. Water Act 74, municipal solid waste management rules, hazardous water management rules, Marpol etc....

Construction debris is disposed off on sites which are approved by Municipal authorities. Solid waste generated is segregated at source in wet and dry waste and is disposed off on to the site approved by Municipal Corporation. The polythene bags are also effectively collected and are disposed off by sending these to recyclers which are approved by state pollution control boards.

Hazardous waste generated in liquid, semi liquid solid form is collected and stored, labeled and disposed off by the approved agency. The effluents are treated in sewage treatment plant or by septic tank followed by filters and these are disposed off on land for gardening or other compliance of MPCB standards laid down by MPCB.

Operation of port activity is in intertidal and subtidal zone and hence no major impacts are anticipated on soil.

For domestic waste it is necessarily required segregation of waste at source into biodredgrable and nonbiogradable waste and then requires to be handed over to the transport operator so that recycling can be done of wastes which\h are metallic, glass paper, cartridges etc... Monitoring committees will have to be established in zones to promote this activity. Even 5tpd plant demonstrated by BARC can generate

	oxidants	▪ Chronic plant injury, excessive leaf dropping, reduced productivity in plants and trees ▪ Soil clothes and structures ▪ Deter ioration, corrosion of stee and other metal structures ▪ Visibility problems, increased accidents	
Human Health	Noise Attributes Physiological effects Physiological effects Communicating effects	▪ Increased tension and fatigue ▪ Increased pulse and respiration rates ▪ Dizziness and loss of balance ▪ Anger, irritation and nervousness ▪ Partial hair loss ▪ Sleep loss ▪ Degradation/effect on structures ▪ Detrimental effects on worker performance	Long-term
Health Aquatic life Aesthetics Socio-economics	Water Attributes Water quantity Suspended solids BOD DO Oil Dissolved solids Nutrients Faecal coli form	▪ Coating of free oil on algae and plankton causing destruction ▪ Interference with re-aeration and photosynthesis ▪ Water soluble fractions of oil likely to cause direct toxic action ▪ Destruction of benthic organisms ▪ Direct deleterious effect on fish due to coating on gills and blanketing bottom	Long-term

biogas as well as electricity as per requirement. This issue can be planned effectively at successfully achieving segregation targets.

X. Flora and Fauna Environment

The port area has little vegetation or habitat for terrestrial organism. There is no forest land in the vicinity. Apart from few trees dense vegetation is not observed. The area has significant activities in the form of port operations residential quarters offices, traffic movement by rail or road etc... Normally in such settings large scale faunal population is not observed. Thus it can be concluded that port site is unlikely causing major adverse impact on terrestrial flora and fauna.

CONCLUSION

If above mentioned mitigate measures are taken the impact on environment has been worked out on the basis of matrix and it comes out to be -7.1% which was earlier -19.08%.

TABLE-5.4

r no	Environmental Component	Project Activity	Activity Importance Units (AIU)	Environmental Impact with EMP	Environmental impact index (EII)with EMP	Weighted EII with EMP	MCEIU	EIU w EMP
1.	Marine Environment	• Sediment Transportation	0.3	Slightly Adverse	-0.2	-0.06		
		▪ Oceanography Parameter	0.2	Slightly Adverse	-0.2	-0.04		
		▪ Oil spills	0.5					
		▪ Dredging			-0.3	-0.15		
		▪ Waste water discharge from land and sea	1.00	Moderately Adverse		-0.25	154	-38.5
2.	Air Quality	▪ DG sets, Boilers, thermos	0.2	Moderately Adverse	-0.3	-0.06		
		▪ Pipelines, storages	0.3		-0.2	-0.06		
		▪ Roads and railways vehicular traffic	0.3	Slightly Adverse	-0.2	-0.06		
				Slightly Adverse	-0.1	-0.02		
		▪ Construction Activity	0.2	Insignificantly Adverse		-0.20	154	-30.8
			1.00					

3.	Water Quality	▪ Domestic Effluents ▪ Commercial Effluents, brine solution, cooling waters ▪ Oil spills ▪ Solid waste activities	0.3 0.4 0.3 1.00	Insignificantly Adverse Slightly Adverse Moderately Adverse	-0.1 -0.2 -0.3	-0.03 -0.08 -0.09 -0.20	115	-23
4.	Noise Environment	▪ Rail and Road transport ▪ Lodging, unloading ▪ Support Activity dredging ▪ Construction dredging	-0.4 -0.2 0.3 0.1 1.00	Moderately Adverse Insignificantly Adverse Slightly Adverse Insignificantly Adverse	-0.3 -0.1 -0.2 -0.1	-0.12 -0.02 -0.06 -0.01 -0.21	39	-8.19
5.	Health	▪ Changes in biophysical environment ▪ Accident, Fire disaster ▪ Secondary Effect on air, noise and water pollution	0.2 0.4 0.4 1.00	Slightly Adverse Moderately Adverse Moderately Adverse	-0.2 -0.3 -0.3	-0.04 -0.12 -0.12 -0.28	115	-32.2
6.	Public Amenities	▪ Public transport ▪ Municipal solid waste ▪ Power, water supply required	0.2 0.3 0.5 1.00	Slightly Adverse Moderately Adverse Moderately Adverse	-0.2 -0.3 -0.3	-0.04 -0.09 -0.15 -0.28	77	-21.56

7.	Economic Activity	▪ Increase in sales tax, excise custom duty ▪ Employment opportunities ▪ Transport and raw material and products ▪ Health and life impairment	0.3 0.3 0.2 0.2 1.00		1 1 1 -0.2	0.3 0.3 0.2 0.04 0.76	154	117.04
8.	Soil Environment	▪ Air emission ▪ Liquid waste disposal ▪ Solid waste disposal ▪ Hazardous waste disposal	0.2 0.3 0.4 0.1 1.00	Insignificantly Adverse Slightly Adverse Slightly Adverse Slightly Adverse	-0.1 -0.2 -0.2 -0.2	-0.02 -0.06 -0.08 -0.02 -0.18	115	-20.7
9.	Flora and Fauna	▪ Air emission ▪ Liquid waste disposal ▪ Solid waste disposal ▪ Hazardous waste disposal	0.1 0.3 0.4 0.2 1.00	Insignificantly Adverse Slightly Adverse Slightly Adverse Insignificantly Adverse	0.1 -0.2 -0.2 -0.1	-0.01 -0.06 -0.08 -0.02 -0.17	77	-13.09
							Total	-71

Total -7.1%

CHAPTER NO-6

OIL SPILL RESPONSE CONTINGENCY PLAN

CHAPTER – 6

OIL SPILL RESPONSE CONTINGENCY PLAN

Introduction & policies

6.1 General Introduction

Statistics show that over 80% of marine oil spills worldwide occur within a port or harbour area. It has been recognized that despite the rigid enforcement of good working practices, oil spills can and do occur. In the year 1996 the Directorate of Operations, Coast Guard under the Ministry of Defense, Government of India, issued a notice of promulgation of the National Oil Spill Disaster Contingency Plan (NOS-DCP) for implementation and co-ordination of oil spill response activities in the event of an oil spill at sea. As per the NOS-DCP the Ministry of Shipping, the Department of Ocean Development, the Ministry of Petroleum and Natural Gas, all oil companies, Port authorities, and maritime states have been made stakeholders in the Plan. Each of them can act independently or in co-ordination with the Coast Guard in any oil spill response scenario in the maritime zones of India.

NOS-DCP has identified the local Port Authority (i.e. the Major Port Trust) as one of the participating as well as a resource agency. Accordingly it has delineated the duties and responsibilities to the Major Ports for monitoring, controlling, and combating marine pollution caused by spillage of oil into the sea, within the respective port limits. The Ports shall have the capability to provide first response to an oil spill in their areas of jurisdiction. The capabilities required should include the minimum requirements of trained manpower and equipment as indicated by NOS-DCP.

