VISAKHAPATNAM PORT TRUST

ENVIRONMENTAL IMPACT ASSESSMENT STUDY FOR MODERNISATION OF EXISTING FACILITIES AND ADDITION OF NEW FACILITIES ENTAILING CAPACITY AT VISAKHAPATNAM PORT

Modified EIA Report

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March 2016

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INTRODUCTION

1.1 PROJECT OVERVIEW

The Port of Visakhapatnam situated on the East Coast of India is one of the pre-eminent Major Ports of the country. The Port has two harbour basins viz., the Inner Harbour and the Outer Harbour. Presently, the inner harbour can accommodate vessels having maximum LOA of 210 mtrs, 32.5 meters beam and 13 mtrs draft on rising tide of 1.05m and also panamax vessels with a beam of 32.5 meters and draft 10.90 mtrs on 0.94 meters tide. The outer harbour on the other hand, can accommodate vessels up to 200,000 DWT size with draft up to 18.10 meters on rising tide of 0.5 meters. At present the Port has completed a number of developmental schemes which include, deepening of outer harbour channel and turning circle to cater to 200,000 DWT vessels and deepening of inner harbour entrance channel and turning circle to cater to panamax vessels up to 14 mtrs draft.

The port, located on the eastern coast of India lies between Chennai and Kolkata (latitude 17^{o} 41' N and longitude 83^{0} 17' E), was opened to commercial shipping on 7th October 1933. The port serves a vast hinterland comprising primary and secondary service area, which includes - Chhattisgarh, Jharkhand, Bihar, Uttar Pradesh, Madhya Pradesh and parts of Orissa, West Bengal and Punjab. Visakhapatnam port is the only Indian port having three International Accreditations viz.

ISO 14001 – 2004 - EMS (Environmental Management System)
OHSAS - 18001–2007 - OHSAS (Occupational Health & Safety Management System)
ISO 9001 - 2008 - QMS (Quality Management System)

The Port of Visakhapatnam handled 58.05 million tonnes of cargo throughput during the year 2014-15 and is consistently making relentless efforts in enhancing its capacity and productivity in consonance with changing requirements of the trade.

The Port which started with traffic of 1.3 lakh tonnes during the year 1933 has made rapid strides in cargo handling and attained a throughput of 68.04 MT in 2010-11. Cargo throughput declined to 59.04 million tonnes during the year 2012-13 mainly on account of decline in iron ore traffic owing to restrictions on mining and decline in transhipment of crude oil to Paradip consequent on development of SPM.

The dry bulk trade at Port of Visakhapatnam is increasing year by year. Projections of dry bulk cargo as per the Maritime Agenda - 2010-2020 by 2014-15 is 51.60 million tonnes and 71.75 million tonnes by 2019-20. To cater to handling needs of cargoes such as coking coal, thermal

coal, steam coal, iron ore, fertilizers, CP coke and LAM coke through bigger size vessels, and to provide a long lasting solution to the environmental concerns, the Port is developing new berths and mechanizing/strengthening existing berths. The present proposal is envisaged in order to cater to handling needs of dry bulk cargoes and any other cargoes.

The existing Ore Handling Plant at outer harbour which was developed in 1976 has completed more than 38 years of life and a need has arisen to replace certain vital components of the system to sustain the efficiency levels. The Port has explored many possibilities to modernize the existing system, viz., through funding from JICA. However, Port could not make any progress in this direction due to reasons beyond its control. Keeping in view the declared policy of the Government to induct private sector participation in development of Cargo handling facilities, with a view to transforming the Port Sector as Landlord Ports in line with Global practices, a view was taken by the Port to modernize the outer harbour facility on DBFOT basis. The task of preparing Techno-Economic Feasibility Report for the modernization of outer harbour was entrusted to MECON and the consultant submitted their draft report in October 2012.

Co-terminus with this, the Port has also taken up the project of development of mechanized handling facilities at inner harbour (WQ1 berth) to handle iron ore which can cater to vessels up to 12.5 m draft. The preparation of Techno-Economic Feasibility Report was entrusted to RITES and the report was submitted in 2011.

It was decided by the Port to integrate these two facilities, i.e., outer harbour and inner harbour as a single project and develop the same on DBFOT basis, instead of having two facilities for the same cargo. This decision was taken keeping in view the variegated vessel sizes deployed for iron ore handling ranging from 40,000 DWT to 170,000 DWT at present. By developing a Mechanized loading facility at inner harbour to cater to vessels up to 12.5 m draft, it would be possible for the operator to have a judicious distribution of iron ore vessels at both the facilities depending upon the size of the vessels. Thus, this facility at inner harbour is viewed as a complementary facility to the one at outer harbour, thus achieving optimum utilization of scarce water front.

However, keeping in view the fact that the traffic will increase in a phased manner and keeping in view the present trend in iron ore trade, a view was taken by the Port to develop this integrated facility in two phases, i.e., Phase I – Upgradation of existing mechanized facility at Outer Harbour and Phase II – Creation of new facility at Inner Harbour at WQ1 berth. However,

option is open for the PPP operator to take up phase-II along with phase-I as per their own assessment and planning of the project.

In view of the above, Visakhapatnam Port has entrusted the Indian Ports Association the task of preparation of Techno-Economic Feasibility study for the project " Upgradation of existing facility and creation of new facility for iron ore handling at the Port on BOT basis, duly taking the technical inputs from the reports prepared by M/s MECON and M/s RITES.

The location of the Visakhapatnam Port is shown in Figure-1.1

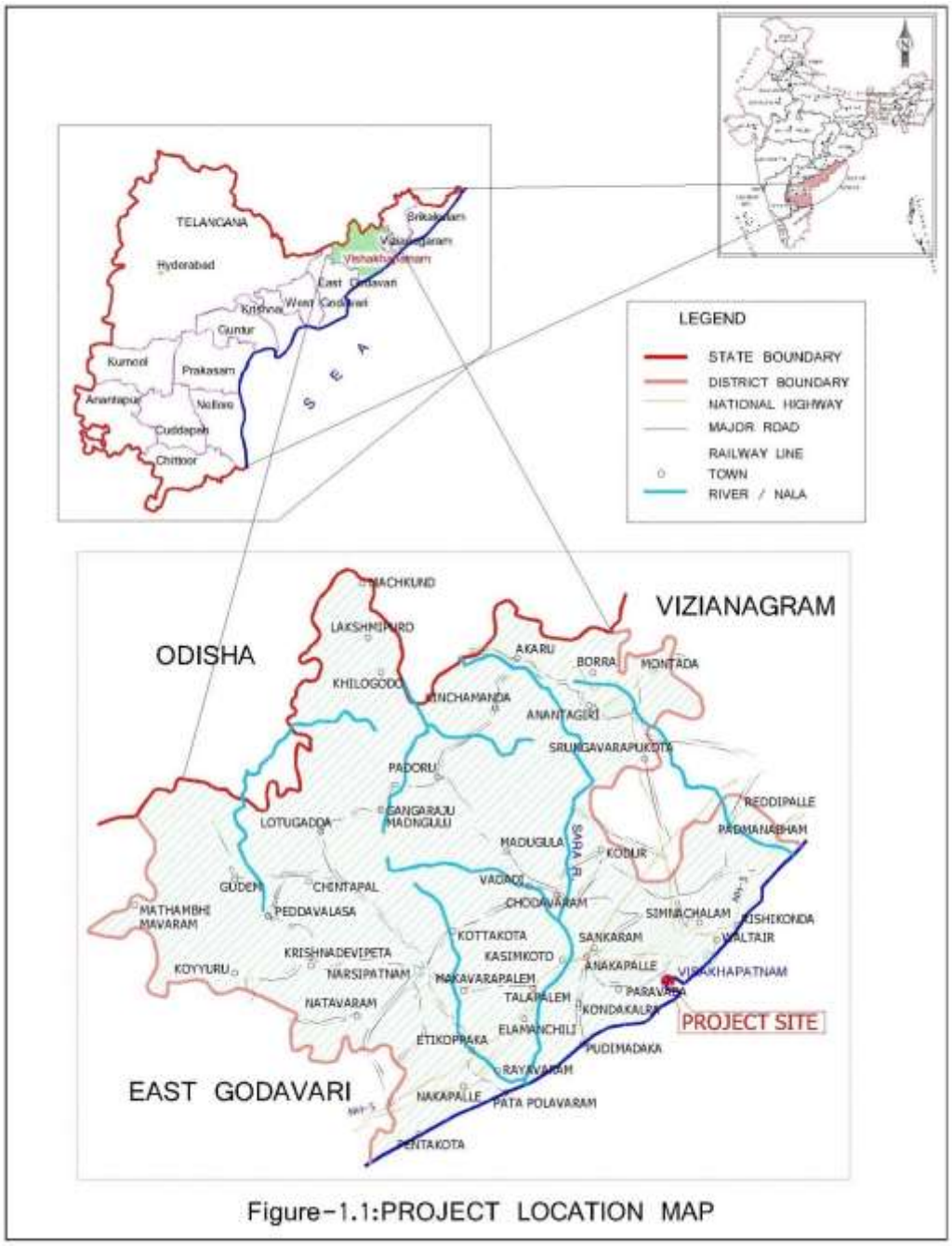

Figure-1.1:PROJECT LOCATION MAP

1.2 PROPOSED PROJECTS

The Visakhapatnam Port proposes to upgrade the existing facilities and creation of new facility at VPT for iron to ore handling extension of existing container terminal in the outer berth and development of West Quay North (WQ-7 & WQ-8) berth with mechanized handling facilities for bulk cargoes.

The proposed project activities are briefly described in the following paragraphs.

a. Up-gradation of Existing Facility and creation of new facility at VPT for Iron ore handling on DBFOT basis (OHC & WQ-I). This project envisages up-gradation of existing conveyor system constructed during 1970s' which has outlived its economic life and causing dust emissions during cargo handling and the Andhra Pradesh Pollution Control Board (APPCB) has directed port to provide closed conveyor system and to replace the existing ship loader. Therefore, VPT has taken up up-gradation of the Iron ore handling system by providing closed conveyor with in-built dust suppression system and to replace the ship loader so as to improve the handling efficiency resulting in modernized equipment for dust control at all the transfer points.

Further, a portion of iron ore is presently handled at WQ1 berth with semi mechanized method which is now proposed to be converted to a fully mechanized system under this project. The layout of the existing and proposed berths in Visakhapatnam Port is shown in Figure-1.2.

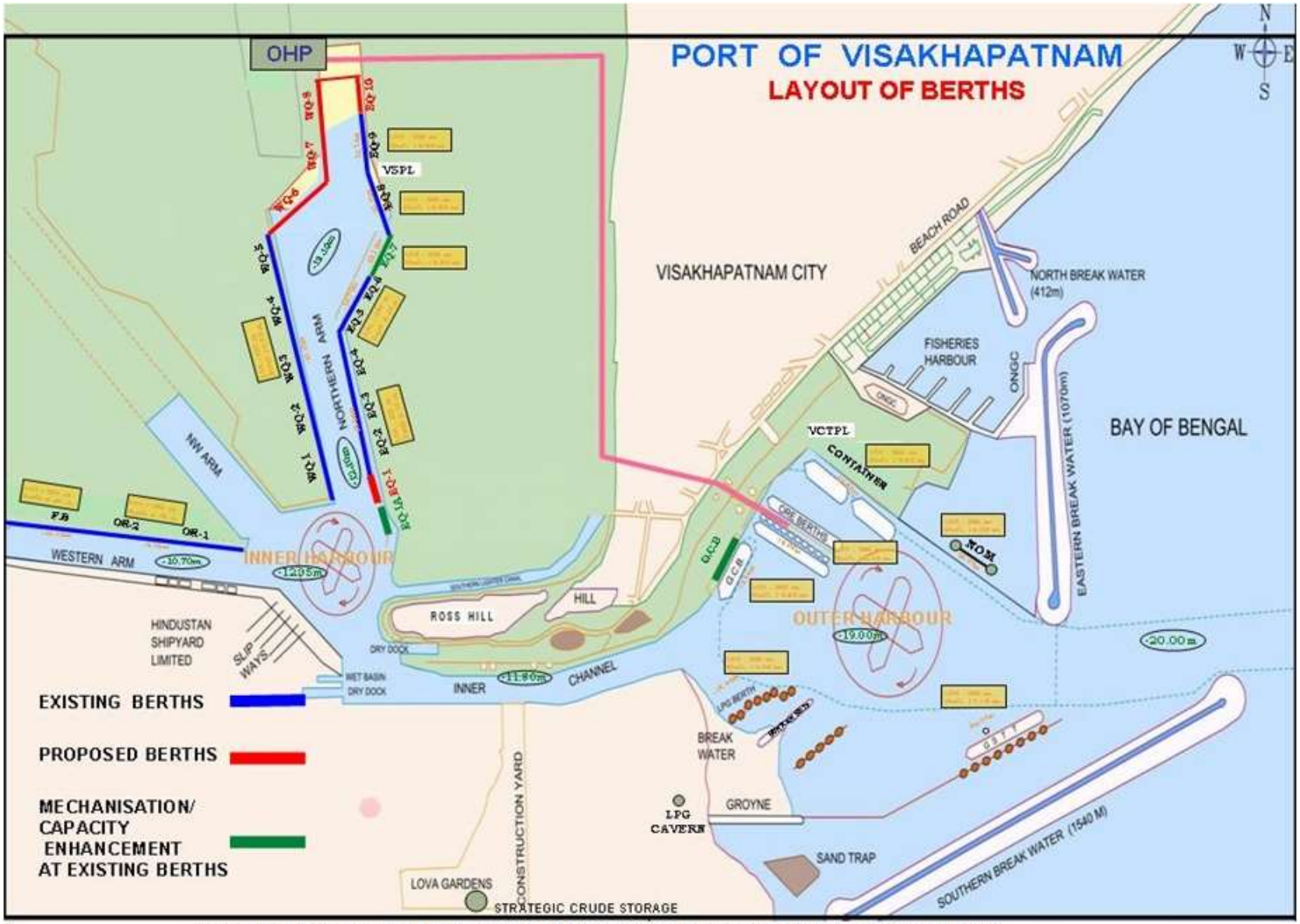

Figure-1.2: Layout of Existing and Proposed Berths in Visakhapatnam Port

b. Extension of Existing Container Terminal in the Outer Harbour of Visakhapatnam Port on DBFOT basis

This project envisages extension of the existing container terminal along with streamlining the transportation activities of the container handling hither to being carried through trucks up-to the Container Freight Station (CFS) destination, situated at a far-off place. The present proposal envisages transportation of containers by rail movement / shuttling operations with a contiguous rail line. The Rail share of the evacuation which is currently Zero would be slowly improved with the active participation of all the stake holders".

In order to enhance capacity handling to the tune of 0.54 MTEUs, VPT propose for extension of existing container terminal in the outer harbour of Visakhapatnam Port. The layout details is shown if Figure 1.3.

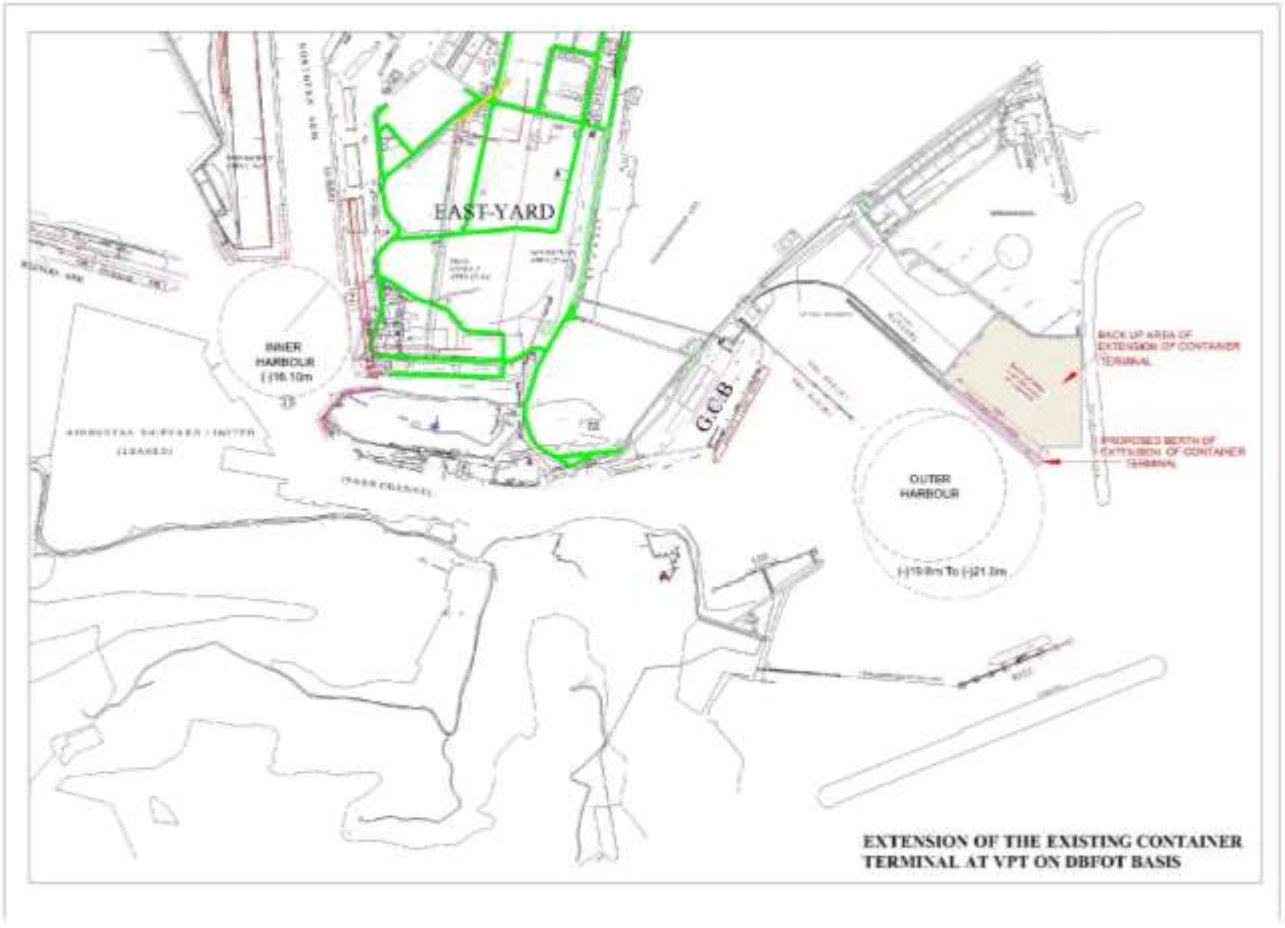

Figure 1.3: Layout details of extension of existing container terminal

c. Development of West Quay North (WQ-7 & WQ-8) berth with mechanized handling facilities for handling bulk cargoes on DBFOT basis.

Presently, the cargo such as blast furnace slag, gypsum and ores other than iron ore proposed under this project (WQ-7 & WQ-8), which are already being handled in a semi-mechanized method elsewhere in port and is now proposed to be changed to fully mechanized handling system. The layout details is shown if Figure 1.4.

This project envisages as follows:

i) Under Phase-I, Development of West quay north WQ7&WQ8 - berth of 560m long would be taken up through internal resources.

ii) While the development of this berth is under progress, during next phase, it is proposed to take up **mechanization** of cargo handling facilities **through PPP mode.**

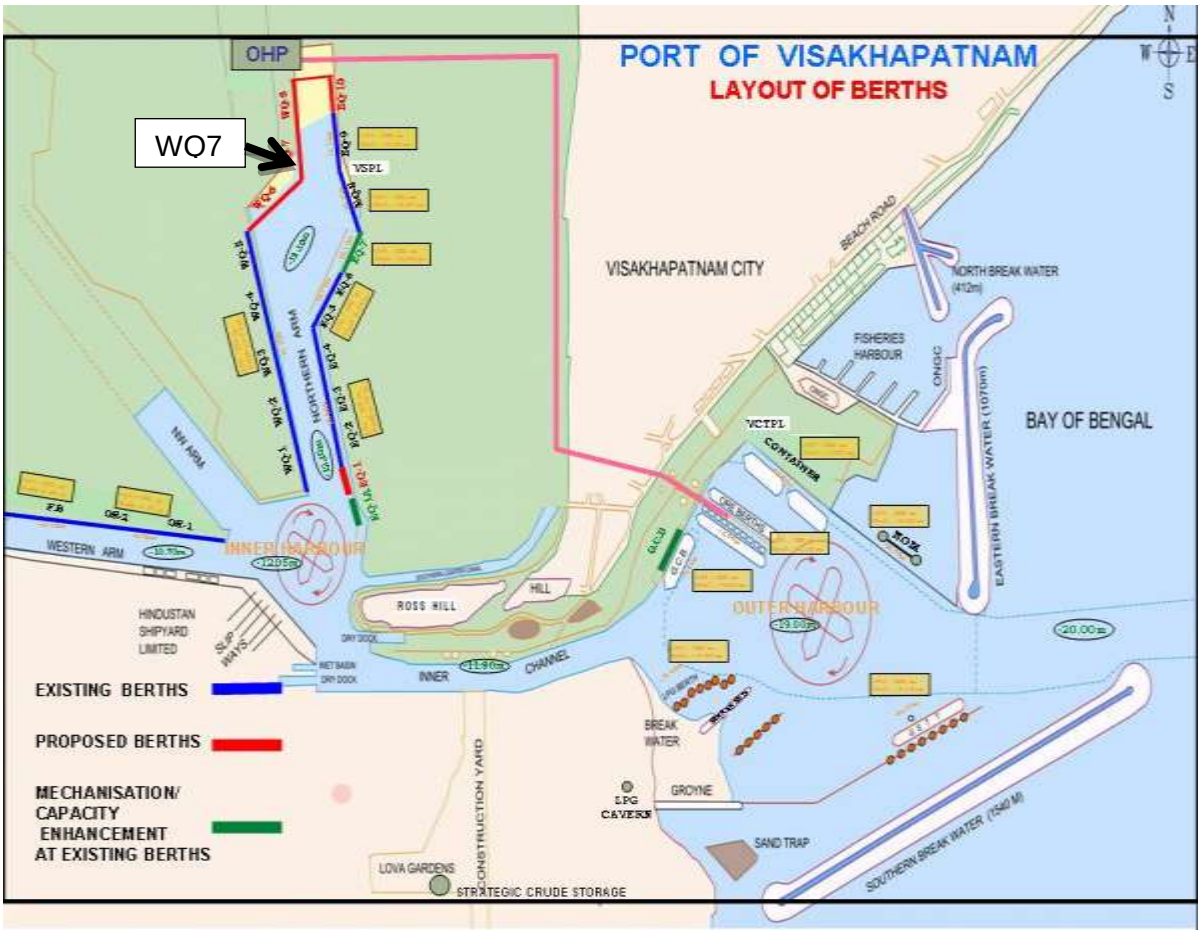

Figure 1.4 Layout details of West Quay North (WQ-7 & WQ-8)

1.3 NEED FOR THE EIA STUDY

The purpose of the Environmental Impact Assessment study (EIA) is to assist in the decision making process and to ensure that the project options under consideration are environmentally sound and sustainable. EIA identifies ways of improving project environmentally by preventing, minimizing, mitigating or compensating for various adverse impacts likely to accrue as a result of the proposed conveyor gallery. In addition an EIA study also leads to the delineation of long-term environmental monitoring requirements.

The EIA study is a pre-requisite for getting the Environmental Clearance as well as the CRZ clearance from Ministry of Environment & Forests, Government of India (MoEF) and No Objection Certificate (NOC) / Consent to Establish (CTE) from the State Pollution Control Board. The key aspects of an EIA study includes:

- Assessment of the existing status of physico-chemical, ecological and socio-economic aspects of the environment.
- Identification of potential impacts on various environmental components due to activities envisaged during construction and operation phases of the proposed project.
- Prediction of significant impacts on major aspects of environment.
- Delineation of EMP outlining measures to minimize adverse impacts during construction and operation phases of the proposed project.
- Formulation of environmental quality monitoring programme for implementation during construction and operation phases.

1.4 STUDY AREA

The Study Area for the proposed EIA study is the area within 10 km radius of the proposed project site. The Study Area is depicted Figure-1.5.

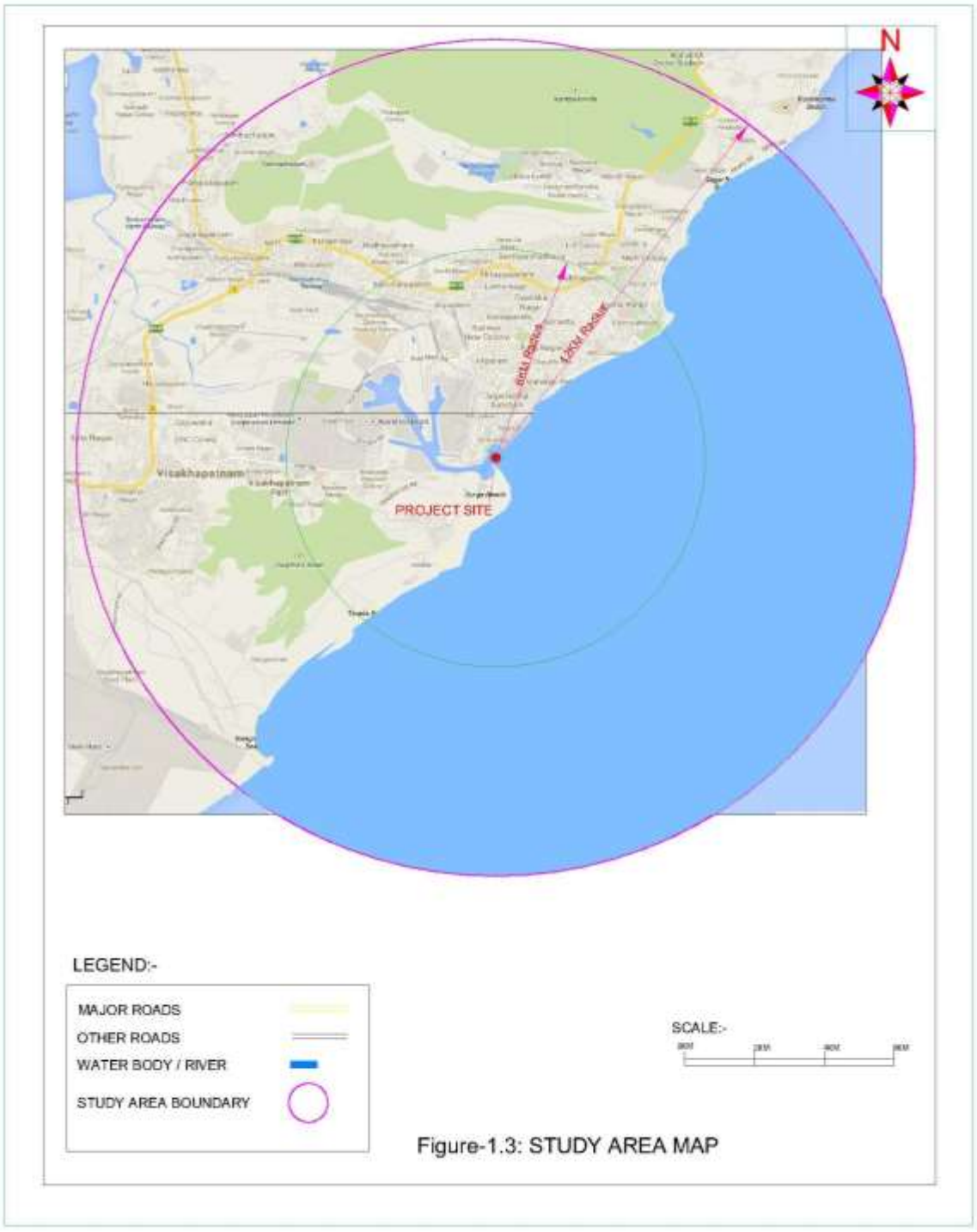

Figure-1.5: Study Area Map

1.5 OUTLINE OF THE REPORT

The contents of the EIA report are arranged as follows:

Chapter 1: The chapter gives an overview of the need for the project, objectives, need for EIA study, etc.

Chapter 2: Describes the existing features of the Visakhapatnam Port.

Chapter 3: The chapter presents a brief description of the project and related appurtenances.

Chapter 4: Baseline environmental conditions including physical, biological and socio-economic parameters, resource base and infrastructure have been described in this chapter. Before the start of the project, it is essential to ascertain the baseline conditions of appropriate environmental parameters which could be significantly affected by the implementation of the project.

Chapter 5: Anticipated positive and negative impacts as a result of the construction and operation of the proposed port expansion project are assessed in the chapter. An attempt has been made to predict future environmental conditions quantitatively to the extent possible. But for certain parameters, which cannot be quantified, the general approach such intangible impacts in qualitative terms so that planners and decision-makers are aware of their existence as well as their possible implications, is addressed.

Chapter 6: This chapter deals with the Environmental Management Plan (EMP) outlined mitigation measures for amelioration of anticipated adverse impacts likely to accrue as a result of construction and operation of proposed project related activities. The approach for formulation of mitigation measures has been to maximize the positive environmental impacts and minimize the negative ones.

Chapter-7 : Outlines the Emergency Response Plan for Oil/Chemical Spill.

Chapter 8: Details a set of measures to be implemented in the vent of man made and natural disasters is also outlined in this Chapter.

Chapter 9: Describes the key features of activities implemented as a part of Corporate Social Responsibility Plan.

Chapter 10: Environmental Monitoring Programme for implementation during project construction and operation phases has been delineated in this chapter. The objective is to assess the adequacy of various environmental safeguards and to compare the predicted and actual scenario during construction and operation phases to suggest remedial measures not foreseen during the planning stage but arising during these phases and to generate data for further use.

Chapter 11: Public hearing proceedings are summarized in this Chapter.

Chapter 12: cost required for implementation of Environmental Management Plan and Environmental Monitoring Programme are summarized in this Chapter

Chapter-13 : Summarizes the project benefits.

Chapter-13 : Presents the Executive Summary and Conclusions of the EIA study.

Chapter 15: Delineates the Disclosure of Consultants.

1.6 TOR COMPLIANCE

The compliance of Approved TOR is enclosed as Appendix-I.

CHAPTER-2
VISHAKHAPATNAM PORT – PROFILE

CHAPTER – 2

VISAKHAPATNAM PORT – PROFILE

2.1 INTRODUCTION

The port of Visakhapatnam situated on the East Coast of India is one of the pre-eminent Major Ports of the country. The Port has two harbour basins viz., the Inner Harbour and the Outer Harbour. The Port is predominantly a bulk cargo handling Port. During 2014-15, the Port handled a total cargo throughput of 58 million tonnes of which dry cargo constituted 62%. While the dry cargo profile at the Port comprises of iron ore, iron pellets, coking coal, steam coal, thermal coal, fertilizers and raw materials etc., iron ore and pellets contribute a significant portion with a share of 38% in the dry cargo trade. Iron ore and iron pellets are handled through mechanized means at outer harbour and in addition, iron ore is also handled at inner harbour through semi-mechanized means.

2.2 EXISTING INFRASTRUCTURE

2.2.1 Details of Inner and Outer Harbour

The port, comprises two harbours viz., the inner harbour and the outer harbour. Besides, there is a fishing harbour adjacent to the Port. The outer harbour is encompassed by three breakwaters viz., north breakwater (412m), south breakwater (1543m) and east breakwater (1070m). The water spread and land areas available in the two harbours are given in Table-2.1. The dimensions of approach channel are given in Table-2.2. The ship dimensions permitted through the inner and outer harbours are given in Table-2.3.

Table-2.1: Water and land area for Inner and Outer Harbour at Visakhapatnam Port (Unit: ha)

Type	Inner harbour	Outer harbour	Total
Water spread	100	200	300
Land area	3881	25	3906
Total	**3981**	**225**	**4206**

Table-2.2: Dimensions of Approach Channel (Unit: m)

Parameter	Inner harbor	Outer harbour
Length	1620	1700
Depth	15.0	22.0
Width	111	200

Table-2.3: Dimensions ship permitted in Inner and Outer Harbour (Unit: m)

Parameter	Inner harbour	Outer harbour
LOA	230	295
Beam	32.5	54
Draft	13	18.10

2.2.2 Berth Facilities

Presently, there are 17 berths in the inner harbour and 6 berths and one oil mooring in the outer harbour. The details of ship sizes permitted and cargoes handled at each of these berths are given in Table-2.4.

Table 2.4: Details of ship size permitted and cargoes handled at each berth

Berths	LOA (m)	Beam (m)	Draft (m)	Commodities handled	Cranes
A. Inner Harbour					
East quay-2 #	167.64	32.50	10.06	Pet coke, Steel, soya, other bulk, BF slag, ores, Ilmenite sand, Feldsper, fertilizers, LAM Coke, Bauxite, coking coal, Gypsum etc.	3 Nos. 10 T
East quay-3 #	167.64	32.50	10.06		4 Nos. 10 T
East quay-4 #	231.00	32.50	10.06		4 Nos. 15 T
East quay-5 #	167.64	32.50	11.00*		2 Nos. 15 T and 1 Nos. 10 T
East quay-6 #	182.90	32.50	11.00*	Liquid ammonia, phosphoric acid, B.F. slag	
East quay-7 #	255.00	32.50	11.00*	Thermal coal, scrap, fertilizers	4 Nos. 20 T
East quay-8 # (BOT)	255.00	32.50	12.50	BF slag, iron ore, steam coal, fertilizers, styrene monomer, manganese ore, Gypsum	3 Nos. 104 T (Harbour mobile crane)
East quay-9 # (BOT)	255.00	32.50	11.00*	BF slag, Steel, feldspar, steam coal, fertilizer, manganese ore, lime stone, Gypsum	
West quay-1 #	212.00	32.50	13.00	Coking coal, thermal coal, limestone and other dry bulk and break bulk cargoes	
West quay-2 #	226.70	32.50	13.00	Iron ore, pellets, thermal coal, coking coal	2 Nos. 140 T (Harbour Mobile Cranes at West Quay side)
West quay-3 #	201.12	32.50	13.00	Coking coal, CP coke, limestone	
West quay-4 #	243.00	32.50	11.00*	Coking coal, thermal coal, steam coal	
West quay-5 #	241.70	32.50	11.00*	Caustic soda, alumina, T. Coal	
West Quay-6 #	205	32.5	11.00	Pet coke, Lam Coke,granite , steel	
RE. WQ.1	170.00	32.20	10.00	Timber and General cargo	
Fertilizer berth	173.13	32.50	10.06	Fertilisers and fertilizer raw materials meant for M/s.Coromandel International	
OR-I **	183.00	32.50	10.06	Petroleum products, Bio-	

Berths	LOA (m)	Beam (m)	Draft (m)	Commodities handled	Cranes
OR-II **	183.00	32.50	9.75	diesel, Styrene monomer	
B. Outer harbour					
Ore berth-1	270.00	48.00	16.50 *	Iron ore, iron pellets	
Ore berth-2	270.00	48.00	16.50 *		
Oil mooring (NOM)	250.00	48.00	15.00	Transhipment of crude & products	
General Cargo Berth (PPP)	295.00	54.00	18.10	Coking coal and steam coal	
Off-shore tanker terminal (OSTT)	408.00	48.00	17.00*	Crude oil, petroleum products	
LPG	370.92	42.00	14.0	LPG, Petroleum products	
Container terminal (operated by M/s. VCTPL – BOT)	451.00	42.00	15.5	Containers	

\# Multipurpose berth
* On rising tide
** Subject to maximum 195 m at one of the two berths

2.2.3 Mechanised Handling Facilities

The details of mechanised handling facilities at Visakhapatnam port are given in Table-2.5.

Table-2.5 : Details of mechanised handling facilities

Cargo	Details of mechanised facilities
Iron ore & Pellets	• Mechanized ore handling plant consisting of ship loader of 8000 TPH capacity • Three bucket wheel reclaimers of 4000 tph each • Twin wagon tipplers of 100 T lifting capacity and 27 tips per hour, Third tippler of 120 T lifting capacity and 30 tips per hour • Two stackers of 2700 TPH each and a conveyor • System of about 9 kms. (both ways)
Alumina	• Ship loader with a capacity of 2200 T/hour and three sylos of • 25000 T each (owned, operated and maintained by M/s NALCO) • Mechanized wagon unloading system to unload Alumina from wagons @ 1100 TPH
Crude Oil	• Three unloading arms with discharge capacity of 5500 tonnes per hour
Transshipment of crude oil	• Direct discharge from ship to ship at one of the oil moorings
Fertilizer and Fertilizer raw material	• Screw type marine unloader of capacity 400 Tonnes/ Hour (Owned, operated and maintained by M/s CFL)

Cargo	Details of mechanised facilities
Import and Export of Petroleum product	• Two oil berths equipped with pipeline facilities connecting the storage tanks of the refinery
Caustic soda	• Direct discharge through pipeline @ 600 TPH in case of caustic soda and three sylos of 10000 T capacity each
Liquid Ammonia and Phosphoric Acid, Sulphuric Acid, Styrene monomar, Molten sulphur, etc.	• Direct discharge facilities through pipeline
At BOT berths	• 3 Nos. 104 T. Harbour mobile cranes,2 nos. 1500 TPH stacker reclaimer, 2 nos. 240 T mobile hoppers, 1 nos. 1100 TPH wagon loader and 2 nos. Weigh bridges

2.2.4 Facilities for transportation of cargo to the hinterland

The port owns, operates and maintains about 200 km of track length. There are 12 sidings and 28 open terminals in the port railway system. The port has 99 km of road network. Port Connectivity Road (PCR) from the operational area with National Highway No.5 exists.

2.2.5 Dry Dock facilities

The Port has two Dry dock –One for repairs of Port craft and other for repairs of fishing trawlers. The dimensions of these dry docks are given in Table-2.6.

Table-2.6: Dimensions of Dry Dock

Dry docks	Dimensions
For port craft	137 x 18 x 5.6 m
For fishing trawlers	65 21 x 6.0 m

2.2.6 Navigation facilities

The permissible vessel dimensions are given in Table-2.7.

Table - 2.7: Permissible vessel dimensions (Unit : m)

	LOA	Beam	Draft	Tide
Day –Inner Harbour	Handy max 210	32.50	13.00	0.85 for LOA up to 200 1.05 for LOA up to 210
	Panamax 225	32.50	13.00	0.94
Night	Up to 200	32.50	10.2	--
Inner Harbour	210	32.50	10.2	0.20
a) Arrivals	225	32.50	10.9	0.94
b) Departures	Upto 200	32.50	11.0	0.85
	210	32.50	10.7	0.71
	225	32.50	8.0	--
Outer Harbour	295	54.00	18.10	0.5

2.2.7 Pilotage

Pilotage is compulsory both for inward and outward movement of ships and for movement of ships between berths and moorings within the harbour. Pilotage services are provided round-the-clock, with prior advice to the harbour Master of the port.

2.2.8 Power supply

The Port draws its entire requirement of power from the Andhra Pradesh Eastern Power Distribution Private Limited (APEPDPL) through the 132 KV sub-station.

2.2.9 Water supply

The main source of water supply to the Port is the Greater Visakhapatnam Municipal Corporation (GVMC). In addition, the port has its own underground water source. **During 2013-14** a quantity of 24.13 lakh kiloliters of water was received by Port from various sources out of which 8.42 lakh kiloliters was met from Port's own resources.

2.3 PAST PERFORMANCE OF THE PORT

2.3.1 Traffic Handled

Visakhapatnam Port witnessed a considerable growth in the cargo throughput over the past one decade. The cargo throughput of the port increased from 44.34 million tonnes in 2000-01 to 67.42 million tonnes in 2011-12. Cargo throughput declined to 59.04 million tonnes during the year 2012-13 mainly on account of decline in iron ore traffic owing to restrictions on mining and decline in transhipment of crude oil to Paradip consequent on development of SPM. Year-wise growth in the cargo throughput of the port vis-à-vis the major ports of the country during the last twelve years is given in Table-2.8. The commodity wise traffic handled is given in Table-2.9.

Table-2.8: Details of Traffic handled at Visakhapatnam Port

Year	Traffic handled (in million tonnes)		% share of traffic handled by Visakhapatnam Port
	Visakhapatnam Port	All major ports of the country	
2001-02	44.34	287.58	15.4
2002-03	46.00	313.55	14.7
2003-04	47.73	344.80	13.8
2004-05	50.15	383.63	13.1
2005-06	55.80	423.41	13.2
2006-07	56.39	463.78	12.2
2007-08	64.60	519.16	12.4
2008-09	63.91	530.36	12.0
2009-10	65.50	560.59	11.7
2010-11	68.04	569.91	11.9
2011-12	67.42	560.15	12.0
2012-13	59.04	545.79	10.8
2013-14	58.50	555.49	10.5
2014-15	58.00	581.34	10.0

Table-2.9: Commodity wise traffic handled at Visakhapatnam Port (Unit: lakh tonnes)

Commodity	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
Crude Oil and Products	197.58	182.90	190.67	184.37	150.36	140.09	146.41
Iron Ore	120.65	143.84	144.15	103.22	75.38	85.19	48.37
Iron Pellets	54.43	37.24	47.00	58.32	47.71	44.80	34.64
Finished Fertilizers	34.08	29.09	32.68	37.17	20.23	17.71	18.38
Fertiliser Raw Materials	7.26	7.75	8.11	8.32	5.65	7.95	7.20
Thermal Coal	34.40	37.13	35.38	31.89	29.51	27.44	27.79
Coking coal	75.61	74.36	73.44	67.80	68.35	69.28	60.74
Containers	13.62	16.78	25.72	42.14	45.54	49.16	43.73
Other cargo	101.45	125.92	123.26	140.97	147.67	143.41	192.78
Total	**639.08**	**655.01**	**680.41**	**674.20**	**590.40**	**585.03**	**580.04**

The details of Overseas and Coastal traffic are given in Table-2.10.