NOS-DCP has also identified Bharat Petroleum Corporation Limited (BPCL) as a nodal agency to co-ordinate and assist the oil spill response activities on the West Coast of India on behalf of all Oil Companies.

Mumbai Port Trust Oil Spill Contingency Plan (hereinafter referred to as the Plan) has been prepared in accordance with the NOS-DCP guidelines for Ports and Harbours, issued by the Director General, Indian Coast Guard (hereinafter referred to as the DGCG) Pollution, Preparedness, Response and Co-operation (OPRC), 1990, and are responsible for applying the NOS-DCP to all Ports, Harbours and Oil Refineries in India. The Plan has been approved by the DGCG, as the competent National Authority, verifying that it is in compliance with the requirements of the OPRC Regulations.

6.2 Purpose of Plan

(a) To guide port personnel through the process of managing a spill originating from operations within the port

(b) To mitigate the consequences of an oil pollution incidents within the port

(c) To allow those involved in the response to a pollution incident to rapidly disseminate information to the parties involved and to ensure the optimum deployment of available equipment.

6.3 Use of the Manual

The Plan is specifically for operations within the Mumbai Port limits and is designed to initiate an appropriate oil spill response in the event of an incident. Specifically, it details a tiered response strategy that is in accordance with NOS-DCP requirements and takes into account the spill risk associated with the operation, the nature of the hydrocarbons that could be spilt, and the prevailing meteorological and hydrographic conditions that might be experienced. In accordance with the Right to Information Act, copies of the plan can be made available to the public on request.

6.4 Scope of the Plan

6.4.1 Area of Jurisdiction

The Plan relates to the Mumbai Port water limits only. The plan shows the location of Mumbai Harbour and area of jurisdiction of Mumbai Port (Figure No.1.1)

6.4.2 Chemical spill incidents are outside the scope of this manual. In event of such an incident, information about the substance would be obtained from the concerned Port User. This in order to determine a preliminary course of action in dealing with the incident whilst awaiting the attendance of external specialists, engaged by the shippers.

6.5 Liaison with Other Authorities

The following organizations were consulted as part of the planning process, during the compilation of this manual.

- Indian Coast Guard
- National Institute of Oceanography, (NIO), Goa.
- Bharat Petroleum Corporation Limited, (BPCL)

Following formal approval of this Plan by the CG, updates to it will be considered as a result of periodic review and regular exercises. Should any proposals for change be considered necessary, the consultation process with the above bodies will continue to apply before any such changes are implemented.

6.6 Identification of the Roles and Responsibilities of Parties Associated with the plan

Within India, as per NOS-DCP there is an adopted structure and procedure for response to marine oil spills, which clearly defines the roles and responsibilities of Industry, the Government of India (including Environmental Agencies) and Maritime Authorities. The competent national authority designed to oversee all matters pertaining to Oil Spills is the DGCG. In the event of an oil spill incident

whining the Port limits, the MbPT's Deputy Conservator will be responsible for the overall co-ordination of the spill response.

6.7 Categories of Incident

The Port has in place a tiered incident response system for oil spillages. This system closely follows an internationally agreed format and classifies the magnitude of a spill to determine the appropriate level of response. It is recognized that using the amount of oil spilt to designate the "Tier Level" of an incident is an approximate methodology only as the quantity of oil on the water is difficult to assess. However, in order to quantify oil thickness, the following can be used as a guide

Appearance	Thickness
Silver Sheen	0.0001 mm
Rainbow Sheen	0.003 mm
Light Brown/ Black slick	0.1 mm
Dark Brown/ Black slick	> 1 mm

To determine an approximate quantity of spilled oil, the following formula should be used:

$$\text{L (meters)} \times \text{W (meters)} \times \frac{\text{Thickness (mm)}}{1000} = \text{Cubic Meters}$$

Probably no two incidents will be the same. However, the tiered responses set out in the plan can be adapted to suit the specific situation. The definition of the tiered levels used in the Port is as follows:

Tier	Quantity of Oil spill(in Tonnes)	Response
Tier- 1	< 700	A small operational spill when events can be controlled by the resources available with MbPT.
Tier- 2	700 to 10,000	A medium size spill that would require assistance of Coast guard and other resource agencies. National Contingency Plan to be implemented.
Tier- 3	> 10,000	A large sized spill that would require to be dealt with using the assistance of Coast Guard, outside contractors and outside international agencies. National contingency Plan to be implemented.

6.8 Disposal of waste & Recovered Materials

Waste disposal is governed by the relevant sections of the following Acts/ Regulations:

- The Environmental (Protection) Act, 1986,
- The Hazardous Waste (Management & Handling) Rules, 1989.

The MbPT considers that disposal of oily waste after an incident is an integral part of any spill clean-up process. As a consequence, the Port recognize that it has a duty of care to ensure that the waste is contained, handled, transported and ultimately disposed of in an appropriate manner.

The options for waste disposal or treatment of materials, be it oily solids, are:

- Temporarily store, clean, stabilize, and then recover or re-use.
- Temporarily store and then take to an appropriate disposal site for burial.
- Send it to a refinery (mainly for oily liquids only)
- Take to an appropriate disposal site.

If the materials are to handled by contractors, then the Pollution Control Cell (PCC) of the Port will ensure that each contractor has the relevant transportation registration and waste management licenses, where applicable.

Department of Customs must be notified of any recovered oil by a dedicated oil recovery vessel.

6.9 Plan Revision

This Plan has an approved life span of 5 years from the date of approval by the CG and it will be submitted in its entirety for re-approval after that time.

In the interim period, the Plan will be reviewed annually. Approval of Plan revision is the responsibility of the Deputy Conservator.

All revisions will first be submitted to the CG for their formal approval before being incorporated into the Manual.

Once approved, revision update(s) will be forwarded to all Plan holders as indicated in the distribution list at the beginning of this book.

6.10 Environmental Policy

For the purposes of oil spill response, the MbPT will endeavour to:

- Take all reasonable steps to ensure that where an oil spill occurs the pollution is avoided or if this is not possible, to be kept to a minimum.
- Dispose of waste oiled material with least impact on the environment.
- Set standards that comply with all environmental Acts/ Regulations.

6.11 Environmental Sensitivities and Priorities for Protection.

Areas considered to be special environmental sensitivity are Elephanta Island, Coastal areas such as Trombay, Vashi, Mora and Mumbai. Many parts of the land in the north and south coast of Thane creek are exposed during neap tide. Hence there is need to protect the ecosystem and marine environment during the oil spill at Jetties at MOT, JD or within the limits of Mumbai Port. During monsoon season the spill moves towards Trombay coast, if there is any spill at jetties. During pre-monsoon season, spill moves towards East Coast of Thane creek and reach Vashi. But spills at jetty-4 moves towards Elephanta Island which is having high marine resources at the coastal line. Spills at all jetties moves towards western open sea except spill at Pirpau jetty during post-monsoon seasons. During post-monsoon season spill at Pirpau jetty moves western coast and reach at Mora coastline.

6.12 Risk Assessment – General

The Port comprises an area of approximately 400 hectares, and handles a diverse range of commodities including Petroleum Oil; edible oil; containers; cars/vehicles; grain; scrap metals; timber; sand; coal; project cargoes; etc.

NIO, Goa has carried out an oil spill risk analysis for Marine Oil Terminal at Jawahar Dweep, Mumbai at the request of BPCL. They have also prepared the oil spill contingency plan to match the perceived risk. Using risk assessment techniques, the location, size and effect of all envisaged potential spills within and around Jawahar Dweep and Pir Pau area of MbPT have been identified.