Table -2.10: Details of Overseas and coastal traffic handled at Visakhapatnam Port (in lakh tonnes)

Description	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
Overseas	431.05	450.39	450.12	447.53	412.12	413.98	434.07
Coastal	208.03	204.65	230.29	226.67	178.28	171.05	145.97
Total	**639.08**	**655.04**	**680.41**	**674.20**	**590.40**	**585.03**	**580.04**

2.3.2 Vessel traffic

The vessel traffic handled at Visakhapatnam Port is given in Table-2.11.

Table- 2.11: Vessel traffic handled at Visakhapatnam Prot (Unit: No.)

Description	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
Liquid bulk	663	715	778	715	589	606	638
Dry bulk							
- Mechanical	272	255	233	189	170	258	269
- Conventional	830	1020	1015	958	754	643	574
Break bulk	271	210	166	219	193	166	180
Container	251	206	277	351	335	297	281
Total	**2347**	**2406**	**2469**	**2432**	**2041**	**1970**	**1942**

2.4 TRAFFIC ANALYSIS & FORECAST

2.4.1 Present traffic

The Port of Visakhapatnam handled a record cargo throughput of 68.04 million tonnes during 2010-11. Cargo throughput declined to 59.04 million tonnes during the year 2012-13 mainly on account of decline in iron ore traffic owing to restrictions on mining and decline in transhipment of crude oil to Paradip consequent on development of SPM. The principal commodities handled at the port are POL, iron ore and iron ore pellets, coking coal, thermal coal, fertilizers and fertilizer raw materials, containers and other cargo.

The cargo composition shows that the Port is predominantly a dry bulk handling Port. During the year 2012-13, 36.91 million tonnes of dry bulk traffic was handled which constitutes 62% of total cargo handled. Dry bulk cargoes handled at the port include iron ore, coking coal, steam coal, fertilizers and fertilizer raw materials, CP coke/Petroleum coke, LAM coke, lime stone, gypsum, bauxite, BF slag, ilmenite sand, manganese ore and others ores etc. The details of total traffic handled at the Port and the traffic handled at Multi-purpose berths of Inner harbour including GCB at outer harbour from 2005-06 to 2012-13 are given in Table-2.12.

Table-2.12: Details of total traffic handled at the port (Unit: million tonnes)

Year	Total traffic	Traffic at MPB's and GCB
2005-2006	55.80	23.15
2006-2007	56.39	24.23
2007-2008	64.60	28.79
2008-2009	63.91	28.04
2009-2010	65.50	32.27
2010-2011	68.04	32.31
2011-2012	67.42	32.39
2012-2013	59.04	24.81
2013-14(includeVGCB)	58.50	29.50
2014-15(include VGCB)	58.00	30.27

The total traffic handled at the above multi-purpose berths of inner harbour in 2012-13 constituted 42% of the total traffic. The berth occupancy of multi-purpose berths during 2012-13 was 76%. The details of dry bulk cargo handled at multipurpose berths of inner harbour during the last five years are given in Table-2.13.

Table-2.13: Details of Dry Bulk Cargo handled at multi-purpose berths of Inner Harbour (Unit: lakh tonnes)

Dry bulk traffic	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
Exports	98.87	118.60	123.31	112.45	91.86	117.10	88.31
Imports	120.28	139.83	135.58	165.13	156.15	130.20	142.97
Total	**219.15**	**258.43**	**258.88**	**277.58**	**248.01**	**247.30**	**231.28**

Presently, the inner harbour berths are catering to 11 m draft vessels. In line with Government's policy of induction of private sector participation in the commercial services of the port sector, Visakhapatnam port has taken a lead in introducing PPP model for the development of berthing facilities and cargo transfer systems for the predominant cargoes such as coal, iron ore and container cargo. To cater to handling needs of cargoes such as coking coal, thermal coal, steam coal, iron ore, fertilizers, CP coke and LAM coke through bigger size vessels, the Port is developing new berths and mechanizing/strengthening existing berths on DBFOT basis. It is now proposed to develop the facilities for handling other import and export minor bulk cargoes**.**

2.4.2 Potential cargoes to be handled at the proposed facility

The cargo profile reckoned for the proposed berth comprises of import of Manganese ore, Gypsum, Bauxite, Limestone and export of BF slag, Ilmenite sand and ores (other than iron ore). The trend in the traffic flow of these commodities during the past five years is given in Table-2.14.

Table-2.14: Details of Potential cargoes to be handled at the proposed facility

Year	Import cargoes				Export cargoes			Total
	Manganese Ore	Bauxite	Gypsum	Lime stone	B.F. Slag	Ilmenite Sand	Ores (other than Iron Ore)	
2014-15	**1340804**	**761133**	**663701**	**303165**	**42800**	**365550**	**49121**	3526274
2013-14	**981796**	**624616**	**1018294**	**661227**	**37600**	**294571**	**69266**	3687370
2012-13	1,002,425	600,049	1,269,139	447,362	--	252,526	99,800	3,671,301
2011-12	675,035	791,395	1,192,192	288,723	54,100	316,476	121,300	3,439,221
2010-11	801,191	323,415	1,098,110	493,520	--	288,455	145,561	2,966,154
2009-10	235,736	684,270	1,090,156	412,076	288,051	115,280	140,585	2,264,211
2008-09	92,319	83,811	493,144	568,794	816,416	61,750	147,977	2,368,125

2.4.3 Vessel Parameters

The average DWT, average parcel and average OSBD of these cargoes during the period 2007-08 to 2012-13 is furnished in Table-2.15.

Table-2.15: Average vessel parameters operating at Visakhapatnam Port

Cargo/Year	Avg. DWT	Avg. GRT	Avg. Parcel (tonnes)	Avg. OSBD (tonnes)
Imp. Manganese Ore	2	3	4	5
2012-13	50,233	28,966	22,276	10,004
2011-12	44,119	25,735	20,908	8,536
2010-11	43,610	25,300	25,845	8,820
2009-10	36,293	21,249	23,574	8,440
2008-09	36,719	22,417	18,464	8,089
2007-08	35,459	21,240	21,191	9,367
Imp. Bauxite	6	7	8	9
2012-13	57,500	32,395	46,158	9,671
2011-12	48,519	28,126	41,652	9,163
2010-11	45,172	26,523	40,427	8,975
2009-10	39,389	23,101	35,983	8,067
2008-09	44,899	26,166	41,906	12,372
2007-08	31,736	18,921	28,970	7,758
Imp. Gypsum				
2012-13	10	11	12	13

Cargo/Year	Avg. DWT	Avg. GRT	Avg. Parcel (tonnes)	Avg. OSBD (tonnes)
2011-12	47,678	27,801	43,532	13,040
2010-11	43,286	25,702	38,458	13,599
2009-10	36,735	21,751	33,276	13,676
2008-09	41,208	24,104	36,339	10,854
2007-08	36,514	22,178	30,822	13,503
	35,383	21,390	33,465	13,976
Imp. Lime Stone				
2012-13	14	15	16	17
2011-12	35,525	20,803	23,545	5,674
2010-11	26,890	15,492	20,623	5,657
2009-10	31,700	18,430	27,418	5,925
2008-09	26,188	15,954	25,755	4,747
2007-08	33,261	19,318	29,937	7,857
	32,395	18,809	28,098	7,082
Exp. B.F. Slag				
2012-13	18	19	20	21
2011-12	--	--	--	--
2010-11	32,467	19,721	27,050	7,391
2009-10	--	--	--	--
2008-09	24,713	15,488	21,702	6,711
2007-08	28,488	17,020	25,647	8,531
	27,506	16,771	23,102	8,742
Exp. Ores (other than iron ore)				
2012-13	22	24	26	28
2011-12				
2010-11	23	25	27	29
2009-10	19,334	12,476	15,234	6,534
2008-09	32,239	20,560	30,325	9,361
2007-08	24,715	16,211	24,260	8,363
	27,187	17,003	20,084	8,478
	26,693	16,074	11,614	5,192
	25,166	16,857	18,477	5,018
Exp. Ilmenite Sand				
2012-13	30	31	32	33
2011-12	14,888	10,245	12,025	8,189
2010-11	16,278	11,315	12,172	7,519
2009-10	15,362	10,825	14,423	6,340
2008-09	16,538	11,267	14,410	5,510
2007-08	20,659	13,351	15,438	6,361
	17,675	11,494	12,257	6,408

2.4.4 Summary of the Traffic Projections

The summary of the Traffic Projections are given in the Table-2.16.

Table-2.16: Summary of Traffic Projections at Visakhapatnam Port (Unit: million tonnes)

S.No.	Commodity	2015-16	2016-17 onwards
1	Import Manganese Ore	1.30	1.60
2	Import Bauxite	0.80	0.80
3	Import Gypsum	1.15	1.30
4	Import Lime Stone	0.70	0.80
5	Export Blast Furnace Slag	0.50	0.90
6	Export Ores(other than iron ore)	0.15	0.15
7	Export Ilmenite Sand	0.45	0.50
	Total	**5.05**	**6.05**

2.5 PROMOTING RENEWABLE ENERGY RESOURCE UTILIZATION:

- Utilization of renewable energy sources thereby reducing the pressure on conventional grid electricity by using the solar power for lighting purpose.
- Solar energy is being utilized for the purpose of lighting in some of the port areas on trial basis at a cost of Rs. 5,09,940/-
- Solar powered water heating system is also being used in different canteens and port guesthouse by investing an amount of Rs. 9,02,412/-
- Solar fencing at identified areas of VPT is proposed at an Estimated cost of Rs 12,65,000/-
- Installation of Solar power plant at Golden Jubilee hospital is proposed at an Estimated cost of Rs 38,00,000/-

Green technology revolution against green house gases evolution:

Possible reduction in fossil fuel consumption by proposing for the deployment of electrical rail engines in place of diesel engines thereby contributing for the development of clean fuel technology..

Green belt development as a barrier against pollution:

Active participation in prioritized green belt development programme as per the Parliamentary standing committee recommendations.

Conservation and Resource optimization:

Strictly adhering to the transportation of cargo by High capacity trucks henceforth will reduce the number of trips and considerable improvement in the cargo handling time and energy consumption will be achieved.

Wastewater recycling and reuse:

A 10 MLD STP is under operation for collecting and treating the city sewage before entering into the harbour water thereby maintaining the harbor water quality. The treated waste water is used for effective dust suppression hence conserving the fresh water resources.

2.6 EXISTING ENVIRONMENT MANAGEMENT SYSTEM AT VPT:

- AAQ is being monitored at six locations by APPCB and AUDC.
- Separate Environmental Cell headed by Executive Engineer and 4 dedicated staff.
- Environment Monitoring Committee (APPCB, Senior Citizens, Air Quality Experts, NGOs, Port users, Officials of GVMC, Representatives of Navy, SAIL and schools) meets once in 2 months.
- Consent of APPCB obtained annually under Air and Water Acts.
- Annual auditing by external agencies (IRQS) for ISO14001
- The Coal stack yards at GCB, WOB, North and South of S4 Conveyor are provided with mechanical dust suppression system at a cost of Rs.8.00 Crores, covering an area of 4,75,000 m^2 commissioned in the year 2002 and the same is effective and water sprinkling is done continuously round the clock.
- Wetting of cargo stacks at R-4 & R-10 by sprinkling of water with water tankers and with mechanical dust suppression system is being done continuously round the clock.
- Wetting of roads through water tankers continuously round the clock to prevent emission of dust during movement of vehicles. A total of 275 trips of water (about 4.0 MLD) is being sprinkled every day through tankers and 3.0 MLD is being sprinkled in stacking areas through Mechanical Dust Suppression System.
- Covering of trucks with tarpaulins.
- Regular Manual sweeping of the roads for maintaining the roads clean.
- Necessary environmental measures including dust suppression system, high-rise enclosures, screensetc. Significant reduction in cargo movement by road there by controlling dust pollution.
- Re-organization of stack yards is proposed by shifting the present location of coal stack to inside from periphery by providing proper environmental safeguards viz. construction of high rise walls, drainage system, MDSS and Plantation which is targeted to be completed by end of March 2016.

Insulation of Coal Stack Yard (East Yard)

A High rise wall of 7.5 mts height along with dust barrier of height 4 mts (total 11.5 mts height) was constructed on the ***eastern and part of northern side of the east yard*** at a cost of Rs.2.0 crores where there is a city interface.

A Highrise wall of 7.5 mts height along with dust barrier of height 4 mts along the ***R-11 area near Gnanapuram.***

A Highrise wall at city interface of 7.5 mts height is proposed to be construed from ***Sea horses Junction to H-7*** at a cost of Rs. 9.75 crores.

Water pollution mitigative measures

- Strict enforcement of rules on ships prohibiting discharge of bilge or ballast water into the harbour basin.
- Harbour water analysis by AUDC at 9 locations for physic- chemical parameters on Quarterly basis.
- Collection of bed samples by M/s GITAM university on Half yearly basis.
- Provision of floating oil boom to contain oil spill during oil handling operations.
- Collection of debris and floating garbage by floating craft.
- Disposal of dredged soil in a location inside the sea identified by CWPRS.
- Strict instructions to the industries to treat the effluents before discharging into port waters.
- 10 MLD sewage treatment plant is in operation to treat the city sewage and sullage entering into port waters to avoid harbour water pollution and the screenings such as coconut shells, plastic bags and other solid waste are being sent to Municipal Corporation dumping yard.
- To avoid pollution of harbour water with oily bilges from the floating crafts, bilge water is being collected in separate reception tank.
- All personnel were instructed not to throw any oily substances into the waters.
- Trays are being provided or storing oil barrels to avoid any accidental spillage to the water.
- While transferring oil, precautions have been taken (like placing save all trays near the dripping points).
- Hoses used for oil transfer are being periodically pressure tested to avoid bursting due to deterioration.

- Peripheral drains along sulphur, rock phosphate yards are proposed to collect the dust mixed with water.

Noise pollution mitigative measures.

- Widening and carpeting of roads for movement of heavy cargo vehicles.
- Noise levels are being measured and monitored.
- Conveyor passing through the town ship was covered.

Land pollution

- Drip trays and save-all trays are being used while carrying out maintenance jobs to avoid oil spillages on land.
- Unserviceable and scrap materials are being disposed time to time.

Disposal of liquid wastes

Liquid waste generated is treated by sodium hypochlorite solution and bleaching powder before disposal of the same. The liquid waste generated in the canteens is being handled in a systematic method by separating the leftover food particles in a separate container prescribed for the purpose letting the water alone into the drains in order to protect the environment.

Disposal of hazardous waste.

- The hazardous waste generated in radiology section) is collected in separate container for safe disposal.
- Hazardous waste like oily cotton waste being re-used in blacksmith shops for energy conservation.
- Hazardous waste like used oil and condemned batteries are being disposed as pert the hazardous waste management rules.

Disposal of solid waste

- The solid waste generated in and around port areas is segregated categorically as biodegradable, non-biodegradable and hazardous waste and collected in separate colour coded dustbins. The garbage thus collected is being disposed in GVMC dumping yard, Kapuluppada.
- Solid waste like corroded steel plates, rubber pieces, discarded spares/ equipments are being disposed on regular basis.

Disposal of Bio-medical waste.

- Bio medical waste generated at the Port Hospital is handled and disposed as per the conditions stipulated by the AP Pollution Control Board

Ongoing & Proposed Studies / works for effective implementation of Environment Management at VPT are as follows:

- Preparation of Environment **Management and Monitoring plan for VPT was entrusted to ASCI Hyderabad and they furnished the report. Actions on** Environment Management Programme are initiated to complete in a time bound manner latest by December 2016.
- A detailed study on ”Assessment of the effectiveness of existing air pollution management plan of PPP partners of VPT and other Port operational areas” is entrusted to JNTU, Kakinada and the study is under progress and will be completed by September 2015.
- A High-rise wall at city interface of 7.5 mts height is proposed to be constructed from Sea horses Junction at a cost of Rs. 9.75 crores and targeted to be completed by end of May 2016.
- Comprehensive Environment Management system consisting of sweeping of roads with mechanical sweeping machines, removal of floating materials from drains and sprinkling of water on stack yards etc. at a cost of Rs. 10.72 crores for a period of two years, which is continuous process.
- For up-keeping of roads and to ensure proper house keeping “Output performance of road contract” is being introduced at a cost of Rs. 43 crores which would commence from mid of July 2015.
- Mechanical truck tyre cleaning facilities at the port roads joining city to upkeep the city interface roads, which would commence from March 2016.

Planned Greenbelt by VPT (future)

Green Belt was developed around the stack yards. Plantation programme is being pursued by VPT on a continuous basis for the last 2 decades for continual improvement and addition of Green Belt in and around Port area. Since 1990s, 4,30,000 plantation has been done covering an area of 630 acres at different areas including Port operational areas, residential and city areas. Most of the Greenery was damaged due to Hudhud cyclone occurred on 12.10.2014. To compensate the lost greenery, 5000 Nos. of plants have already been planted. Plantation of 36,000 No. of plants has been 2015-16 and another 16000 saplings will be planted in the year 2016-17.

CHAPTER-3
PROJECT DESCRIPTION

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3.1 INTRODUCTION

Visakhapatnam Port Presently, there are 17 berths in the inner harbour and 6 berths and one oil mooring in the outer harbour. Existing cargo handling capacity of the port is 88.1 million tonnes per annum. As a part of the proposed developments in Visakhapatnam Port, the following facilities are proposed to be developed.

- Up-gradation of Existing Facility and creation of new facility at VPT for Iron ore handling on DBFOT basis (OHC & WQ-I).
- Development of West Quay North (WQ-7 & WQ-8) berth with mechanized handling facilities for handling bulk cargoes on DBFOT basis
- Extension of Existing Container Terminal in the Outer Harbour of Visakhapatnam Port on DBFOT basis

This project envisages extension of the existing container terminal along with streamlining the transportation activities of the container handling hither to being carried through trucks up to the container freight station destination, situated at a far-off place. The present proposal envisages transportation of containers by rail movement / shuttling operations with a contiguous rail line. The Rail share of the evacuation which is currently Zero would be slowly improved with the active participation of all the stake holders. The cargo handling capacity of the port will increase by 37.49 MMTPA after the implementation of the proposed development. Hence the total cargo handling capacity of the port after the proposed expansion will be 12.59 MMTPA. The details of the existing and proposed cargo handling capacity of different berths are summarised in Table-3.1.

3.2 UPGRADATION OF EXISTING FACILITY & CREATION OF NEW FACILITY FOR IRON ORE HANDLING (OHC & WQ1)

The inner harbour of the Visakhapatnam Port comprises three navigational arms i.e., Northern Arm, North-western Arm and the Western Arm. The berths (Oil Berth Wharves) OB1 & OB2 are located on the Northern bank of the Western Arm of the Inner Harbour of the Visakhapatnam Port. The details are given in Figure-3.1.

Table-3.1 Details of the existing and proposed cargo handling capacity

Sl. No.	Description	Capacity in MMTPA	Reference
	Existing facilities as per existing EC obtained		
1	M/s.Visakhapatnam Port Trust (EQ 1to EQ 7, WQ 1 to WQ 5 berths, OR 1 and OR2 berths and Fertilizer berths & OSTT, NOM,	34.1	As per CFO, APPCB No.APPCB/VSP/VSP/45/CFO/HO/2014/883, Dt.26.12.2014. Valid upto: 31.12.2016
	M/s.Vizag Sea Port Limited (EQ-8 & 9)	9.5	As per CFO, APPCB No.APPCB/VSP/VSP/13519/CFO/HO/ 2014/ /557, Dt.09.05.2014. Valid upto: 31.12.2016
	M/s. AVR Infra Private Limited (EQ-10)	1.84	As per CFO, APPCB .APPCB/VSP/VSP/230/CFO/HO/2015/3549, Dt.19.08.2015. Valid upto: 31.08.2016
	M/s West Quay Multiport Pvt.Ltd	6.0	As per CFO, APPCB No.APPCB/VSP/VSP/229/CFO/HO/2015/439, Dt.19.04.2015. Valid upto: 31.01.2016
	M/s.Adani Vizag Coal Terminal Private Limited (EQ-1)	6.41	As per CFO, APPCB No.APPCB/VSP/VSP/264/CFO/HO/2014/97, Dt.24.10.2014. Valid upto: 30.11.2015 Application for renewal is submitted
	M/s.Vizag General Cargo Berth Private Limited (GCB)	10.18	As per CFO, APPCB No.APPCB/VSP/VSP/45/CFO/HO/ 2014/686, Dt.04.12.2014. Valid upto: 31.07.2017
	M/s.SEW Vizag Coal Terminal Private Limited (EQ-1A)	7.36	As per EC granted vide Lr.No.F.No.11-33/2010-IA.III, Dt.08.07.2011
	M/s.Visakha Container Private Limited (existing)	7.5 (0.50 MTEUs)	As per CFO, APPCB No.APPCB/VSP/VSP/242/CFO/HO/ 2015/2061, dt.16.03.2015.
	M/s.Vizag Agriport Private Limited (EQ-7 upgraded)	5.21	As per CFE, APPCB No.302/PCB/CFE/RO-VSP/HO/2012/4118, Dt.15.12.2012
	Total capacity of Existing Facilities	**82.1**	
2	**Proposed additional facilities**		
	M/s.Essar Vizag Terminals Limited (OHC)	Phase – I 16.2(OBI & OBII) Phase-II 6.8(WQ-1)	**Under Consideration by EAC**
	M/s.Visakha Container Terminal Private Limited(extension)	8.1 (0.54 MTEUs)	
	Development of WQ-7 & 8 (WQ-North berth)	6.39	
	Total capacity of proposed additional facilities	**37.49**	
3.	**Total capacity after expansion**	**125.59**	

3.2.1 Existing structures

The existing berths are 366m long contiguous structures built during the 1950s, comprising of concrete/masonry monoliths (wells) of 9.14 m by 7.92 m each with a gap of about 1.5 m in between the monoliths and the gap filled with sheet piles to prevent the back fill from leaching into the harbour side. The subsoil at the founding level comprises of sand with granite stone chips. The dredged depth alongside these berths built in the Inner Harbour was initially of the order of about -8.5m CD. However, based on requirements to cater to larger ships and enhanced cargo volumes, dredged depths have been increased to -10.7 m CD in phases. About 2.0 m of embedment of the structure in the soil below dredged level is available now as against more than 4.5 m of embedment of structure in the soil. With the increase in depth due to dredging, potholes have developed in many places. Before further dredging is done, berths have to be strengthened. It is envisaged that PANAMAX vessels of 230m LOA, 32.2m beam will be handled at the OR1 & OR2 berths with 12.5 m draft initially and 14 m draft ultimately.

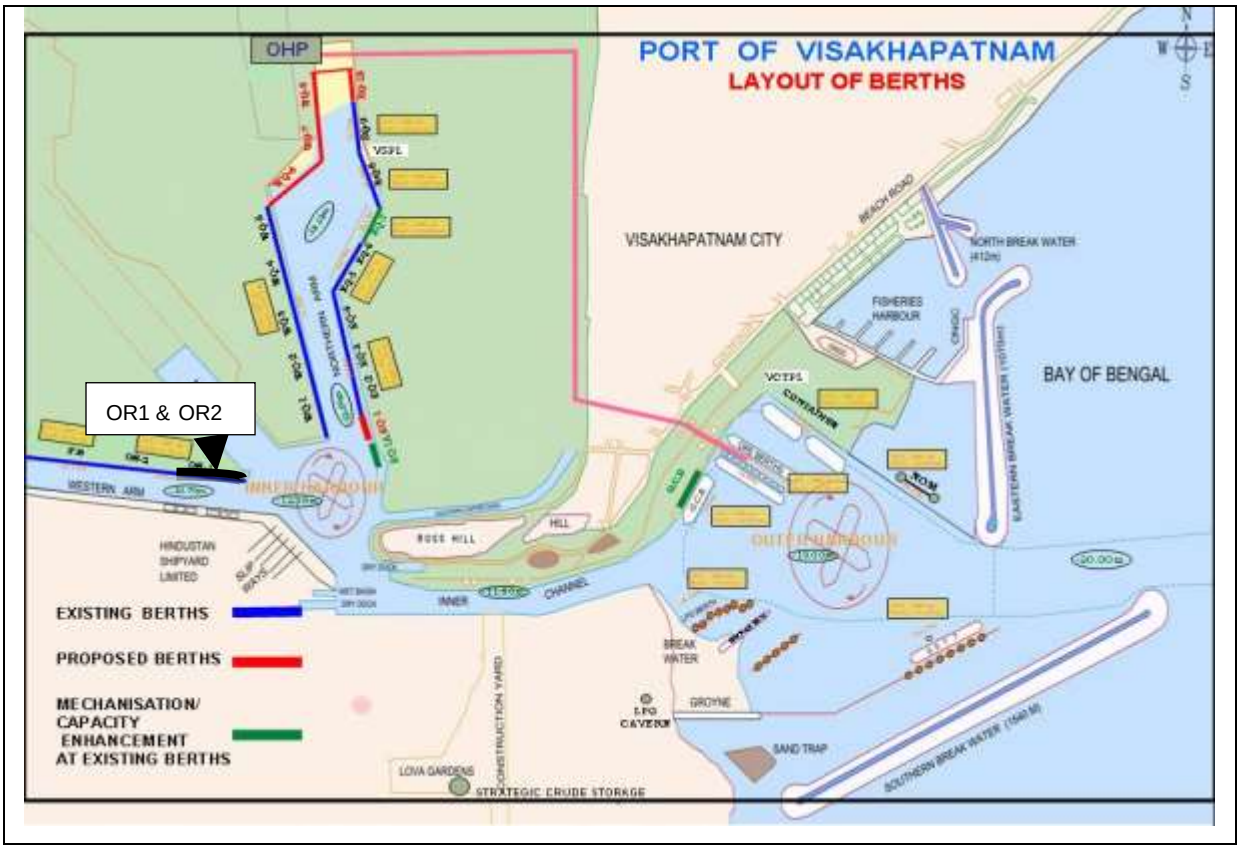


Figure-3.1: Layout of Berths and location of Project Site

3.2.2 Need for Mechanization of iron ore handling at Inner harbour

The present system of iron ore handling through semi mechanized means has led to serious environmetnal concerns. With the output rate achieved at the inner harbour, which is less than 12000 Tonnes, Port would not be able to retain the customers in the long run, in the wake of developments that are taking place in the hinterland.

The Port has a commitment to Andhra Pradesh Pollution Control Board (APPCB) to mechanize the iron ore handling system. Further, the bulk handling is to be done in a phased manner to address environmental concerns and accordingly, a need has arisen to mechanize iron ore handling at inner harbour.

The vessel size deployed at iron ore handling ranged between 40,000 DWT to 1,70,000 DWT. There is a need to lower the boom of the ship loader frequently to align with the hatch in order to handle Handymax vessels and Super Handymax vessels at outer harbour berth, which is designed to cater to large size vessels,. Also there is a need to place the spacers to adjust boom length of the loader in the respective hatches, resulting in dust pollution, thus causing much inconvenience to the habitants staying close by. Owing to this technological and environmental limitations, it is felt prudent to handle vessels of 65,000 DWT above at outer harbour, leaving the handling of Handymax and Super Handymax vessels at inner harbour. Accordingly, Port has taken a view to create a new facility at inner harbour for iron ore handling in addition to upgradation of the existing mechanized facility at Outer Harbour on DBFOT basis.

3.2.3 Proposed Up gradation

Proposed up-gradation of Existing Facility and creation of new facility at VPT envisages mechanize the current mode of handling through tipplers, stackers, reclaimers, conveyors, ship loaders, which would significantly reduce the pollution levels. The main components of the proposed projects are summerised below:

- Mechanization of exisiting berth West Quay-1 in the Inner harbour for handling iron ore.
- Modernization of exisiting/old iron ore handling facility at Outer Harbour by refurbishment ie., full covering of the conveyor system, replacement of outlived ship loader, stacker/ reclaimer etc.

Hence, the proposal is to mechanize the current mode of handling through tipplers, stackers, reclaimers, conveyors, ship loaders, which would significantly reduce the pollution levels

The proposed system for mechanized loading of iron ore at WQ-1 berth has been planned keeping in view the area earmarked for stockyard development, as well as the other ongoing developments in the port. The alignments of the proposed conveyors in the system takes into

account all the existing and proposed structures under the ongoing development schemes in the port area in all the three alternate proposals.

In all the three alternate proposals, for handling the receipt of iron ore through rail at the proposed facility, it is essential to install a twin wagon tippler system with a rated capacity of 20 tips /hour. A receiving conveyor system with a rated capacity of 3000 TPH compatible with the wagon unloading from tippler house to the stockyard is proposed. A typical cross section of stockpile configuration is given as Figure-3.2.

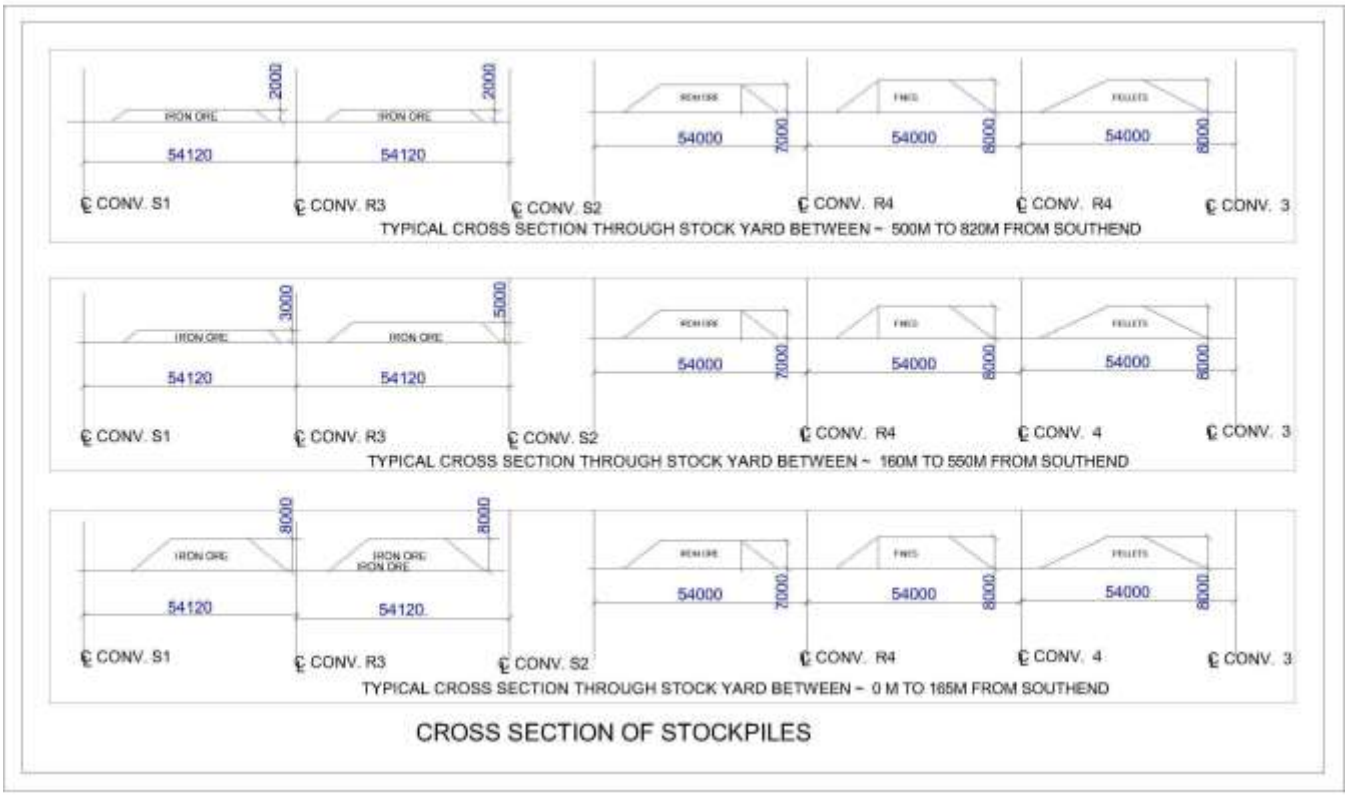


Figure-3.2.: Typical cross section of stockpile configuration

The following three alternative proposals were studied for the proposed project:

Alternate-1: Wagon tippling at the West of OHC (proposed 7 & 8 plots) and transferring cargo by conveyor for stacking, reclaiming and ship loading at West Quay back up area

Alternate-2: Wagon tippling, stacking and ship loading at West Quay back up area

Alternate-3: Wagon tippling at OHC Canteen area and after tippling, transferring the cargo by conveyor for stacking, reclaiming and ship loading at West Quay back up area

Ship Loading

In all the three proposals, stacking of iron ore and ship loading operations are carried out in West Quay back up area behind the berth. The area permits location of two stockpile area each of 591 X 40 m with stacker cum reclaimer tracks laid parallel with sufficient boom length centrally. Each equipment catered on both sides having connected to wagon tipplers and ship loader respectively. Also, a twin wagon tippler is proposed in all cases to improve the turn round time of railway rakes.

Alternative – I

In this alternative, the wagon tippler system is proposed to be installed at the western side of OHC and ESSAR plots in the manual siding area. This location is considered as most suitable with least disturbance to the existing facilities.

The conveyor alignment from tippling station to stock yard is taken along the boundaries of the port area thus facilitating adequate backup area for the other West Quay berths. A length of 2,657 m, of conveyor system is required for the whole arrangement in this alternative.

This alternative has the advantage of avoiding tippling and all railway movements on the West Quay backup area thus providing additional space for stack yard. However, this alternate proposal is expected to interrupt the existing iron ore manual sidings and future expansion of OHC operations on 7 & 8 plots. The shortage of outer haul length may affect the oil loop line operations also. To avoid the interruption to other operations in the location, connecting conveyor from tippler station to stack yard is proposed to be taken on an elevated gallery.

Alternative – II

In this alternative, the wagon tippler system is proposed to be installed in the backup area near the boundary of the North Western Arm by extending the railway line from the proposed lines in the area. This alternative facilitates the rake movement behind the proposed stockpiles.

In this Alternative, backup spaces for western quay berths are encroached upon by the installation of wagon tippler and the proposed railway yard for post tippling operation. Further, frequent wagon movement in tippling operation would disturb the road access to other West Quay berths. The only advantage in this alternative is that the conveyor length is the least compared to other options.

A 1.812 km length of conveyor is required for receiving and shipping in this alternative, with all other equipments and machineries remaining common for all alternatives. However, capital cost

for extending the railway line to the proposed backup area would be an additional expenditure compared to other alternatives.

This alternative –II will have an advantage of shifting the tippling operations away from berth side by installing the wagon tippler on the west side of the proposed West Quay backup area. This is also expected to facilitate another manual siding for stacking cargo like bauxite in the available space on the west of the stacking yard. This alternate however requires a curved inner haul with which locos cannot be used for pushing the wagons in wagon tippling. However, pusher cars can be used for the same in place of locos for the said purpose.

Alternative – III

In this alternative, the wagon tippler system is proposed to be installed in the vicinity of the existing wagon tippler station near the Water Tank in the existing railway lines suitably connected to the tippler station.

This will have an advantage of avoiding all railway movements on West Quay back up area and also provides additional stacking place in the stack yard. All the tippler operations are planned to be carried out near to the existing VPT tipplers. The disadvantage being the present manual sidings 1A and 1B plots will be utilized for outer haul operations and also a lengthy conveyor is necessary preferably on a gallery keeping in view of other operations. Also, this will have a cumulative effect of dust and sound levels with the existing tippler operations.

The conveyor alignment is proposed along the NMDC periphery wall and follows the alignment considered for alternate-I. The alignment along the railway line is not considered feasible due to adjoining built up area and would interfere operations at WQ berths.

This alternate requires a higher conveyor lengths in comparison to Alternate I and II. i.e., this system requires roughly 3.653 km length of conveyor in comparison to 2.657km in alternate-I and 1.812km in Alternate-II. The construction of wagon tippler station and connecting tunnel / conveyor system from tippling station to Transfer Tower-I could lead to disturbance to the existing facilities and hence is not considered as a feasible option by the consultants.

3.2.4 Ore Handling Equipment

The norms for ore handling equipments mentioned by TAMP are considered; however the requirement of handling equipments are suitably revised based upon the proposed stockpile configuration and the present requirement for the given annual throughput. A list of major equipment required for handling of iron ore for all the three alternatives is given in Table-3.2.

Table-3.2: List of major equipment required for handling of iron ore in various alternatives

S. No.	Description of Item	No. of units required		
		Alternate-I	**Alternate-II**	**Alternate-III**
1	Twin Wagon Tippler system rated capacity 23 tips / hour	1	1	1
2	Receiving and Shipping Conveyor System 1600 mm width	1.635km	1.812km	3.653km
3	Receiving Conveyor System 1200 mm width	1.022km	0.177km	2.018km
4	Stacker cum Reclaimer (3000 TPH)	2 units	2 units	2 units
5	Ship Loaders (3000 TPH)	1 unit	1 unit	1 unit
6	Transfer Towers & Drive House	TT:9 DH:1	TT:5 DH:1	TT:10 DH:1
7	Railway yard system for wagon unloading	1	1	1
8	Pay loaders	4nos.	4nos.	4nos.
9	Metal Detectors and weighers	4 + 2	4 + 2	4 + 2

After studying the above three alternatives, Alternative 1 have been selected based on the following considerations:

- Availability of backup space without hindrance from wagon movements in the stockyard, thereby avoiding disturbance to other berth users.
- Advantage of avoiding tippling and all railway movements on the West Quay backup area, thereby providing additional stockyard space.

3.2.5 Dredging

The total quantity of dredged material likely to be generated in the proposed project has been estimated as 8,66,249 m^3. Project wise details of the quantity of dredged material are given as below:

- Up gradation of OHC :1,84,000 m^3
- Extension of Container Terminal :5,96,024 m^3
- Development of Water Quay 7&8 berths :1,86,225 m^3

Total **9,66,249 m^3**

Maintenance dredging quantities during the period 2010 to 2015 varied from 1.18 to 5.99 lakh M^3 and annual maintenance dredging requirement would be of the order of 2.56 Lakh M^3. The entire dredged material shall be disposed at designated disposal sites selected based on the Radio-Active Tracer (RAT) study carried out by Bhabha Atomic research Centre (BARC) and modeling studies by CWPRS. The dumping site is located in the deeper contours

beyond -40m, with more offset distance of 1.45Km from the port approach channel. The total area of the proposed dumping site is 2.6 Sq.km. As per the dumping ground survey conducted by CWPRS in the year 2015 the proposed dumping site is suitable for the disposal of dredged material likely to be generated due to the implementation of the proposed project. The proposed dumping site suggested by BARC and CWPRS is shown in Figure-3.3.

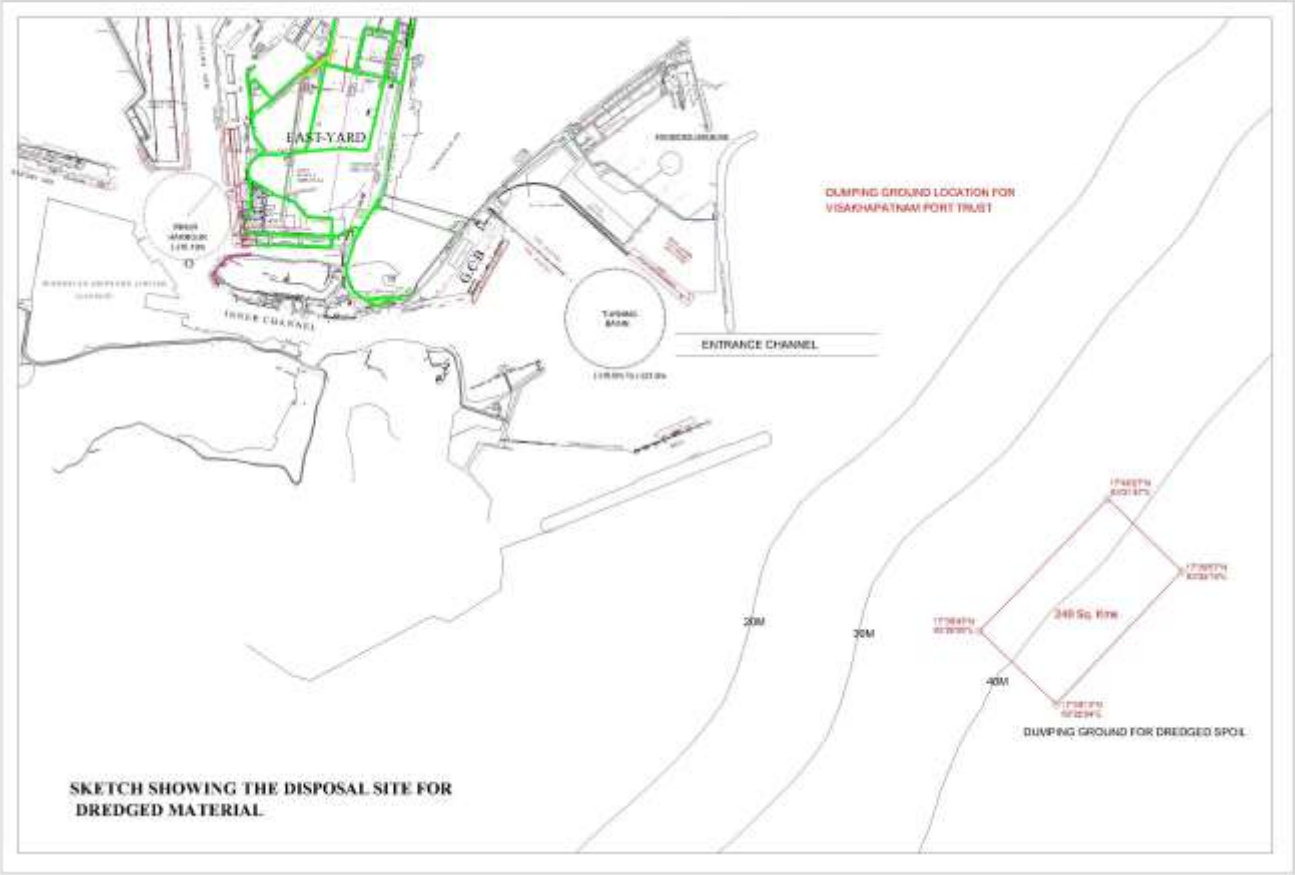


Figure-3.3: Dredged material disposal site based on the RAT study

3.2.6 Functional Planning of the Proposed Facility at Inner Harbour

One twin wagon tippler of 23 trips per hour, one ship loader of 3000 TPH and two numbers of stacker cum reclaimers of 3000 TPH are proposed to be installed at inner harbour berth for iron ore handling.