The demands on the Contingency Plan could change over a period of time. As a consequence, the risk assessments will be reviewed for suitability, at periodic intervals.

6.13 Hazard Identification

Possible operations/incidents within the Port limits that could result in pollution have been identified as follows:

a) Two vessels colliding with one another resulting in a rupture of one or more fuel tanks.

b) Oily bilge water inadvertently pumped into the dock water from a vessel.

c) Fuel oil or waste oil transfer operations between a ship and a barge or a ship and a barge or a ship and a road tanker.

d) An incident at a berth/ trestle where oil is spilt into the sea by rupture/leak in the oil pipelines.

e) Extraordinary angle of impact of a vessel's side plating on quayside whilst berthing, resulting in rupture of side fuel tank.

f) Willful discharge of oil into the dock water by vandals.

6.14 Quantification of Risk

For each of the identified hazards above where there could be a potential for pollution, the probability (frequency) and severity (consequence) of a spill occurring have been considered.

Probability has been quantified in each case using maintained historical data, as well as taking into account the amount of shipping traffic, navigational hazards, types and size of vessels and the time of year. The possibility of more than one spill occurring at any one time has also been considered.

6.15 Risk Management

MbPT has recognized the identified risks and where it has not been possible to eliminate them, has control measures, working procedures and practices in place to mitigate any effects resulting from those risks.

However should an oil spill occur in MbPT's enclosed docks, it is considered most unlikely that any oil could pass to the harbour. The reasoning for this is that two sets of lock gates are normally maintained in the closed position, other than when lock transits are in progress. However, during this time there will always be one set of gates kept closed.

6.15.1 General

There are no tides within the enclosed dock, although the dock level can vary slightly when there is a heavy shipping programme through the lock, and water is gradually lost to the sea before the impounding pumps can regain the normal level. However, during this period of loss/impound, the flow of water is not significant enough to affect safe navigation. In addition, the outlet from the impounding pumps is channelled to emerge into the branch dock extension, to minimize water current effect.

6.15.2 Safe Navigation :

The following localized procedures contribute to ensuring the safe navigation of vessels within the enclosed dock:

To maintain depths, dredging takes place at intervals determined upon the results of periodic hydrographic surveys.

Recognizing that a segment of the determined water depth towards the dock bottom may include some fluid mud, as an additional precaution to ensure the safe navigation of moving vessels, the dock level is over-impounded by approximately_____ centimeters when the draft exceeding _____ meters is underway.

Daily removal of flotsam and other debrio in the dock that could be dangerous to navigation, using a craft deployed specifically for the task. In addition, regular dock patrols are undertaken using the Port's launch, to determine any irregularities in the water and quayside areas that could impact upon shipping.

6.15.3 Pre- Arrival checks and Lock Transit

During the approach, into the lock the Dock Master on duty ensures that any necessary information such as distances off and distances to go are advised to the vessel's Master and/or Pilot.

6.15.4 In-Dock passage & Berthing Operations

For all vessels Mumbai Port provide the services of a licensed dock pilot. For any vessel entering the dock using tugs, a Dock Pilot is insisted upon, except in special circumstances as many be agreed by the Harbour Master. Whilst an inwards vessel is secured in the lock, the dock Master issues the Master with berthing instructions. In addition, prior to moving off into the enclosed dock, he is verbally advised of any movements of any other craft in the dock. Movement of two vessels in the same dock branch at the same time is not normally undertaken, in order to minimize any possibility of risk of collision.

6.15.5 Bunkering Operations

A limited number of known supplier's provide marine diesel and blended fuel oil to vessels whilst alongside in the enclosed dock or in the MbPT outer harbour limits.

6.16 Incidence Response Organization

This section identifies those Personnel and Organizations that are likely to be involved in oil spill response and their operational responsibilities, should such a spill occur within the MbPT limits.

6.17 Integration with Other Contingency/Emergency Plans

This Plan is complimentary to the following other third party produced plans:

- The National Oil Spill Disaster Contingency Plan (NOS-DCP) - DGCG
- The Regional Oil spill Disaster Contingency Plan (ROS-DCP) - Coast Guard Region (West).
- Oil Spill Contingency Plans - Jawaharlal Nehru Port Trust (JNPT)

Copies of the above are maintained at the Deputy Conservator's Office at MbPT head office. Sr. Dock Master's Office at Indira Dock and also with dock master's office of Jawaharlal Dweep. The framework for this Plan is based upon the NOS-DCP and adopts the same prescribed format the terminology.

6.18 Responsibilities

6.18.1 Mumbai Port Trust

Following an initial report of any pollution incident to the Port Department, the Dock Master on duty will confirm the incident details and initiate the appropriate call-out actions. The Dock Master will also be responsible for informing the Port Controller on duty at JNPT of any pollution incident or risk of pollution, which could affect the traffic in their Port.

The Port Department will be responsible for :

- Mobilising the Port's response equipment for Tier 1 category incident.
- The attendance of the Coast Guard and the external contractors in event of a Tier 2/3 incident.
- Making arrangements for the safe storage and legal disposal of wastes arising out of the incident.

The Port Department under the direction of the Dock Master on duty will provide resource to man the floating crafts to assist in the deployment of spill response equipment maintained by the MbPT.

The Deputy Conservator will:

Liase with the Port's PCC and Engineering Department on equipment and resource needs. The responsibility for escalating an incident from a Tier 1 to Tier 2 response lies with the Deputy Conservator.

- Ensure the necessary reporting arrangements to Indian Coast Guard and other Government Agencies are followed.
- Act as overall incident controller. He will retain this position for any spill incident of Tier 2 or Tier 3 magnitude unless a change is agreed with any Government Agencies involved.
- If necessary, alert the Port's Core Emergency Team.
- Following investigation, initiate any necessary prosecution of offenders after consultation with the MbPT Chariman.

6.18.2 Oil Companies

Oil Companies will

- Assist MbPT and Coast Guard for combating oil spill within MbPT limits by providing required funds. They will also provide their available resources and skilled manpower, if required.

- Liase with Shippping Companies for deploying ships or barges at the incidence site for storage of recovered oil.
- Inform the customs department of any recovered oil during the Oil spill Response operation.
- Make arrangements for receiving the recovered/ waste oil.
- Assist in investigations of the oil spill incidence and recovery of costs from the ship/vessel owner.

6.18.3 Ship owners and /or Cargo Owners

The ship owner is responsible for any clean-up costs of pollution in the Port attributable to his vessel. In reality, the owner's involvement may be limited to the appointment of the local correspondent of his P & I Club to receive such claims.

6.19 Internal Alerting and Call Out Procedure

An initial report of an oil spill may arise from a number of sources:

- Vessel or Berth
- Personnel on a dock patrol
- Other vessels in the vicinity
- Contractor in the MbPT limits
- Any other personnel from the Port or Oil Companies.

The advice should be relayed in the first instance to the Dock Master on duty located at the Indira Dock office, which is manned 24 hours a day, 365 days of the year.

Reporting may be made via the following means:

- Telephone
- Marine Band VHF Radio

6.20 Incident Control Arrangements

Following a significant incident, a Response Centre will be established at the office of Sr. Dock Master, near the Lock Gate, Indira Dock. If it becomes necessary, the Port has a procedure for dealing with the media during any incident. This procedure includes a pre-written proforma for "holding statement".

6.21 Statutory Reporting Arrangements.

Under OPRC Regulations, there is a requirement to report any discharge or possible discharge of oil. The initial reporting point is the local Coastguard station (in the case of MbPT, to Coastguard Region [West], Prabhadevi, Worli), using Oil Spill

Report Form. Coastguard Region (West) will then initiate the appropriate cascade system to alert other Coast Guard personnel.

The Deputy Conservator will be responsible for ensuring such notification is given.

CHAPTER NO-7

RESPONSE STRATEGIES & DISASTER MANAGEMENT.

CHAPTER – 7

RESPONSE STRATEGIES & DISASTER MANAGEMENT

7.1 Health and Safety

7.1.1 Statutory Duties

The following point have been considered in the compilation of this Plan:

- The Health & Safety at work-an employer and persons responsible for premises to ensure that the workplace is safe and in the case of an employer, to have a safe system of work.
- The Management of Health and Safety – an employer to carry out a suitable and sufficient Risk Assessment of all tasks to be undertaken in the workplace. The employer executes a Safety Management System and the measurement of performance against standards is made.
- The provision and Use of Work Equipment – all equipment provided for us at work is safe and fit for purpose. The persons using the equipment must be adequately trained in its use and the Operation must be properly supervised.
- The Personal Protective Equipment – all equipment provided is fit for purpose and does not cause adverse effect.
- The Manual Handling – all work where lifting, pulling and pushing is involved is assessed and all risks to the health and safety of those involved are reduced to a level as low as reasonably practicable.
- The Control of Substances Hazardous to Health – all substances to which a worker may be exposed are properly assessed and the risks to health reduced to a safe and acceptable level.
- The Health & Safety (First Aid) – the requirements for training first-aiders and the equipment that must be provided.

7.1.2 Site Safety

To achieve a safe operation, those in charge of a spill response must follow the generalize requirements of this Contingency Plan, which apply in all circumstances. In addition, in the case of a medium or large spill, elements that may be site or individual response specific will need to be borne in mind. In these cases, a site safety assessment will be undertaken to prevent uncontrolled incident occurring which may cause further damage to the environment or loss due to damage, injury or illness. The deputy Conservator in conjunction with the Port's engineering Department will undertake this assessment.

The following list indicates typical subject, which will be addressed in such a site survey, but which is by no means exhaustive.

- Communications requirements
- Exposure to temperature
- Requirement for rails or ropes
- Hazards to the eyes
- Lack of shelter from the weather
- Lighting conditions
- Machinery usages
- Manual handling
- Sample collection
- Vehicle traffic
- Visibility
- Water hazards

In addition, apart from the standard spill response equipment, the need to use the following equipment will be considered:

- Cranes
- Fork Lifts
- Trailers
- Hoses & Pumps
- Motor vehicles
- Sweeping equipment
- Marine Craft

Access to the area on the quay where oil is being recovered will be restricted to those personnel who are essential to the clean up only. Accordingly, arrangements will be made for the area to e cordoned off.

If the weather is at all inclement, protective clothing will be issued to workers and will include coveralls, gloves, boots, eye protection and headgear. If the weather is warm, the use of the same protective clothing may be necessary, but the requirements for ventilation and cooling will be greater.

7.1.3 Safety on the Water

Personnel operating from either of the marine craft will need to consider the use of lifejackets where there is a risk of falling overboard. Personnel should be assessed regularly to ensure that they remain unaffected by lengthy exposure to adverse

conditions. Everyone should be familiar with regular drills, which will be held as part of routine to maintain satisfactory recovery capability.

7.1.4 Decontamination

Conditions requiring Decontamination.

Where workers have been wearing protective clothing, it is likely that the clothing will become contaminated by oil during the clean up operation. The clothing needs to be cleaned to prevent further contamination. Facilities for such cleaning will be made near to but clear of the work site.

Personal Hygiene Practices on the Job.

Workers should be instructed on the dangers of ingesting hydrocarbons through contact of contaminated equipment or clothing, such as gloves with the mouth and nose. Facilities for removing protective clothing and washing before consuming food should be made available.

Decontamination Area Drainage.

The decontamination area where clothing and personal equipment is cleansed should be arranged so that cleansing water and contaminants are drained into tanks. Care should be taken to ensure that contaminated waste does not drain into either the normal drainage system nor into the soil under the decontamination area.

Disposal of Contaminated Clothing.

Clothing which is not fully washable or capable of having all traces of contaminant removed may need to be disposed of safely. Such clothing may comprise Special or Hazardous waste.

7.2 Characteristics of Oil and Oil Spills

7.2.1 Properties of Oil

Oil contains a variety of different types of hydrocarbons. The actual composition is dependent upon its origins. Oil may also contain a variety of impurities such as sulphur and nitrogen products. Generally, oil is of relatively low toxicity; however this is dependent upon the properties of the source oil. The route of human exposure is via inhalation and skin absorption.

7.2.2 Behavioaur of Oil on water

Oil spilt onto a water surface will spread and evaporate at varying rates and to varying degrees, dependent upon the oil characteristics and weather conditions. This process, known as weathering, may bring about a number of chemical and physical processes, which change the compounds that make up oil.

The type of oil spilt has a major effect on the outcome of a spill incident, very light oils will naturally disperse and evaporate quickly reducing the level of pollutant, whilst heavier oils will persist an in some case may form emulsions which are very resistant to biodegradation. Studies have shown that 75% of diesel can be lost by evaporation within 4 to 48 hours, compared with only 10% from a heavy or residual fuel oil.

The effect of wind on an oil patch is to move the oil at 2.5 to 3.5% of wind velocity.

7.2.3 Explosion and fire Hazards

- Any spilled petroleum-base product is volatile. This means that it can produce a gas, which then mixes with air around the spill. It is this gas which can cause explosions and fire. However, the mixture of hydrocarbon gas and air must be of a certain composition in order to burn.
- Where there is a risk of a flammable atmosphere, the area should be tested and assessed using an instant readout instrument such as a gasometer. This devise will provide readings of the proximity to the Lower Explosive Limit. To control fire and explosion hazards, the LEL should be kept below 20%. Entry into such area should not be considered until the area is sufficiently ventilated and tested. If for any reason the oil has ignited, where there is no danger of the fire causing damage to person or property, consideration may be given to allow any fire to burn out.

7.3 Response to Oil Spills

Regardless of the size of spill, the first consideration will be contain the oil or allow it to travel with the wind to a convenient catchments area. A boom maintained on pallets can be towed to a site area as required.

Small quantities of oil spilt within will in the first instance be recovered using either sorbent pads or a skimmer unit. In the event that a larger spill occurs, it will be recovered and disposed of using port personnel in conjunction with an approved contractor, nominated in this plan. Waste arising will be legally carried for disposal.

The Deputy conservator has the authority to order any other marine craft held with the Port department to tend the participate in clean-up operations.

7.4 Oil Spill Samples

Samples of spilt oil should be taken as soon as possible before the oil has weathered. These samples may be required as evidence in legal proceedings. Guidance in the matter of collecting samples is given in this Plan.

Sample bottles (each 50 ml) are kept at the office of Sr. Dock Master, Indira Dock and Dock Master, JD. Samples should be duplicated with one sample being offered (of his choice) to the master of a vessel concerned.

7.5 Disposal Plan

All waste arising out from an oil spillage will be handled systematically and strictly in line with current Regulations.

Initial holdings and storage in the Port will be made possible trough the provision of suitable containment and disposal methods identified by the Port.

In the event of a Tier 2/3 spill response, the legal disposal of recovered oil will be undertaken though a disposal route agreed with the Oil Companies on behalf of the Port.

7.6 Training Policy

For an effective and efficient response to any oil spillage, the Port recognizes that key personnel involved must have an understanding of their roles and responsibilities. Consequently, specified individuals involved in management aspects of oil spill response will attend recognized courses run by internationally accredited establishments covering oil spill contingency planning and response.