3.2.6.1 Wagon Receiving System

Considering the annual throughput level of 6.8 MTPA, an average time of 2.22 hours per rake for wagon unloading operations with a system occupancy level of 75% and an overall unloading efficiency of 75%, the rated wagon unloading capacity required is about 2300 TPH. Hence, a

twin wagon tippler system with a rated capacity of 23 tips per hour for meeting the wagon handling requirements shall be installed. For receiving the material unloaded at the tippler a receiving conveyor system of 3000 TPH is required to be provided between the wagon tippler house and the stockyard. Correspondingly, the rated stacking capacity shall be 3000TPH. Hence, It is proposed to have two stacker cum reclaimer at the stock yard each with a rated capacity of 3000TPH to facilitate stockpiling operations at either of the stockyard. The stock pile configuration is given as below:

- Stock Pile length 2 x 591m
- Stock Pile width 40m

3.2.6.2 Ship Handling Requirement

Reclaiming Capacity

For handling an annual throughput of 6.80 MTPA through the system with a ship loading capacity of 3000 TPH, it is proposed to install one ship loader of 3000 TPH rated capacity with shipping conveyor system from stockyard to WQ-1 berth.

Deepening and strengthening of the Berth

The WQ1 berth in the inner harbour was constructed in 1994 and was originally designed to cater 35,000 DWT vessels. The length of the berth is 212 m. keeping in view the requirements of the trade, berth was subsequently deepened to cater to 11.0 m draft and strengthened to cater to 12.5 m draft. Cost of dredging to cater to 12.5 m draft for 60 m from face line of the berth, is included in the cost.

Based on the anticipated deployment pattern and keeping in view the fact that the present proposal is an integrated facility for iron ore handling at outer harbour and inner harbour, it is felt that the draft of 12.5 m at WQ1 berth is adequate to cater to 60,000 DWT vessels and vessels beyond this size can be handled at outer harbour.

As such, the strengthening and deepening of the WQ1 berth to cater to 14 m draft is not envisaged in the present proposal. However, depending on the trade requirement, the operator may take up the deepening and strengthening the berth at appropriate time at his cost, with the consent of Port Trust and approval of Ministry of Environment, Forests and Climate Change, if required.

The VPT’s land required for the proposal as aforesaid for storage, receipt, dispatch, transportation of cargo etc., will be allotted as per the payment terms & other terms and conditions in force as per Govt. guidelines and land policy for allotment of land.

3.2.7 Conceptual planning and development of back up areas

The backup area of the berth is adequate to store the cargo. The cargo storage shall be in the area proposed to be allotted behind the berth which is contiguous to the backup area of the berth. While roads, general lighting, water supply, fire fighting system etc. will be common to all berth users, these shall be deployed as required for each berth.

3.2.8 Development of back up area

(i) Dismantling / Realigning:

The existing railway lines in the backup area required to be dismantled / realigned to facilitate the stockyard.

(ii) General filling in back up area

At present the existing ground levels at the proposed site are at the elevations of about +3.5m CD and less. The backup area shown in the drawing will have to be raised to +3.60m with selected granular fill.

(iii) Peripheral road

A new service road is being developed along the periphery of the stacking area.

(iv) Customs Boundary

The proposed area is to be provided with the customs boundary wall and customs offices with gates.

v) Ground Improvement of Back up area

The ground is of low bearing capacity due to the presence of very soft-to-soft clay layer extending up to thickness of the order of 20m. The loading of the ground in the present state would not only cause bearing capacity failure but also would be subjected to large uncontrolled settlements. As per the results of the soil investigations carried out at in this location, initial shear strength of the clay layers varies from 1.0t/m^2 to 2.0t/m^2 only. Hence, ground improvement with the preloading and use of vertical drains in the form of band drain shall be carried out, to achieve a bearing capacity upto 15.0t/m^2.

Lighting of berths

To illuminate the berth and the adjoining back up area 30m high masts with 400W high-pressure sodium vapour floodlight fixtures are required to be provided to achieve an average lux level of 25 which is considered for such applications. Similarly adequate lighting has been considered for the peripheral road as well.

3.2.9 Project Cost

The capital cost estimate of upgradation of existing facility and creation of new facility at Visakhapatnam Port for Iron Ore handling in two phases on DBFOT basis shall be Rs. 845.41 Crores. The details of the cost estimate for Phase –I and Phase-II are given in Table 3.3 and Table 3.4 respectively.

Table-3.3: Phase-I- outer harbour modernisation

(Unit: Rs. lakh)

S.No	Description	Base Cost	3% Contingency	7% PS Charges	2.80% WCT	Total
1	**Cargo Handling Activity**					
1	Mechanical Works					
1.1	Ship Loader-8000 TPH (1 No.)	3883.04	116.49	279.97	119.83	4399.32
1.2	Reclaimer- 4000 TPH (2 Nos)	4646.37	139.39	335.00	143.38	5264.15
1.3	Twin Tippler-27 Tips/hr-1 Set	1486.84	44.61	107.20	45.88	1684.53
1.4	Rotary type 3rd Tippler-30 Tips/hr-1 No)	743.42	22.30	53.60	22.94	842.26
1.5	Mobile Crane	106.20	3.19	7.66	3.28	120.20
1.6	Stacker- 2700 TPH (2 Nos.)	3252.46	97.57	234.50	100.37	3684.90
1.7	Strengthening of Existing Conveyor System	2588.69	77.66	186.64	79.88	2932.88
1.8	Procurement of Belts (1200 MM)	181.47	5.44	13.08	5.60	205.60
1.9	Procurement of Belts (1600 MM)	477.25	14.32	34.41	14.73	540.70
1.10	Dust Suppression	1619.59	48.59	116.77	49.98	1834.93
1.11	Electrical Works	1294.35	38.83	93.32	39.94	1466.45
1.12	Water Supply System	38.50	1.16	2.78	1.19	43.62
1.13	Others	862.67	25.88	62.20	26.62	977.37
	Total Mechanical Works (1)	**21180.85**	**635.43**	**1527.14**	**653.62**	**23997.03**
2	**Civil Works**					
2.1	Material Handling Structure Works (Junction Houses and Conveyor Galleries)	3248.00	97.44	234.18	100.23	3679.85
2.2	Material Handling Structures	170.80	5.12	12.31	5.27	193.50
2.3	Electrical Sub-Stations	180.00	5.40	12.98	5.55	203.93
2.4	Junction Houses	37.50	1.13	2.70	1.16	42.49

S.No	Description	Base Cost	3% Contingency	7% PS Charges	2.80% WCT	Total
2.5	Track for stacker reclaimers	352.50	10.58	25.42	10.88	399.38
2.6	Strengthening of and stock piles 1&2 (800M X 36M X 2) east & Middle stock piles	6500.00	195.00	468.65	200.58	7364.23
2.7	Conveyor trestle modification 200 Nos. (New Concrete)	5325.00	0.16	0.38	0.16	5325.70
2.8	Construction of Existing railway track	200.00	6.00	14.42	6.17	226.59
2.9	Dismantiling of of Existing railway track	10.00	0.30	0.72	0.31	11.33

Table 3.4: Phase II (2017-18) Mechanisation of iron ore loading at inner harbour

(Unit: Rs. lakh)

S.No	Description	Base Cost	3 % Contingency	7% PS Charges	2.80% WCT	Total
1	**Civil Costs**					
1.1	Storage Yard Development	2305.82	69.17	166.26	71.15	2612.40
1.2	Work shop area Buildings	36	1.08	2.61	1.11	40.80
1.3	Electrical Sub Station Buildings	44	1.32	3.17	1.36	49.85
1.4	Railway lines, Sidings & Foundation for Stacker, Reclaimer & Ship Loader	1730	51.90	124.73	53.39	1960.02
1.5	Approach Roads	578	17.34	41.67	17.84	654.85
1.6	Conveyor galleries	2624	78.72	189.19	80.97	2972.88
1.7	Transfer Towers	120	3.60	8.65	3.7	135.95
1.8	Dumper Houses	2441	73.23	176	75.33	2765.56
1.9	Misc. Water Supply, Administrative Buildings, Power Control Room, stores etc	670	20.10	48.31	20.68	759.09
1.10	Dredging cost at the berth (upto 50m) from the face of the berth (40000 cu.m including tolerances)	120	3.60	8.7	3.7	136.00
1.11	Pollution Control					300.00
1.12	Fire Fighting					250.00
1.13	Miscellaneous (IDC, Misc. equipment etc.)					200.00

S.No	Description	Base Cost	3 % Contingency	7% PS Charges	2.80% WCT	Total
	Total 1					12837.40
2	**MECHANICAL EQUIPMENT**					
2.1	Twin wagon Tippler-1No,(20tips/hrs) includinq side arm charges	2160	64.8	155.74	66.66	2447.2
2.2	Stacker cum Reclaimer - 3000 TPH (2Nos)	4252.46	127.57	306.6	131.23	4817.86
2.3	Ship Loader 3000 TPH-1 No	2179	65.37	157.11	37.24	2438.72
2.4	Belt Conveyors- 1600 mm wide	1953.7	58.61	140.86	60.29	2213.46
2.5	Belt Conveyors- 1200 mm wide	861	25.83	62.08	26.57	975.48
2.6	Metal Detector and weighers (4+2 Nos)	50	1.5	3.61	1.54	56.65
2.7	Pay Loaders -4 Nos	120	3.6	8.65	3.7	135.95
2.8	Work Shop Equipments	100	3	7.21	30.9	141.11
2.9	Electrical Power & Control switch gears	341	10.23	24.59	10.52	386.34
	Total 2	12017.16	360.51	866.45	370.84	13614.96
	Total Capital cost for Cargo Handling Activity (B)(1 + 1)(Rs. In Crores)					**264.52**
	Grand Total (A+ B)				**Rs. In Crores**	**845.41**
2.10	Conveyor trestle modification RCC dismantling	2.50	0.08	0.18	0.08	2.83
2.11	Piles of 500 mm dia 325 No. Length of each 12 M (av)	487.50	14.63	35.15	15.04	552.32
2.12	Dredging (144000 Cu.M x Rs.300/-Cu.m)	432.00	12.96	31.15	13.33	489.44
2.13	Strengthening of the existing berth	1000.00	30.00	72.10	30.90	1133.00
2.14	Pollution control measures on (LS)					500.00
2.15	Fire Fighting (LS)					400.00
2.16	Miscellaneous charges (IDC, Misc equipment etc. (LS)					300.00
	Total civil works (2) Rs. in Lakhs					**15504.84**
	Total mechanical & civil works (1+2)					**395.02**

S.No	Description	Base Cost	3 % Contingency	7% PS Charges	2.80% WCT	Total
	(Rs. In Cr.)					
3	**UPFRONT FEE (Rs. In Crores)**					
3.1	Residual Value Mechanical Works to be continued					103.76
3.2	Residual Value Mechanical Works to be replaced					32.80
3.3	Residual value for other works					49.31
	UPFRONT FEE (3)					**185.87**
	TOTAL (2 + 3)					**580.89**

3.2.10 Implementation Schedule

This project “Installation of mechanized iron ore handling facilities at WQ-1 berth in inner harbour of Visakhapatnam Port on DBFOT basis” is proposed to be completed in 24 months period from the date of award of the work.

3.3 DEVELOPMENT OF WQ-7 & WQ8 BERTHS INCLUDING MECHANICAL HANDLING FACILITIES IN THE NORTHERN ARM OF INNER HARBOUR OF VISAKHAPATNAM PORT

3.3.3 Description of project

This specific project is to plan, design and construct 280m length of berth to cater to the berthing requirements of vessels up to 230m LOA, 32.5m Beam, 12.5m draft initially and 14.0m draft ultimately. The berth shall be designed for an initial dredged depth of (-)13.5m CD and an ultimate dredge depth of (-)16.10m CD. Back up area, water supply, area illumination, fire fighting, railway and road facilities etc are also part of the project. The layout of berths is depicted in Figure-3.4.

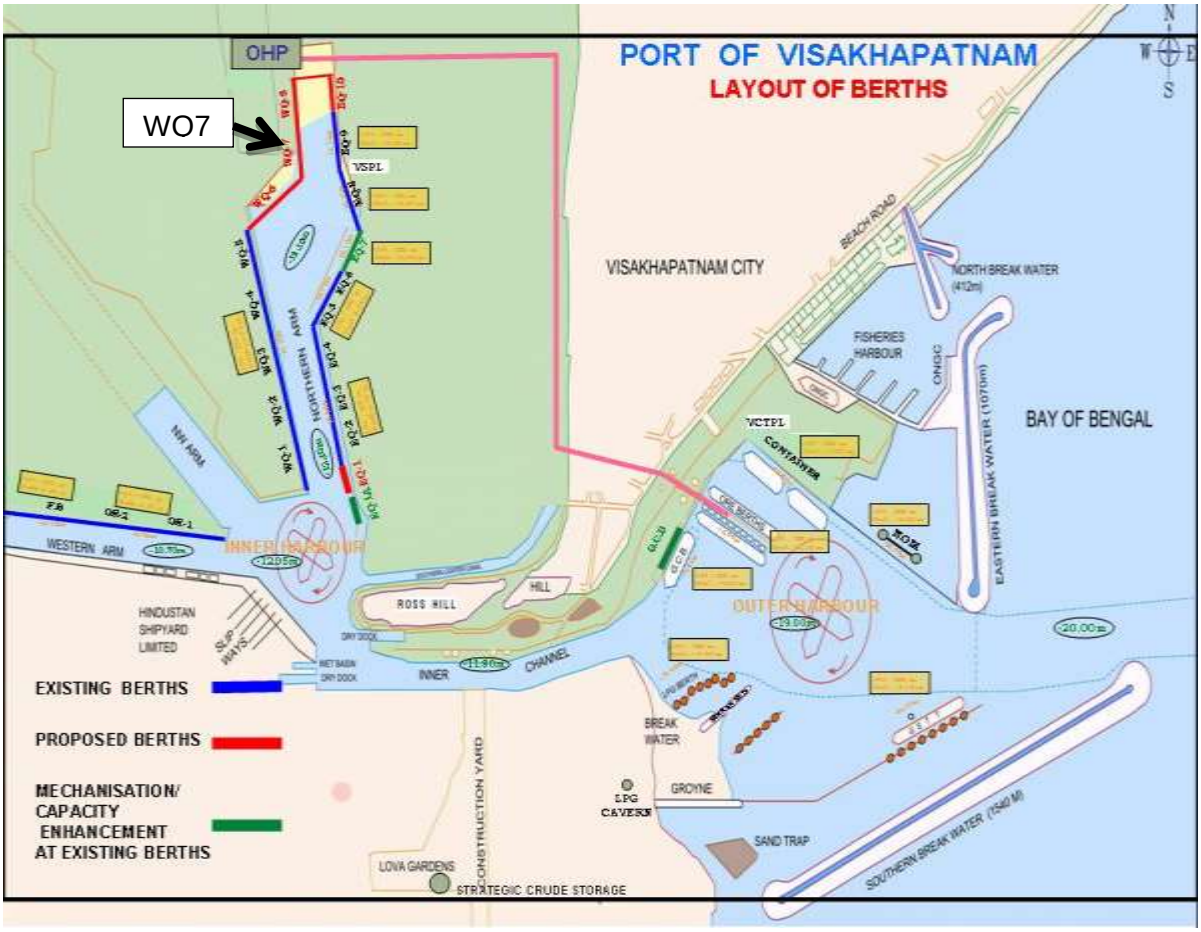


Figure-3.4: Layout of Berths

3.3.4 Need for the project

The dry bulk trade at VPT is increasing year after year. To cater to the handling of such cargoes, the port is developing new berths and mechanizing existing berths on DBFOT basis. To cater to the needs of other import dry bulk cargoes such as gypsum, bauxite, other dry bulk (excluding all types of coal, coke and finished fertilizers), ores (other than iron ore), etc, the present proposal is envisaged.

3.3.5 Options considered

According to the technical feasibility report, four alternate designs were considered:

- Diaphragm wall with Anchor Diaphragm wall and three rows of cast-in-situ bored piles
- Concrete T-Diaphragm wall with piled anchorage (Vertical and Racker piles)
- Concrete Diaphragm wall with vertical piles and pre-stressed rock anchors
- Rectangular Diaphragm wall with vertical piles

Option 2 was considered preferable based on the performance of the existing nearby berthing structures of EQ-7 berth and also keeping in view that these structures shall be embedded into hard rock which is available at -28.0m (approx.) at both the locations of EQ-7 and WQ-7 though there is variation in the composition of soil at intermediate levels.

3.3.6 Existing structures

Since the backup area of the berth is not sufficient to store cargo, this has to be developed. In the process, various existing structures shall be dismantled.

3.3.7 Proposed Activities

General filling of the back-up area has to be carried out. At present, existing ground levels at the proposed site are at the elevations of about +3.5m CD and less. The technical feasibility reports says that the backup area will have to be raised to 3.6m with selected granular fill. Ground improvement with preloading and use of vertical drains will have to be carried out as well. Dredging will be carried out after the construction of front diaphragm wall, vertical and racker piles and connected with RCC deck. Dredging shall be carried out in two stages, upto -16.10m to cater to 14 m draft vessels, ultimately synchronizing with the stage wise dredging plans of Concessioning Authority.

3.3.6 Project Features

The location of the project is at the extended Northern Arm of inner harbour which is the only waterfront available in Northern Arm. Further, this proposal is clubbing of Existing WQ-7 berth and proposed WQ-8 berth to be developed in continuation to the existing WQ-7 as a single berth. Hence, basis of selection of location is the most advantageous to have a contiguous quay length of 560m to accommodate two Panamax vessels. The layout for the proposed berth is depicted in Figure-3.5.

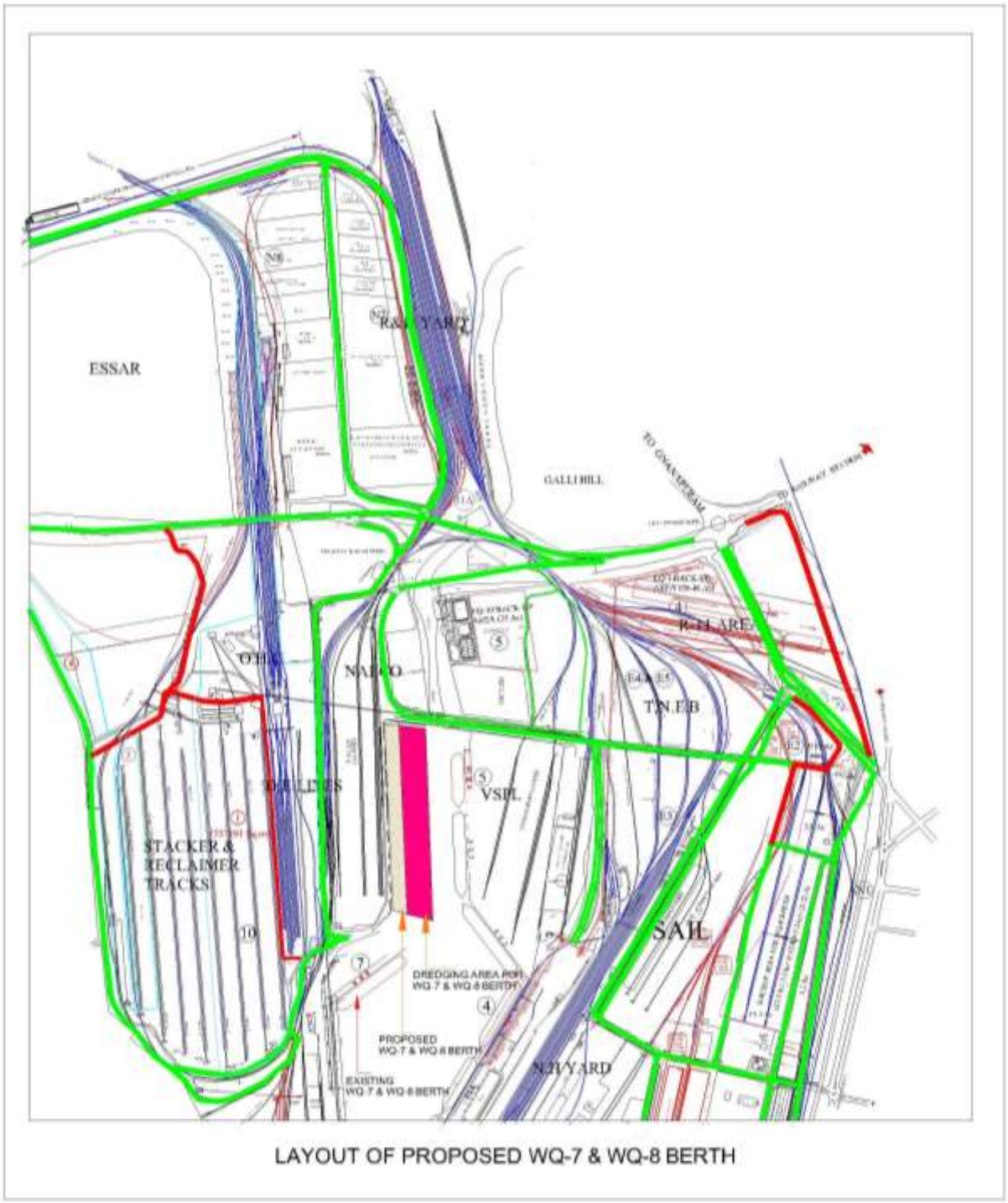


Figure-3.5: Layout for the proposed berth

This layout gives maximum flexibility for accommodating two 230m LOA vessels in the berth of 560 m length. The proposed apron width is 34.45 m. The width of the backup area available from the front edge of the proposed berth to the existing compound wall of M/s NALCO is 60.00m (approximate). The berth is to be constructed to cater to the envisaged ultimate dredge

depth of (-)16.10 m. Two berths were taken up through PPP i.e 1) EQ-10 berth on East quay side opposite to proposed West Quay - North (WQ-7& WQ-8) berth for handling 120 m LOA vessels in continuation to a BOT berth EQ-9 and 2) WQ-6 berth on South end of proposed West Quay - North (WQ-7& WQ-8) berth. The above projects were awarded and the construction works of the two projects are in progress. This layout adherence to the available channel width of 176 m between the berths West Quay - North (WQ-7& WQ-8) berth and EQ-9 suitable for Panamax size vessel having beam of 32.50 m as laid down in IS-4651.

A two-lane road with drain has already been formed along the proposed construction of West Quay - North (WQ-7& WQ-8) berth. The effective width available from the drain to the front end of the proposed berth would be 40 m after deducting the area for roads and drains. Since the width of the berth is 34.45 m, there is no immediate back up area available at this berth. However, backup area of about Ac. 4.5 has been identified for this berth at a nearby location within the port area.

3.3.7 Study of Alternative Proposals

3.3.7.1 Design of Berthing Structure

The existing ground level along the proposed berth is around +3.80 m offering excellent land based access for construction equipment without having to resort either to a floating equipment or to that suitable for operations in tidal zone except for carrying out dredging. This facilitates a land-based construction, which is less expensive and assists in achieving speedier progress. Therefore, berth construction work is principally guided by the advantage of the site conditions and the emphasis is focussed on keeping the berth construction as a land based operation.

Tidal variation		**Highest w.r.t. datum**
Highest high water recorded	-	+2.38 m
Mean high water level spring	-	+2.06 m
Mean high water level neap	-	+1.50 m
Mean sea level	-	+0.80 m
Mean low water level spring	-	-0.16 m
Mean low water level neap	-	+0.50 m
Chart datum (CD)	-	0.00 m
Lowest low water recorded (March 2007)	-	(-) 0.55 m

During the ‘Tsunami’ of December 2004, maximum and minimum levels of sea water varied between +3.00 m to -1.00 m respectively.

3.3.7.2 Open Type Structure with Touch Piles

This type of construction consists of front RCC touch piles of 1250 mm dia and 750 mm dia placed in the front face of the berth. These touch piles are to be designed to with stand the

imposed forces. The touch piles are to be constructed over a length of 560m. Six rows of RCC cast-in-situ bored 1250 mm/1400mm dia vertical piles spaced at 10.00 m, 4.00 m and 5.00m center to center connected to the front RCC touch piles through main beams of size 1400 mm X 1400 mm and the intermediate piles are connected through longitudinal beams, crane beams and retaining beams of various sizes over which a RCC slab imparting considerable rigidity to the entire structure. As a result of the rigid tie back at the top front touch piles are almost prevented from moving outward under the pressure to retain soil. The RCC deck structure shall consist of hallow RCC box frames filled with river sand connects touch piles and vertical piles. The deck shall provide a suitable platform for the efficient operation of the material handling equipment. The width of the berth is 34.45m.

The drawing showing the Plan and Cross-section of the above selected scheme for the berth construction enclosed as Figure-3.6 and 3.7 respectively. The key features of the berth are given as below:

Berth length	560 m
Size of vessel	Two Vessels of of 230m LOA, 32.5m beam and a draft of 14.00 m.
Dredge depth	Dredging shall be carried out up to (-) 16.10 m to cater to 14 m draft vessels ultimately
Surcharge load	5 tonnes per sq.m.
Type of construction (Suggested)	Open type structure with 1400 mm / 1250 mm / 750 mm bored cast-in-situ piles and deck slab.
Illumination	Sufficient (30m high mast towers on average lux level of 25)

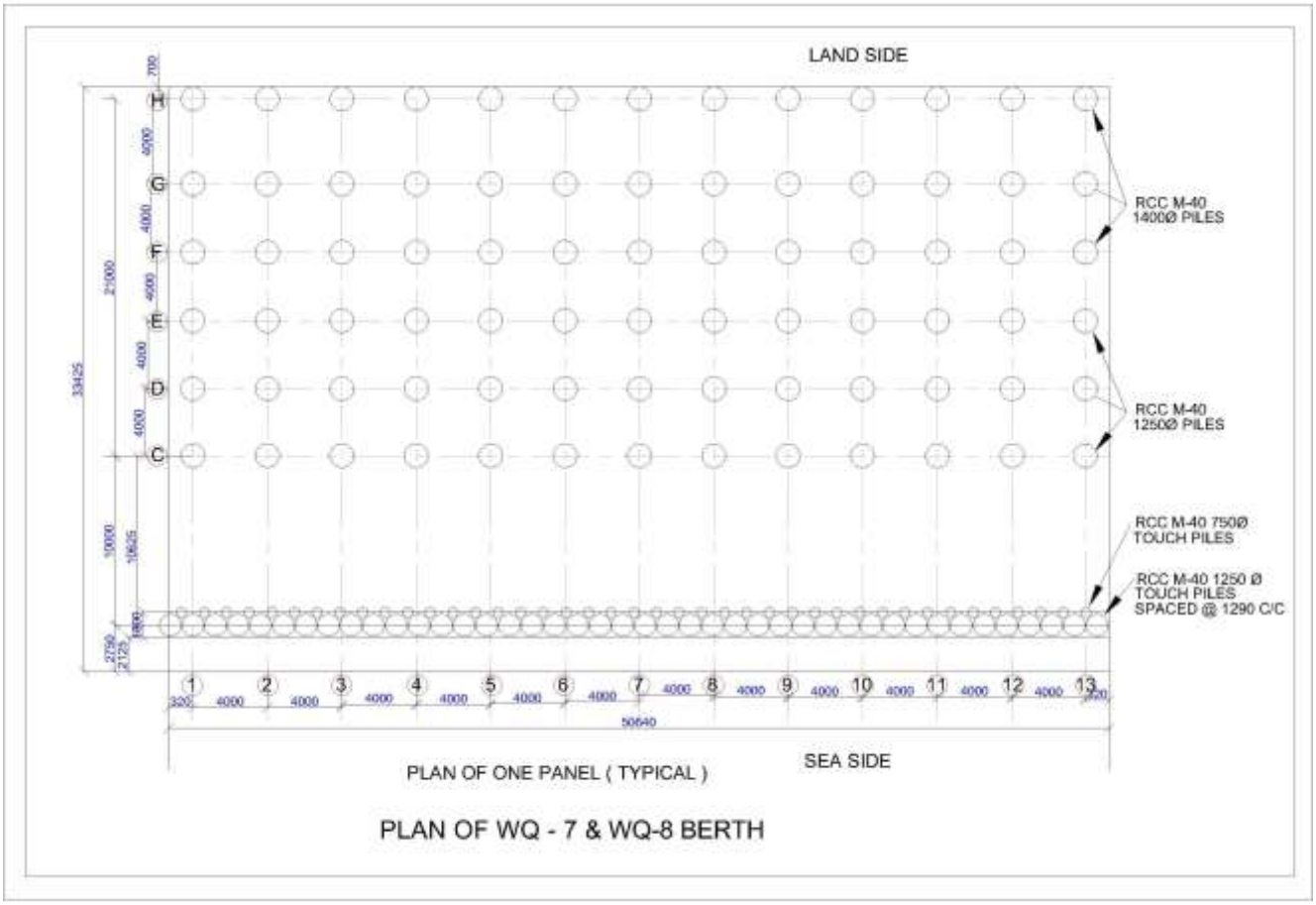


Figure-3.6: Layout Plan of the proposed WQ 7 and WQ 8 Berths

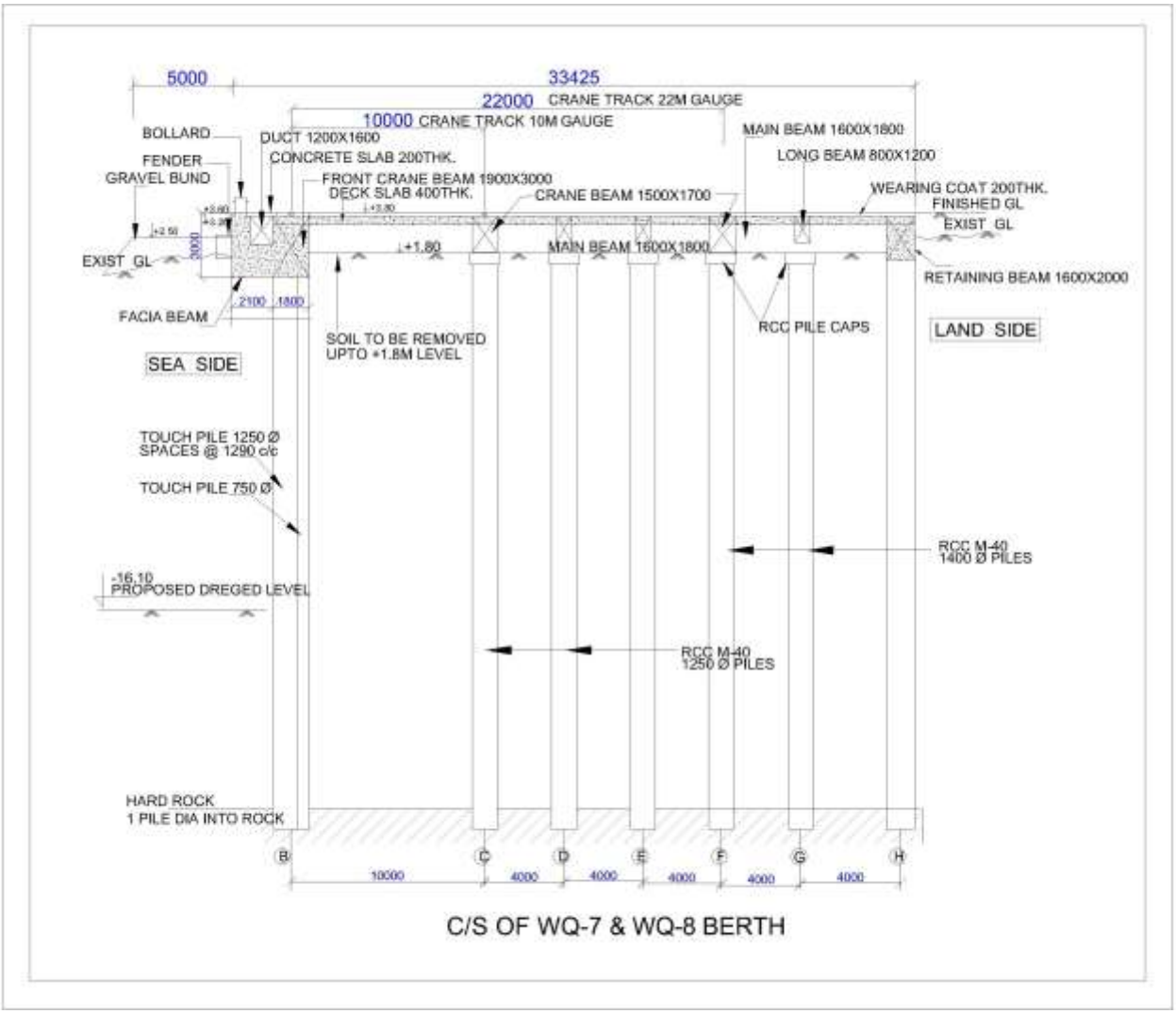


Figure-3.7: Cross-section of the proposed WQ-7 and WQ-8 Berths.

3.3.8 Conceptual planning and development of back up areas

(i) Construction of Berth

Plan, design and construct 560 m length of berth to cater to the berthing requirement of two vessels each up to 230m LOA, 32.5m Beam and 14.0m draft vessels ultimately. However, the project is envisaged as a Turnkey project.

(ii) Dismantling

The following existing facility shall be dismantled.

a) Dismantling of Cement Concrete (Wearing Course).
b) Dismantling of RCC beams, Facia Service trench (upt to +1.00m).
c) Lifting, removing and stacking of RCC precast slabs.
d) Dismantling of existing crane track including check railing.

e) Dismantling of existing cross drain, paving at North of WQ-8.
f) Dismantling of Gabbion mattress.
g) Dismantling existing culvert.
h) Extraction of sheet piles at North end of WQ-7 and at culvert.
i) Dismantling existing compound wall.

(iii) Illumination for berth area

To illuminate the WQ-North (WQ-7 & WQ-8) berth and the adjoining area, 8 nos of 30m high masts with 400W high-pressure sodium vapour floodlight fixtures have to be provided to achieve an average lux level of 25 which is considered for such applications. The electrical load requirement will be to the order of 100KW and the load requirement of WQ-7 will be fed through a feeder pillar located suitably which would receive power (415V, 3Ph, 50Hz) from the proposed sub-station intended for WQ6, WQ7 and WQ8 berths. The incoming cable (500m length) from feeder pillar from its respective sub division and distribution of power from feeder pillar to various lighting loads would be by means of cables directly buried in the ground. Earthing in accordance with Indian Electricity rules and IS : 3043 has to be provided for feeder pillars, high masts, cables, lands, etc.

(iv) Dredging

The total quantity of dredged material in the proposed project has been estimated as 8,66,249 m^3, of which 1,86,225 m^3 is likely to be generated due to the development of Water Quay 7&8 berths.

Since the construction of the WQ-North (WQ-7 & WQ-8) berth being the land based operation, dredging shall be commenced after completion of the construction of the front touch piles, vertical piles and connected both with the main beams and RCC deck. Dredging shall be carried out in front of the berth to the depth up to (-) 16.1 m CD from the present ground level / soundings. As per the typical sub soil profile at the proposed site, it is evident that only soft soil would be encountered while dredging within the range of the depth mentioned above and a suitable back hoe / grab dredger or standard cutter suction dredger or TSHD would suffice for the purpose. The dredged material shall be disposed at the identified and approved disposal ground in the open sea.

3.3.9 Implementation Schedule

The Development of WQ-North (WQ-7 & WQ-8) berth in the Inner Harbour of Visakhapatnam Port can be completed in 24 months period from the date of award of the work. 18 months time period is required as the construction of the main berth structure and dredging to follow after completion of structures with 6 months time period.

3.4 EXTENSION OF EXISTING CONTAINER TERMINAL IN THE OUTER HARBOUR OF VISAKHAPATNAM PORT ON DBFOT BASIS

This project envisages extension of the existing container terminal along with streamlining the transportation activities of the container handling hither to being carried through trucks up to the container freight station destination, situated at a far-off place. The present proposal envisages transportation of containers by rail movement / shuttling operations with a contiguous rail line. The Rail share of the evacuation which is currently Zero would be slowly improved with the active participation of all the stake holders. In order to enhance capacity handling to the tune of 0.54 MTEUs, VPT propose for extension of existing container terminal in the outer harbour of Visakhapatnam Port. The layout details is shown if Figure 3.8. The total cost shall be 633.11 crores. The details of the cost estimate are given in Table 3.5.

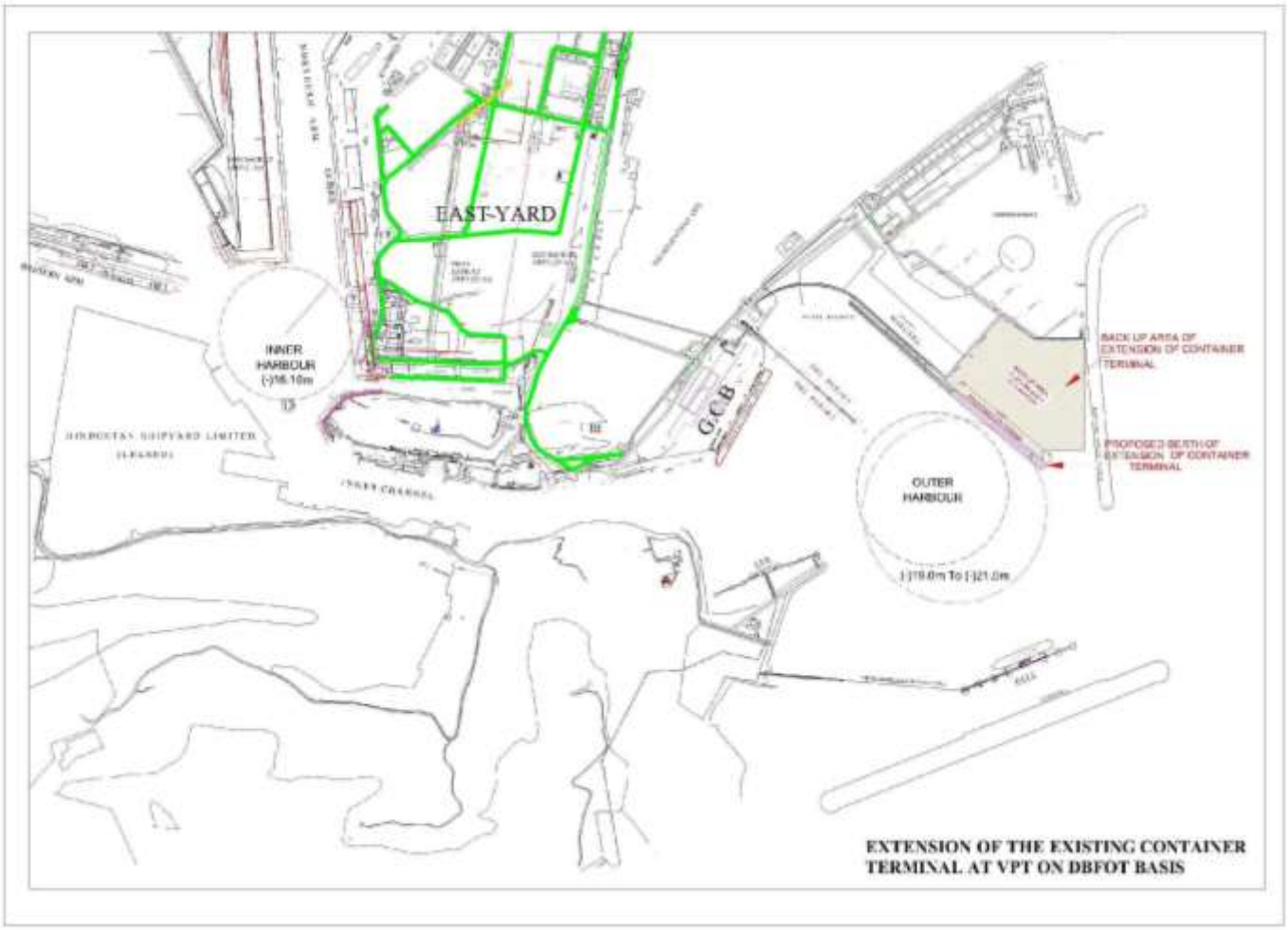


Figure 3.8: Layout details of extension of existing container terminal

Table-3.5: Break-up of capital cost of the project

S. No.	Description	Amount (Rs. lakhs)
I	Civil Works	
1	Construction of berth (395mx34m)	10723.12
2	Construction of a 200 T capacity Mooring Dolphin	476.26
3	Dredaing Cost	558.68
4	Rock Bund Construction & filling	8153.94
5	Pavement of Container Storage Yards, Terminal Roads and other Operational areas	2243.68
6	Storm-Water Drainage Svstem	145.42
7	Buildings, Security Compound wall and Gates	608.92
8	Water Supply including Water Tanks	30
	Total Civil Works (I)	**22940.02**
II	**Mechanical & Electrical Works**	
1	3 Nos. Ship to Shore Cranes	15000
2	**9** Nos. Rubber Tyred Gantry	9000
3	24 Nos. Tractor- Trailer units	1200
4	5 Nos. Reach Stackers	1500
5	1 No. Top Lift Truck	200
6	Power Supply and Illumination	1114
7	Fire Fighting System	200
	Total Mechanical & Electrical **(II)**	**28214**
	Total (I+II)	**51154.02**
III	- Add 3% Contingency	**1534.62**
	- Add **7%** Project Supervision Charges	**3688.2**
	- Add 2**.8%** Work Contract Tax	**1578.55**
	Total (III)	**6801.37**
IV	IT System Cost @2% on Total excluding cost of berth, mooring dolphin & dredging *	**892.68**
V	Other cost @10% on total cost excluding cost of berth, mooring dolphin & dredging *	**4463.4**
	Grand Total	**63311.48 say, Rs. 633.11 crores**

(*) as per TAMP Guidelines

3.5 WATER REQUIREMENT

Total fresh water available for drinking, sanitation etc. from GVMC and VPT own sources per month is 219,583 kl. Total fresh water requirement is of the order of available for drinking, sanitation etc is 201,894 kl. Total fresh water requirement for the proposed facility has been estimated as 90000 kl/month, which shall be shall be drawn from GVMC. VPT is having 10 MLD capacity and treated water is used for dust suppression. Total 300,000 kl/month of treated water is available for dust suppression. However the total water demand for dust suppression is 236,400 kl/month. The details of the water requirement and availability is given in Table-3.6.

Table-3.6: Details of the water requirement and availability

S. No.	Item	Quantity
A) FRESH WATER FOR DRINKING, SANITATION etc.		
1	Fresh water to be drawn from Greater Visakhapatnam Municipal Corporation (GVMC) as per agreement per month	167,309 KL
2	Fresh water drawn from GVMC per month (Average) a) Operational areas: 43,174 KL b) Residential areas: 1,01,246 KL c) Others: 5,200 KL	149,620 KL
3	Fresh water available from wells and infiltration galleries of Visakhapatnam port trust (VPT) per month	52,274 KL
4	Fresh water being drawn from wells and infiltration galleries of VPT per month a) Operational areas including oil wharf, ships etc.: 27,274 KL b) Residential areas: 25,000 KL	52,274 KL
5	Total **fresh water available** for drinking, sanitation etc. from both GVMC and VPT own sources per month	**219,583 KL**
6	Total fresh water consumed for drinking, sanitation etc. from both GVMC and VPT own sources per month.	201,894 KL
7	Fresh **water demand** for construction, drinking, sanitation etc. **for future projects** assuming 1000 KL per day per project: i) WQ7 & 8 berths: 30,000 KL ii) Container terminal: 30,000 KL iii) OHC project: 30,000 KL	90,000 KL
8	**Total demand of fresh water** including future projects	**291,894 KL**
9	**Deficit in fresh water demand which shall be drawn from GVMC**	**72,311 KL**
B) STP TREATED WATER FOR DUST SUPPRESSION:		
1	STP treated water available per month	300,000 KL
2	STP treated water being used for dust suppress per month a) By VPT: 165,000 KL b) By PPP operators: 41,400 KL	206,400 KL
3	STP treated water demand for dust suppress for the proposed projects per month a) OHC project: 15, 000 KL b) WQ7&8 project: 15, 000 KL	30,000 KL
4	Total treated water available per month	300,000 KL
5	Total treated demand per month	236,400 KL
6	Total **treated water balance** per month	**63,600 KL**

3.6 HTL/LTL DEMARCATION

As per the clause No3 (i), (a) of the CRZ Notification of 6th January 2011, the proposed expansion and modernization activity at Visakhapatanam port is permissible activity. However, as per the Coastal Regulation Zone (CRZ) notification dated 6th January 2011, project specific HTL/LTL demarcation is required for the projects requiring CRZ clearance. CRZ mapping is required to be done indicating HTL and LTL and proposed project layout for the project by one of the authorised agencies approved by MoEF in a scale of 1:4000. Hence, CRZ mapping for the proposed site in Visakhapattanam Port has been done through Institute of Remote Sensing (IRS) Anna University, Chennai and the report prepared by IRS is enclosed as **Appendix-II.**

As per the CRZ Notification, proposed project area falls in CRZ-II, which includes the areas that have been developed up to 500 m distance from High Tide Line in case of sea. In case of creek, canal or river with tidal influence, it is up to 100 m distance or width of water body whichever is lesser from High Tide Line.

3.6.1 Methodology Adopted

In order to prepare the local level map on 1:4,000 scale, the site was visited bt Experts from IRS, Anna University. The tide level observations for the last 19 years were studied from the Tide Tables. From the satellite imagery of the coastal zone, geomorphology has been studied. Based on the geomorphic units, high tide line has been identified in the field and traced by field survey.

As per the definition of High Tide Line, it is the line on the land up to which the highest water line reaches during the spring tide. At the mapping area, there is a clear boundary between the tidal portion and vegetation which is usually very much apparent. This boundary line coincides with the HTL line interpreted from the high resolution satellite imagery.

3.6.2 Field Survey

Dual Frequency GPS (Model: Trimble 5700) instruments were used for HTL demarcation and image control points observation. Field surveys were carried out to trace the tide levels in the project area in the third week of July 2014. Four teams involved in the field survey. During field survey, two teams had taken control points for Satellite imagery and Village maps for the corresponding area and the other two teams had taken HTL / L TL points along the coast.

3.6.3 Data Processing

The following softwares were used for data processing.

- Trimble Geomatics Office for GPS data downloading and Processing
- ArcGIS 9.2 for Map rectification and Map making

The observed GPS data have been downloaded and processed in the Trimble Geomatics Office software. The processed GPS coordinates were entered into ArcGIS 9.2 for Imagery Geo referencing. The processed HTL points were plotted using the same software on the Cadastral maps at the scale of 1:4,000.

3.6.4 Output

The observed baselines of GNSS receivers were processed using TBC software to derive the coordinates of HTL reference points, ground control points for Georeferencing of satellite imagery and cadastral maps. The ground control points were used to georeference cadastral maps of villages covering 7 km radius area around the project sites. The processed HTL co-ordinates in WGS 84 system are presented at Annexure I of CRZ report. The HTL observed in July 2014 as per the guidelines given in CRZ notification 2011 was superimposed on to georeferenced cadastral maps for an area covering 7 Km radius around the project sites. These maps are presented in 1: 25,000 scale in Annexure-II of CRZ report and 1:4,000 scale in Annexure – III of CRZ report. The 200m/500m setback lines from HTL for sea and creek width/100m setback lines from creeks are also generated and superimposed on these maps. The various coastal regulation zones falling inside the project sites and also in the area covering 7 km radius around the project sites are also shown in the CRZ maps.

3.6.5 Observations and Conclusions

(i) The cadastral maps in 1:4,000 scale have been used as base maps. In these maps, High Tide Line (HTL), 200m/500m setback lines from HTL for sea and creek width/100m setback lines from creeks and Low Tide Line(LTL) as per CRZ notification 2011 have been marked for an area covering 7 km radius around the project site. The processed coordinates of HTL as per CRZ notification 2011 are furnished in annexure-I of CRZ report. The boundary of proposed project sites as provided by the client have also been superimposed on the CRZ map.

(ii) The CRZ map covering 7 km radius around the project site (as per CRZ notification 2011) in 1:25,000 scale is prepared and furnished in Annexure – II of CRZ report.

(iii) CRZ map showing HTL and LTL are enclosed with this report as annexure-III. The details of various Coastal Regulation Zones as per CRZ notification 2011 in the proposed project locations are given as below:

Project Component -1

- Ore handling complex : Non-CRZ area
- WQ-1 : CRZ-II

Project Component -2

- Development of WQ-7 & 8 : CRZ-II & CRZ-IVB

Project Component -3

- Existing Container Terminal : CRZ-II
- Proposed Container Terminal : CRZ-IVA.

(iv) No mangroves are present at proposed project sites. However mangroves were observed outside the project sites. The distance to nearest mangroves from the project site is 1532.80 m.

(v) The Kambalakonda wild life sanctuary lies on the northern side of the project sites as shown in Annexure II of CRZ report. The shortest distance between the project sites and Kambalakonda wild life sanctuary is 5503.70 m.

CHAPTER-4
ENVIRONMENTAL BASELINE STATUS

CHAPTER-4
ENVIRONMENTAL BASELINE STATUS

4.1 GENERAL

The assessment of baseline status of relevant environmental parameters which are likely to be affected as a result of the construction and operation of the proposed project is an integral part of any EIA study. It also helps in identifying the problems/issues already existing in the area. A similar approach has been adopted for conducting the EIA study for the proposed berths in Visakhapatnam port. A Scoping Matrix was formulated to identify various issues likely to be affected as a result of the proposed project. Based on the specific inputs likely to accrue in the proposed project, aspects to be covered in the EIA study were identified. The other issues as outlined in the Scoping Matrix were then discarded. The planning of baseline survey thus, commenced with the shortlisting of impacts and identification of parameters for which the data needs to be collected.

4.2 METEOROLOGY

The project area has a typical coastal climate. The year can be divided into four distinct seasons. The period from March to May comprises the summer season and in subsequent months from June to September, the area comes under the influence of south-west monsoons. The months of October and November experience the post-monsoon season, the area experiences mild winter from December to February.

Temperature

May is the hottest month of the year, with mean monthly maximum temperature being 36.2°C. The month of January, is the coolest month of the year with a monthly minimum temperature of 18.0 °C. The monthwise temperature variations in the project area district is shown in Figure-4.1

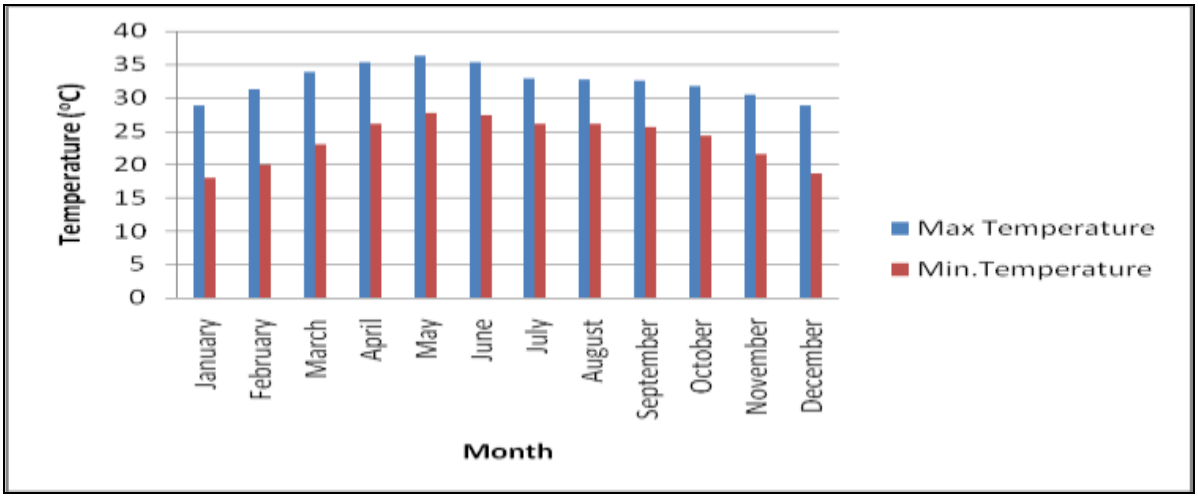


Figure-4.1: Monthwise temperature variation in project area

Winds

Winds blow from the western or south-western direction during the rainy season from June to September. In the post-monsoon months and up to the month of December, pre-dominant wind direction is from east. However, during this period, decrease in wind speed is observed. During the months from December to March, winds blow from north-east and north-east direction in the morning and south and south-east direction in the evening. In the remaining part of the year, wind blows from directions between west and south-west in the mornings and evenings. The wind speed is highest in the months from March to August.

Rainfall

The average annual rainfall in the Visakhapatnam district is 945.7 mm. On an average, the project area district has about 52 rainy days per year. Most of the rainfall (80%) is received in the months from June to October under the influence of south-west monsoons. The monthwise rainfall received in project area districts depicted in Figure-4.2

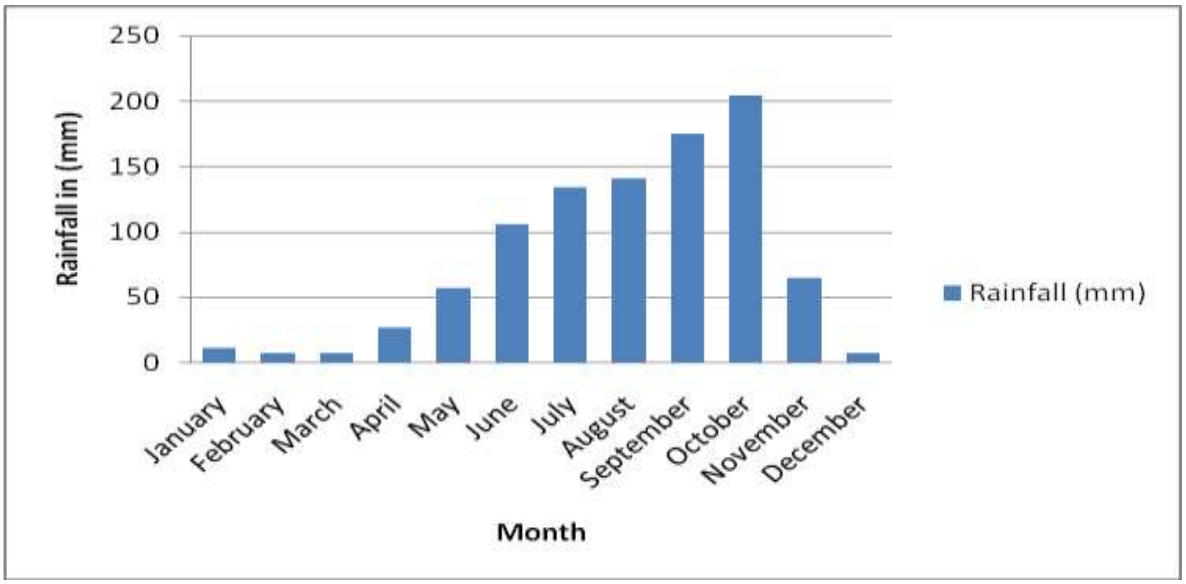


Figure-4.2: Monthwise rainfall variation in project area

Humidity

The humidity is generally high throughout the year. During the monsoon months i.e. July and October, humidity ranges from 77.5% to 78.5%. During rest of the year, humidity varies from 66-72%. The average humidity observed over the year is 72%. The monthwise humidity level in project area is depicted in Figure-4.3

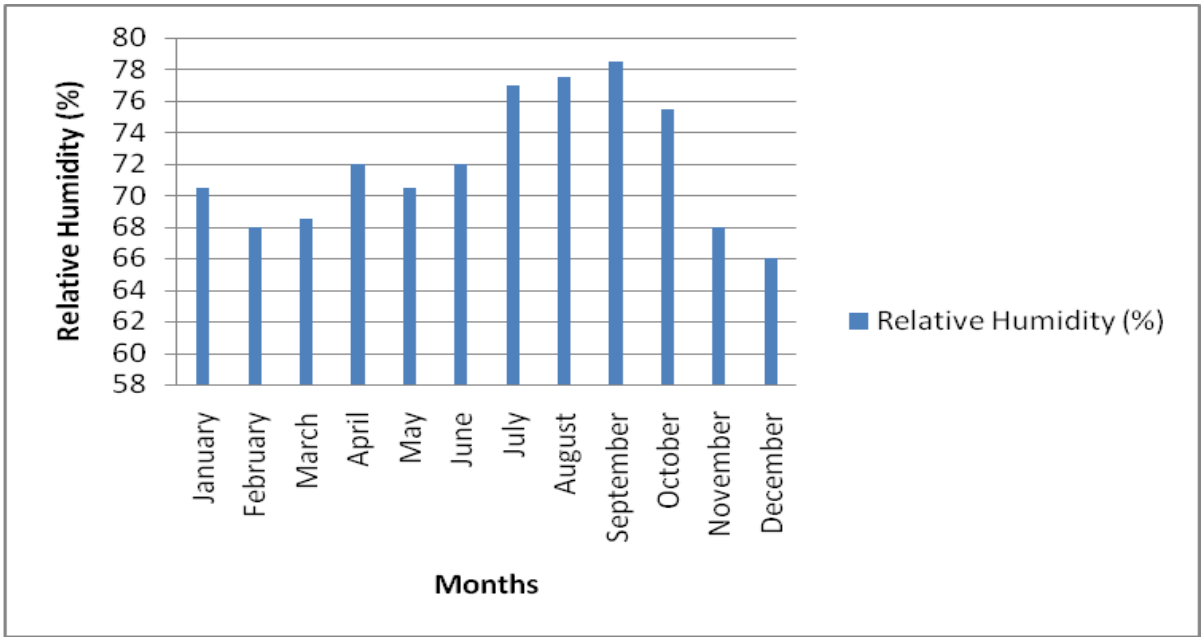


Figure-4.3: Monthwise variation humidity in project area.

The average meteorological conditions of the project area district are outlined in Table 4.1.

Table-4.1: Average meteorological conditions in the project area district

S. No.	Month	Temperature(°C)		Rainfall(mm)	No. of Rainy Days	Relative Humidity (%)
		Max.	Min.			
1	January	28.9	18.0	11.4	0.5	70.5
2	February	31.3	19.9	7.7	0.5	68
3	March	33.8	23.0	7.5	0.5	68.5
4	April	35.3	26.1	27.6	1.2	72
5	May	36.2	27.7	57.8	3.0	70.5
6	June	35.3	27.3	105.6	6.4	72
7	July	32.9	26.1	134.6	8.7	77
8	August	32.7	26.0	141.2	9.3	77.5
9	September	32.5	25.6	174.8	9.9	78.5
10	October	31.7	24.3	204.3	8.7	75.5
11	November	30.4	21.6	65.3	2.7	68
12	December	28.9	18.6	7.9	0.6	66
	Total			**945.7**	**52.0**	
	Average	**32.49**	**23.68**			**72**

Source: IMD

4.3 LAND USE PATTERN OF THE STUDY AREA

Land use classification of the study area has been studied using digital satellite data of IRS P6, LISS III sensor. The satellite data was procured from National Remote Sensing Agency (NRSA), Hyderabad and was processed in-house by the Consultant using image processing software.

Ground truth verification was conducted and the digital satellite data was processed for the land use classification. The raw and classified satellite image of the Study Area is given in Figures-4.4 and 4.5 respectively. The land use pattern of the Study Area is outlined in Table-4.2.

The major landuse category in the study area of Modernisation of existing facilities and addition of new entailing capacity of Visakhapatanam Port project is water body, as it accounts for about 50.01% of the study area followed by Scrub (14.3%). The area under Agricultural Land is 4.74% of the study area. The area under barren land and Vegetation accounts 5.88% and 11.91% of the study area respectively. Settlement accounts for about 13.16%. The details of the landuse pattern of the study area are given in Table-4.2.

Table-4.2: Landuse pattern of the Study Area based on satellite data

Type	**Area (ha)**	**Area (%)**
Vegetation	3742	11.91
Scrub	4495	14.30
Barren Land	1848	5.88
Water Body	15717	50.01
Agriculture Land	1489	4.74
Settlement/Built-up Area	4137	13.16
Total	**31428**	**100**

There is no National Park, wildlife sanctuary, ecologically sensitive areas etc. within the study area.

4.4 AMBIENT AIR QUALITY

The ambient air quality of an area used to form baseline information of the project area and helps to evaluate to ascertain the impacts of the proposed activities during project construction and operation phases. Ambient air quality monitoring was conducted at various locations for two days per week for a period of 12 consecutive weeks January-2014 and April-2014. The location of ambient air quality monitoring station is given in Table-4.3. The sampling locations of various ambient air quality monitoring locations is shown in Figure-4.6.

Table-4.3: Ambient Air quality Sampling Locations

Sampling Code	**Locations**
AAQ1	Railway Office (Near Krishna Gate)
AAQ2	West Q7 (Out Gate)
AAQ3	SE Office (R&D Yard Northwest Cabin)
AAQ4	ONGC Office, Near Fishing Harbour

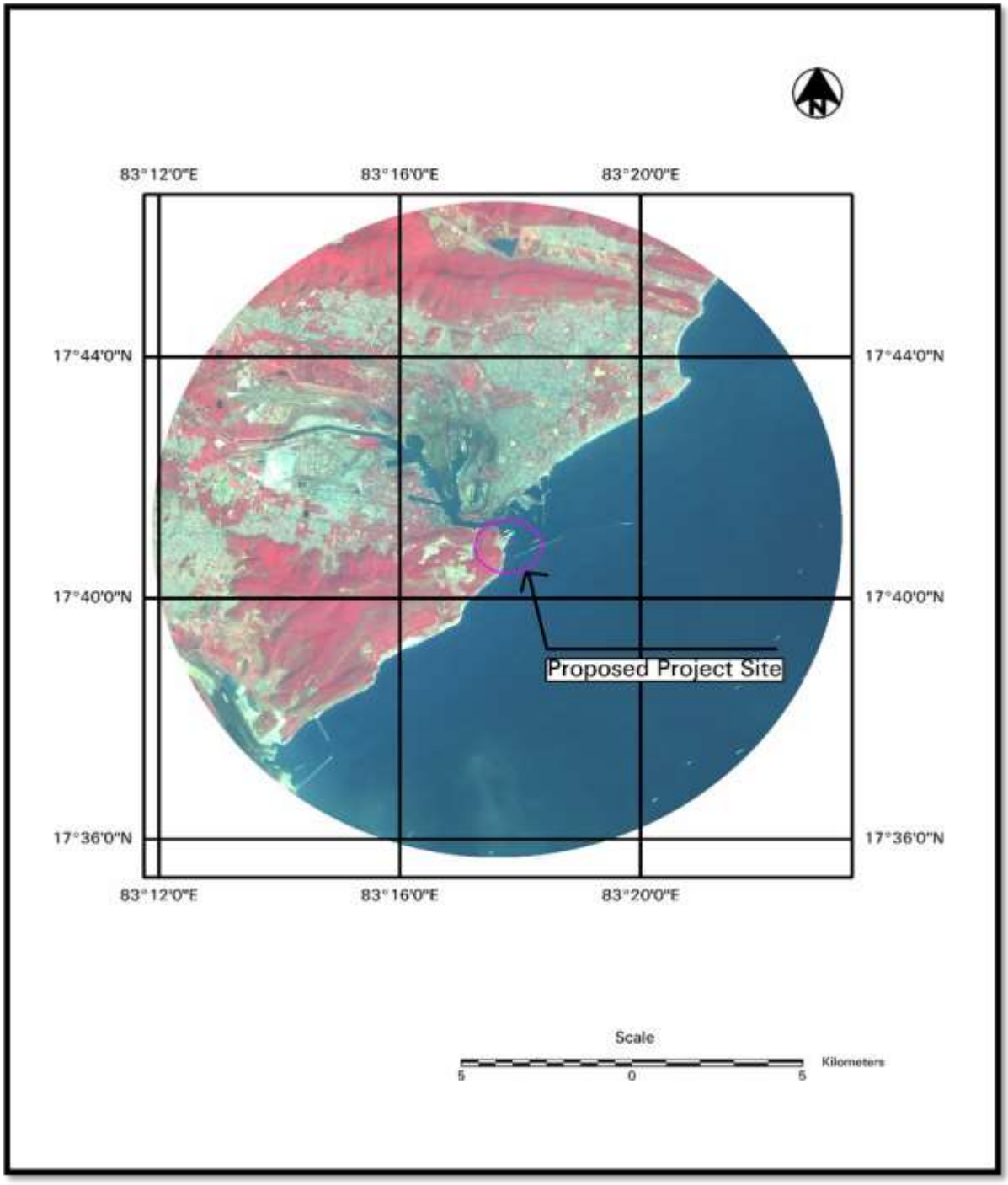


Figure-4.4: FCC of the study area for VPT Project

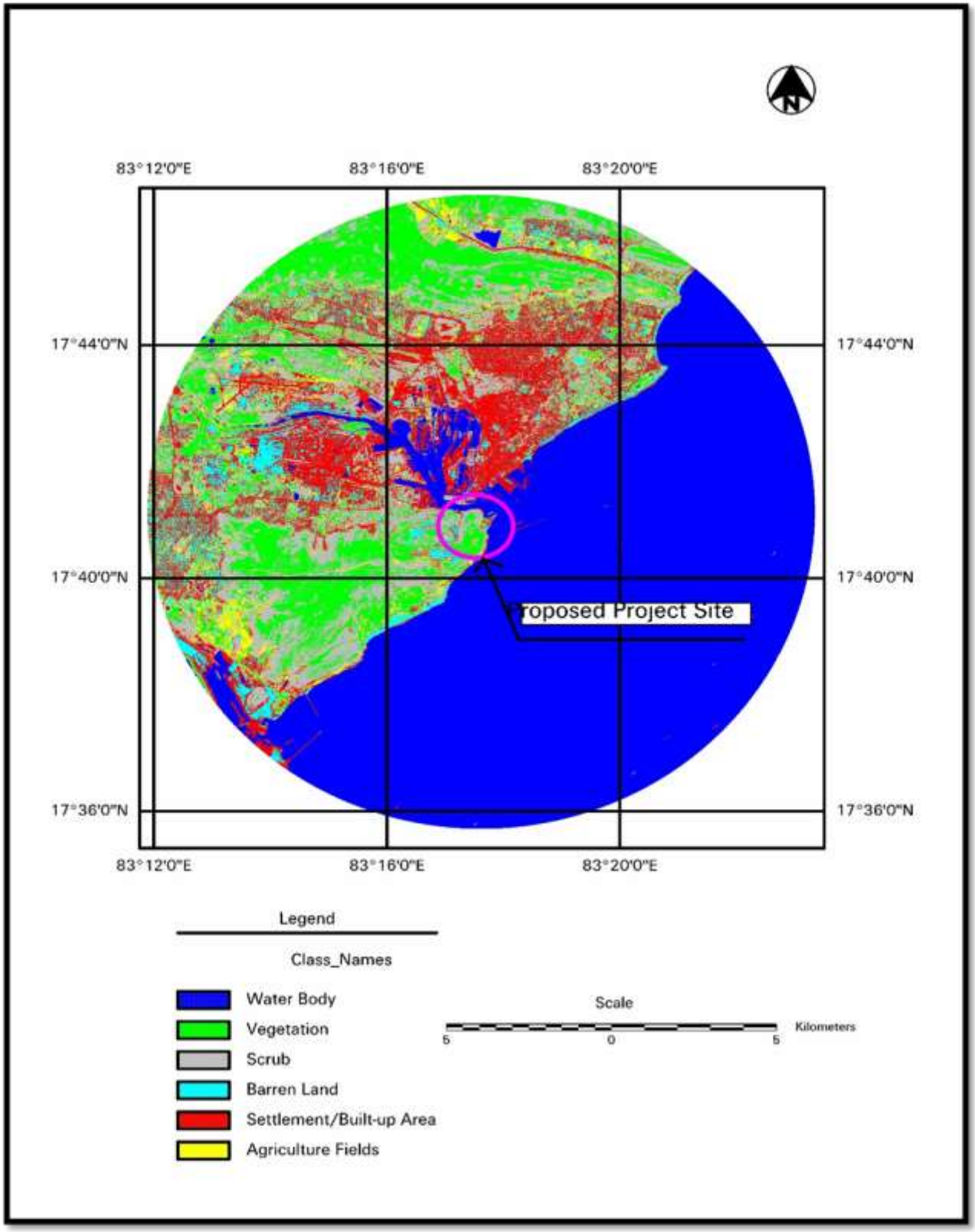


Figure-4.5: Classified imagery of the study area for VPT Project

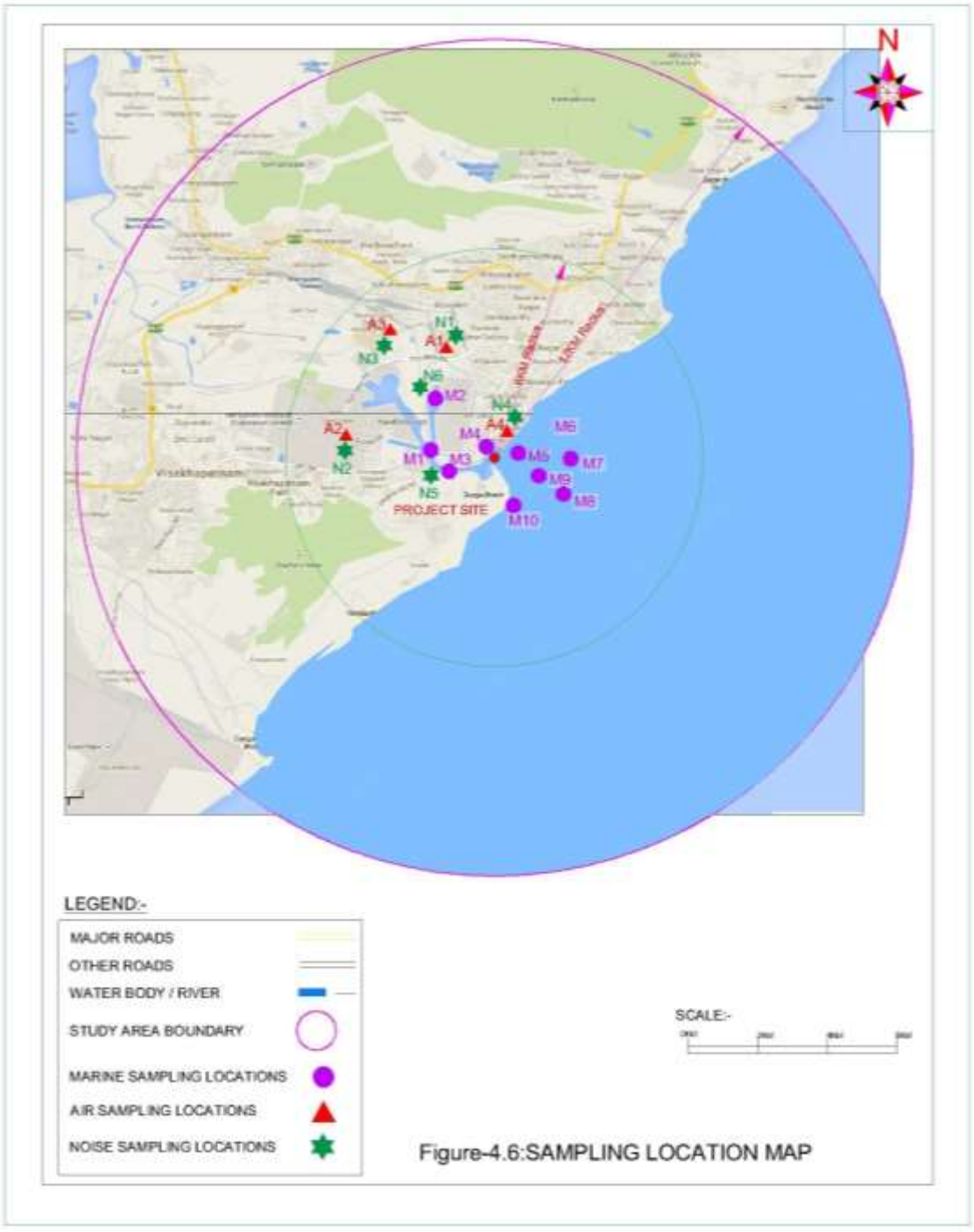


Figure-4.6: Sampling Location Map

Results of ambient air quality monitoring

The ambient air levels of the parameters: PM_{10}, $PM_{2.5}$, SO_2, NO_2 for all the sampling locations, as monitored, are presented in Tables-4.4 to 4.7. The summary of ambient air quality monitoring survey is given in Table-4.8. The National Ambient Air Quality Standards are given in Annexure-II.

Table-4.4: Results of Ambient Air Quality Monitoring Survey On top of Railway Office (Near Krishna Gate) (AAQ1)

S.No.	Sampling Date	Parameters monitored			
		SO_2 (µg/m^3)	NO_2 (µg/m^3)	PM_{10} (µg/m^3)	$PM_{2.5}$ (µg/m^3)
1	10-11.01.2014	10.6	24.7	64.9	29.9
2	13-14.01.2014	9.5	22.1	58.1	26.8
3	16-17.01.2014	10.1	23.5	61.8	28.5
4	21-22.01.2014	10.3	24.0	63.0	29.0
5	24-25.01.2014	10.8	25.1	66.1	30.5
6	27-28.01.2014	9.8	22.8	60.0	27.6
7	30-31.01.2014	11.0	25.6	67.3	31.0
8	04-05.02.2014	10.7	24.9	65.5	30.2
9	07-08.02.2014	10.0	23.5	61.9	28.5
10	10-11.02.2014	10.5	24.7	65.0	30.0
11	13-14.02.2014	9.7	22.8	60.1	27.7
12	18-19.02.2014	10.8	25.4	66.9	30.8
13	21-22.02.2014	11.2	26.4	69.3	32.0
14	24-25.02.2014	10.3	24.2	63.8	29.4
15	27-28.02.2014	11.0	25.9	68.1	31.4
16	04-05.03.2014	9.5	22.4	58.8	27.1
17	07-08.03.2014	10.3	24.5	64.5	29.7
18	10-11.03.2014	11.0	26.2	68.9	31.8
19	13-14.03.2014	10.6	25.2	66.4	30.6
20	18-19.03.2014	11.2	26.7	70.2	32.3
21	21-22.03.2014	11.5	27.4	72.1	33.2
22	24-25.03.2014	10.8	25.7	67.7	31.2
23	27-28.03.2014	12.0	28.6	75.2	34.6
24	01-02.04.2014	11.7	27.9	73.3	33.8

Table-4.5: Results of Ambient Air Quality Monitoring Survey on top of West Q7 Out Gate (AAQ2)

S.No.	Sampling Date	Parameters monitored			
		SO_2 (µg/m^3)	NO_2 (µg/m^3)	PM_{10} (µg/m^3)	$PM_{2.5}$ (µg/m^3)
1	10-11.01.2014	11.2	27.3	78.0	31.5
2	13-14.01.2014	10.5	25.6	73.2	29.5
3	16-17.01.2014	11.6	28.3	80.8	32.6
4	21-22.01.2014	11.9	29.0	82.9	33.4
5	24-25.01.2014	12.3	30.0	85.7	34.6
6	27-28.01.2014	11.7	28.5	81.5	32.9
7	30-31.01.2014	12.1	29.5	84.3	34.0
8	04-05.02.2014	12.5	30.5	87.1	35.1
9	07-08.02.2014	12.4	27.7	79.1	31.9

S.No.	Sampling Date	Parameters monitored			
		SO_2 (µg/m^3)	NO_2 (µg/m^3)	PM_{10} (µg/m^3)	$PM_{2.5}$ (µg/m^3)
10	10-11.02.2014	12.8	28.6	81.6	32.9
11	13-14.02.2014	13.2	29.5	84.2	33.9
12	18-19.02.2014	12.2	27.2	77.8	31.4
13	21-22.02.2014	13.5	30.1	86.1	34.7
14	24-25.02.2014	12.6	28.1	80.4	32.4
15	27-28.02.2014	14.0	31.3	89.3	36.0
16	04-05.03.2014	13.8	30.8	88.0	35.5
17	07-08.03.2014	13.5	30.7	87.7	35.3
18	10-11.03.2014	14.2	32.3	92.2	37.2
19	13-14.03.2014	13.7	31.1	89.0	35.9
20	18-19.03.2014	14.0	31.8	90.9	36.7
21	21-22.03.2014	14.5	33.0	94.2	38.0
22	24-25.03.2014	13.3	30.2	86.4	34.8
23	27-28.03.2014	14.3	32.5	92.9	37.4
24	01-02.04.2014	13.9	31.6	90.3	36.4

Table-4.6: Results of Ambient Air Quality Monitoring Survey on top of Superintendent Engineer Office (R&D Yard Northwest Cabin) (AAQ3)

S.No.	Sampling Date	Parameters monitored			
		SO_2 (µg/m^3)	NO_2 (µg/m^3)	PM_{10} (µg/m^3)	$PM_{2.5}$ (µg/m^3)
1	11-12.01.2014	10.2	20.8	56.3	21.2
2	14-15.01.2014	9.0	18.4	49.6	18.7
3	17-18.01.2014	10.5	21.4	57.9	21.8
4	20-21.01.2014	11.0	22.4	60.7	22.8
5	23-24.01.2014	11.4	23.3	62.9	23.6
6	28-29.01.2014	10.7	21.8	59.0	22.2
7	31-01.02.2014	11.8	24.1	65.1	24.5
8	03-04.02.2014	10.3	21.0	56.8	21.4
9	06-07.02.2014	9.8	20.4	55.2	20.7
10	11-12.02.2014	10.8	22.5	60.8	22.9
11	14-15.02.2014	9.5	19.8	53.5	20.1
12	17-18.02.2014	10.0	20.8	56.3	21.2
13	20-21.02.2014	10.5	21.9	59.1	22.2
14	25-26.02.2014	11.0	22.9	61.9	23.3
15	28-01.03.2014	10.6	22.1	59.7	22.4
16	03-04.03.2014	10.2	21.3	57.4	21.6
17	06-07.03.2014	10.6	22.6	61.0	22.9
18	11-12.03.2014	10.0	21.3	57.5	21.6
19	14-15.03.2014	10.4	22.1	59.8	22.5
20	17-18.03.2014	11.0	23.4	63.3	23.8
21	20-21.03.2014	12.0	25.5	69.0	25.9
22	25-26.03.2014	10.2	21.7	58.7	22.1
23	28-29.03.2014	11.7	24.9	67.3	25.3
24	31-01.04.2014	12.2	26.0	70.2	26.4

Table-4.7: Results of Ambient Air Quality Monitoring Survey on top of ONGC Office (Near Fishing Harbour) (AAQ4)

S.No.	Sampling Date	Parameters monitored			
		SO_2 (µg/m^3)	NO_2 (µg/m^3)	PM_{10} (µg/m^3)	$PM_{2.5}$ (µg/m^3)
1	11-12.01.2014	9.5	17.3	40.2	16.0
2	14-15.01.2014	8.7	15.8	36.8	14.7
3	17-18.01.2014	9.0	16.4	38.1	15.2
4	20-21.01.2014	9.3	16.9	39.3	15.7
5	23-24.01.2014	10.0	18.2	42.3	16.8
6	28-29.01.2014	9.8	17.8	41.4	16.5
7	31-01.02.2014	10.6	19.3	44.8	17.9
8	03-04.02.2014	8.8	16.0	37.2	14.8
9	06-07.02.2014	9.0	16.7	38.8	15.4
10	11-12.02.2014	9.4	17.4	40.5	16.1
11	14-15.02.2014	8.7	16.1	37.5	14.9
12	17-18.02.2014	9.2	17.0	39.6	15.8
13	20-21.02.2014	10.0	18.5	43.1	17.2
14	25-26.02.2014	10.3	19.1	44.4	17.7
15	28-01.03.2014	9.7	18.0	41.8	16.6
16	03-04.03.2014	8.4	15.6	36.2	14.4
17	06-07.03.2014	9.5	18.3	42.5	16.9
18	11-12.03.2014	9.1	17.5	40.7	16.2
19	14-15.03.2014	9.7	18.7	43.4	17.3
20	17-18.03.2014	10.3	19.8	46.1	18.4
21	20-21.03.2014	10.7	20.6	47.9	19.1
22	25-26.03.2014	11.4	21.9	51.0	20.3
23	28-29.03.2014	12.1	23.3	54.1	21.6
24	31-01.04.2014	12.5	24.0	55.9	22.3

Table-4.8: Summary of Ambient Air Quality Monitoring Survey

Station No.	Parameter	Average	Maximum	Minimum
AAQ1	SO_2 (µg/m^3)	10.6	12.0	9.5
	NO_2 (µg/m^3)	25.0	28.6	22.1
	PM_{10} (µg/m^3)	65.8	75.2	60.1
	$PM_{2.5}$ (µg/m^3)	30.3	34.6	26.8
AAQ2	SO_2 (µg/m^3)	12.9	14.5	10.5
	NO_2 (µg/m^3)	29.8	33.0	25.6
	PM_{10} (µg/m^3)	85.1	94.2	73.2
	$PM_{2.5}$ (µg/m^3)	34.3	38.0	29.5
AAQ3	SO_2 (µg/m^3)	10.6	12.2	9.0
	NO_2 (µg/m^3)	22.1	26.0	18.4
	PM_{10} (µg/m^3)	59.9	70.2	49.6
	$PM_{2.5}$ (µg/m^3)	22.5	26.4	18.7
AAQ4	SO_2 (µg/m^3)	9.8	12.5	8.4
	NO_2 (µg/m^3)	18.3	24.0	15.6
	PM_{10} (µg/m^3)	42.6	55.9	36.2
	$PM_{2.5}$ (µg/m^3)	17.0	22.3	14.4

Observations on PM_{10} values

The average PM_{10} value ranged from 42.6 - 85.1 µg/m^3. The average maximum value was observed at station no. AAQ2 and the average minimum value was observed at station no. AAQ4. The PM_{10} values were observed to be within the permissible limit of 100µg/m^3 specified for industrial, rural and other areas.