These are as follows:

Deputy Consecrator/ Harbour Master - Similar to IMO level - 1 model Spill Operations Supervisor (Ports)

Engineering Charge hands - Similar to IMO level - 2 model - First Responder

Marine Operative - Similar to IMO level 3 - model - First Responder

Other operation staff - Training conducted by Indian Coast Guard

In addition, general awareness training on the Mumbai Port Trust Oil Spill Response Plan will be provided for applicable other employees.

7.7 Exercise Programme

For the plan to be of value, it must be familiar to those expected to use it. The plan will thus be exercised at periodical intervals to ensure it functions as expected.

A full exercise will be carried out annually and will include call-out, establishment of a command centre, deployment of equipment, interface with other plans, and communications with outside agencies.

At other periods within the year, smaller exercises will focus on certain aspects of the response (communications, equipment deployment, notifications etc.) to ensure each element can operate efficiently.

Following the full exercise, using feedback from the various participants, the plan will be reviewed by the Deputy Conservator, to determine:

- Whether any improvements can be incorporated
- Whether the demands of the plan have changed for such reason as new type of trade to the Port.

EXERCISES IN THE USE OF THIS PLAN		
Annual Exercise	**Timing**	**Type of Exercise**
Desktop	First Quarter	Communication Test.
Inspection and use of equipment	Second Quarter	Inspection and use of equipment, updating personnel in procedures and use.
Oil Spill Response	Third Quarter	Simulation of an Oil Spill incident using the Oil Spill Contingency Plan, mobilizing equipment and personnel as appropriate
Revalidation	5 years	Update and Test.

7.8 Oil Spill Response Plan Distribution List – Internal

Copy No.	Holder	Signature
01	Chairman	
02	Dy. Chairman	
03	Manager (SOM)	
04	Deputy Conservator	
05	Harbour Master	
06	Director (P & R)	
07	Chief Mechanical Engineer	
08	Chief Engineer	
09	Traffic Manager	
10	Chief Welfare Officer	
11	Chief Security Officer	
12	Sr. Dock Master, ID	
13	Dock Master, In-Charge, MOT, JD	

Distribution List – external

Copy No.	Holder	Signature
01	Coast Guard, Region West	
02	Bharat Petroleum Corporation Limited	
03	Jawaharlal Nehru Port Trust]	

7.9 Resources and Facilities at MbPT for Tackling Disasters

7.9.1 Emergency control rooms and fire fighting

The Indira Dock is a part of Mumbai Port Trust which is already established and operating for last 133 years. The on site emergency preparedness plan has been already existing at MbPT. The equipments and facilities available with MbPT to handle the disaster and hazards are listed on the Tables below:

Emergency control room equipment

Equipment & Accessories	Numbers
Emergency lights and torches	2
Computer	1
Fax	1
Printer	1
Telephone hotline – State Govt., Civil Defense HQ, Police, Army, Navy & Fire Brigade	6
Telephone (MTNL & MbPT EPABX)	4
Blackboard	1
Identifying helmets and arm bands	6
Loud Speaker	1
Copy of Crisis ---------- Plan	2
Table-seating	5
Tables for equipment	3
Chairs	15

Control rooms of various departments

Sr. No.	Control Room	Location	Person in Charge	Telephone No.
1	Civil Defence	Mezzanine Floor Nirmal Bhavan	Staff Officer	2186, 2187, 2188, *3751776
2	Security	Yantra Bhawan, G/Fl. L Dock	Asstt. Security Officer	2665
3	Medical Department	Port Trust Hospital Wadala	CMO	5728/ 1728, 412 7947, 412 9684
4	Labour Department	2nd Floor, Vijay Deep	Labour Officer	3051 261 8501
5	Mechanical Engineering Department	Nirman Bhavan	Adm. Officer	3510
6	Civil Engineering Department	Port House	Adm. Officer	2581 261 1458
7	Port Department	Port House, Ballard Pier	Adm. Officer	2203
8	Docks Department	H.O. Hamllage	Dy. Mgr. (Ham.)	3484

		Building	Asst. Mgr. (Ham.)	261 7409

Note: *(Direct Line during activation, Number will be provided by Director- P & R)

Fire fighting resources at MbPT

Sr. No.	Location
A.	**Fire stations**
1	Prince's Dock (Near G. Shed)
2	Haji Bunder (adjacent to Haji Bunder Hazardous Cargo Complex)
3	Pir Pau (at Marine Oil Terminal)
4	Jawahar dweep (at Marine Oil Terminal)
5	Port Fire & Safety Officer (Res.: 26, Wilson House, Colaba)
6	Asst. Duty Officer (Res.: T/107, R/No. 11, Chembur Colony, Mumbai-400 074.)
7	MbPT Fire Brigade Control Room, PD
B.	**Staff for all the Fire Stations**
8	Port Safety & Fire Officer -1
9	Asst. Port Safety & Fire Officer – 1
10	Sr. Section Leader -5
11	Section Leader – 7
12	Sub Section Leader – 22
13	Motor Driver – 26
14	Pump Operator – 12
15	Fireman – 112
	Total – 186

It must be mentioned that all the fire stations are manned round the clock. Turn-out at fire stations is kept as 40 seconds. In case of fire which is beyond the capability/ resources of fire fighting department of MbPT, Mumbai Fire Brigade is contacted on mutual-aid basis. Two fire tugs also are fitted with fire monitors in the fire station. All the fire stations and fire floats are equipped with wireless communication sets.

MbPT has kept sufficient equipments for combating oil spills form the ships. The list of resources, these locations and quantity is explained in Table-6.4 respectively.

Resources for combating oil spills.

Type of Equipment	Location	Numbers
Oil Containment Boom	"M" Shed Prince's Dock	10
Cassette Skimmers	-do-	2
Rainbow Oil skimmers	-do-	2
Flexi tanks	-do-	2
Multi-purpose Oil recovery	-do-	2
Mobile surface cleaning system	-do-	1
Garbage Lifters	-do-	2
Mobile Air Pollution Monitoring	Pollution Control Cell at BPX	1

In the present Harbour Wall Berths project there are no chances of toxic leakage, or leakage of hazardous waste, etc. In case of oil/chemical spill there is adequate provision in the existing plan of MbPT which can be implemented, if required for Harbour Wall Berths.

CHAPTER NO-8

ENVIRONMENTAL MONITORING PROGRAMME

CHAPTER – 8

8. ENVIRONMENTAL MONITORING PROGRAMME

8.1 General

Monitoring becomes essential to ensure that the mitigation measures planned by way of environmental protection, function effectively during the project operation phase. Moreover, changes external to the project site may at any future stage endanger environmental conditions rendering the existing mitigation measures inadequate. Hence, the necessity of remaining vigilant through a well planned and meticulously implemented environmental monitoring programme.

The aim of the monitoring programme is to develop an "early warning" system of indicators to detect when pollution begins to approach or exceed permitted levels. Suggested measures for monitoring in the post-project phase are described in the following sections.

8.2 Marine Water and Sediments

The chemical characteristics of marine water quality at four locations selected by MbPT should be monitored once in a month excluding monsoon season and biological parameters once a year along the navigational route of the vessels. Both surface and bottom waters and sediments should be sampled and analysed. The parameters to be monitored are as follows :

Marine water

Physio-chemical parameters

- pH
- Salinity
- Electrical conductivity
- TDS
- Turbidity
- Phosphates
- Sulphides
- Sulphates
- Chlorides

Biological parameters

- Light penetration
- Chlorophyll 'a'
- Primary productivity
- Phytoplanktons (No. of species and their density)

- Zooplanktons (No. of species and their density)

Sediments

Physico-chemical parameters

- Texture
- pH
- Sodium
- Potassium
- Phosphates
- Chlorides
- Sulphates

Biological Parameters

- Benthic Mero-fauna
- Benthic Macro-fauna

An amount of Rs.0.45 million/ year needs to be earmarked for this purpose.