Observations on $PM_{2.5}$ values

The average value of $PM_{2.5}$ in the Study Area ranged from 17.0 - 34.3 µg/m^3. The average maximum value was monitored at station no. AAQ2 and the average minimum value was observed at station no. AAQ4. The $PM_{2.5}$ values were within the permissible limit of 60µg/m^3 specified for industrial, rural and other areas.

Observations on SO_2 values

The average value of SO_2 in the study Area ranged from 9.8 – 12.9 µg/m^3.The average maximum SO_2 level was observed at station AAQ2 and the average minimum value was observed at station AAQ4. The SO_2 values were well within the permissible limit of 80µg/m^3 specified for industrial, rural and other areas.

Observations on NO_2 values

The average NO_2 value ranged from 18.3 – 29.8 µg/m^3. The average maximum value was observed at station no. AAQ2 and the average minimum value was observed at station no. AAQ4. The NO_2 values were within the permissible limit of 80µg/m^3 specified for industrial, rural and other areas.

Results of ambient air quality monitoring by M/s Adani construction in Vishakhapattanam Port

The ambient air quality of the all (12) parameters i.e. PM_{10}, $PM_{2.5}$, SO_2, NO_2, NH_3, O_3, CO, C_6H_6, BaP, Pb, As, Ni for four sampling locations have been monitored by M/s Adani construction in Vishakhapattanam Port. The sampling locations are listed as below:

L1 - ADM Building

L2 - Pond Area in Back Up

L3 - Control Building

L4 - Adani Construction (L&T Side) Backup Area

The monitoring was done for a period from April 2014 to September 2014 and the results are enclosed as Annexure-II. The summary of ambient air quality monitoring is given in Table-4.9.

Table-4.9: Summary of Ambient Air Quality Monitoring Survey

Station No.	Parameter	Average	Maximum	Minimum
L-1	PM_{10} ($\mu g/m^3$)	59.31	76.5	42.6
	$PM_{2.5}$ ($\mu g/m^3$)	22.63	35.9	15
	SO_2 ($\mu g/m^3$)	10.45	15.81	5.2
	NO_2 ($\mu g/m^3$)	23.47	32.35	15.75
	NH_3 ($\mu g/m^3$)	BDL	BDL	BDL
	O_3 ($\mu g/m^3$)	12.56	25.41	5.17
	CO (mg/m^3)	0.57	1.13	0.11
	C_6H_6 ($\mu g/m^3$)	BDL	BDL	BDL
	BaP ($\mu g/m^3$)	BDL	BDL	BDL
	Pb ($\mu g/m^3$)	BDL	BDL	BDL
	As ($\mu g/m^3$)	BDL	BDL	BDL
	Ni (ng/m^3)	BDL	BDL	BDL
L-2	PM_{10} ($\mu g/m^3$)	78.41	96.5	38.5
	$PM_{2.5}$ ($\mu g/m^3$)	33.90	48.5	15.3
	SO_2 ($\mu g/m^3$)	16.75	25.7	8.5
	NO_2 ($\mu g/m^3$)	31.82	41.1	20.2
	NH_3 ($\mu g/m^3$)	28.03	48.4	16.4
	O_3 ($\mu g/m^3$)	17.86	27.7	8.6
	CO (mg/m^3)	0.74	1.8	0.2
	C_6H_6 ($\mu g/m^3$)	BDL	BDL	BDL
	BaP ($\mu g/m^3$)	BDL	BDL	BDL
	Pb ($\mu g/m^3$)	BDL	BDL	BDL
	As ($\mu g/m^3$)	BDL	BDL	BDL
	Ni (ng/m^3)	11.06	12.2	10.1
L-3	PM_{10} ($\mu g/m^3$)	93	47.5	68.00
	$PM_{2.5}$ ($\mu g/m^3$)	55.4	15.6	29.74
	SO_2 ($\mu g/m^3$)	28.4	5.4	13.46
	NO_2 ($\mu g/m^3$)	36.7	14.5	27.03
	NH_3 ($\mu g/m^3$)	25.48	15.2	19.29
	O_3 ($\mu g/m^3$)	23.7	6.2	14.91
	CO (mg/m^3)	1.83	0.15	0.79
	C_6H_6 ($\mu g/m^3$)	BDL	BDL	BDL
	BaP ($\mu g/m^3$)	BDL	BDL	BDL
	Pb ($\mu g/m^3$)	BDL	BDL	BDL
	As ($\mu g/m^3$)	BDL	BDL	BDL
	Ni (ng/m^3)	11.6	10.8	11.17
L-4	PM_{10} ($\mu g/m^3$)	85.95	99.4	62.5
	$PM_{2.5}$ ($\mu g/m^3$)	40.27	60	24.4
	SO_2 ($\mu g/m^3$)	20.13	28.63	11.29
	NO_2 ($\mu g/m^3$)	36.44	44.5	27.58
	NH_3 ($\mu g/m^3$)	30.87	44.68	12.53
	O_3 ($\mu g/m^3$)	20.22	27.85	12.67
	CO (mg/m^3)	0.83	1.83	0.22
	C_6H_6 ($\mu g/m^3$)	BDL	BDL	BDL
	BaP ($\mu g/m^3$)	BDL	BDL	BDL

Station No.	Parameter	Average	Maximum	Minimum
	Pb (µg/m^3)	BDL	BDL	BDL
	As (µg/m^3)	BDL	BDL	BDL
	Ni (ng/m^3)	11.78	13.11	10.35

Observations on PM_{10} values

The average PM_{10} value ranged from 38.5 – 99.4 µg/m^3. The average maximum value was observed at station no. L-3 and the average minimum value was observed at station no. L-1. The PM_{10} values were observed to be within the permissible limit of 100 µg/m^3 specified for industrial, rural and other areas.

Observations on $PM_{2.5}$ values

The average value of $PM_{2.5}$ in the Study Area ranged from 15.0 - 60 µg/m^3. The average maximum value was monitored at station no. L-3 and the average minimum value was observed at station no. L-1. The $PM_{2.5}$ values were within the permissible limit of 60 µg/m^3 specified for industrial, rural and other areas.

Observations on SO_2 values

The average value of SO_2 in the study Area ranged from 5.2 – 28.63 µg/m^3.The average maximum SO_2 level was observed at station L-3 and the average minimum value was observed at station L-1. The SO_2 values were well within the permissible limit of 80µg/m^3 specified for industrial, rural and other areas.

Observations on NO_2 values

The average NO_2 value ranged from 15.75 – 44.5 µg/m^3. The average maximum value was observed at station no. L-4 and the average minimum value was observed at station no. L-1. The NO_2 values were within the permissible limit of 80 µg/m^3 specified for industrial, rural and other areas.

Observations on NH_3 values

The average NH_3 value ranged from 12.53 – 48.4 µg/m^3. The average maximum value was observed at station no. L-4 and the average minimum value was observed at station no. L-1. The NH_3 values were within the permissible limit of 100 µg/m^3 specified for industrial, rural and other areas.

Observations on O_3 values

The average O_3 value ranged from 5.17 – 27.85 µg/m^3. The average maximum value was observed at station no. L-3 and the average minimum value was observed at station no. L-1. The O_3 values were within the permissible limit of 100 µg/m^3 specified for industrial, rural and other areas.

Observations on CO values

The average CO value ranged from 0.11 – 1.83 mg/m^3. The average maximum value was observed at station no. L-3 and the average minimum value was observed at station no. L-1. The CO values were within the permissible limit of 2 mg/m^3 specified for industrial, rural and other areas.

Observations on Ni values

The average Ni value ranged from 10.1 – 13.11 ng/m^3. The average maximum value was observed at station no. L-4 and the average minimum value was observed at station no. L-1. The Ni values were within the permissible limit of 20ng/m^3 specified for industrial, rural and other areas.

Observations on C_6H_6, BaP, Pb, As values

The **C_6H_6, BaP, Pb, and As** values are below the detectable limites during the monitoring period.

4.5 MARINE WATER QUALITY

In order to assess the ambient marine water quality, the samples were collected from seven locations including the Harbour (Nearer to Berths) and Breakwater. The samples were analyzed for different components under water, sediment and macro and micro fauna and flora. The sampling sites covered are listed in Table-4.10 and shown in Figure-4.7.

Table-4.10: Sampling Locations and its Geographical Coordinates

S. No.	St. Code	Latitude	Longitude
1.	**VPT-1:** Inner Turning circle	17°41'26.19"N	83°16'51.01"E
2.	**VPT-2:** West Q-I Iron Ore Berth	17°42'17.91"N	83°16'56.00"E
3.	**VPT-3:** West Q-7 & 8	17°41'17.27"N	83°17'1.85"E
4.	**VPT-4:** Ore Berth Start point	17°41'27.71"N	83°17'48.71"E
5.	**VPT-5:** Ore Berth End point	17°41'23.37"N	83°17'53.18"E
6.	**VPT-6:** Vizag Container Terminal Pvt. Ltd.	17°41'29.26"N	83°18'3.21"E
7.	**VPT-7:** Mouth Entrance Channel	17°41'21.41"N	83°18'16.80"E
8.	**VPT-8:** Outer Turning Circle	17°41'13.11"N	83°18'5.71"E
9.	**VPT-9:** Jetty Near OSTT	17°41'1.66"N	83°18'10.74"E
10.	**VPT-10:** Jetty Near OSTT	17°40'55.10"N	83°17'50.13"E

Inner Turning Circle

West Q-1 Iron Ore Berth

Plankton sample collection

Mouth Entrance Channel

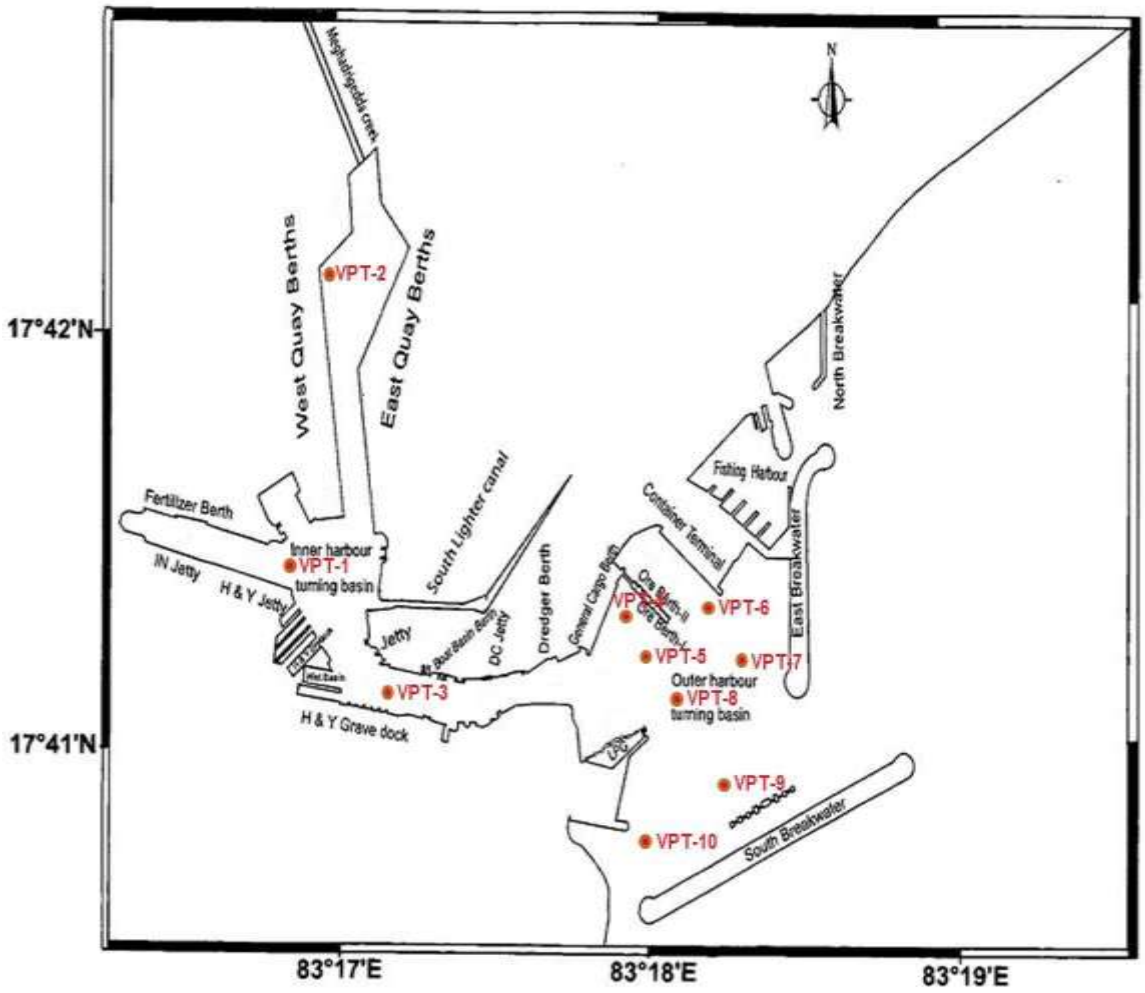


Figure-4.7 Map showing Marine water Sampling Locations

4.5.1 Methodology adopted for sampling

Water samples were collected using Universal water sampler below the surface and transferred to the pre-cleaned polypropylene and glass containers. Sediment samples were collected using a Van Grab, transferred to clean polythene bags and transported to the laboratory. The samples were air-dried and the plant root and other debris were removed and stored for further analysis.

4.5.2 Water Analysis

Temperature, Salinity and pH

The physical parameters such as temperature, salinity and pH were measured *in-situ* in the field. The subsurface temperature was measured with a mercury thermometer (±0.02°C accuracy) and the pH was measured by a calibrated pH pen (pH ep-3 model). Salinity was estimated using a Hand Refractometer (Erma Company, Japan). Water samples collected for

dissolved oxygen estimation were transferred carefully to BOD bottles. The DO was immediately fixed and brought to the laboratory for further analysis.

Preservation and Laboratory Analysis

After collection, the samples were immediately cooled to 4°C and then brought to the laboratory in an insulated thermo cool box. In the laboratory, water samples were filtered through Whatman GF/C filter paper and analysed for organic matter and other nutrients. Unfiltered samples were used for the estimation of total nitrogen and total phosphorus. All the analyses were carried out by adopting Standard procedures for samples of aquatic origin.

The methodology for analysis of various parameters is given in the following paragraphs.

Dissolved Oxygen

The modified Winkler's method as described by Strickland and Parsons (1972) was adopted for the estimation of dissolved oxygen.

Nitrate and Nitrite

The nitrate and nitrite content of samples were analysed by following the method described by Strickland and Parsons (1972). The nitrite was estimated from highly coloured azo dye formed by the addition of N (1-Napthyl) ethylene diaminedihydro-chloride and sulfanilamide into the solution was then measured at 543 nm in a spectrophotometer. The same procedure was followed for the estimation of nitrate. For this, nitrate was reduced to nitrite by passing the sample through copper coated cadmium column.

Inorganic Phosphate

The single solution mixed reagent procedure developed by Murphy and Riley (1962) was followed for the estimation of dissolved inorganic phosphate levels in water samples. This involves the conversion of phosphate into phosphomolybdic acid, which was then reduced to molybdinum blue colour complexes and then the intensity of colour was measured at 882 nm in a spectrophotometer.

Total Phosphorus

The Total Phosphate in samples was estimated by adopting the method described by Menzel and Corwin (1964). This procedure involves the conversion of organically bound phosphate into inorganic phosphate by wet oxidation of samples with potassium persulphate in an autoclave for 30 min at 15 lbs pressure. The converted inorganic phosphate was then estimated by using the method described by Murphy and Riley (1962). The subtraction of original dissolved inorganic phosphate from total phosphate yielded the organic phosphate in the water sample.

Reactive Silicate

The reactive silicate content of water was estimated by following the method of Strickland and Parsons (1972). In this method, the intensity of blue colour formed by silico-molybdate complex was measured in a spectrophotometer at 810 nm and the calculated values are expressed in µmol of Silica/l.

4.5.3 Sediment Analysis

For the analysis of textural composition and pH, the air-dried sediment samples were used as such. For all other analyses of organic matter, sediment samples were ground to fine powder and dried in an oven at 110°C to constant weight for an hour.

Total Organic Carbon:

The estimation of total organic carbon in sediment was performed by adopting the method of El Wakeel and Riley (1956). The procedure involves chromic acid digestion and subsequent titration against Ferrous ammonium sulphate solution in the presence of 1-10 phenonthroline indicator. The values calculated are expressed in mg C/g of sediment.

Bacteriological Methods

Collection of samples:

Surface water samples were collected in 30ml sterile screw capped bottles for bacteriological assessment. Enough air space was left in the bottles to allow thorough mixing. Precautionary measures were taken to avoid contamination through handling. For microbial assessment in sediment samples, a known quantity of samples was collected from the grab samples using sterilised spatula. The central portion of the collected sediment was aseptically transferred into sterile polyethylene bags. All the samples were brought to the laboratory in portable icebox soon after collection and bacteriological analyses were carried out in the laboratory at CAS immediately, with necessary dilution.

Enumeration of Total Viable Counts:

TVC was enumerated by adopting the spread plate method using Zobell's Marine Agar medium (EA123, Hi-Media, Mumbai). The samples (water and sediment) were diluted using the sterile sea water and 0.1 ml of the diluted sample was pippeted into the petriplates containing Zobell's Marine Agar and it was spread using a 'L' shaped glass spreader. The plates after inoculation were incubated in an inverted position at a temperature of 28+2°C for 24to 48 h. The colonies were counted and the population density expressed as Colony Forming Unit (CFU) per ml or g of the sample. The bacterial colonies were picked up from the pertidishes and re-streaked in appropriate nutrient agar plates thrice before a pure culture was established in agar slants.

Enumeration of Total Coliforms:

Macconkey agar with 0.15% bile salt, crystal violet and NaCl has been recommended in accordance with USP/Nfxi (1) for the detection, isolation and enumeration of coliforms and intestinal pathogens in water, dairy products, pharmaceutical preparations, etc. The agar weighing 51.5 g in 1000 ml distilled water was heated up to the boiling point to dissolve the medium completely and sterilized by autoclaving at 15 lbs pressure (121°C) for 15 min. suitably diluted samples were inoculated in the petriplates containing medium and were incubated for 48 h. After incubation, the colonies of *E. coli* appeared with pink color.

M-FC agar is employed for detection and enumeration Faecal Coliforms by the membrane filter technique at higher temperature (44.5°C). The agar weighing 52 g was suspended in 1000 ml of distilled water and heated up to the boiling point to dissolve the medium completely, 10ml of Rosolic acid (dissolved in 0.2 N NaOH) was added, heated with frequent agitation and boiled for 1 min. Then the medium was cooled to 50°C. Finally, the medium was poured into small 60mm plates. Samples filtered by Millipore apparatus using 0.45µm Whatman filter papers were impregnated in the petriplates. After 48 h of incubation, the colonies of *E. coli* appeared with blue colour.

Chlorophyll `a':

The samples were filtered through Whatman GF/C filter papers and the chlorophyll was extracted into 90% acetone. The resulting colored acetone extract was measured in a spectrophotometer at different wavelengths and the same acetone extracts were acidified and measured for the phaeo-pigments. The detailed methodology as described in APHA manual (1989) was followed.

Phytoplankton:

Phytoplankton samples were collected from the surface waters of the study areas by towing a plankton net (mouth diameter 0.35 m) made of bolting silk [No.30 mesh size 48 µm) for half an hour. These samples were preserved in 5% neutralized formalin and used for qualitative analysis. For the quantitative analysis of phytoplankton, the settling method as described by Sukhanovo (1978) was adopted. Numerical plankton analysis was carried out using Utermohl's inverted plankton microscope.

Phytoplankton species was identified using the standard works of Hustedt (1930-1966), Venkataraman (1939), Cupp (1943), Subramanian (1946), Prescott (1954), Desikachary (1959 and 1987), Hendey (1964), Steidinger and Williams (1970) and Taylor (1976) and Anand*et al.* (1986)

Zooplankton:

Zooplankton samples were collected from the surface waters of the study areas by horizontal towing of plankton net with mouth diameter of 0.35 m, made of bolting silk (No. 70 mesh size 200 µm) for half an hour. After collection, the samples were preserved in 5% neutralized formalin and used for quantitative analysis. The zooplankton collected were identified to the species level using the classical works of Dakin and Colefax (1940), Davis (1955), Kasthurirangan (1963) and Wickstead (1965) and Damodara Naidu (1981). For the quantitative analysis of zooplankton, a known quantity of water (100 l) was filtered through a bag net (0.33 mm mesh size) and filtrate was made up to 1 litre in a wide mouthed bottle and then enumerated using Utermohl's inverted plankton microscope. The plankton density is expressed as number of organisms/m^3.

Benthic Community:

For studying the benthic organisms, sediment samples were collected using a Van veen grab which covered an area of 0.1m^2. The wet sediment was sieved with varying mesh sizes for segregating the organisms. The organisms retained in the sieve were fixed in 5-7% formalin and stained further with Rose Bengal solution for easy spotting at the time of sorting. After a day or two, the organisms were sorted into various groups. The number of organisms in each grab sample was expressed as number per meter square. According to size, benthic animals are divided into three groups. (i) macrobenthos (ii) meiobenthos and (iii) microbenthos (Mare, 1942). All the species were sorted, enumerated and identified to the advanced level possible with the consultation of available literature. The works of Fauvel (1953), Day (1967) were referred for polychaetes; Barnes (1980) and Lyla*et al*. (1999) for crustaceans; SubbaRao*et al.* (1991) and Ramakrishna (2003) for molluscs.

4.5.4 Findings of marine water quality

Based on the physio-chemical, biological and sediment characteristics of the study sites, an assessment of the ecological status of the study area was made. The physiochemical properties of marine water are listed in Table-4.11 and the nutrients are given in Table-4.12.

Table– 4.11: Physico - Chemical Properties of marine Water

St. Code	Water Tem. (°C)	Salinity (psu)	pH	DO (mg/l)	BOD (mg/l)	TSS (ppm)	Turbidity (NTU)
VPT-1	27	32	8.4	5.00	2.54	90	10.0
VPT-1-SS	26.5	31.5	8.2	5.20	2.61	130.8	12.0
VPT-2	27	32.5	8.4	4.78	2.19	172.8	10.2
VPT-2-SS	26.4	32.1	8.2	5.10	2.56	150.4	12.0
VPT-3	28	33	8.3	3.80	2.68	123.6	13.0
VPT-3-SS	26.5	32.6	8.1	4.00	2	91.6	17.0
VPT-4	28	33	8.4	5.10	2.22	98.4	12.0

St. Code	Water Tem. (°C)	Salinity (psu)	pH	DO (mg/l)	BOD (mg/l)	TSS (ppm)	Turbidity (NTU)
VPT-4-SS	27.4	32.5	8.2	5.10	2.56	97.2	13.5
VPT-5	27	33.5	8.3	4.90	2.58	84.8	12.0
VPT-5-SS	26.6	33.2	8.2	5.10	2.37	99.6	13.0
VPT-6	27.2	34	8.4	5.10	2.52	98	12.0
VPT-6-SS	26.8	33.5	8.3	5.22	1.9	80.8	14.0
VPT-7	28	34.4	8.4	4.84	2.6	91.6	10.0
VPT-7-SS	27.6	34.2	8.2	4.98	2.5	94.8	11.0
VPT-8	28.5	35.6	8.5	5.11	2.31	97.2	9.0
VPT-8-SS	28	35.5	8.4	5.01	2.41	103.6	8.0
VPT-9	31	36	8.5	4.33	2.1	90	9.0
VPT-9-SS	30	35	8.3	4.50	2.01	102.8	10.0
VPT-10	30.5	35.2	8.4	4.66	2.3	90.8	8.0
VPT-10-SS	30.1	34.5	8.3	4.90	2.09	99.2	9.0

Table– 4.12: Nutrients characteristics of Marine Water

St. Code	NO_2 (µmol/l)	NO_3 (µmol/l)	NH_4 (µmol/l)	TN (µmol/l)	TP (µmol/l)	IP (µmol/l)	SiO_4 (µmol/l)	POC (µgC/l)	PHC (µg/l)
VPT-1	0.134	6.01	1.25	22.7321	2.9	1.1	32.3741	90.6	0.8
VPT-1-SS	0.156	5.60	2.05	20.4372	2.6	1.5	42.3674	92.5	0.9
VPT-2	0.145	6.11	1.83	23.0037	3.0	0.5	33.4365	90.7	1.2
VPT-2-SS	0.107	7.72	1.90	21.8634	2.6	1.5	30.1324	92.6	7.6
VPT-3	0.056	3.30	2.45	18.9327	1.9	1.7	41.3651	90.8	1.6
VPT-3-SS	0.178	4.50	3.90	28.67	1.8	1.6	28.9756	94.7	8.46
VPT-4	0.078	5.70	0.89	20.9836	2.1	0.8	46.7548	69.5	0.7
VPT-4-SS	0.098	4.04	0.95	16.7832	1.7	1.5	35.0449	76.4	2.3
VPT-5	0.046	4.94	0.21	17.2763	1.9	0.9	31.6521	86.8	0.6
VPT-5-SS	0.067	7.51	0.65	30.45	3.1	1.8	30.3427	89.7	2.3
VPT-6	0.192	4.64	1.06	15.8643	2.8	1.2	29.0769	78.6	0.80
VPT-6-SS	0.345	3.80	0.90	14.874	1.8	1.0	40.2316	89.7	5.4
VPT-7	0.0594	4.60	0.52	16.7632	1.5	0.8	28.7653	70.6	0.54
VPT-7-SS	0.153	5.80	0.25	19.0763	2.5	1.3	32.7814	80.3	5.67
VPT-8	0.134	4.43	0.90	13.6549	1.9	0.9	31.654	72.3	1.16
VPT-8-SS	0.038	4.71	1.05	14.8765	2.0	1.2	32.871	79.3	1.84
VPT-9	0.096	4.01	0.92	12.8763	1.9	0.9	27.987	70.4	1.51
VPT-9-SS	0.086	4.04	0.96	14.9871	2.0	1.2	25.6543	75.5	1.83
VPT-10	0.0964	5.80	0.90	16.8216	1.8	0.8	30.432	69.5	1.77
VPT-10-SS	0.0972	5.60	1.89	17.8632	1.6	0.9	31.9876	72.3	1.32

Table-4.13: Heavy metals recorded in marine water

Stations	Hexavalent Chromium (µg/l)	Lead (µg/l)	Copper (µg/l)	Mercury (µg/l)
VPT-1	5.2	5.1	14.4	0.41
VPT-1-SS	5.8	6.8	15.3	0.5
VPT-2	5.7	5.7	14.0	0.52
VPT-2-SS	5.8	6.3	16.6	0.41
VPT-3	4.4	6.9	14.4	0.57
VPT-3-SS	6.8	6.4	17.8	0.61
VPT-4	3.9	7.5	15.2	0.52
VPT-4-SS	4.1	8.3	14.4	0.46
VPT-5	5.4	5.7	13.2	0.42
VPT-5-SS	4.7	6.1	13.4	0.43
VPT-6	6.5	6.2	15.5	0.49
VPT-6-SS	5.2	6.2	16.2	0.41
VPT-7	5.8	7.7	11.4	0.49
VPT-7-SS	5.7	4.6	11.5	0.41
VPT-8	5.1	3.7	12.5	0.49
VPT-8-SS	3.8	4.3	13.3	0.42
VPT-9	3.7	5.1	15.4	0.43
VPT-9-SS	4.0	5.2	16.0	0.45
VPT-10	3.6	4.4	12.8	0.4
VPT-10-SS	4.1	4.7	14.5	0.42

Depth

The depth at various sampling stations varied between 19 m to 25 m with maximum was at VPT-7 and minimum at VPT-1 (Refer Figure-4.8).

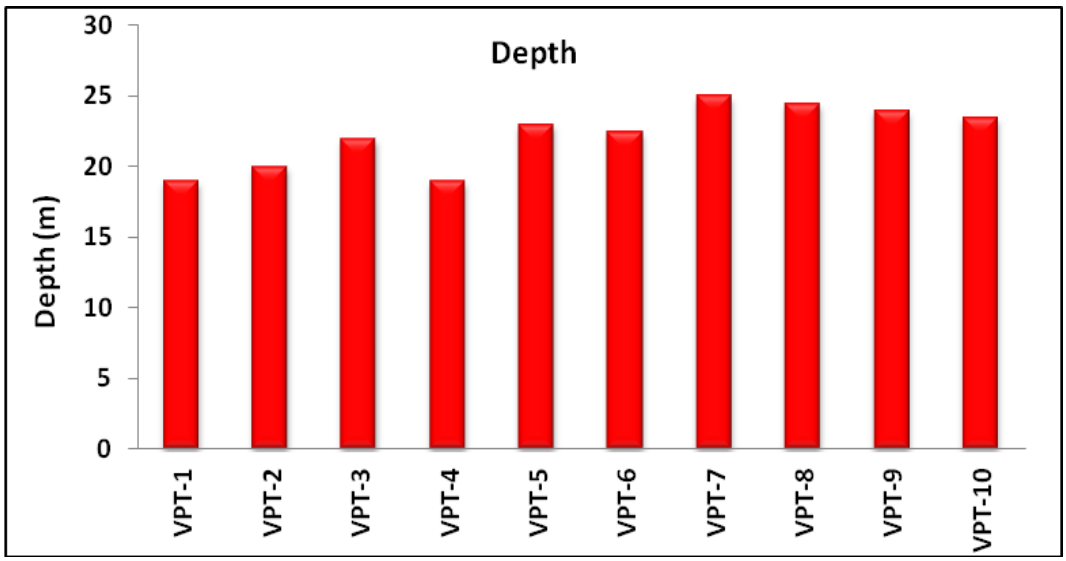


Figure-4.8: Depth recorded at various stations

Water Temperature

The water temperature fluctuated from 26.4 to 31°C. The maximum was recorded at VPT-9 and minimum was at VPT-2-Refer (Refer Figure-4.9).

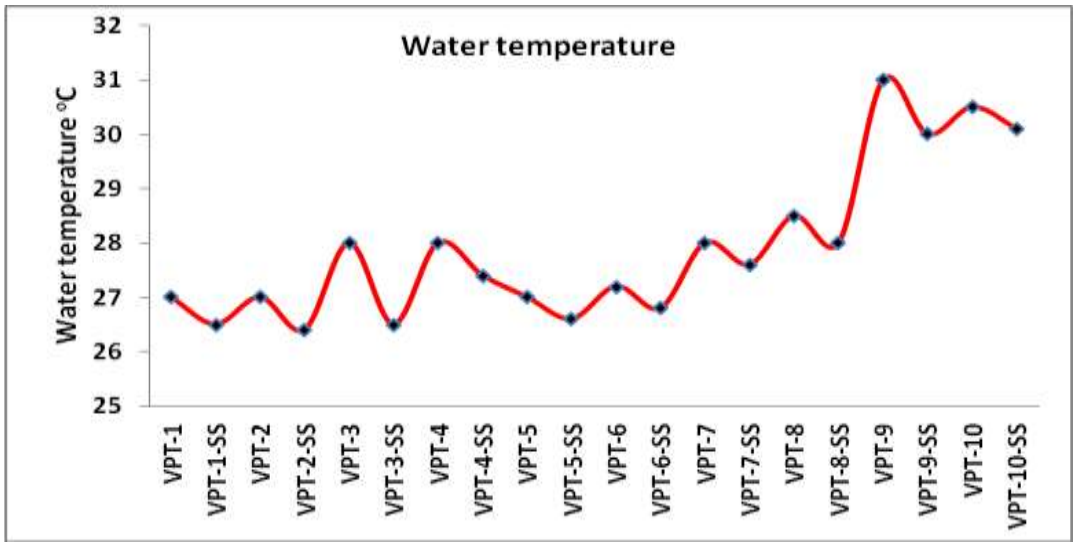


Figure-4.9: Water temperature recorded at various stations

Surface water temperature of the study area ranged between 30.1° to 31.9° C. The difference was only very low. This may be due to the absence of any inflow of cold fresh water from the upper reaches of the river. Values of salinity in the creek and sea support this inference. The creek water was seawater itself. Hence all the physical characteristics of seawater were found in the creek.

Bottom water temperature ranged from 30.0° to 31.3° C. Depth in the creek being low there seems to be mixing of the water without any stratification. The tides do not seem to affect these parameters.

Salinity

The water salinity varied from 31.5 to 36PSU. The salinity was found to be higher at VPT-9 and lower at VPT-1 (Refer Figure-4.10).

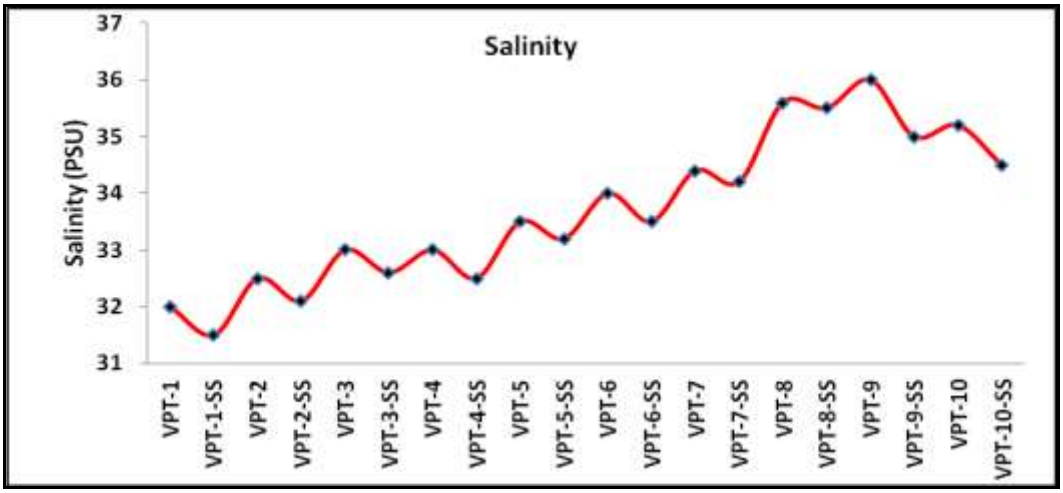


Figure-4.10: Salinity recorded at various stations

pH

The pH at various sampling locations ranged from 8.1 and 8.5 with maximum was recorded at VPT-9 and minimum was recorded at VPT-3 (Refer Figure-4.11).

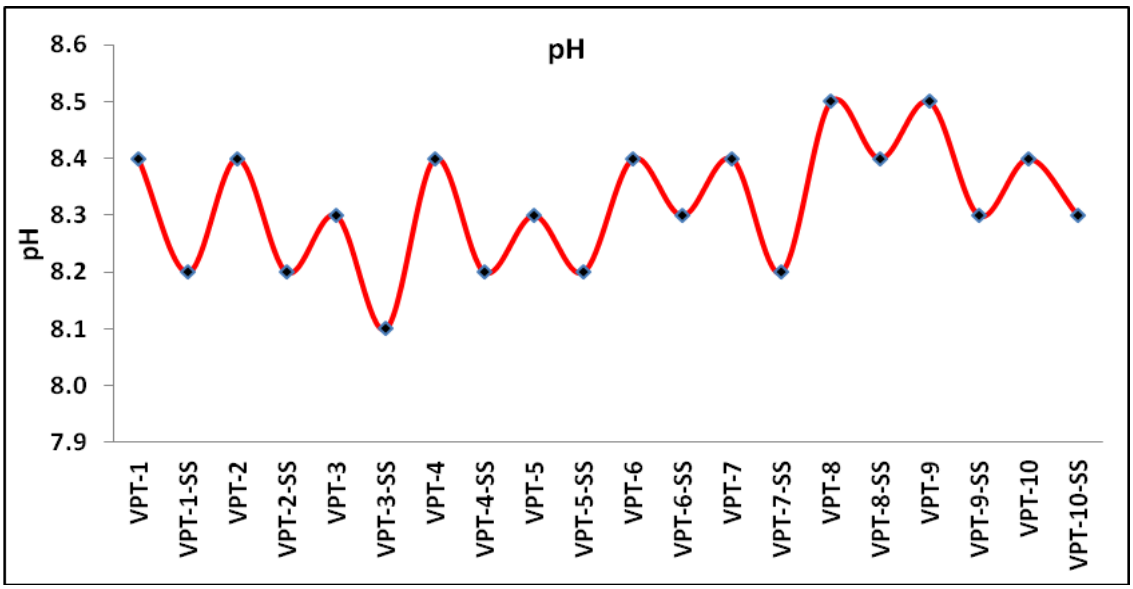


Figure-4.11: Water pH recorded at various stations

Values of pH of surface and bottom water of all study sites also did not show any significant difference. Dissolved oxygen content of both surface and bottom waters of all the 4 study sites were almost the same. This again is due to the fact that the water in the creek is seawater itself and the marginal difference is on account of tidal influence.

Total Suspended Solids

The Total Suspended Solids values at various sampling stations ranged between 80.8 and 172.8 ppm. The maximum was recorded at VPT-2 and minimum was recorded at VPT-6-ss (Refer Figure-4.12).

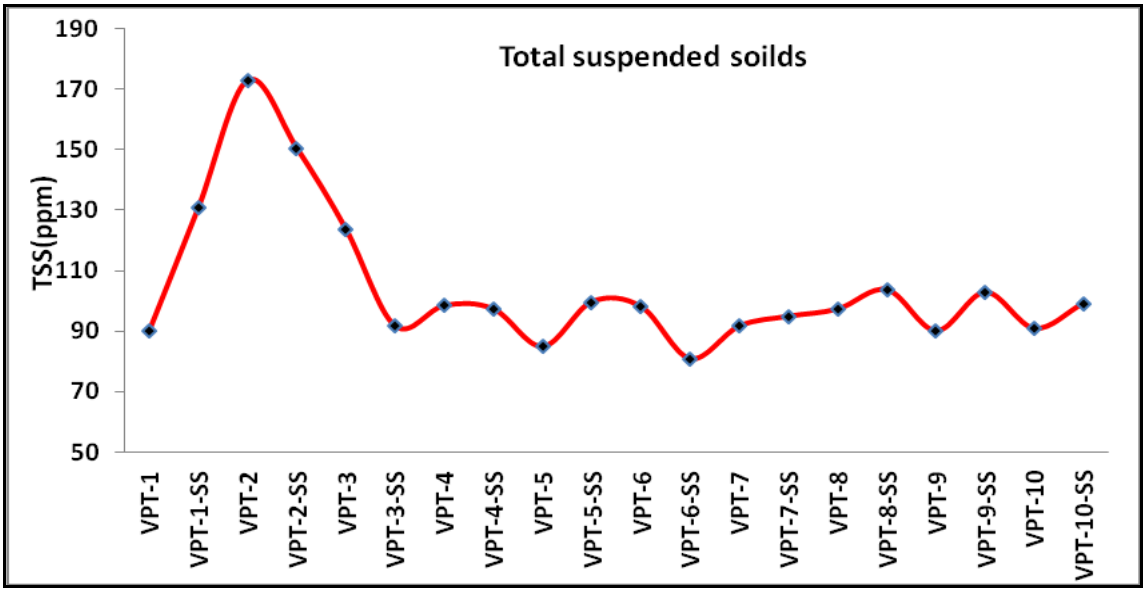


Figure-4.12 Total suspended solids recorded at various stations

Turbidity

The turbidity values were between 8.0 and 17.0 NTU at various sampling locations. The maximum level was at VPT-3-ss while the minimum level was at VPT-8-ss (Refer Figure-4.13).

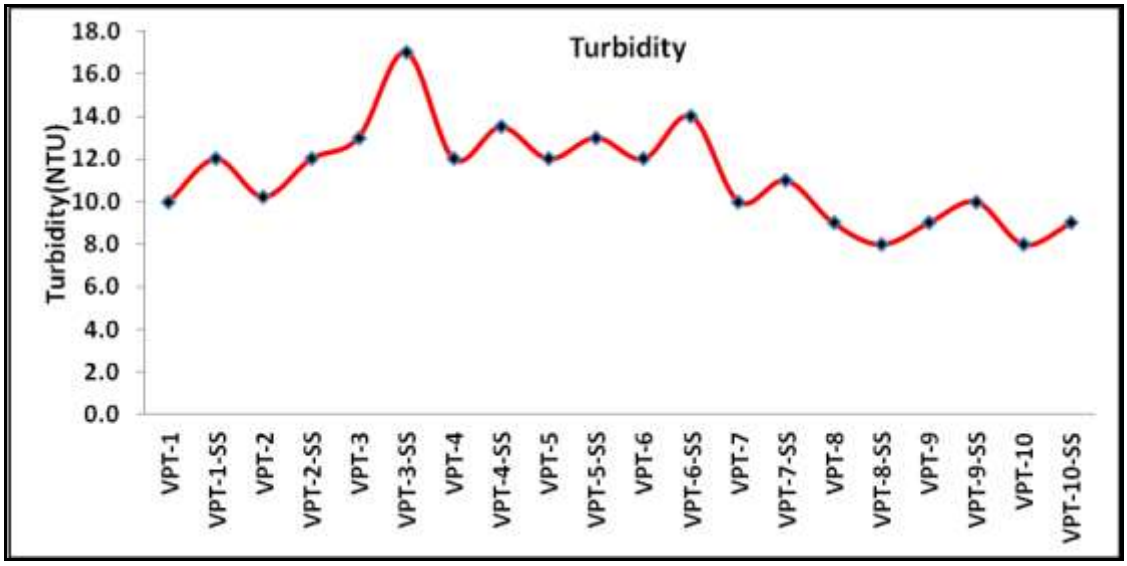


Figure-4.13: Turbidity recorded at various stations

Dissolved Oxygen

The Dissolved Oxygen level in the water varied between 3.8 and 5.22 mg/l. The higher level was recorded at VPT-6-ss and lower value at VPT-3 (Refer Figure-4.14).

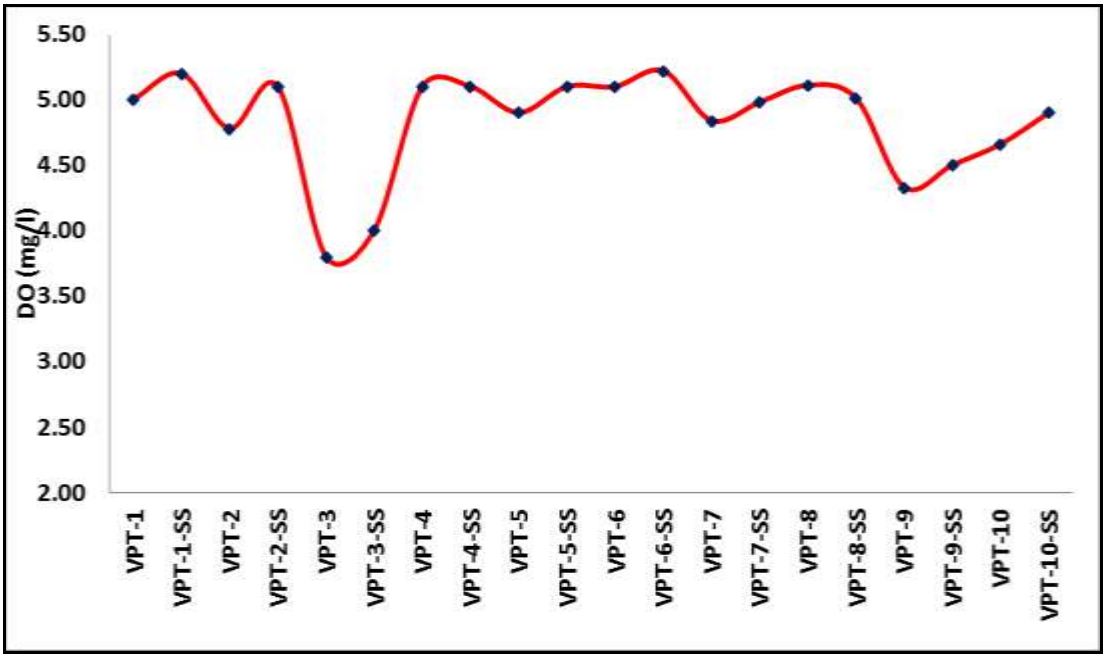


Figure-4.14: Dissolved Oxygen recorded at various stations

Biological Oxygen Demand

The BOD values varied between 1.90 and 2.68 mg/l with maximum value was recorded at VPT-3 and minimum at VPT-6 (Refer Figure-4.15).

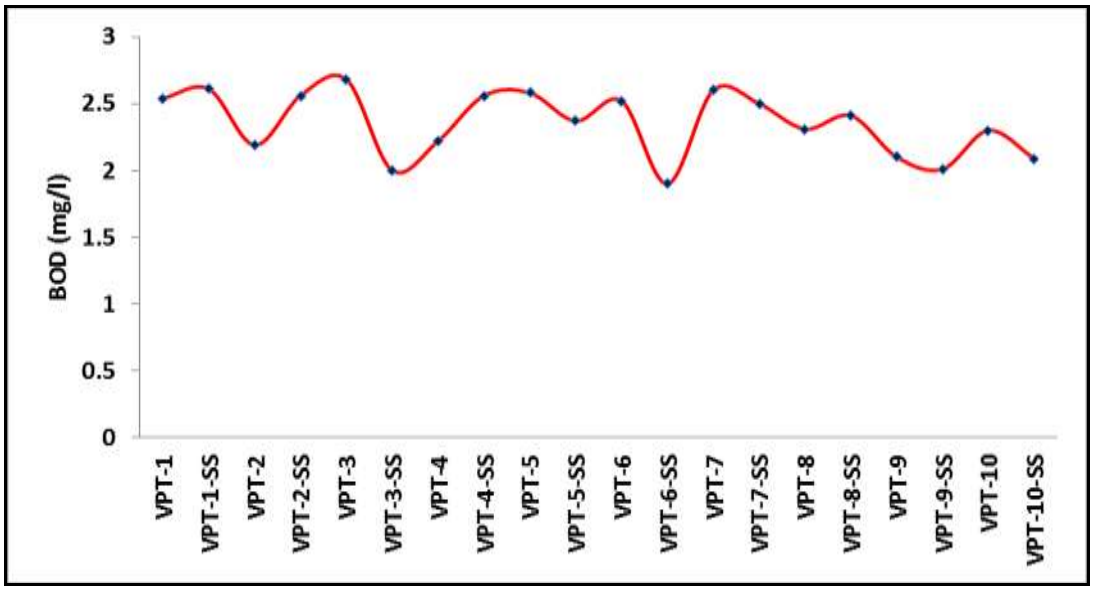


Figure-4.15: Biological oxygen demand recorded at various stations

Waters

Except in site 2, which is the mouth region of the creek, values of BOD were lower indicating the absence of any serious pollution. In site 2 the presence of the fishing jetty seems to be responsible for the higher BOD values.

Nutrients

The life supporting processes in the sea requires an array of inorganic substances, of which the role of nitrogen, phosphorus and silicon are considered to be very vital in marine ecosystem. Among the nitrogenous nutrients, nitrite, nitrate and ammonia are the major constituents, which play a key role in the phytoplankton growth and proliferation.

Nitrite

The nitrite level varied from 0.038 to 0.345 µmol/l with maximum was recorded at VPT-6-ss and minimum was recorded at VPT-8-ss (Refer Figure-4.16).

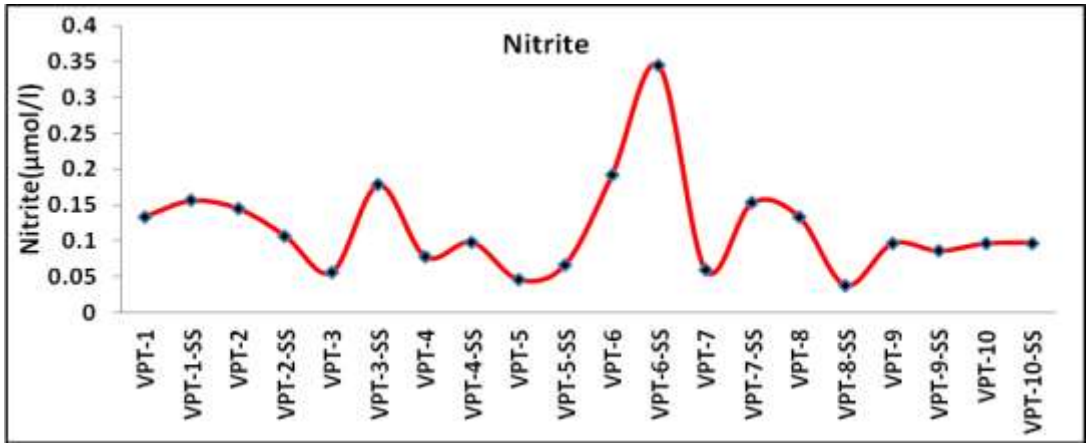


Figure-4.16: Nitrite recorded at various stations

Nitrate

Nitrate concentration ranged between 3.3 and 7.7µmol/l with maximum was recorded at VPT-2-ss and minimum at VPT-3 (Refer Figure-4.17).

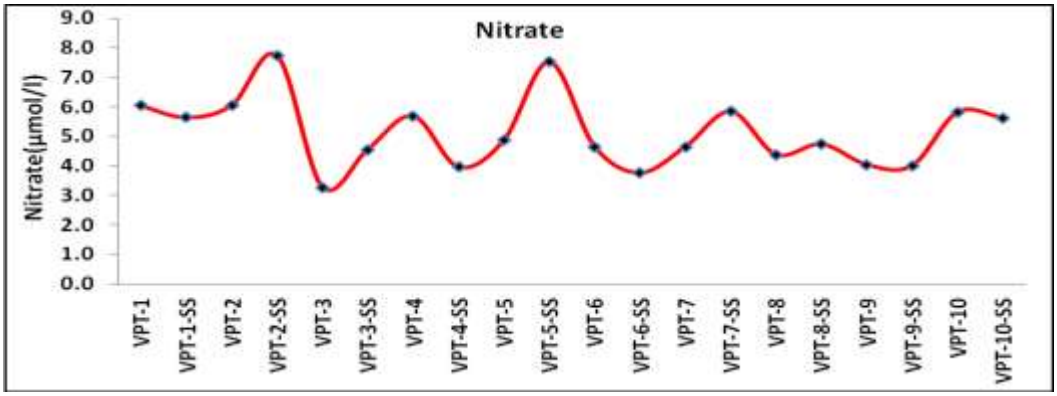


Figure-4.17: Nitrate recorded at various stations

Ammonical Nitrogen

The ammonia concentration varied from 0.21 to 3.90µmol/l. The maximum concentration (3.90 µmol/l) was recorded at VPT-3-ss and minimum (0.21 µmol/l) was at VPT-5 (Refer Figure-4.18).

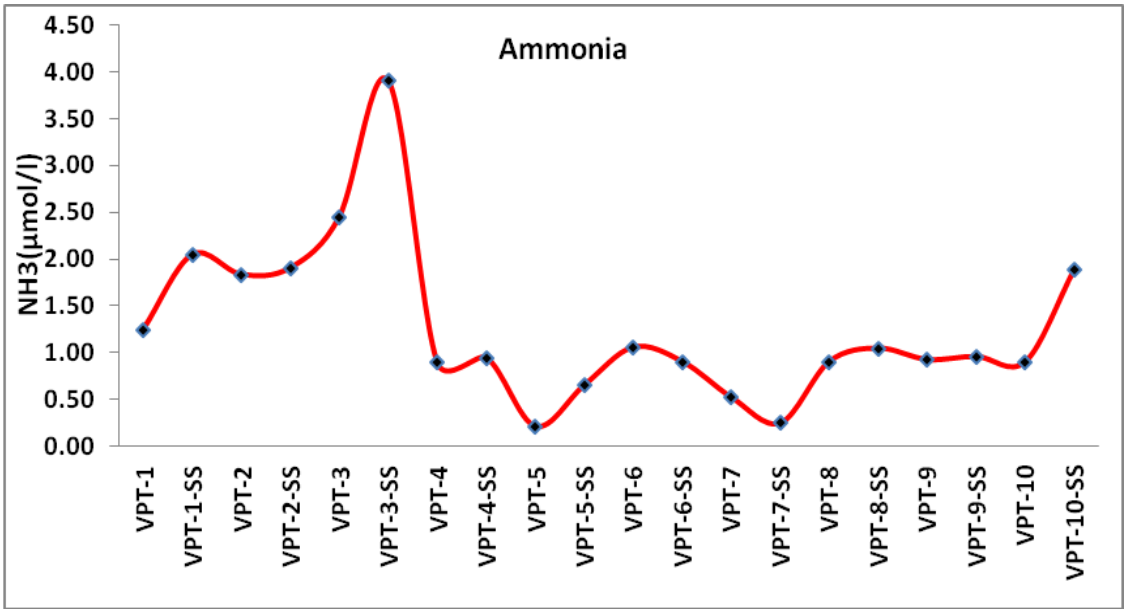


Figure-4.18: Ammonical Nitrogen recorded at various stations

Total Nitrogen

The Total nitrogen values ranged from 12.87 to 30.45µmol/l. The maximum concentration was found at VPT-5-ss and minimum at VPT-9 (Refer Figure-4.19).

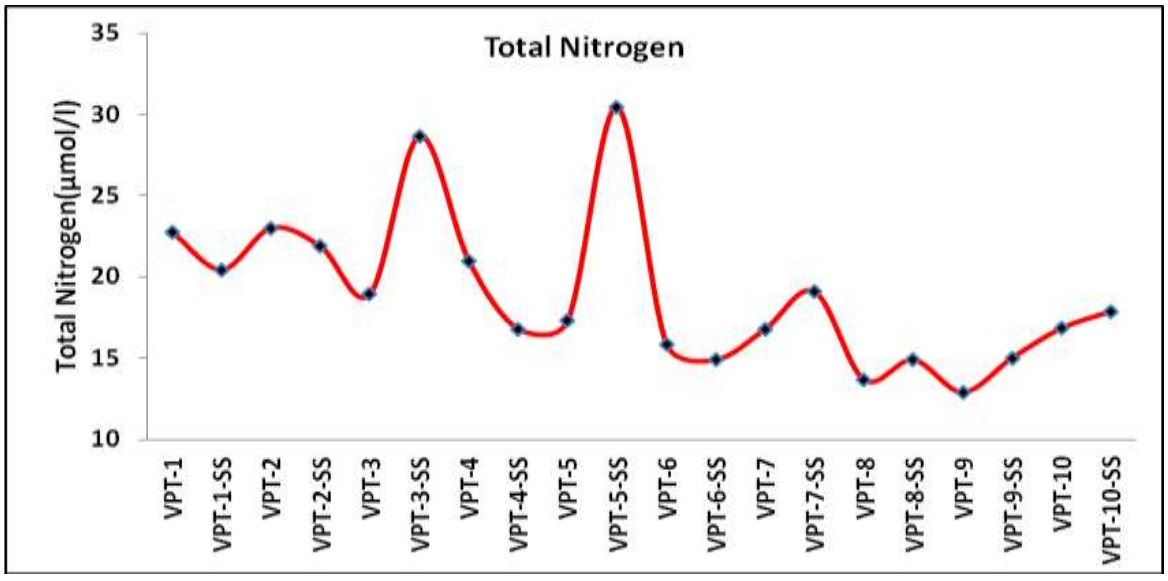


Figure-4.19: Total Nitrogen recorded at various stations

Total Phosphorus

The Total phosphorus values ranged from 1.5 to 3.1µmol/l with maximum was recorded at VPT-5-ss and minimum value was recorded at VPT-7 (Refer Figure-4.20).

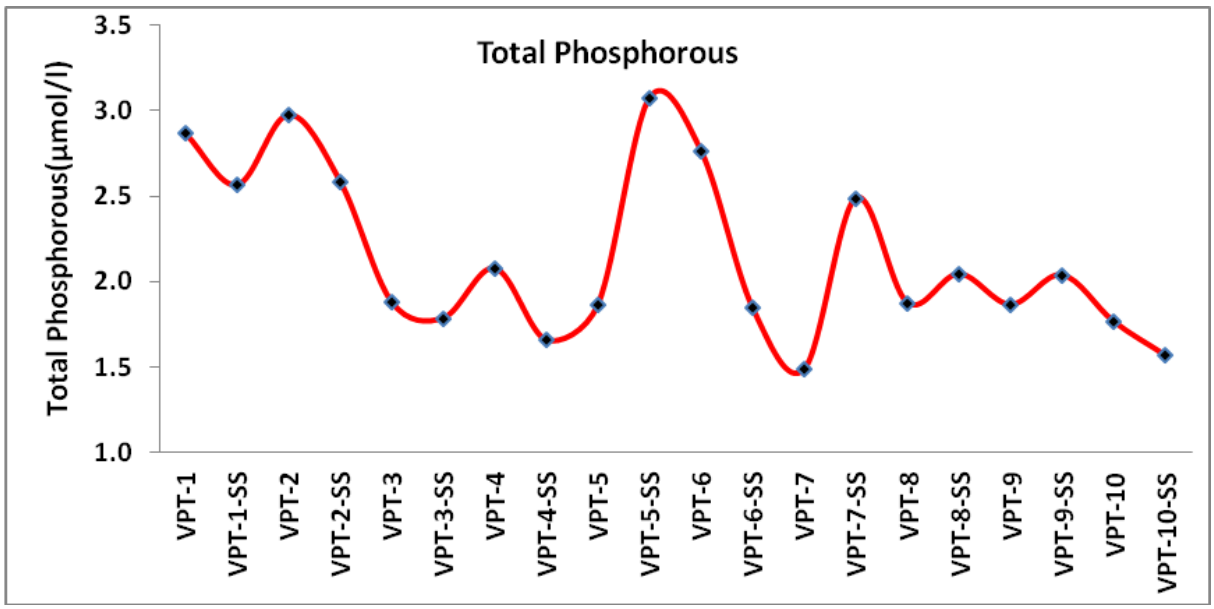


Figure-4.20: Total Phosphorus recorded at various stations

Inorganic Phosphate

The inorganic phosphate values ranged between 0.5 and 1.8µmol/l with maximum value was recorded at VPT-5-ss and minimum at VPT-2 (Refer Figure-4.21).

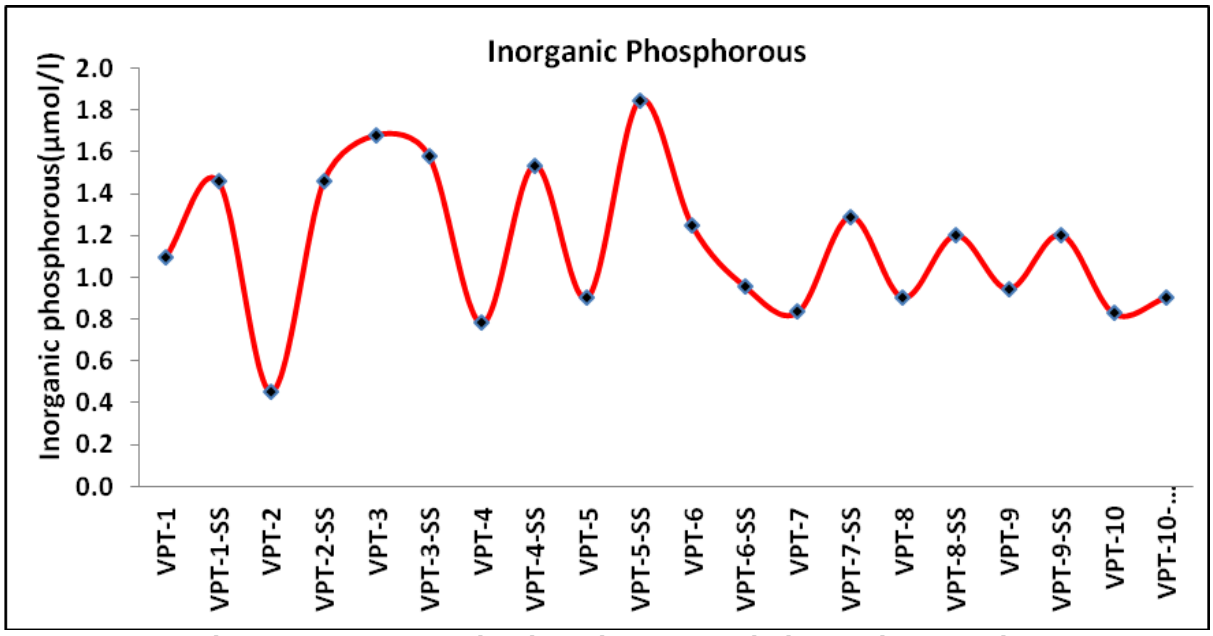


Figure-4.21: Inorganic Phosphate recorded at various stations

Reactive Silicate

The silicate values ranged between 25.65 and 46.75µmol/l. The maximum (46.75 µmol/l) and minimum (25.65µmol/l) values were recorded at VPT-4 and VPT-9-ss respectively (Refer Figure-4.22).

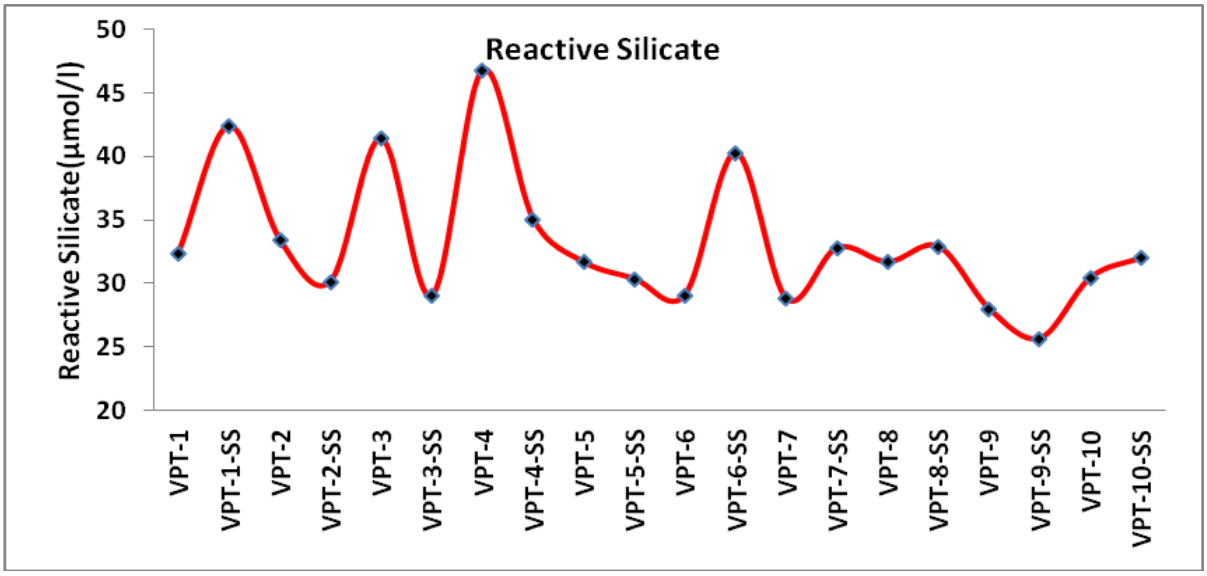


Figure-4.22: Reactive silicate levels recorded at various stations

Particulate Organic Carbon

The Particulate Organic Carbon level ranged between 69.5 and 94.7µgc/l with maximum (94.7µgc/l) at VPT-3-ss and low (69.5µgC/l) at VPT-10 (Refer Figure-4.23).

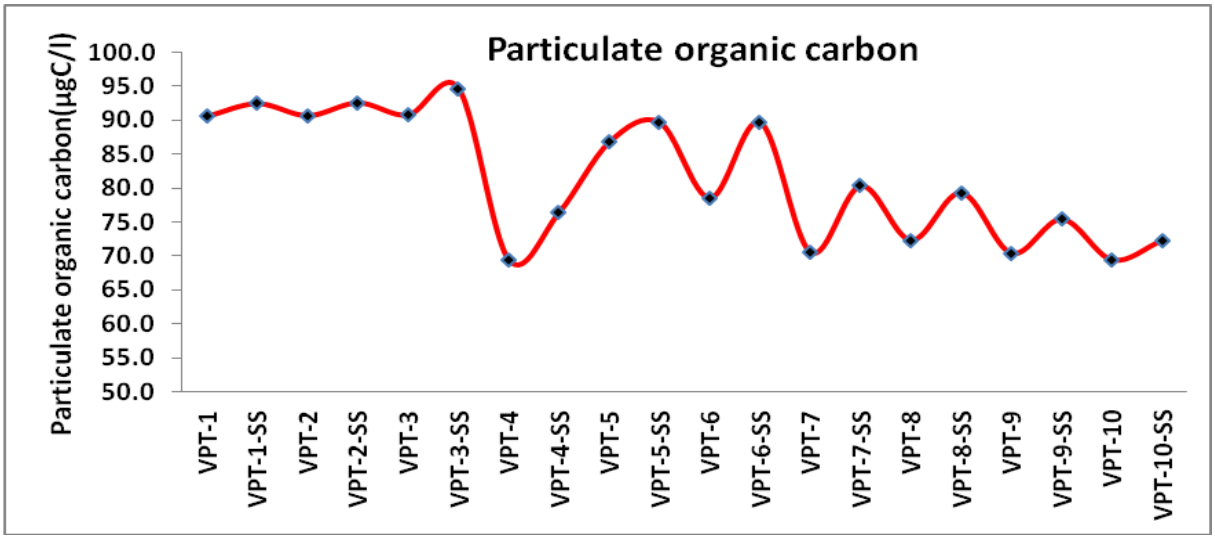


Figure-4.23: Particulate Organic Carbon levels recorded at various stations

Petroleum hydrocarbon

The Petroleum hydrocarbon level ranged between 0.54 and 8.46µg/l with maximum at VPT-3-ss and minimum at VPT-7 (Refer Figure-4.24)

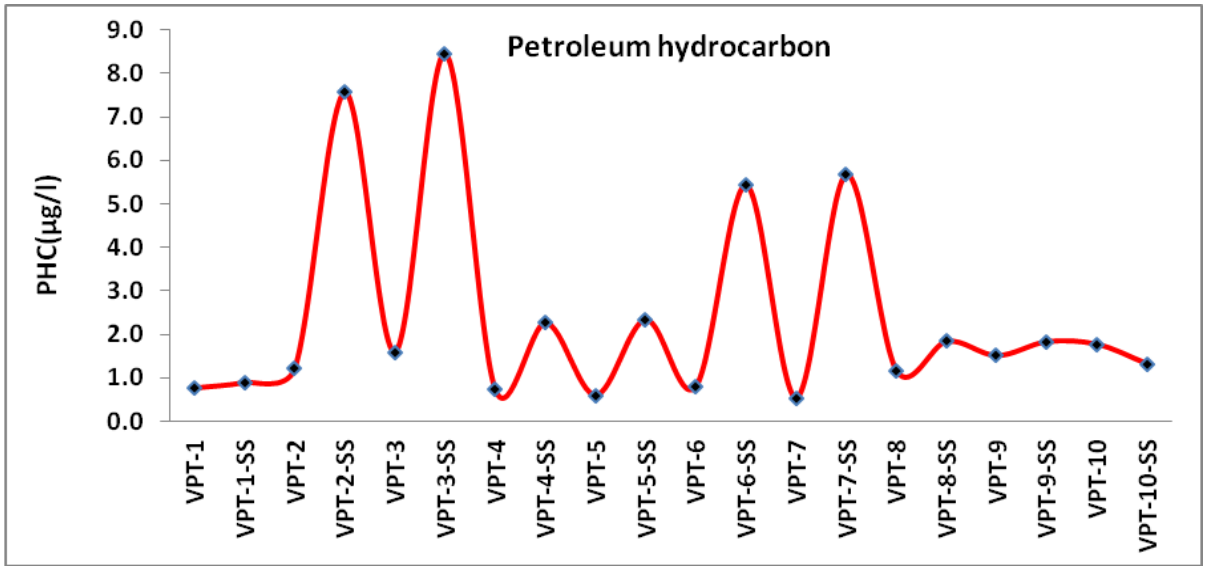


Figure-4.24: Petroleum Hydrocarbon levels recorded at various stations

Hexavalent Chromium

The Hexavalent Chromium level varied from 3.6 to 6.8µg/L (Figure-4.25). The maximum was recorded at VPT-3-ss and the minimum was recorded at VPT-10 during this survey.

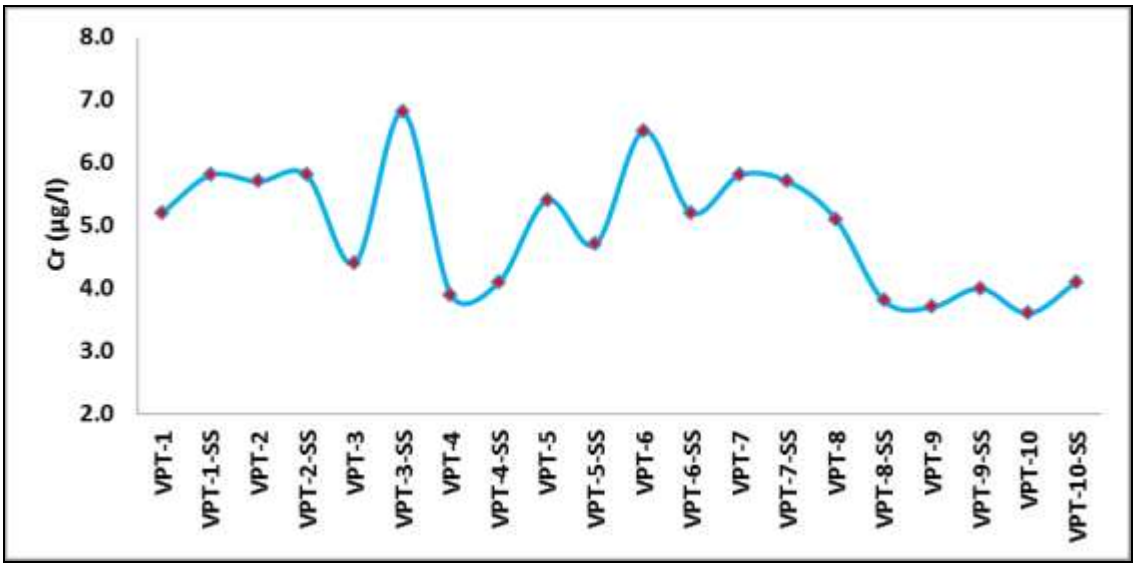


Figure-4.25: Hexavalent Chromium level recorded at various stations

Lead

The Lead level varied from 3.7 to 8.3µg/L (Figure-4.26). The maximum was recorded at VPT-4-ss and the minimum was recorded at VPT-8 during this survey.

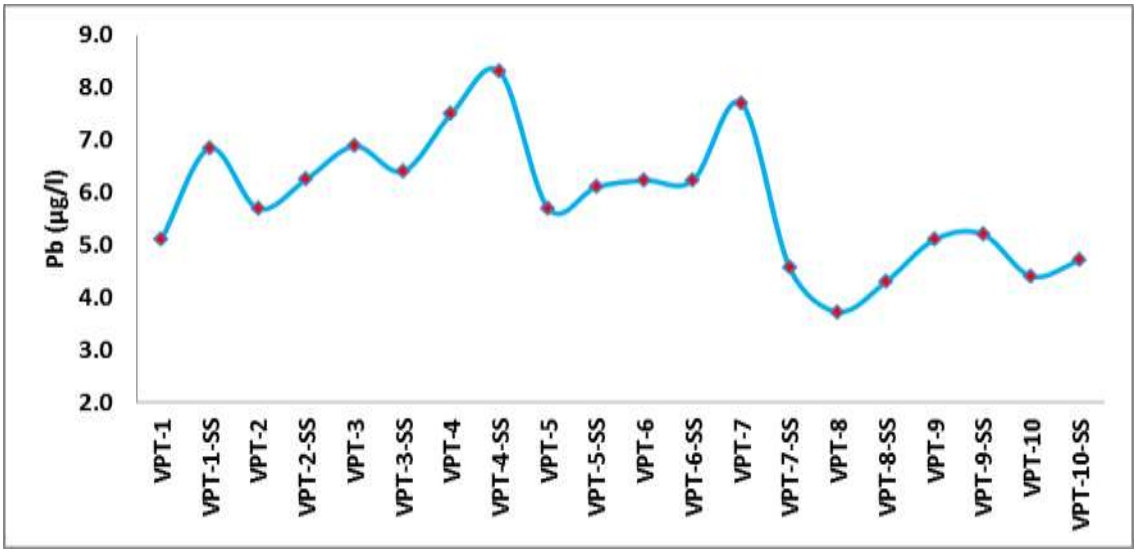


Figure-4.26: Lead level recorded at various stations

Copper

The copper level varied from 11.4 to 17.8µg/L (Figure-4.27). The maximum was recorded at VPT-3-ss and the minimum was recorded at VPT-7 during this survey.

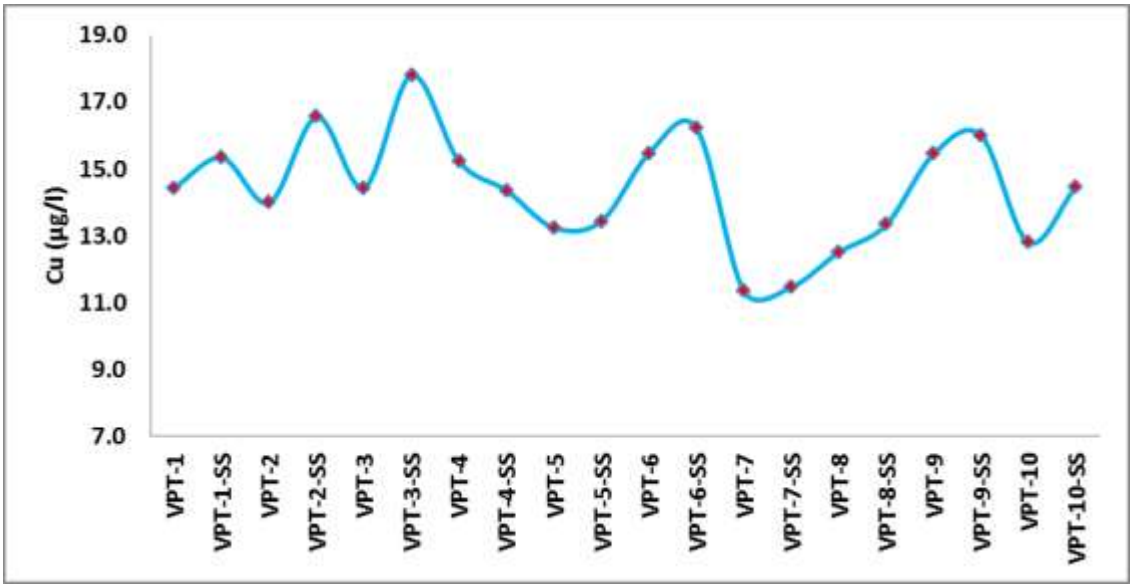


Figure-4.27: Copper level recorded at various stations

Mercury

The mercury level varied from 0.4 to 0.61µg/L (Figure-4.28). The maximum was recorded at VPT-3-ss and the minimum was recorded at VPT-10 during this survey.

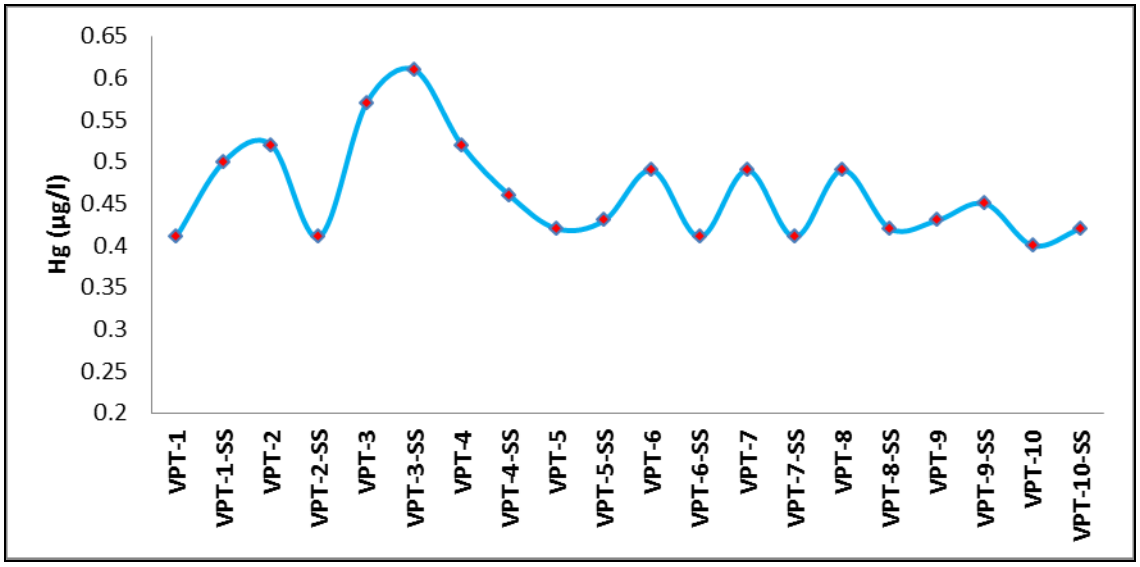


Figure-4.28: Mercury level recorded at various stations

4.6 SEDIMENT CHARACTERISTICS

In a water body, there is a close relationship between the type of sediments with physio-chemical and biological parameters of water. Similarly, the activities in the area also have a profound effect on the sediment composition. Hence, an understanding of the physio-chemical and biological characteristics of the sediments is essential. With this view, the sediment samples from various stations were collected and their physio-chemical and biological characteristics were analysed. Sediment inside the creek is predominantly clayey and in the sea it is predominantly sandy. Physio-chemical characteristics of the sediment did not show the presence of any pollutants or heavy metals harmful to the aquatic fauna. Nutrient content of the sediment was slightly higher in the mouth area of the creek. In the sea sediment was mainly sandy and nutrient content was slightly lower.

4.6.1 Methodology Adopted for Sediment Analysis

For the analysis of textural composition and pH, the air-dried sediment samples were used as such. For all other analyses of organic matter, sediment samples were ground to fine powder and dried in an oven at 110°C to constant weight for an hour.

The estimation of total organic carbon in sediment was performed by adopting the method of El Wakeel and Riley (1956). The procedure involves chromic acid digestion and subsequent

titration against Ferrous ammonium sulphate solution in the presence of 1-10 phenonthroline indicator. The values calculated are expressed in mg C/g of sediment

4.6.2 Findings of Sediment Analysis

The pH, soil texture, Total Organic Carbon of sediments at various sampling locations is given in Table-4.14.

Table– 4.14: pH, Soil Texture, Total Organic Carbon of Sediment

St. Code	Sediment pH	Sand (%)	Silt (%)	Clay (%)	TOC (mgC/g)	PHC (µg/g)
VPT-1	8.4	81.82	15.66	2.52	10.3	1.5
VPT-2	8.4	79	16.98	4.02	12.3	5.7
VPT-3	8.3	70.06	20.4	9.54	14.6	10.3
VPT-4	8.4	77.19	17.17	5.64	10.2	1.2
VPT-5	8.3	75.12	18.72	6.16	10.3	3.6
VPT-6	8.4	76.02	18.1	5.88	12.5	7.5
VPT-7	8.4	82	14.9	3.1	14.3	1.3
VPT-8	8.5	86.01	11.59	2.4	10.3	4.5
VPT-9	8.5	87.24	10.28	2.48	9.0	2.2
VPT-10	8.4	83.02	14.66	2.32	8.3	1.4

Sediment pH

The sediment pH showed maximum (8.5) at VPT-8 and minimum (8.3) value at stationVPT-3 (Refer Figure-4.29).

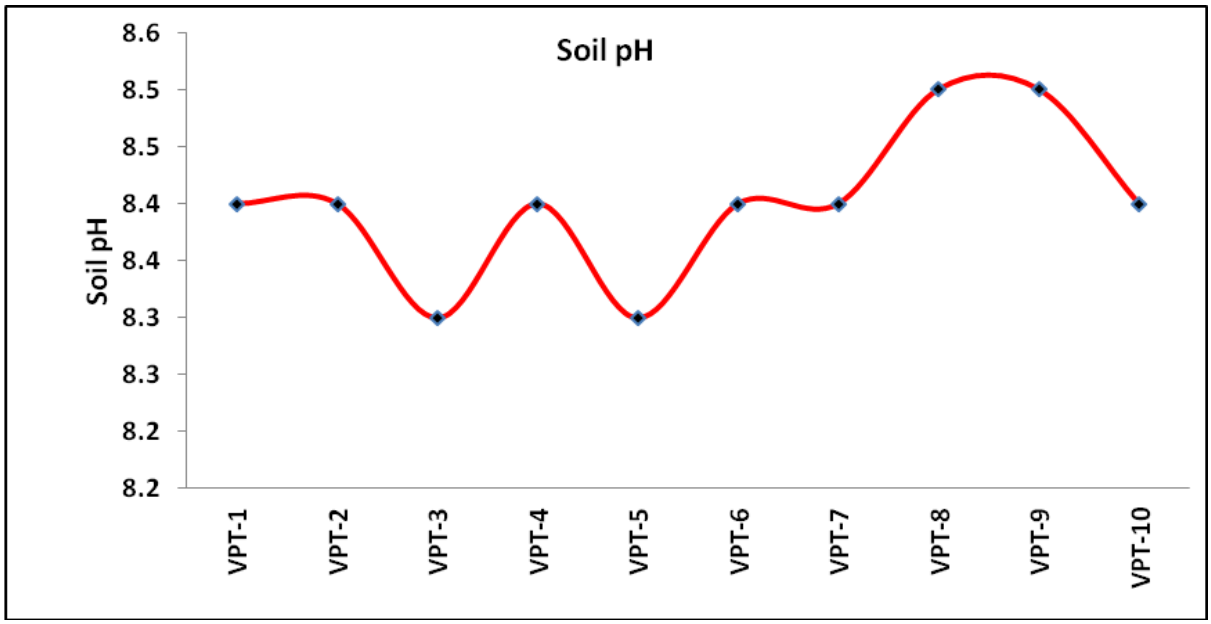


Figure- 4.29: Soil pH recorded at various stations

Texture

The sand content varied from 70.06 to 87.24 % with the maximum value at VPT-9 and the minimum at VPT-3; maximum silt content was found to be at VPT-3 (20.4%) and minimum at VPT-10 (10.28 %) and the maximum clay was found to be at VPT-3 (9.54%) and minimum at VPT-10 (2.32%) (Refer Figure-4.30).