At present, pollution control cell is monitoring following parameters namely.

Temperature, Acidity, Alkalinity, Conductivity, Hardness, pH, Turbidly, total dissolved solids, suspended solids, Dissolved oxygen, B.O.D. 3 days 27degree C. Oil & grease, chlorides, chlorine, cadmium chromium, copper, iron, load & zinc.

Following stations have been established namely, I.D. Lock gate, V.D. lockgate, P.D. lockgate, Sassors Fish jetty, Kasar basin, Hay bunder, Haji bunder, Sevri Mud flat.

Monitoring by pollution control cell be continued. However as per MPCB Consent & conditions, the tests prescribed by MPCB in the Consent order be carried out by recognized laboratory only by MOEF. Frequency of third party assessment be as per MPCB. Consent order i.e. Once in a Month.

8.3 Domestic Effluent - Most of the areas have been provided by sewerage system provided by MCGB. However for the unsewered areas.MbPT will have to request MCGB to provide the same or otherwise MbPT will have to provide full fledged treatment system with disposal arrangements. The parameters to be monitored will be pH, Suspended Solids, BOD 3days, 27 degree C., Oil & grease.

MbPT will have to find out the areas which are not sewered and what facilities have been provided for treatment & disposal. Planning should be done by carrying out survey & based on quality of affluent which is discharged into sewer, on land & into creak / sea.

8.4 Ambient air Monitoring –

It is desired by MPCB in the draft consent order to establish air monitoring station in MbPT area and carry out air quality monitoring by establishing well equipped laboratory.

At present MbPT is monitoring air quality by portable air quality instrument at stations and monitor SO2, NOX and NH3, MbPT also has entrusted air quality assessment work to "Ashwamedh Consultants" an agency approved by MOEF. Air quality in respect of So2, RSPM, TSPM & NOX is assessed at 4 stations. This is mainly to asses the air quality due to coal plants & D.G. sets.

MbPT may continue to operate their portable lab to asses the air quality in respect of So2, NOX, NH3 but should plan to procure High volume samplers to asses TSPM & RSPM respectively or continue to entrust the work to recognized laboratory by MOEF.

8.5 Noise Monitoring:

Ambient Noise levels be monitored as far as possible near sources of noise generating sources like D.G. sets & other sensitive areas. Noise monitoring should be carried out at 4 stations established by Ashwamedh Consultants and also near D.G. sets. Noise levels be monitored once in a week at these stations, on hourly basis for 24 hours once in a fortnight.

Hazardous Waste

8.6.1 Hazardous waste is generated mainly due to oil spills, and leakages in pipeline & valves while pumping to storages in dry dock or due to faulty handling of cargo.

These should be analysed as and when required to know the safe ambiance. The analysis of the pollutants be entrusted to polluter or be done by MbPT and charged to the polluter

8.6.2 Municipal Solid waste –

At present it is collected by the approved agents and disposed off on municipal disposal site at Deonar near Chembur. The analysis may be done for the parameters prescribed by MOEF for biodegradable waste & non biodegradable waste, viz, specific gravity, Moisture Content, % of biodegradable & non biodegradable wastes, calorific value etc.

8.6.3 Battery (Management & Handling) Rules 2000 –

The batteries after its use be disposed off as per Battery (Management & Handling) Rules 2000. The used batteries be given back to manufacturer or agencies which are approved by MOEF/CPCB/MPCB.

8.6.4 Bio Medical waste – Biomedical waste be segregated, collected stored, treated as per provisions prescribed by CPCB or should be given to authorized agencies by MPCB. The register showing quantity, type of waste & its disposal be recorded and communicated to MPCB as per authorization issued by MPCB.

E.T.P. BLOCK DIAGRAM

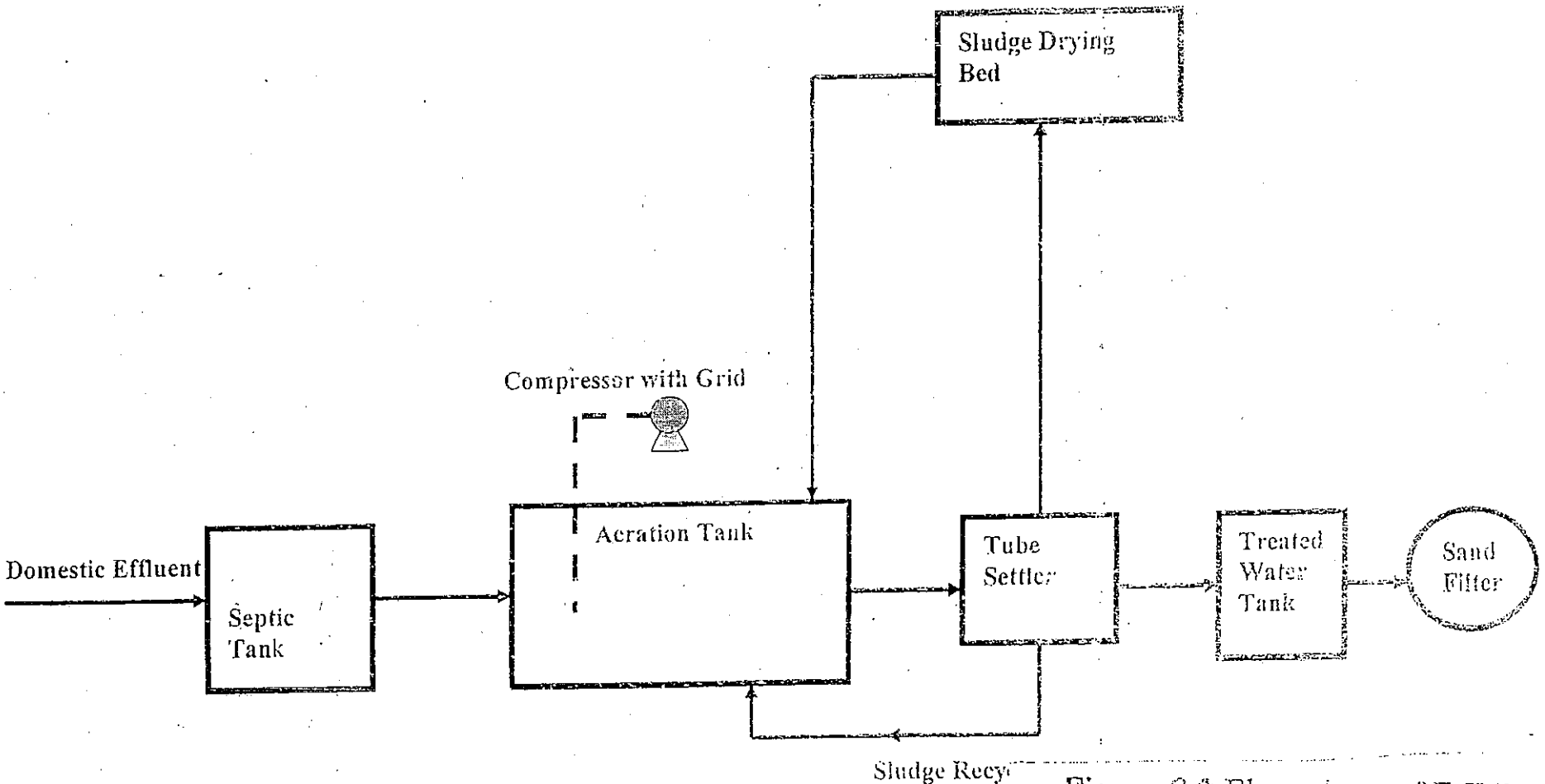

Figure 8.2 Flow sheet of E.T.P.

CHAPTER NO-9

ESTIMATION FOR MONITORING PROGRAMME

CHAPTER – 9

ESTIMATION FOR MONITORING PROGRAMME.

9.1 Domestic effluents –Cost of E.T.P. for domestic effluents discharging in open creek, nalla or sea & not meeting the standards.

Alternatively – BMC shall be requested to allow these discharges to be connected to sewer lines either by pumping or gravity. This will depend upon findings of the MbPT which is being carried out by civil engineering department.

Connection to Sewer lines – Monitoring of effluents for parameters viz pH, suspended solids, BOD 3 days 27 degree C, COD, oil & grease be carried out.

The sample shall be analysed once in a month for major discharges going to sewer lines. It should also be ensured whether BMC is disposing these effluents & whether there is treatment facility provided by BMC.

The cost of collection, analysis of each sample will be Rs.1000/- which includes analysis charges including collection charges as per CPCB. However the quotation be called from recognized agencies and decided.Total no of sample per month – 10 nos.

9.2 a) Harbour water sampling – At present Harbour water sampling is done by MbPT. Same shall be continued. The parameters which are not covered as per consent order are free ammonia, sulphides, ammonical nitrogen, Mercury may be analysed either in the MbPT laboratory or in the recognized laboratory. Frequency will be once in a month. Total no. of samples for HTL & LTL will be 30 nos. The parameters mentions above are not applicable for Sassoon Dock, ferry wharf.

b) Sediment Analysis – These samples may be analysed by NIO. The frequency be twice in a year excluding Monsoon season for above mentioned Docks & Wharf & Haji Bunder. No of samples will be 40 nos. per year Parameters are stated above.

General note: While considering the Budget the samples shall not be collected in Monsoon season i.e. for (June, July, August & September)

9.3 Ambient Air Quality Monitoring –

MPCB desires that Ambient Air Monitoring work be carried out by MbPT by establishing a laboratory. At present A.A.Q.M. is carried out by MbPT by using portable air quality monitor for the parameters of So2, NOX & NH3. It will be required to procure two high volume samplers costing about Rs.1.5 Lac to carry out monitoring of RSPM & TSPM. Once this is done it will be possible to monitor at five stations, Sagar Darshan, M. shed, BPX, Haji Bunder, Salvage etc.

The frequency will be two days in a week on 8 Hourly basis.

However the A.A.Q. Monitoring is done by Ashwamedh Engineers at 4 stations. For So2, NOX, RSPM, TSPM be continued. This is being do neat 4 stations. In order to asses A.A.Q. This should be also done two days in a week on 8 hourly basis. The tender cost offered to them be considered if the work to this agony is entrusted by MbPT.

9.4 Noise Monitoring -

Ambient noise levels be monitored at 8 hourly per day at 4 station, once in a week on hourly basis. For this purpose noise monitoring equipments of Rs.1 lac be procured. Similarly at 4 stations stated above, noise levels be monitored once in a week on hourly basis for 24 hours simultaneously with A.A.Q.M. by Ashwamedh Engineers a recognised agency of MOEF or any other agency recognised by MOEF as per the tender cost received by MbPT.

9.5 Waste Monitoring -

(a) Oil Spills - Monitoring costs for oil spills as well as Hazardous waste be considered as per the previous occasions in a year. A major amount be however kept of Rs.10 Lac or so for monitoring purposes be provided.

If required D.G. sets be provided with inlet & exhaust mufflers to reduce noise. It is also possible to provide barriers around D.G. set to offset noise propagation.

b) Solid waste - Solid waste generated in the residential & port area be segregated and collected in separate bins. Wet waste which is biodegradable can be used for composting, biomethanisation & also for limited power generation. In fact MbPT may consider this proposal & establish 5MT/ 10 MT per day capacity biogas plant. Bhabha Atomic Research Organisation has successfully provided such plant and are operating gas plant for domestic purpose. MbPT can also make provision for such project as after some time BMC may not accept such waste.

As per Municipal Waste Management rules it is necessary to segregate biodegradable waste & non biodegradable waste and then dispose it by incorporating reduce, regulate & reuse options.

These wastes should be transported by authorized agencies and disposed off after treatment at approved sites.

Stricter backup by in corporately stricter methods of refusing to collect nonsegregated waste will have to be adopted by MbPT particularly in residential area. It is necessary to appoint advisory committees in various residential zones for implementing such provisions to comply legal responsibility of waste generator.

c) Battery waste management & handling rule -2000 - Segregated area be reserved for this purpose and exhausted batteries are transported through authorized agencies to manufacturers or suppliers.

d) Bio Medical waste – As per authorization segregation, storage, labeling and transporting these waste through approved agencies to designated agencies for treatment & disposal is necessary if the generator of waste do not own a facility for treatment.

9.6 Budgetory Provision for Environment Management Plan

(I)

Sr. No.	Particulars	No.	Rate	Total
1	Effluent Analysis for pH, BOD, S. Solids, oil & grease. (10 Nos. per month) for eight Months (Excl. monsoon)	80	Rs.2000/-	Rs. 1.60 Lac.
2	-Do- for above for discharges in creeks, see in open for eight-month say 10 places	80	Rs.2000/-	Rs. 1.60 Lac.
3	Marine Water Analysis for parameter not conveyed by MbPT as per draft consent order - 30 no.s of places for eight months	240	Rs.3000/-	Rs.7.2 Lac.
4	Sediment Analysis to be done for parameter mention in E.I.A. say 10 places for 2 seasons exclusively monsoon for H.T.L. & L.T.L.	40 No.s.	To be done by NOI	4.5 Lacs ----------
5	Ambient Air Monitoring Programme at Haji Bunder which is being monitored by Ashwamedh Engineering. 2 times a week for 104 nos in a year at four stations for 24 hours.on 8 hourly basis	416 no.	-	7 Lacs.
6	Noise Monitoring to be carried out 4 places. Once a week for 52 nos./ station.	208 no.	-	5 Lacs

(II)

i	Air monitoring to be done by MbPT at 5 places for SO2, NOX, NH3 by continuous monitoring equipment.	Expenditure be worked out for a year.
ii	Marine Water Analysis to be contd. At 30 places on is	-do-

	being done at present.	
iii	Bio-Medical waste collection Transportation disposal charges.	-do-
iv	Solid Waste Management Charge, collection, Transportation & disposal.	-do-
v	Hazardous waste Management charges	-do-
vi	Oil spill contingencies	Rs.10 Lacs.

(III) Capital Costs

i	Providing E.T.P. for places discharging in open and not confirming standards or connection to B.M.C. sewers.	Depends upon No. quality of effluent and the B.M.C. charges if connections are to be done.
ii	Providing High Volume Sampler 2 Nos. of noon continuous type (8 hourly basis)	1.60 Lacs
iii	Noise 2 Nos. Monitoring Equipment - 1 No.	0.60 Lacs.
iv	Biogas plant for 5TPD/ 10TPD if required to be provided as per B.A.R.C. design & consultancy	Offer of B.A.R.C. will include consultancy Capital Investment & Operation Charges.

9.7 Recommendation

Environment Management involves almost all sections of the port & harbour Constitution of India also assigns duties to everybody to safeguard environment by mitigating measures as well as to reduce recycle reuse methods in planning any activity. It is therefore necessary for all sections of the port such as civil defense, security. Medical, Labor, Dock Department, Port Department, Mechanical Engineering Dept., Civil Engineering department and the Pollution Control cell to carry out assigned functions.

In fact it is necessary to elevate pollution control cell to Environment Division by inducting eligible, scientists, environmental engineers to meticulously supervise and implement necessary tasks assigned by MPCB in the consent order & various environmental clearances by MOEF.