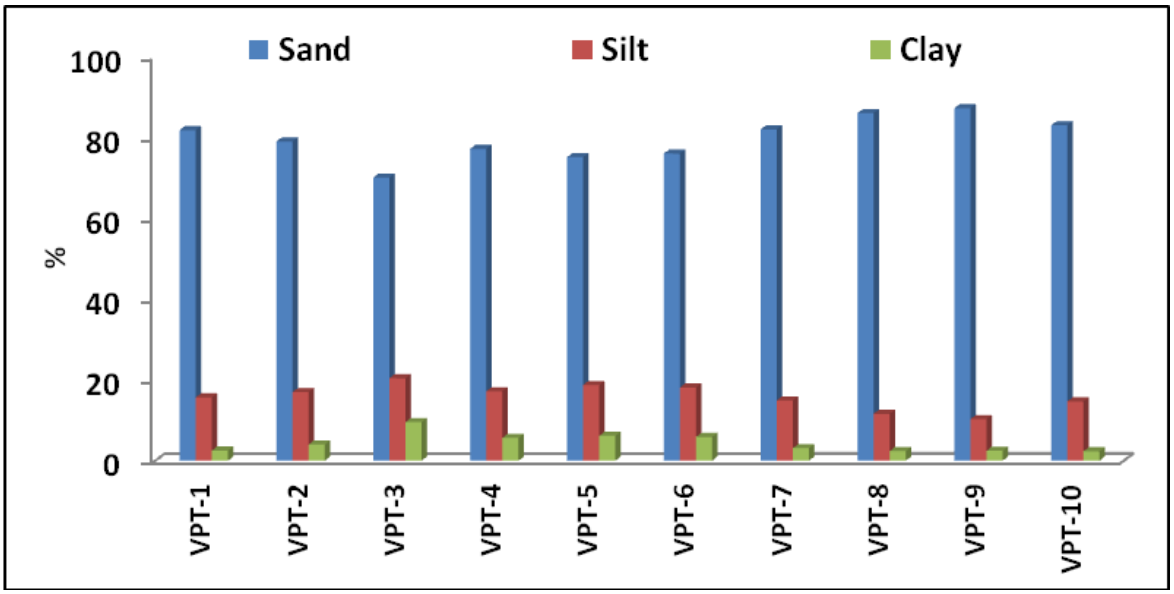


Figure- 4.30: Variations in soil texture recorded in various stations

Total Organic Carbon

The Total Organic Carbon ranged between 8.3 and 14.6mgC/g. The maximum level (14.6 mgC/g) was found at VPT-3 and low (8.3 mgC/g) at VPT-10 (Refer Figure-4.31).

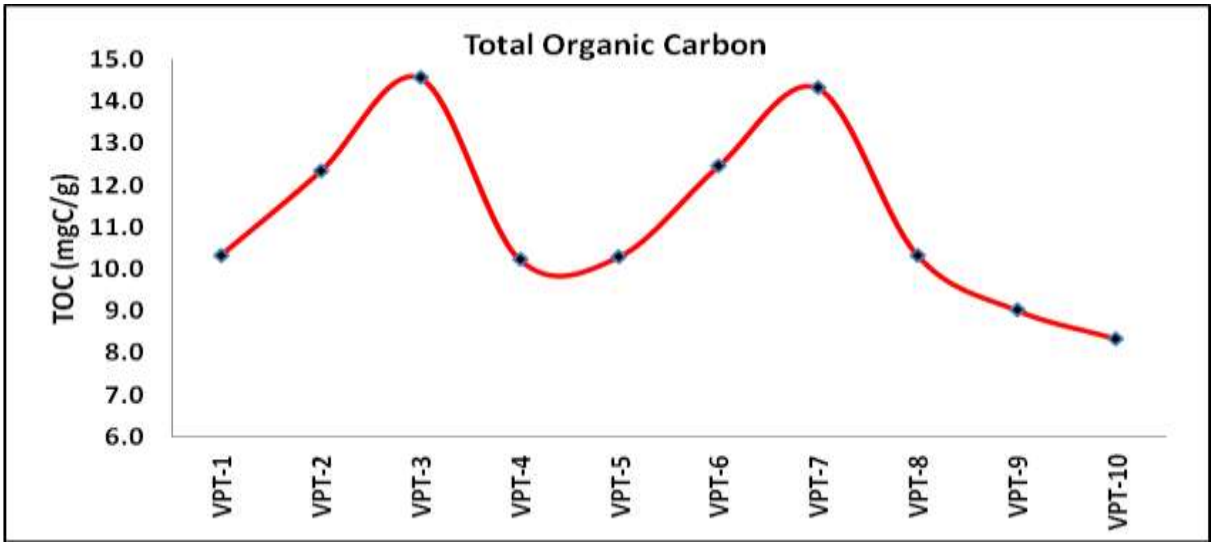


Figure- 4.31: Total Organic Carbon recorded in various stations

Petroleum Hydrocarbon

The Petroleum hydrocarbon ranged between 1.2 and 10.3µg/g. The maximum level (10.3 µg/g) was found at VPT-3 and low (1.2 µg/g) at VPT-4 (Refer Figure-4.32).

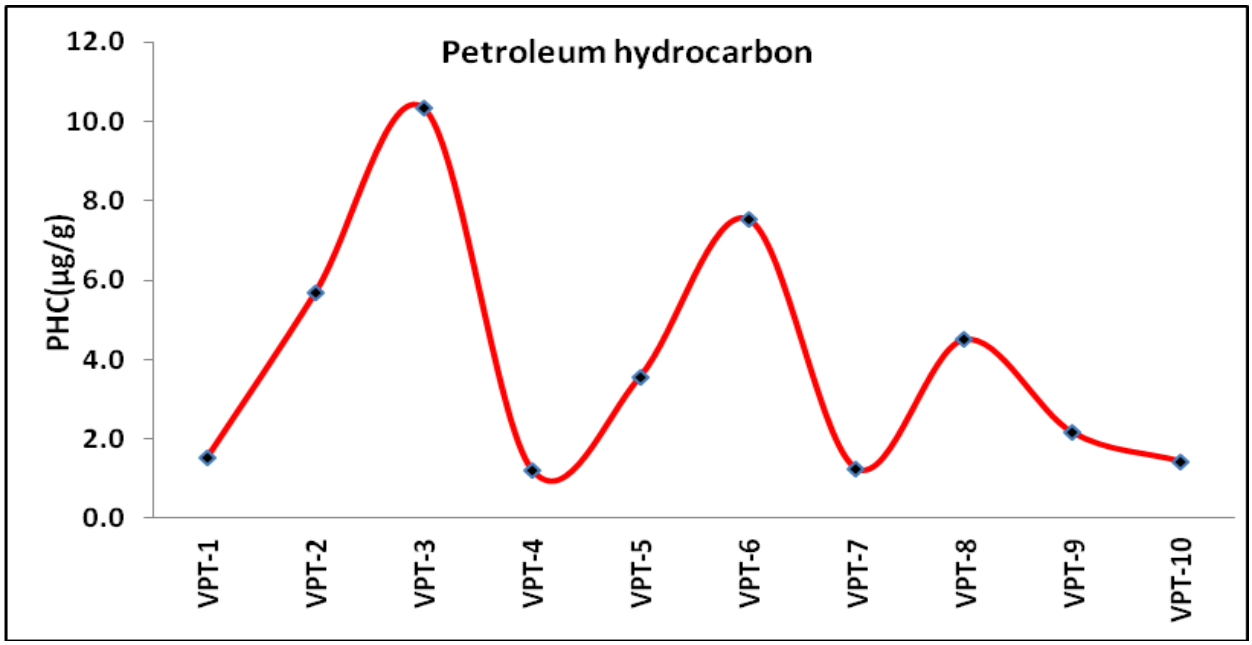


Figure- 4.32: Petroleum Hydrocarbon levels

Heavy metals in Sediments

Table- 4.15: Heavy metals recorded in sediment Vizaq Port waters

Stations	Hexavalent Chromium (µg/g)	Lead (µg/g)	Copper (µg/g)	Mercury (µg/g)
VPT-1	15.1	11.79	23.7	0.56
VPT-2	14.1	13.7	21.7	0.53
VPT-3	14.4	14.46	23.9	0.66
VPT-4	15.8	15.81	16.5	0.57
VPT-5	11.8	17.79	17.0	0.42
VPT-6	13.6	11.68	17.2	0.55
VPT-7	13.7	13.59	20.7	0.61
VPT-8	15.4	11.57	22.3	0.53
VPT-9	11.7	11.64	15.1	0.47
VPT-10	11.5	15.57	21.3	0.42

Chromium

The Hexavalent Chromium level varied from 11.5 to 15.8µg/g (Figure-4.33). The maximum was recorded at VPT-4 and the minimum was recorded at VPT-10 during this survey.

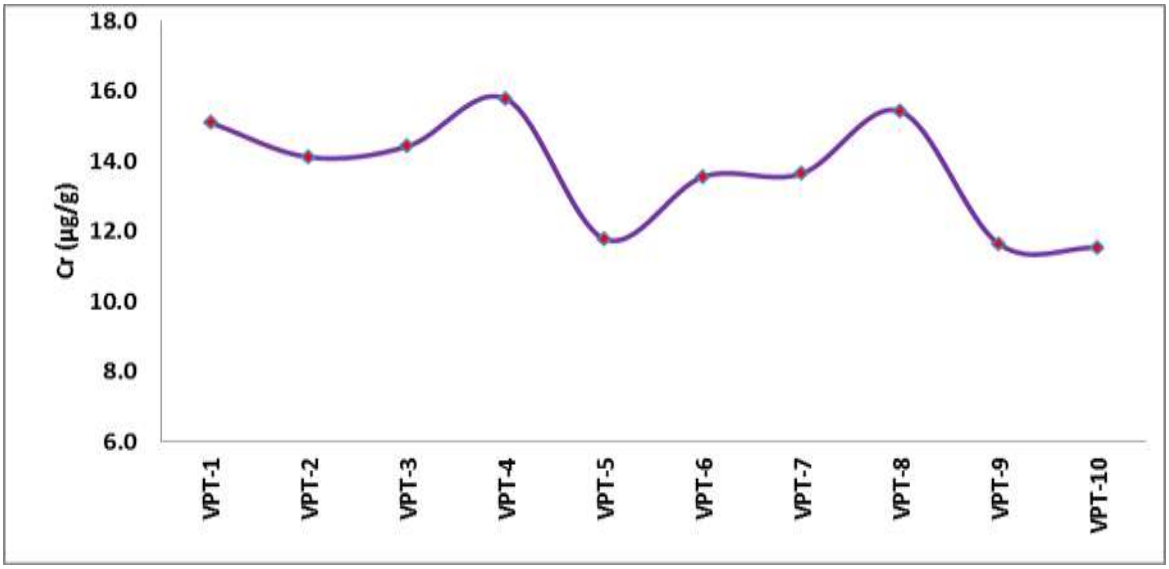


Figure-4.33: Hexavalent Chromium level recorded at various stations

Lead

The lead level varied from 11.5 to 17.79µg/g (Figure-4.34). The maximum was recorded at VPT-5 and the minimum was recorded at VPT-8 during this survey.

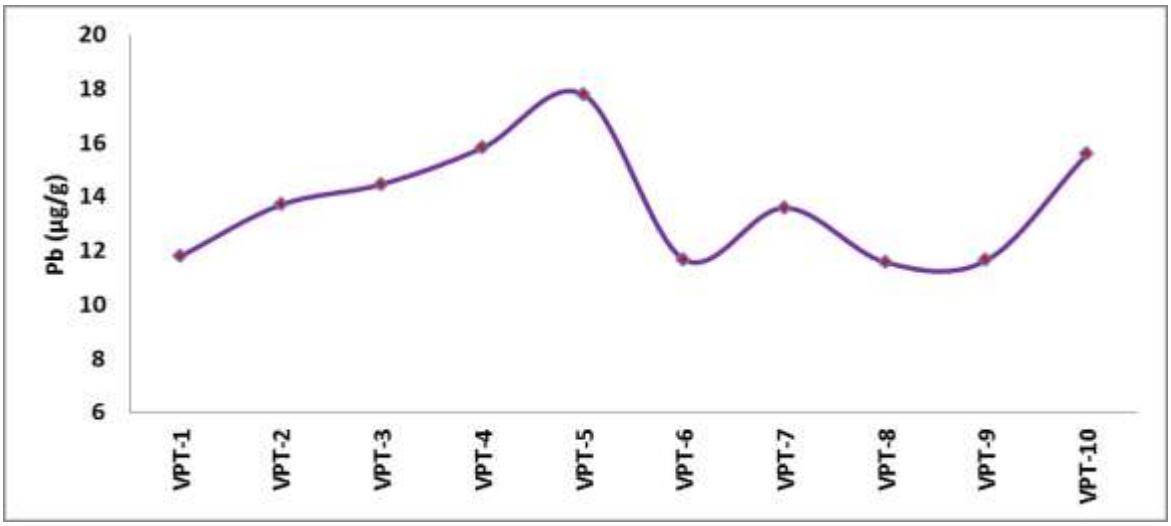


Figure-4.34: Lead level recorded at various stations

Copper

The copper level varied from 15.1 to 23.9µg/g (Figure-4.35). The maximum was recorded at VPT-3 and the minimum was recorded at VPT-9 during this survey.

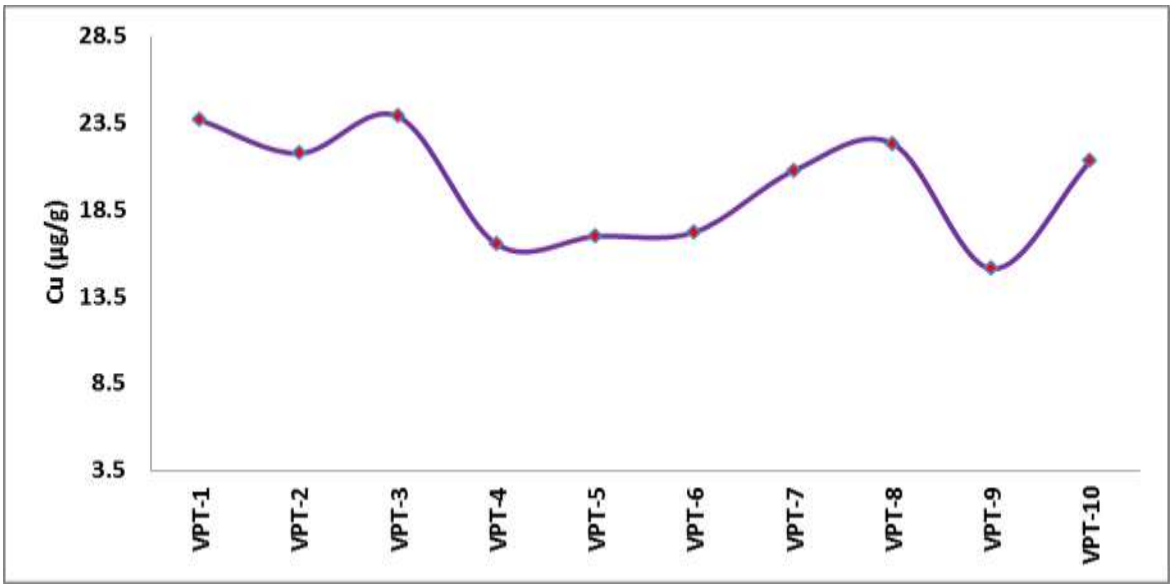


Figure-4.35: Copper level recorded at various stations

Mercury

The lead level varied from 0.42 to 0.66 µg/g (Figure-4.36). The maximum was recorded at VPT-3 and the minimum was recorded at VPT-10 during this survey.

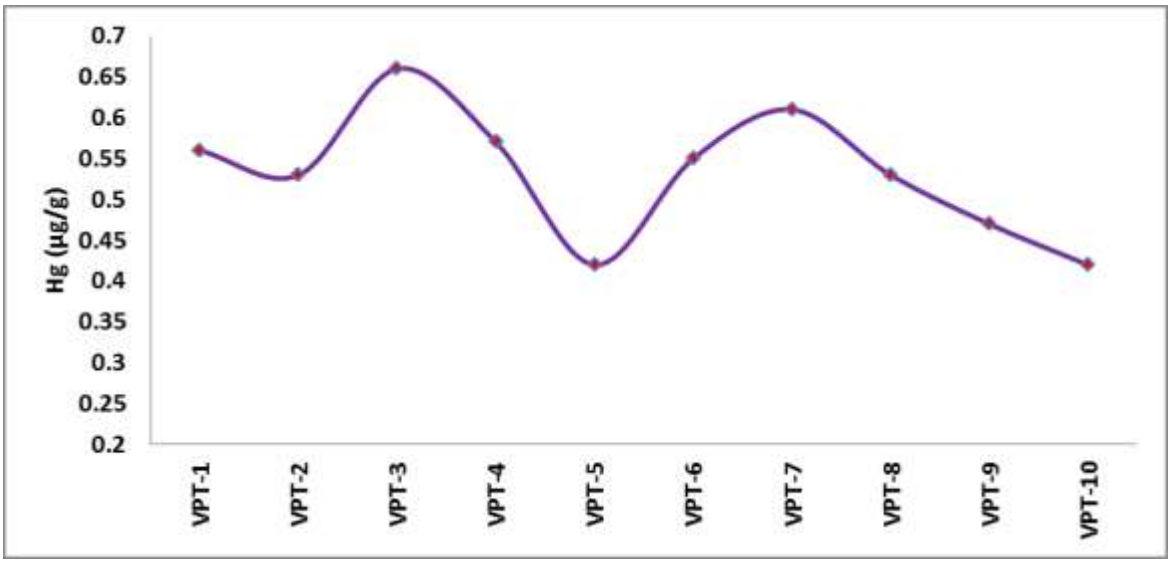


Figure-4.36: Mercury level recorded at various station

4.7 TERRESTRIAL ECOLOGY

Floral diversity

The study was aimed at enumeration of the available plant resources and obtaining a broad representation of the existing floristic variations in and around the proposed project site. Baseline data on the availability of floral species in the study area district was collected through field observations and from secondary data sources. Diverse systems such as dense and open forest, cultivated lands, sand dune vegetation, wetlands and human habitation were present in the study area that supported diverse floral species. Details of the floral species reported in the study area district are given in Table-4.16.

Table-4.16: Distribution of plants in the study area district

Botanical Name	Family
Acacia auriculiformis A. Cunn ex Benth.	Mimosaceae
Acacia farnesiana (L.) Willd.	Mimosaceae
Acacia leucophloea (Roxb.) Willd.	Mimosaceae
Achyranthes aspera L.	Amaranthaceae
Aegle marmelos (L.) Correa	Rutaceae
Albizia lebbeck (L.) Willd.	Mimosaceae
Albizia saman F.Muell.	Mimosaceae
Aloe vera (L.) Burm.f.	Aloeaceae
Amaranthus viridis L.	Amaranthaceae
Anacardium occidentale L.	Anacardiaceae
Azadirachta indica A. Juss.	Meliaceae
Azima tetracantha Lam.	Salvadoraceae
Bambusa vulgaris Schrad. ex Wendl.	Poaceae
Bauhinia purpurea L.	Caesalpiniaceae
Bauhinia racemosa Lam.	Caesalpiniaceae
Bombax ceiba L.	Bombacaceae
Butea monosperma (Lam.) Taub.	Papilionaceae
Cassia angustifolia M. Vahl	Caesalpiniaceae
Cassia fistula L.	Caesalpiniaceae
Cassia siamea Lam.	Caesalpiniaceae
Casuarina equisetifolia L.	Casurinaceae
Catharanthus roseus (L.) G.Don.	Apocynaceae
Delonix regia (Boj. ex Hook) Rafin.	Caesalpiniaceae
Desmodium laxiflorum DC.	Papilionaceae
*Eucalyptus tereticornis*Sm.	Myrtaceae
Euphorbia geniculata Ortega	Euphorbiaceae
Euphorbia hirta L.	Euphorbiaceae
Ficus benghalensis L.	Moraceae
Ficus racemosa L.	Moraceae
Ficus religiosa L.	Moraceae
Ipomoea alba L.	Convolvulaceae
Jasminum scandens Vahl	Oleaceae
Jatropha gossypifolia L.	Euphorbiaceae
Justicia adhatoda L.	Acanthaceae

Botanical Name	Family
Justicia betonica L.	Acanthaceae
Mangifera indica L.	Anacardiaceae
Phoenix sylvestris (L.) Roxb.	Arecaceae
Prosopis juliflora (Sw.) DC.	Mimosaceae
Psidium guajava L.	Myrtaceae
Pterolobium hexapetalum (Roth.) Sant. & Wagh	Caesalpiniaceae
Syzygium cumini (L.) Skeels	Myrtaceae
Terminalia alata Heyne ex Roth	Combretaceae
Terminalia arjuna (Roxb.) Wight & Arn.	Myrtaceae
Terminalia bellerica (Gaertn.) Roxb.	Combretaceae
Terminalia catappa L.	Combretaceae
Terminalia chebula Retz.	Combretaceae
Trichodesma indicum (L.) R. Br.	Boraginaceae
Waltheria indica L.	Sterculiaceae
Xanthium strumarium L.	Asteraceae
Xylia xylocarpa (Roxb.) Taub.	Mimosaceae
Ziziphus mauritiana Lam.	Rhamnaceae

Fauna

Based on field observations and the available secondary information, a total of 14 species of mammals, 17 species of reptiles and 5 species of amphibians were recorded in the study area. (Refer Table-4.17).

Table-4.17: List of mammals, reptiles and amphibians species reported from the study area

S. No	Common Name	Scientific Name	IUCN Category
Mammals			
1.	Black-napped Hare	*Lepus nigricollis*	LC
2.	Common House Mouse	*Mus musculus*	LC
3.	Common House Rat	*Rattus rattus*	LC
4.	Common Langur	*Semnopithecus entellus*	LC
5.	Common Mongoose	*Herpestes edwardsi*	DD
6.	Domestic Cat	*Felis catus*	LC
7.	Domestic Cattle	*Bos taurus*	LC
8.	Domestic Dog	*Canis familiaris*	LC
9.	Indian Crested Porcupine	*Hystrix indica*	LC
10.	Indian Fox	*Vulpes bengalensis*	LC
11.	Indian Hare	*Lepus nigricollis*	LC
12.	Jackal	*Canis aureus*	LC
13.	Rhesus Macaque	*Macaca mulatta*	LC
14.	Three-striped Palm squirrel	*Funambulus palmarum*	LC
Amphibians			
15.	Asian Common Toad	*Bufo melanostictus*	-
16.	Common Tree Frog	*Polypedates maculatus*	-

S. No	Common Name	Scientific Name	IUCN Category
17.	Indian Skipper Frog	*Euphlyctis cyanophlyctis*	-
18.	Indus Valley Toad	*Duttaphrynus stomaticus*	-
19.	Paddyfield Frog	*Fejervarya limnocharis*	-
Reptiles			
20.	Asian House Gecko	*Hemidactylus frenatus*	LC
21.	Banded Racer snake	*Argyrogena fasciolata*	-
22.	Checkered Keelback	*Xenochrophis piscator*	-
23.	Common Cat Sanke	*Boiga trigonata*	LC
24.	Common House Gecko	*Hemidactylus flaviviridis*	-
25.	Common Indian Krait	*Bungarus caeruleus*	-
26.	Common Kukri	*Oligodon arnensis*	-
27.	Common Sand Boa	*Gongylophis conicus*	-
28.	Common Skink	*Mabuya macularia*	-
29.	Common Trinket Snake	*Coelognathus helena*	-
30.	Indian Chameleon	*Chamaleon zeylanicus*	-
31.	Indian fan-throated lizard	*Sitana ponticeriana*	LC
32.	Indian Rat Snake	*Ptyas mucosus*	-
33.	Little Skink	*Lygosoma punctata*	-
34.	Oriental Garden Lizard	*Calotes versicolor*	-
35.	Russel's Kukri snake	*Oligodon taeniolatus*	LC
36.	Spectacled Cobra	*Naja naja*	LC

A total of 72 species of birds are reported in the study area of the proposed project. The habitat types of the area include agricultural land, scrub jungle, plantation, seasonal ponds, marshlands and fallow grasslands. The list of avifauna reported in the study area along with their migratory status is given in Table-4.18. Indian Peafowl is the only schedule-I species found in the studyarea district.

Table-4.18: List of birds documented during the study period

S.No	Common Name	Scientific Name	Migratory Status
1	Ashy Drongo	*Dicrurus leucophaeus*	R
2	Ashy Prinia	*Prinia socialis*	R
3	Ashy-crowned Sparrow Lark	*Eremopterix grisea*	O
4	Asian Koel	*Eudynamys scolopacea*	R
5	Asian Palm Swift	*Cypsiurus balasiensis*	R
6	Asian Paradise Flycatcher	*Terpsiphone paradisi*	R
7	Asian Pied Starling	*Gracupica contra*	R
8	Baya Weaver	*Ploceus philippinus*	R
9	Bay-backed Shrike	*Lanius vittatus*	R

S.No	Common Name	Scientific Name	Migratory Status
10	Black Drongo	*Dicrurus macrocercus*	R
11	Black-headed Ibis	*Pseudibis papillosa*	R
12	Black-headed Oriole	*Oriolus xanthornus*	R
13	Black-rumped Flameback	*Dinopium benghalense*	R
14	Black-shouldered Kite	*Elanus caeruleus*	R
15	Blue Rock Pigeon	*Columba livia*	R
16	Blue-tailed Bee-eater	*Merops philippinus*	M
17	Brahminy starling	*Sturnus pagodarum*	R
18	Cattle Egret	*Bubulcus ibis*	R
19	Common Cuckoo	*Cuculus canorus*	R
20	Common Hoopoe	*Upupa epops*	R
21	Common Myna	*Acridotheres tristis*	R
22	Common Sandpiper	*Charadrius dubius*	M
23	Common Swallow	*Hirundo rustica*	M
24	Common Woodshrike	*Tephrodornis pondicerianus*	R
25	Coppersmith Barbet	*Megalaima haemacephala*	R
26	Domestic Chicken	*Gallus gallus domesticus*	R
27	Eurasian Collared Dove	*Streptopelia decaocto*	O
28	Golden Fronted Leafbird	*Chloropsis aurifrons*	R
29	Greater Coucal	*Centropus sinensis*	R
30	Green Bee-eater	*Merops orientalis*	R
31	Grey Francolin	*Francolinus pondicerianus*	R
32	House Crow	*Corvus splendens*	R
33	House Sparrow	*Passer domesticus*	R
34	House Swift	*Apus affinis*	R
35	Indian Cuckoo	*Cuculus micropterus*	R
36	Indian Grey Hornbill	*Ocyceros birostris*	R
37	Indian Peafowl	*Pavo cristatus*	R
38	Indian Pond-Heron	*Ardeola grayii*	R
39	Indian Robin	*Saxicoloides fulicata*	R
40	Indian Roller	*Coracias benghalensis*	R
41	Indian Silverbill	*Lonchura malabarica*	R
42	Indian Treepie	*Dendrocitta vagabunda*	R
43	Intermediate Egret	*Mesophoyx intermedia*	R
44	Jungle Babbler	*Turdoides striatus*	R
45	Jungle Bush-Quail	*Perdicula asiatica*	R
46	Jungle Owlet	*Glaucidium radiatum*	R
47	Large Egret	*Casmerodius albus*	R
48	Lesser Coucal	*Centropus bengalensis*	R
49	Lesser Pied Kingfisher	*Ceryle rudis*	R
50	Little Brown Dove	*Streptopelia senegalensis*	R

S.No	Common Name	Scientific Name	Migratory Status
51	Little Cormorant	*Microcarbo niger*	R
52	Little Egret	*Egretta Garzetta*	R
53	Oriental Magpie-Robin	*Copsychus saularis*	R
54	Paddyfield Pipit	*Anthus rufulus*	R
55	Pied Crested Cuckoo	*Clamator jacobinus*	R
56	Plain Prinia	*Prinia inornata*	R
57	Plum-headed Parakeet	*Psittacula cyanocephala*	R
58	Purple-rumped Sunbird	*Nectarinia zeylonica*	R
59	Red-rumped Swallow	*Hirundo daurica*	R
60	Red-vented Bulbul	*Pycnonotus cafer*	R
61	Red-wattled Lapwing	*Vanellus indicus*	R
62	Rose-ringed Parakeet	*Psittacula krameri*	R
63	Rosy Starling	*Sturnus roseus*	R
64	Rufous-backed Shrike	*Lanius schach*	R
65	Small Blue Kingfisher	*Alcedo atthis*	R
66	Spotted Dove	*Streptopelia chinensis*	R
67	Spotted Owlet	*Athene brama*	R
68	White-bellied Sea Eagle	Haliaeetus leucogaster	M
69	White-breasted Kingfisher	*Halcyon smyrnensis*	R
70	White-breasted Water hen	*Amaurornis phoenicurus*	R
71	White-browed Wagtail	*Motacilla maderaspatensis*	R
72	White-necked Stork	*Ciconia episcopus*	M

Note: R-Resident; M-migratory, O-Occasional

Butterflies

A total of 27 butterfly species belonging to 6 families are reported in the study area and details of the same are given in Table-4.19.

Table-4.19: List of butterflies in the study area

S.No	Common Name	Scienticfic Name
1	Blue Pansy	*Junonia orithya*
2	Blue Tiger	*Tirumala limniace*
3	Chocolate Pansy	*Junonia iphita*
4	Common Baron	*Euthalia garuda*
5	Common Cerulean	*Jamides celeno*
6	Common Emigrant	*Catopsilia pomona*
7	Common Grass Yellow	*Eurema hecabe*
8	Common Indian Crow	*Euploea core*
9	Common Jezebel	*Delias eucharis*
10	Common Leopard	*Phalanta phalanta*
11	Common Mormon	*Papilio polytes*
12	Common Pierrot	*Castalius rosimon*
13	Common Sailor	*Neptis hylas*

S.No	Common Name	Scienticfic Name
14	Crimson Rose	*Pachliopta hector*
15	Danaid Egg fly	*Hypolimnas misippus*
16	Glassy Tiger	*Parantica algea*
17	Gram Blue	*Euchrysops cnejus*
18	Great Egg fly	*Hypolimnas bolina*
19	Grey Pansy	*Junonia atlites*
20	Indian Skipper	*Spialia galba*
21	Lemon Pansy	*Junonia lemonias*
22	Peacock Pansy	*Junonia almana*
23	Pioneer	*Anaphaeis aurota*
24	Plain Tiger	*Danaus chrysippus*
25	Plum Judy	*Abisara echerius*
26	Striped Tiger	*Danaus genutia*
27	Yellow Pansy	*Junonia hierta*

4.8 MARINE ECOLOGY

The productivity of a water body in the aquatic eco-system is determined by the biological parameters. Primary productivity is an important indicator of pollution level in any aquatic ecosystem and the primary productivity depends upon the presence of phytoplankton & zooplanktons. Fish production is dependent on production of zooplanktons, which in turn is dependent on the phytoplankton production or primary productivity. All these are related to physio-chemical characteristics of the water. Detailed marine ecological survey was conducted in the Study Area to understand the existing status of marine ecology.

4.8.1 Methodology Adopted for Analysis.

Chlorophyll 'a'

The samples were filtered through Whatman GF/C filter papers and the chlorophyll was extracted into 90% acetone. The resulting colored acetone extract was measured in a spectrophotometer at different wavelengths and the same acetone extracts were acidified and measured for the phaeo-pigments. The detailed methodology as described in APHA manual (1989) was followed.

Phytoplanktons

Phytoplankton samples were collected from the surface waters of the study areas by towing a plankton net (mouth diameter 0.35 m) made of bolting silk [No.30 mesh size 48 µm) for half an hour. These samples were preserved in 5% neutralized formalin and used for qualitative analysis. For the quantitative analysis of phytoplankton, the settling method as described by Sukhanovo (1978) was adopted. Numerical plankton analysis was carried out using Utermohl's inverted plankton microscope.

Phytoplankton species was identified using the standard works of Hustedt (1930-1966), Venkataraman (1939), Cupp (1943), Subramanian (1946), Prescott (1954), Desikachary (1959 and 1987), Hendey (1964), Steidinger and Williams (1970) and Taylor (1976) and Anand*et al.* (1986)

Zooplanktons

Zooplankton samples were collected from the surface waters of the study areas by horizontal towing of plankton net with mouth diameter of 0.35 m, made of bolting silk (No. 70 mesh size 200 µm) for half an hour. After collection, the samples were preserved in 5% neutralized formalin and used for quantitative analysis. The zooplankton collected were identified to the species level using the classical works of Dakin and Colefax (1940), Davis (1955), Kasthurirangan (1963) and Wickstead (1965) and Damodara Naidu (1981). For the quantitative analysis of zooplankton, a known quantity of water (100 l) was filtered through a bag net (0.33 mm mesh size) and filtrate was made up to 1 litre in a wide mouthed bottle and then enumerated using Utermohl's inverted plankton microscope. The plankton density is expressed as number of organisms/m^3.

Benthic Community

For studying the benthic organisms, sediment samples were collected using a Van veen grab which covered an area of 0.1m^2. The wet sediment was sieved with varying mesh sizes for segregating the organisms. The organisms retained in the sieve were fixed in 5-7% formalin and stained further with Rose Bengal solution for easy spotting at the time of sorting. After a day or two, the organisms were sorted into various groups. The number of organisms in each grab sample was expressed as number per meter square. According to size, benthic animals are divided into three groups. (i) macrobenthos (ii) meiobenthos and (iii) microbenthos (Mare, 1942). All the species were sorted, enumerated and identified to the advanced level possible with the consultation of available literature. The works of Fauvel (1953), Day (1967) were referred for polychaetes; Barnes (1980) and Lyla *et al*. (1999) for crustaceans; Subba Rao *et al.* (1991) and Ramakrishna (2003) for molluscs.

4.8.2 Finding of Marine Ecological Survey

Chlorophyll, Phaeopigments and Total Biomass

In the present study, the chlorophyll '*a*' in water sample varied from 1.366 to 3.681 mg/m^3 with maximum at VPT-2 and minimum at VPT-5-ss. The Phaeopigments content varied from 0.134 to 4.112 mg/m^3 with maximum was observed in VPT-3 and minimum in VPT-2-ss. The total biomass varied from 21.515 to 38.031 ml/100m^3 with maximum was observed in VPT-3 and minimum in VPT-2. The values are listed in Table-4.20.

Table-4.20: Chlorophyll *a*, Phaeo pigments and Total Biomass

Stations	Chl-a (mg/ m^3)	Phaeo pigments (mg/ m^3)	Total Biomass (ml/100 m^3)
VPT-1	2.926	1.280	23.537
VPT-1-SS	1.973	1.308	26.374
VPT-2	3.681	1.234	21.515
VPT-2-SS	1.538	0.134	10.155
VPT-3	2.107	4.112	38.031
VPT-3-SS	2.207	1.976	31.012
VPT-4	1.669	0.214	26.648
VPT-4-SS	1.669	1.015	28.648
VPT-5	2.047	2.003	22.662
VPT-5-SS	1.366	1.015	29.692
VPT-6	1.466	1.015	23.882
VPT-6-SS	1.567	0.748	24.104
VPT-7	1.669	0.481	23.882
VPT-7-SS	1.567	0.748	25.748
VPT-8	1.757	0.214	28.181
VPT-8-SS	1.567	0.748	26.321
VPT-9	2.192	1.549	25.124
VPT-9-SS	2.045	0.240	26.231
VPT-10	2.176	0.828	22.147
VPT-10-SS	2.176	0.561	27.154

Phytoplanktons

In the present survey, species belonging to three groups namely diatoms, dinoflagellates, and blue greens were recorded. Of these, diatoms were found to be the dominant group with 45 species in stations studied. Dinoflagellates formed next group with 6 species and blue green algae came last in the order with 3 species in all the stations.

Among the diatoms, *Coscinodiscus centralis, C. granii, Chaetoceros affinis, Cerataulina* sp. *Leptocylindrus danicus, Skeletonema costatum, Thalassionema nitzschioides, Triceratium favus*, *Cyclotella* sp*. Nitzschia* sp*. Odentella mobilensis, O. aurita, O. sinensis, Pleurosigma normanii, Melosira* sp*.* and *Pseudonitzschia inflatula* were found to be the common species in the samples collected in various stations. Coming to dinoflagellates, *Ceratium furca, C. trichoceros* and *Protoperidinium oceanicum* and in blue green algae species such as *Anabeana* sp. and *Spirulina* sp. were the common species in the samples collected in different stations of Vizag port waters. The abundance of phytoplanktons at various sampling sites is given in Table-4.21.

Table-4.21 Diversity and abundance of phytoplankton recorded at various sampling sites

Phytoplankton	Nos/l									
	VPT-1	**VPT-2**	**VPT-3**	**VPT-4**	**VPT-5**	**VPT-6**	**VPT-7**	**VPT-8**	**VPT-9**	**VPT-10**
Blue greens										
Oscillatoria sp.	*	33	*	33	*	330	120	330	220	35
Spirulina sp.	*	*	40	120	60	120	10	220	*	220
Tricodesmium erythraeum	330	220	*	220	10	220	60	*	*	1120
Diatoms										
Asterionella japonica	25	22	*	120	1120	822	220	*	220	120
Bacillaria paradoxa	120	220	*	33	*	*	1200	220	220	*
Bacteriastrum sp	*	*	*	*	*	10	12	*	*	*
Bellerochea malleus	*	*	35	450	35	10	330	1120	220	*
Cerataulina bergonii	330	330	*	*	*	*	1220	1120	*	120
Cerataulina orientalis	*	12	*	10	10	330	10	*	*	*
Chaetoceros affinis	2120	*	*	*	1120	*	10	10	*	*
Chaetoceros indicus	120	10	20	10	345	1200	1200	220	60	80
Chaetoceros curvisetus	*	*	*	*	33	210	22	*	*	452
Climacodium frauenfeldianum	10	*	*	22	120	*	220	*	*	325
Coscinodiscus perferatus	0	120	*	320	*	*	10	410	1120	*
Coscinodiscus centralis	330	450	185	550	*	120	60	*	*	*
C. ecentricus	9	120	*	120	3120	*	120	853	10	420
C. gigas	*	*	1120	*	*	*	*	220	220	*
C. granii	*	*	*	1250	420	10	320	110	330	*
Coscinodiscus sp	120	33	220	450	458	120	0	*	330	450
Dinophysis sp	*	*	*	*	*	120	*	110	220	*
Ditylum brightwelli	*	35	*	*	120	330	10	*	10	125
Diatoma anceps	*	120	*	80	220	*	*	120	220	*
Eucampia zoodicus	*	*	120	*	330	*	120	2220	1120	*
Fragilaria sp.	*	*	*	450	*	*	653	330	*	*
Grammatophora marina	*	120	60	220	*	330	*	330	220	330
Leptocylindrus danicus	243	*	*	*	120	120	1120	*	133	10
Lithodesmium undulatum	*	120	55	*		1120	*	*	10	*
Melosira borreri	*	10	*	65	120	330	12	330	10	10
Navicula sp	45	10	10	10	35	*	1120	220	220	220

Phytoplankton	Nos/l									
	VPT-1	**VPT-2**	**VPT-3**	**VPT-4**	**VPT-5**	**VPT-6**	**VPT-7**	**VPT-8**	**VPT-9**	**VPT-10**
Nitzschia closterium	155	*	*	*	22	120	*	80	33	22
Nitzschia seriata	10	50	120	*	120	10	65	80	120	*
Nitzschia longisima	*	*	*	550	*	*	220	1120	220	*
Odontella mobiliensis	455	10	1200	*	*	*	2120	80	*	*
Odontella sinensis	220	*	*	450	*	10	60	220	*	*
Peridinium claudicans	330	220	10	330	*	120	1220	120	220	10
Planktonella sol	12	*	10	*	*	35	25	10	12	10
Pleurosigma elongatum	85	220	70	20	*	1120	33	1200	82	330
Rhizosolenia alata	120	22	10	*	*	30	450	120	85	*
Rhizosolenia imbricata	*	450	*	*	320	1200	335	*	*	450
Rhizosolenia styliformis	*	120	220	220	220	220	*	60	120	10
Skeletonema costatum	1200	*	10	*	220	*	2120	*	125	850
Stephanophysis palmeriana	45	35	*	60	*	*	*	*	120	125
Streptotheca sp.	350	*	155	*	*	10	12	220	240	*
Thalassionema nitzschioides	650	80	10	*	1120	220	*	10	10	*
Thalassiothrix frauenfeldii	*	1250	10	33	*	*	80	330	1120	50
Triceratium favus	120	420	120	120	60	*	120	220	*	220
Triceratium reticulatum	250	220	*	220	10	*	100	*	750	1120
Dinoflagellates										
Ceratium furca	*	22	30	120	1120	*	220	*	*	120
Ceratium macroceros	220	220	*	33	1120	330	120	220	450	*
Ceratium tripos	*	*	120	*	*	*	80	*	*	*
Protoperidinium depressum	220	*	220	20	*	45	200	1120	70	*
Protoperidinium oceanicum	330	330	330	*	*	220	*	1120	*	1120
Pyrophagus stenii	22	12	*	10	10	*	120	*	45	*

*** - Organisms not present**

The density of phytoplanktons varied from 4,510 to 15,897 Nos/l with maximum at VPT-7 and minimum at VPT-3 (Refer Figure-4.37).