It is also necessary to raise the status of Mr. Bangale who is qualified & competent and had gained sufficient experience in port and harbour activities to be in charge of the division.

Dr. D.R. Rasal

Successful Environment Management Plan means success to all sections of the port. It is therefore necessary to implement E.M.P. in letters and spirit by the port management.

Adviser Environment

ANNEXURES

Annexure 1

NAAQS (National Ambient Air Quality Standards) for India

Pollutant and time weighted average	Concentration in ambient air (ug/m3)			Methods of measurement
	Industrial area	Residential, rural and other areas	Sensitive areas	
Sulphur dioxide				
Annual average	80.0	60.00	15.00	Improved West and Gaeke method
24 hours	120.0	80.00	30.00	Ultravoilet fluorescence
Oxides of Nitrogen				
Annual average	80.0	60.00	15.00	Jacob and Hochheiser modified (Na-Arsenite) method
24 hours	120.0	80.00	30.00	Gas-phase chemiluminescence
Suspended particulate matter				
Annual average	360.	140.00	70.00	High-volume sampling (average flow rate not less than 1.1 m3 per minute)
24 hours	120.0	80.00	30.00	
Respirable particulate matter (size less than 10 um)				
Annual average	120.0	60.00	50.00	Respirable particulate matter sampler
24 hours	120.0	80.00	30.00	
Lead				
Annual average	1.0	0.75	0.50	Atomic absorption spectrometry after sampling using EMP 2000 or an equivalent filter paper
24 hours	1.5	1.00	0.75	
* Carbon monoxide				
Annual average	5.0*	2.00*	1.00*	Non-dispersive infrared spectroscopy
24 hours	10.0*	4.00*	2.00*	
Ammonia				
Annual average	-	400	-	-
24 hours	-	100	-	-

- mg/m3

Notes:

1. Annual average is annual mean of minimum 104 measurements in a year taken twice a week at 24 hourly intervals.
2. 24-hourly and 8-hourly values should be met 98% of the time in a year. However, 2% of the time, it may exceed but not on two consecutive days.
3. NAAQS, the levels of air quality necessary with an adequate margin of safety to protect public health, vegetation, and property.
4. Whenever and wherever two consecutive values exceed the limit specified above for the respective category, it would be considered adequate reason to institute regular/continuous monitoring and further investigations.
5. The state government / state board shall notify the sensitive and other areas in the respective states within a period of six months from the date of notification of NAAQS.
6. Standard for ammonia specified vide notification dated 14 October, 1998. It does not mention about the type of areas for its applicability nor the method of measurement is being specified.

Sources :

1. CPCB. 1994. Central Pollution Control Board Notification, New Delhi: Central Pollution Control Board, Ministry of Environment and Forests.
2. CII, 1999. Environmental legislation in India.. A Guide for Industry and Business. New Delhi: Environment Management Division, Confederation of Indian Industry.

Annexure 2

Noise Standards

Area Code	Category of Area	Limits in dB (A)	
		Day Time (6 a.m. to 10 p.m.)	Night Time (10 p.m. to 6 a.m.)
A	Industrial	75	70
B	Commercial	65	55
C	Residential	55	45
D*	Silence Zone	50	40

* area up to 100 m around premises such as hospitals, educational institutions, and courts.

Note : The silence zones are to be declared by the competent authority. Use of vehicular horns, loudspeakers, and bursting of crackers are banned in theses zones.

Source :

Ministry of Environment and Forests Notifications, New Delhi, February 14, 2000.

Annexure 3

Primary Water Quality Criteria for class SW-II Waters for Fishing and Recreation (Non-contact)

Sr. No.	Parameter	Criteria	Rationale/ Remarks
1	pH range	7.5-8.5	Range does not cause skin or eye irritation and is also conducive for propagation of aquatic life.
2	Dissolved Oxygen	4.0 mg/l or 50 percent saturation value, whichever is higher	Not less than 3.5 mg/l at any time of the year for protection of aquatic life.
3	Colour and Odour	No noticeable colour of offensive odour	Specially used by chemical compounds like creosols, phenols, naphtha, pyridine, benzene, toluene etc. causing visible colouration of water and tainting of odour in fish flesh.
4	Floating matters	Nothing obnoxious or detrimental for use purpose.	None in concentration that would impair usages specially assigned to this class.
5	Turbidity	30 NTU (Nephelo Turbidity Unit)	Measure at 0.9m depth
6	Faecal Coliform	100/100 ml (MPN)	The average value not exceeding 200/100 ml in 20 percent of samples in the year and in three consecutive samples in monsoon months.
7	Biochemical Oxygen Demand (5 days at 20 degree C)	3 mg/l	Restricted for bathing (aesthetic quality of water). Also prescribed by IS: 2296-1974.

Annexure 4

Primary Water Quality Criteria for Class SW-IV Water (For Harbour Waters)

Sr. No.	Parameter	Criteria	Rationale/ Remarks
1	pH range	6.5-9.0	To minimise corrosive and scaling effect
2	Dissolved Oxygen	3.0 mg/l or 40 percent saturation value, whichever is higher	Considering bio-degradation of oil and inhibition to oxygen production through photosynthesis.
3	Colour and Odour	No visible colour or offensive odour	None from reactive chemicals which may corrode paints/ metallic surfaces.
4	Floating materials oil and grease and scum (including Petroleum Products)	10 mg/l.	Floating matter should be free from excessive living organisms which may clog or coat operative parts of marine vessels/ equipment.
5	Faecal Coliform	1000/100 ml (MPN)	Not exceeding 2000/100ml. in 20 percent of samples in the year and in 3 consecutive samples in monsoon months.
6	Biochemical Oxygen Demand (5 days at 20 degree C)	5 mg/l	To maintain water relatively free from pollution caused by decomposable wastes.

Annexure 5

Physico-chemical Characteristics

Sr. No.	Parameters	Methodology	Detection Limits
1	pH	Electrometric method	0.1 pH unit
2	Conductivity	Conduct metric method	Less than 10 uS/cm greater than 10,000 to 50,000 uS/cm
3	Turbidity	Nepheometric method	<1 (about 0.02 NTU)
4	Total alkalinity	Electrometeric method	Less than 20 mg/L as of CaCo3
5	Total dissolved solids	Gravimetric method	--
6	Total suspended solid	Gravimetric method	--
7	Chlorides	Argentometric method	--
8	Sulphates	Turbidimetric method	1 mgSO4 2-/L
9	Hardness	EDTA titrimetric method (Complexometric titration)	--
10	Sodium	Flame photometric method	5 ug/L
11	Potassium	Flame photometric method	0.1 mg/L
12	Nitrate	U.V. Spectrophotometer screening method	--
13	Phosphate as T. phosphorous	Stannous chloride method (Spectrophotometrically)	3 ug P/L
14	Chemical oxygen demand	Closed reflux and titrimetric method	--
15	Dissolved oxygen	Iodometric/ winkler titrimetric method	--
16	Biochemical oxygen demand	5 days incubation test at 20 degree C	2mg/L for a minimum D.O. depletion of 2 mg/L

Heavy Metals

Sr. No.	Heavy Metals	Detection limits	
		AAS	ICP
1	Cadmium	0.004-1.8 PPM	1-5 PPb
2	Chromium	0.03-10 PPM	1-5 PPb
3	Copper	0.01-4 PPM	1.5 PPb
4	Lead	0.1-12 PPM	11-25 PPb
5	Iron	0.05-8 PPM	1-5 PPb
6	Manganese	0.015-4 PPM	<1 PPb
7	Zinc	0.005-2 PPM	1-5 PPb

Dr. D.R. Rasal