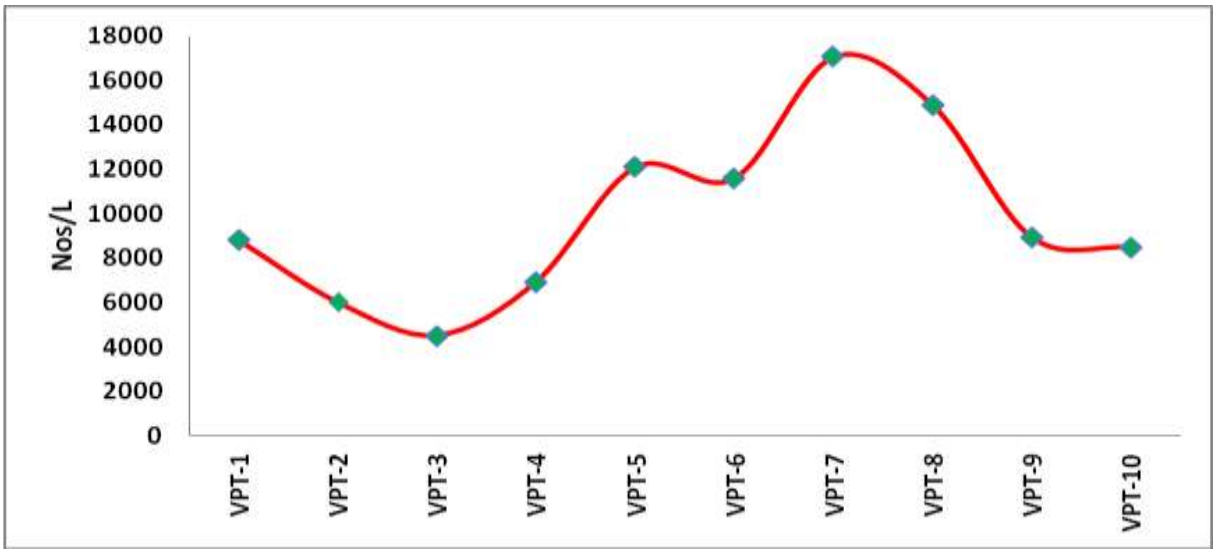


Figure- 4.37: Population density of Phytoplankton

When the results of percentage composition of phytoplankton were viewed, diatoms constituted the maximum with 70% to the total followed by dinoflagellates with 20% and blue greens with 10% of the total (Refer Figure-4.38).

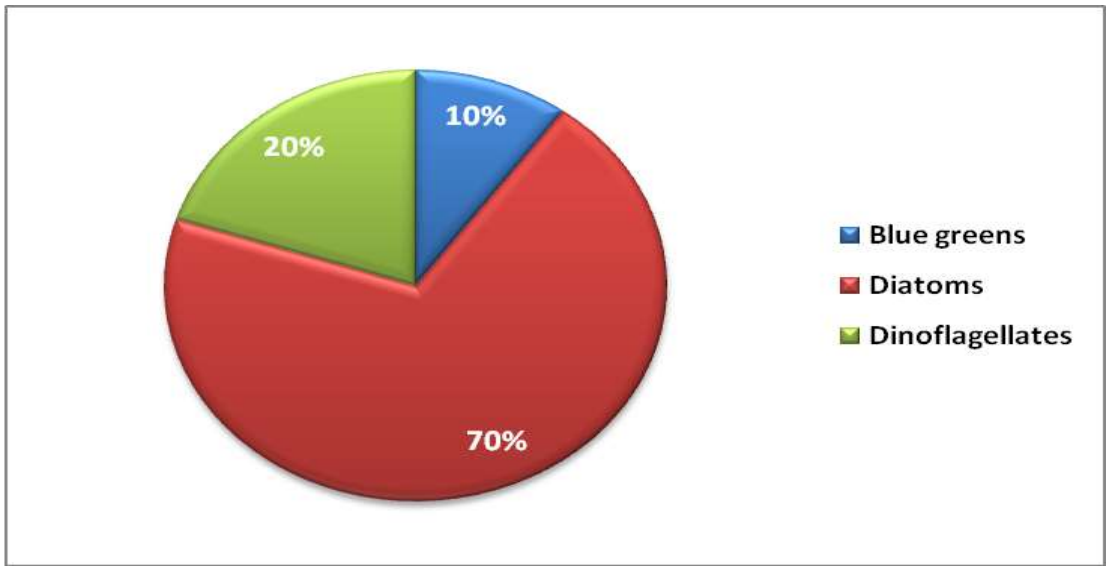


Figure- 4.38: Percentage composition of Phytoplankton

Zooplanktons

During the study period, three groups of macro zooplankton namely, calanoids, cyclopoids, and harpacticoids and two groups of micro zooplankton namely, spirotricha and larval forms and miscellaneous group “others” were recorded. Among the various groups of zooplankton,

calanoida were found to be the dominant group with 16 species. Larval forms came as next dominant group with 8 species. Cyclopoida came next in the order with 7 and harpacticoida and spirotricha with 5 species each. While group “Others” showed only meager contributions in the collection.

As regards species-wise distribution in various groups, species namely, *Acartia danae, Acrocalanus gibber, A. gracilis Labidocera sp. Nannocalanus minor, Paracalanus parvus, Temora discaudata* in calanoids; *Oithona rigida, O.brevicornis, O. similis, Corycaeus danae* in Cyclopoids; gastropod veliger, bivalve veliger, barnacle nauplii in larval forms; and *Macrosetella aculata, Microsetella norvegica* in harpacticoids were found to be the common species in the collections made in various stations. In the case of spirotricha, *Tintinnopsis cylindrica, T. uruguayensis Sagitta bifunctata, Oikopleura* sp. showed consistency in their occurrence in the samples collected in various stations. The abundance and density of zooplanktons is given in Table-4.22.

Table-4.22: Abundance of zooplankton density recorded at various sampling sites

Zooplankton	Nos/m^3									
	VPT-1	**VPT-2**	**VPT-3**	**VPT-4**	**VPT-5**	**VPT-6**	**VPT-7**	**VPT-8**	**VPT-9**	**VPT-10**
Calanoida										
Acartia danae	5	350	*	35	*	40	*	*	6	*
A. clause	10	350	*	*	350	*	225	*	*	350
A. spinicauda	225	256	35	*	*	*	*	350	*	*
Acrocalanus giber	10	45	*	50	8	45	20	*	35	75
A. gracilis	20	*	350	*	120	350	0	45	225	450
Calanopia minor	50	*	*	*	*	20	*	*	25	*
Centropages furcatus	0	35	65	225	45	*	80	*	*	125
Clausocalanus arcuicornis	350	50	120	40	350	*	35	350	10	*
Eucalanus sp.	350	*	6	*	225	225	*	*	*	25
Labidocera pavo	6	*	46	50	20	*	45	350	50	120
Labidocera sp.	*	125	*	*	10	350	350	840	350	75
Nannocalanus minor	45	*	150	20	*	80	350	90	*	650
Paracalanus parvus	8	650	*	350	6	350	650	*	350	*
Pontella sp.	20	35	40	50	*	*	*	356	225	8
Rhincalanus sp.	350	*	*	120	*	450	350	*	350	350
Temora discaudata	*	60	25	350	30	540	*	*	350	*
Cyclopoida										
Oithona brevicornis	80	350	350	*	540	*	40	225	540	25
O. rigida	320	350	540	*	*	350	*	225	350	540
O. similis	*	*	20	120	45	65	90	2250	*	40
Corycaeus danae	0	35	15	*	30	20	540	35	840	350
C. catus	225	*	95	350	350	*	350	*	540	20
Sapphirina sp.	*	*	*	20	*	45	*	*	60	540
Copilia sp.	350	350	*	350	*	46	15	650	350	*
Harpacticoida										
Macrosetella aculata	25	*	40	25	*	*	30	224	*	10
M. gracilis	225	350	*	225	120	350	*	*	350	450
Microsetella norvegica	350	225	*	350	158	540	*	225	350	*
M. rosea	*	25	*	540	70	350	350	*	*	120
Euterpina acutiforns	225	*	650	*	*	125	*	225	540	*

Zooplankton	**Nos/m^3**									
	VPT-1	**VPT-2**	**VPT-3**	**VPT-4**	**VPT-5**	**VPT-6**	**VPT-7**	**VPT-8**	**VPT-9**	**VPT-10**
Spirotricha										
Favella brevis	225	*	45	350	*	350	25	60	10	350
Tintinnopsis cylindrica	350	40	*	*	*	*	20	*	*	250
Tintinnopsis uruguayensis	*	*	*	20	15	35	45	350	*	85
Oikopleura dioica	225	85	*	75	*	40	120	225	650	20
Oikopleura parva	120	*	85	225	360	*	80	*	*	*
Larval forms										
Barnacle naupilii	*	540	25	*	350	*	350	50	45	30
Bivalve veliger	*	350	540	*	35	*	350	350	*	*
Copepod naupilii	60	*	100	*	540	350	*	45	*	225
Crustacean naupilii	*	65	350	60	0	50	80	350	110	120
Gastropod veliger	350	350	45	225	20	225	75	60	*	*
Mysis larvae	*	*	*	*	*	*	130	*	*	850
Polychaete larvae	540	25	225	0	350	25	0	0	120	*
Shrimp zoea	*	350	60	*	*	450	225	*	*	350
Others										
Lucifer hanseni	350	*	*	450	1225	20	65	*	40	125
Sagitta sp	15	45	*	*	75	350	*	120	225	20

The population density of zooplankton collected in various stations varied from 3933 to 8056 Nos/m^3 with maximum at VPT-8 and minimum at VPT-3 (Refer Figure-4.39).

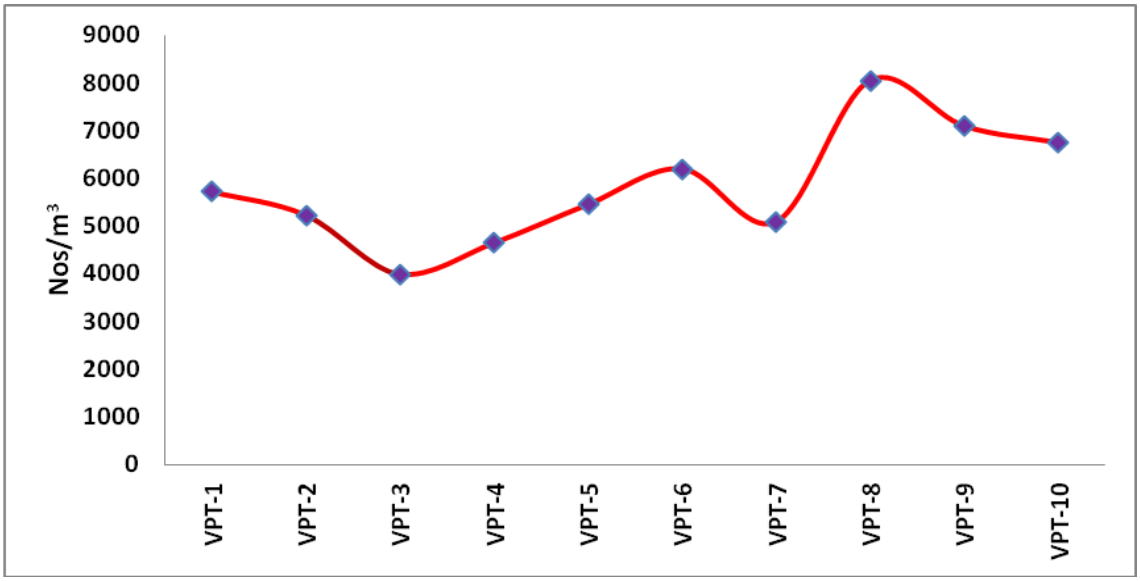


Figure- 4.39: Population density of Zooplankton

With respect to percentage composition, as stated above, calanoida emerged as the dominant group by constituting 33%, followed by larval forms with 25%, cyclopoida with 17% and Harpacticoida 13% spirotricha with 8% and group “others” with 4% of the total organisms recorded (Refer Figure-4.40).

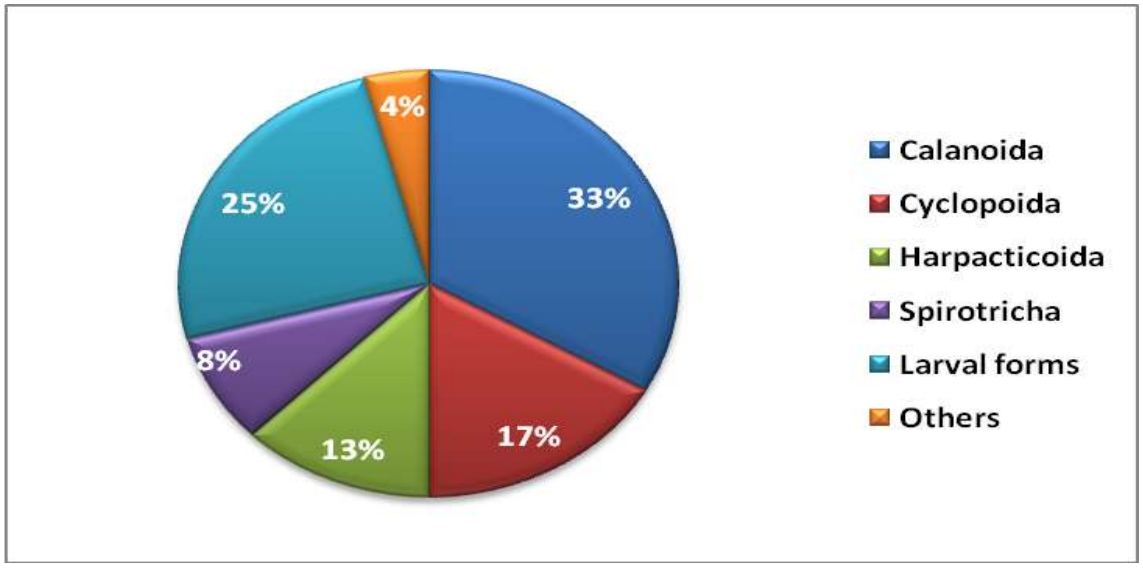


Figure- 4.40: Percentage composition of Zooplankton

Macro benthos

A total of 40 species of macro fauna were recorded. Of this, polychaetes topped the list with 23 species. Crustaceans and gastropods were found to be the next dominant groups in the order of abundance with seven and six species respectively followed by bivalves last with 4 species.

As a part of marine ecological survey, four animal taxa namely polychaetes, crustaceans and gastropods and bivalves were recorded. Of these, polychaetes constituted the dominant group followed by crustaceans and gastropods and bivalves. Among the polychaetes, *Armandia* sp., *Capitella capitata, Cirratulus africanus, Goniada emerita, Lumbrineris heteropoda, Neries* sp., *Platynereis* sp., and *Prionospio pinnata* were found to be the common species in the samples collected in Vizag port waters. With respect to crustaceans, *Ampithoe rubricate, Angeliera phreaticola, Campylaspis* sp., and *Gammarus* sp., showed consistency in their occurrence in the samples collected. Coming to bivalves, Anadara veligers, Meretrix veligers and gastropods *Cerithidea cingulata* and *Nassarius variegatus* were found to be the common species in the collection. The details of macro benthos is given in Table-4.23.

Table-4.23: Abundance of macrobenthos density recorded at various sampling sites

Polychaetes	Nos/m^2									
	VPT-1	VPT-2	VPT-3	VPT-4	VPT-5	VPT-6	VPT-7	VPT-8	VPT-9	VPT-10
Armandia intermedia	*	75	25	25	75	75	*	50	*	*
Armandia longicaudata	50	*	*	25	*	100	50	*	*	50
Boccardia polybranchia	*	25	*	*	*	*	*	175	*	125
Capitella capitata	50	*	50	*	100	*	200	*	150	50
Cirratulus africanus	*	*	*	*	75	75	50	*	*	100
Cirratulus concinnus	25	150	*	100	*	*	125	50	125	*
Exogone clavator	50	*	25	*	*	25	50	100	*	*
Goniada emerita	*	50	50	*	50	*	25	*	*	*
Lumbrineris	75	*	*	*	*	*	*	150	125	100
Lumbrineris heteropoda	*	*	75	*	*	*	25	*	*	*
Nephtys dibranchis	50	*	*	50	*	125	*	50	*	50
Nephtys hombergi	*	*	25	50	25	25	75	*	*	75
Nereis sp.	75	150	*	*	*	*	*	125	100	*
Notomastus aberans	*	*	*	25	50	*	25	*	25	50
Perinereis capensis	*	25	75	*	*	*	*	75	25	*
Pisione Africana	*	*	*	*	25	*	*	*	*	*
Platynereis calodonta	25	*	*	75	*	25	*	125	*	*
Platynereis sp.	*	50	50	50	100	*	25	*	50	*
Polydora ciliate	*	*	*	25	*	*	*	25	25	25
Prionospio capensis	*	50	50	*	*	25	*	100	*	*
Prionospio cirrifera	50	*	*	25	*	25	50	*	*	*
Prionospio pinnata	100	*	*	*	*	*	50	50	75	75
Syllis sp.	*	75	*	100	100	*	*	*	50	*

Polychaetes	**Nos/m²**									
	VPT-1	**VPT-2**	**VPT-3**	**VPT-4**	**VPT-5**	**VPT-6**	**VPT-7**	**VPT-8**	**VPT-9**	**VPT-10**
Bivalves										
Anadara veligers	*	50	*	50	*	*	*	100	100	100
Cardium veligers	*	*	75	*	125	*	50	*	*	*
Donax veligers	125	100	75	*	50	100	*	*	*	*
Meretrix veligers	*	*	*	75	*	*	75	125	125	125
Gastropods										
Bullia veligers	*	100	25	*	175	150	150	*	*	*
Nassarius variegatus	*	125	*	*	*	*	*	200	175	125
Cerithidea cingulata	100	*	*	150	100	75	75	*	100	*
Littorina veligers	50	*	50	*	*	50	*	75	*	100
Natica veligers	50	*	*	50	*	*	*	*	50	*
Turris veligers	*	*	25	*	25	75	25	*	*	100
Crustaceans										
Ampithoe rubricata	125	75	100	*	*	200	100	*	*	*
Ampithoe romondi	175	*	50	50	150	200	200	*	*	200
Angeliera phreaticola	*	*	*	*	*	*	*	*	100	*
Campylaspis sp.	150	100	125	125	75	100	150	75	225	100
Gammarus sp.	50	*	*	50	100	*	150	*	50	125
Gynodiastylis sp.	*	*	*	50	*	*	*	150	*	*
Paragnathia formica	*	*	*	50	175	150	*	50	*	50

*** - Organisms not present**

The population density varied from 950 to 1850 no.m^{-2} with maximum at VPT-8 and minimum at VPT-3 (Refer Figure-4.41).

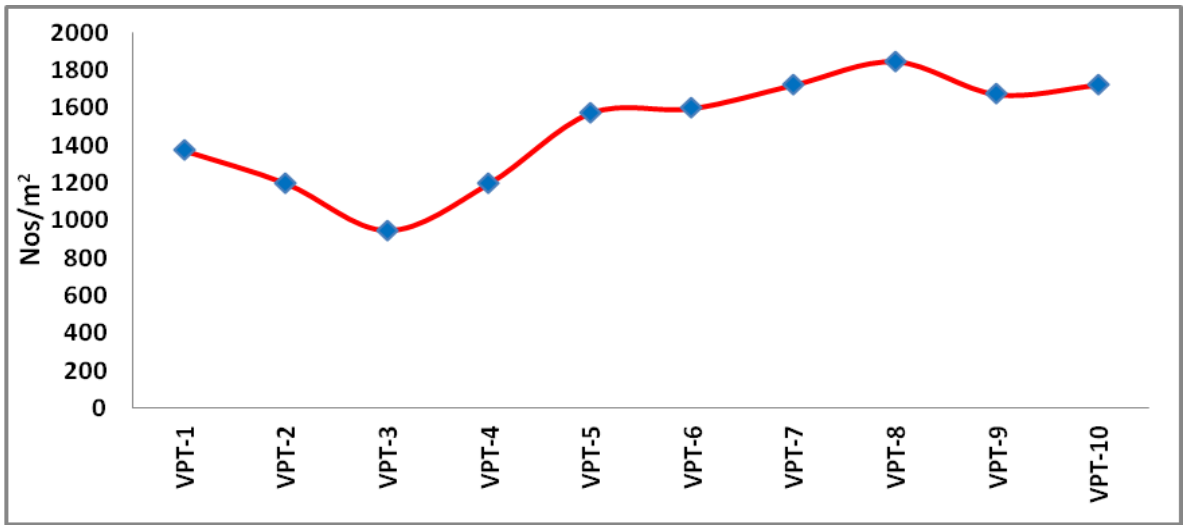


Figure- 4.41. Population density of macro benthos

As per the results of percentage composition of macro benthic fauna were viewed, polychaetes constituted the maximum with 44% to the total benthic organisms. Crustaceans, gastropods and bivalves contributed 28%, 17% and 11% respectively to the benthic samples collected (Refer Figure-4.42).

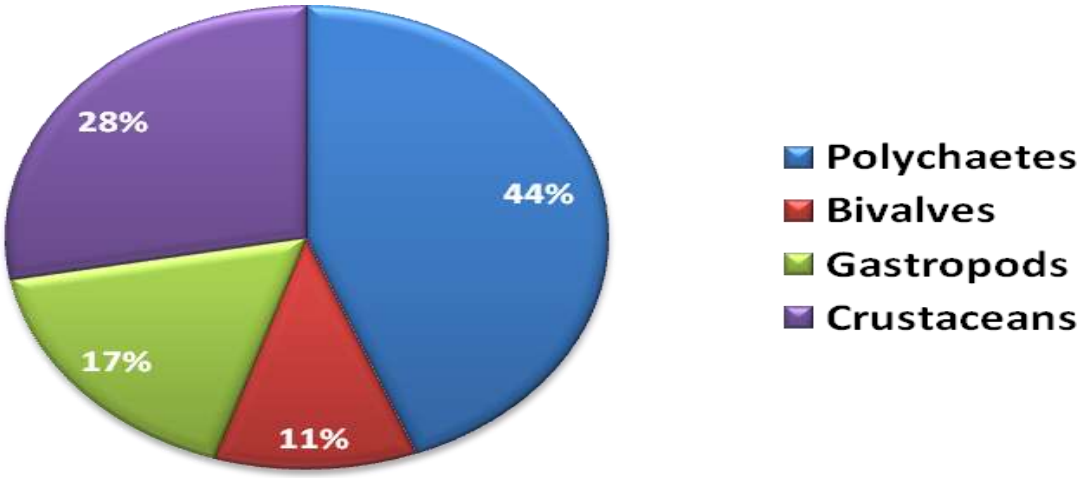


Figure-4.42. Percentage composition of macro benthos

Meio-benthos

In the present study, 58 species of meio-benthic fauna were recorded in Vizag coastal waters. Of these, foraminiferans topped the list with 22 species. Nematodes were found to be the next

dominant group in the order of abundance with 16 species. Harpacticoids and ostracodes came next with 8 and 7 species respectively. Tanaidacea and cumacea came last in the order with 3 and 2 species respectively.

A total of six groups of meio-benthic organisms namely foraminiferans, nematodes, harpacticoids, ostracodes, tanaidacea and cumacea were recorded. Of these, foraminiferans were found to be dominant group followed by nematodes, harpacticoids, ostracodes, tanaidacea and cumacea. Among the foraminiferans, *Ammonia beccarii, Bolivina abbreviate, Discorbis* sp*., Globigerina* sp*., Nonion depressulum, Quinqueloculina* sp*., Rosilania globularis* and *Spirillina limbata* were found to be the common species. Regarding nematodes, *Halalaimus filum, Desmoscolex falcatus, Draconema* sp., *Theristus* sp*., Tricoma* sp*., and Viscosia* sp*.,* were found to be the common species in the samples collected in various stations. Coming to harpacticoids, species such as *Diarthrodes* sp*., Laptastocus* sp*., Tisbe furcata* and in ostracodes, *Diasterope schmitti, Leptocythere* sp*., Tanella indica,* were found to be common species in the collection. With respect to tanaidacea and cumacea, *Heterotanais oerstedi, Apseudes setosus* and *Campylaspis* sp*.,* showed consistency in their occurrence in the samples collected. The details of abundance of meio-benthos is given in Table-4.24.

Table-4.24: Abundance of meiobenthos density recorded at various sampling sites

Nematodes	**Nos/10cm^2**									
	VPT-1	**VPT-2**	**VPT-3**	**VPT-4**	**VPT-5**	**VPT-6**	**VPT-7**	**VPT-8**	**VPT-9**	**VPT-10**
Astomonema sp.	21	2	15	19	16	22	14	14	14	19
Daptonema conicum	9	11	1	6	8	9	9	16	11	4
Desmoscolex falcatus	20	*	14	19	12	17	22	17	15	17
Draconema sp.	2	3	4	2	5	2	*	3	2	*
Greeffiella sp.	2	2	2	*	5	4	*	5	3	*
Halalaimus filum	20	23	15	17	25	22	22	22	19	22
Microlaimus sp.	*	3	5	4	*	5	5	6	*	5
Neochromodora sp.	*	1	2	2	5	5	6	11	*	4
Odontophora sp.	2	4	*	2	*	5	4	6	5	6
Pselionema sp.	4	1	5	*	6	5	*	*	8	*
Spirinia sp.	3	1	*	1	5	4	4	11	5	5
Stephanolaimus sp.	*	3	5	4	*	4	5	9	*	4
Synonchus sp.	3	3	2	2	2	3	3	2	2	2
Theristus sp.	2	*	1	*	2	*	2	2	*	1
Tricoma sp.	2	2	3	2	3	2	2	3	3	2
Viscosia sp.	3	14	14	9	9	14	11	19	9	9
Foraminiferans										
Ammonia beccarii	14	16	14	11	16	17	11	14	12	15
Ammonia dentate	5	19	24	9	12	22	24	13	26	31
Ammonia tepida	3	14	14	9	9	14	11	19	9	9
Amphisorus sp.	9	*	1	6	8	9	9	16	11	4
Astrorotalia inflate	5	1	*	6	6	*	5	3	6	3
Bolivia abbreviate	20	23	15	17	25	22	22	22	12	22
Cibicides lobatulus	*	1	1	*	1	3	2	*	3	3
Discorbis sp.	24	21	12	17	20	22	15	19	14	15
Eponides repandus	8	4	5	4	8	4	6	6	8	5
Globigerina sp.	4	3	*	*	5	*	8	*	*	3
Hauerina miocenica	17	15	15	21	17	25	14	17	15	25
Lagena sp.	9	11	11	7	9	13	9	9	5	9
Nonion depressulum	*	6	*	3	3	*	5	3	11	8
Oridosalis umbonatus	*	4	3	4	*	5	3	3	*	5
Quinqueloculina sp.	3	*	3	*	4	2	4	5	*	4

Nematodes	**Nos/10cm²**									
	VPT-1	**VPT-2**	**VPT-3**	**VPT-4**	**VPT-5**	**VPT-6**	**VPT-7**	**VPT-8**	**VPT-9**	**VPT-10**
Rosalina bertheloti	22	22	*	25	17	22	22	26	20	17
Rosalina bradyi	2	3	2	3	1	3	2	1	1	3
Rosalina globularis	3	3	3	1	2	3	3	2	2	3
Rotalia translucens	3	2	1	2	5	*	*	3	3	*
Spirillina limbata	1	3	2	3	0	2	2	3	5	5
Spiroloculina sp.	2	*	1	*	4	*	5	2	6	5
Triloculina austriaca	2	3	4	2	4	5	*	3	5	5
Cumacea										
Campylaspis sp.	2	2	4	3	5	6	3	2	6	*
Gynodiastylis sp.	2	1	*	*	8	*	4	*	3	6
Harpacticoids										
Apodopsyllus vermiculiformis	1	3	5	3	*	4	5	3	*	*
Cervinia sp.	*	2	6	2	10	8	5	1	2	4
Cylindropsyllus sp.	2	3	5	1	1	2	1	2	1	2
Diarthrodes sp.	3	1	6	2	1	1	1	3	1	1
Laophonte thoracica	2	3	2	2	1	1	1	3	1	1
Laptastocus sp.	*	2	2	1	1	1	1	*	1	2
Stenhelia sp.	3	1	5	2	1	1	1	2	1	1
Tisbe furcate	3	2	4	3	1	2	2	3	*	2
Ostrocodes										
Basslerites liebaui	1	1	1	1	*	*	2	1	2	1
Diasterope schmitti	2	*	1	2	1	1	1	3	1	1
Leptocythere sp.	1	1	1	1	1	1	1	1	1	1
Philomedes globosus	1	2	3	1	1	1	3	1	1	1
Tanella estuarii	2	4	2	*	1	1	*	4	*	2
Tanella indica	1	1	2	3	1	2	3	4	1	2
Tanella kingmaii	1	1	1	1	1	2	1	1	2	1
Tanaidacea										
Heterotanais oerstedi	2	2	2	1	1	1	1	1	1	1
Apseudes setosus	3	11	6	10	*	4	3	3	2	3
Apseudes spinosus	6	2	4	3	5	*	3	10	6	*

*** - Organisms not present**

The population density of meio-benthic fauna varied from 278 to 380 no.10cm^{-2} with maximum at VPT-8 and minimum at VPT-3 (Refer Figure-4.43).

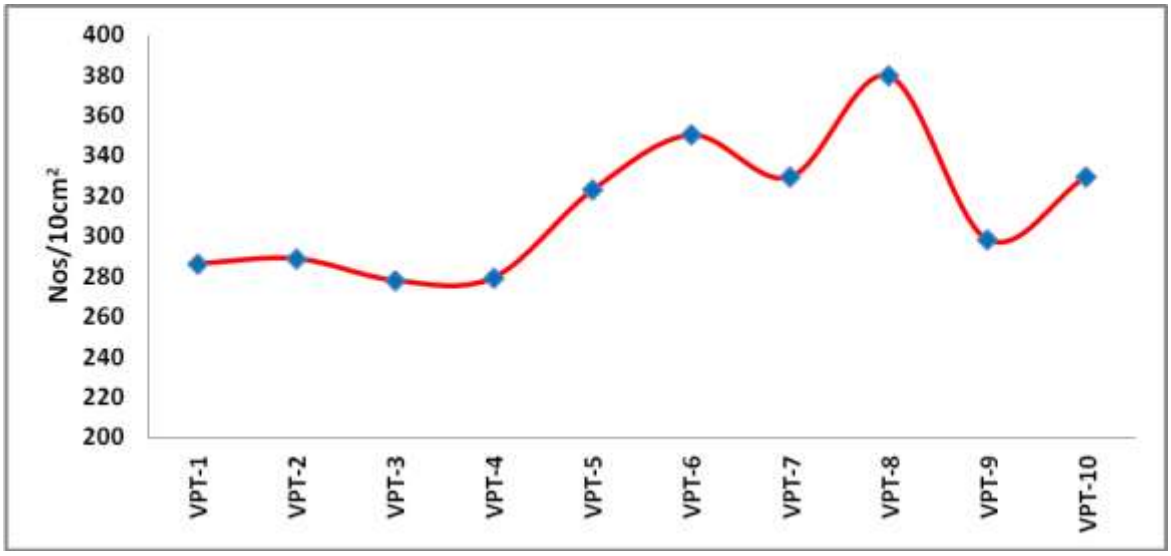


Figure- 4.43: Population density of meio-fauna

When the results of percentage composition fauna were viewed, foraminiferans constituted the maximum with 54% of the total benthic organisms. Nematodes, harpacticoids with 32% and 6% respectively and ostracodes and tanaidacea with 3% each to the total meio-benthic samples collected. Cumacea came last in the order with a meagre percentage occurrence of 2% (Refer Figure-4.44).

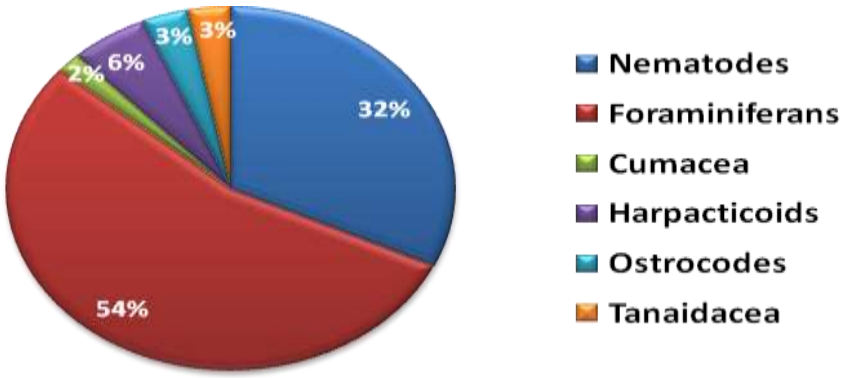


Figure- 4.44: Percentage composition of meio benthos

4.8.3 DIVERSITY INDICES

Phytoplanktons

In VPT waters, during the study period, the data on phytoplankton species were subjected to various diversity indices namely Shannon diversity (H'), Margalef richness (d) and Pielou's evenness. The Shannon diversity varied from 2.822 to 4.375 with maximum in VPT-9 and minimum in VPT-3. The species richness (d) ranged between 2.971 and 4.239 with maximum in VPT-7 and minimum in VPT-3. The species evenness varied from 0.728 to 0.851 with the maximum in VPT-8 and minimum in VPT-3 (Table-4.25).

Table-4.25: Diversity Indices, A-Shannon Diversity (H'); B-Margalef Richness (D) And C-Pielou's Evenness (J') Calculated For Phytoplankton In Vpt Waters

Stations	H'	D	J
VPT-1	3.964	3.201	0.808
VPT-2	4.136	3.703	0.820
VPT-3	2.822	2.971	0.728
VPT-4	4.160	3.518	0.832
VPT-5	3.704	2.977	0.762
VPT-6	4.123	3.383	0.825
VPT-7	4.221	4.239	0.783
VPT-8	4.363	3.540	0.851
VPT-9	4.375	3.847	0.846
VPT-10	3.996	2.985	0.831

Zooplanktons

Zooplankton, species diversity (H') fluctuated from 3.791 to 4.324 with maximum in VPT-6 and minimum in VPT-3. The species richness (d) ranged between 2.557 and 3.368 with maximum in VPT-1 and minimum in VPT-8. The evenness varied from 0.725 to 0.890 with minimum in VPT-3 and maximum in VPT-6 (Table-4.26).

Table-4.26: Diversity indices, a-Shannon diversity (H'); b-Margalef richness (d) and c-Pielou's evenness (J') calculated for zooplankton in VPT waters

Stations	H'	D	J'
VPT-1	4.314	3.368	0.879
VPT-2	4.169	2.903	0.887
VPT-3	3.791	2.892	0.725
VPT-4	4.118	2.840	0.787
VPT-5	3.832	2.906	0.817
VPT-6	4.324	3.204	0.890
VPT-7	4.194	3.164	0.872

Stations	H'	D	J'
VPT-8	3.823	2.557	0.834
VPT-9	4.207	2.932	0.885

BENTHOS

Macro benthos

As done for phytoplankton, the macro benthic data were also subjected to various diversity indices. The Shannon diversity index varied from 2.414 to 3.912 with maximum at VPT-8 and minimum at VPT-3. The Margalef richness fluctuated from 1.975 to 2.683 with maximum at VPT-7 and minimum at VPT-2; with respect to Pielou's evenness, it varied from 0.867 to 0.967 with maximum at VPT-8 and minimum at VPT-3. The details are given in Table-4.27.

Table-4.27: Diversity indices a-Shannon diversity (H'); b-Margalef richness (d) and c-Pielou's evenness (J') calculated for macro benthos in VPT waters

Stations	Shannon diversity (H')	Margalef richness (d)	Pielou's evenness (J')
VPT-1	2.748	2.353	0.941
VPT-2	2.588	1.975	0.955
VPT-3	2.414	2.334	0.867
VPT-4	2.851	2.380	0.902
VPT-5	2.749	2.309	0.953
VPT-6	2.690	2.304	0.931
VPT-7	2.824	2.683	0.927
VPT-8	3.912	2.393	0.968
VPT-9	2.722	2.290	0.942
VPT-10	2.848	2.415	0.963

Meio-benthos

The diversity values varied from 3.374 to 4.126 with maximum at VPT-8 and minimum at VPT-3. Species richness fluctuated from 3.401 to 4.235 with maximum at VPT-5 and minimum at VPT-2; with respect to Pielou's evenness, it varied from 0.751 to 0.901 with maximum at VPT-8 and minimum at VPT-3. The details of various indices for meio-benthos at various sampling stations is given in Table-4.28.

Table-4.28: Diversity indices a-Shannon diversity (H'); b-Margalef richness (d) and c-Pielou's evenness (J') calculated for meio benthos in VPT waters

Stations	Shannon diversity (H')	Margalef richness (d)	Pielou's evenness (J')
VPT-1	3.928	3.416	0.873
VPT-2	3.914	3.401	0.866
VPT-3	3.374	3.409	0.751
VPT-4	4.248	3.430	0.781
VPT-5	4.654	4.235	0.893
VPT-6	4.857	3.436	0.883
VPT-7	4.913	3.544	0.897
VPT-8	4.126	3.568	0.899
VPT-9	4.325	3.480	0.892
VPT-10	4.964	3.440	0.879

4.8.4 Macro algae (Sea Weeds and sea grasses)

Sporadic distribution of sea weeds namely Gracilaria corticata and Ulva sp. was recorded during the marine ecological survey carried out at various locations for the proposed project. However, Lakshmi and Rao (2009) reported the occurrence of following seaweed species such as *Ulva fasciata, Enteromorpha compressa, Gelidiopsis variabilis, Gelidium pusillum, Pterocladia heteroplatos, Amphiroa fragilissima, Hypnea valentiae. Chaetomorpha antennina*, and *Spongomorpha indica* along the Visakhapatnam coast.

4.8.5 Mangroves and coral bed

Mangroves were not found during the present survey in Visakhapatnam port area. However, patchy occurrence of mangrove species namely Avicennia officinalis, Avicennia marina, Acanthus ilicifolius, and Suaeda maritime was reported by Ushakiranmai and Raja Sekhar (2015) during their survey. Similarly, corals were not recorded from the Visakhapatnam port area during the present survey and also no previous reports on the occurrence of corals were made in the said area.

4.8.6 Turtle and other marine endangered species

Though the east coast region is known for nesting ground for turtles, during the field studies turtles were not sighted. Similarly, other vulnerable species like Sea horse, Sea cucumber, Indian otter, salt water crocodile, etc., were also not observed in the study area.

4.8.7 Coastal vegetation

Coastal vegetation has high ecological values like soil binders, major role in aquifers, and stabilization of dunes. The common plant species observed in the study area are *Casuarina litorea* trees, *Prosopis juliflora* (Veelikkaruvai), *Ipomea pescaprae, Launea sermentosa,*

Pedalium sp., Calotropis gigantea, Spinifex littoreus, Salicornia sp., Sesuvium sp., Porteresia sp., Opuntia stricta and *Anacardium sp.*

4.8.8 Fisheries at Visakhapatnam Fishing Harbour

Visakhapatnam Fishery Harbour is located near to the port and Kotha Jalaripeta Fish Landing Centre is located in the study area. There are about 10,000 families depends on Fishing harbour from all Stakeholders, like Boat Owners, Crew Members, Fish Exporters, Fish Vendors, Net Mending etc.There are Seven Fishermen Cooperative Societies functioning in Visakhapatnam Fishing harbour, for their livelihood. There is no inland culture area in and around Fishing harbour, Visakhapatnam. Details of the crafts the types and number of fishing Craft in Visakhapatnam Fishing harbor are given in Table 4.29. Species wise fish production at Visakhapatnam Fishing harbor from 2010 to 2015 is given in Table 4.30.

Table-4.29: Types and number of Crafts used for fishing in Visakhapatnam

Types of Craft	Number
Traditional Craft	27
Mechanised Fishing Boats	683
Motorised Fishing Boats	300

Table-4.30: Marine Fish and Shrimp Production 2010 to 2015 (Unit: Metric tonne)

S.No	Name of the species	2010-11	2011-12	2012-13	2013-14	2014-15
1	Shark	607	460	342	119	80
2	Skates	114	253	207	196	120
3	Rays	545	256	218	141	132
4	Oil Sardine	1008	3491	3484	3854	5290
5	Other Sardine	741	1344	1870	2248	2540
6	Hilsa Shad	19	34	184	99	102
7	Other Shads	437	303	498	312	350
8	Thrisocies	439	587	429	1139	1241
9	Anchovies	2289	2216	3159	4663	4521
10	Other Clupeids	516	876	1774	2988	3100
11	Harpodan neres	127	28	0	0	0
12	Chriocentrus	495	520	397	290	320
13	Polynemids	839	1149	777	339	410
14	Chorinemus	367	562	441	257	260
15	Trichuridae	2004	1637	3644	7830	6845
16	Carangids	3545	4241	1897	2964	2857
17	Indian mackeral	7873	11669	15774	14090	12345
18	Other mackerals	2502	5036	3462	4057	5621
19	S.commerson	1599	914	592	503	680
20	S.guttatus	749	676	439	311	350
21	S.leneoitus	408	419	141	117	120

S.No	Name of the species	2010-11	2011-12	2012-13	2013-14	2014-15
22	Tunnies	6496	6142	4090	10037	10998
23	Mugil	951	497	148	83	110
24	Eels	700	214	194	123	154
25	Cat fish	692	547	659	481	598
26	Threadfin breams	638	934	1447	838	911
27	Pigface breams	416	435	332	293	302
28	Other perches	1151	1156	1294	1605	1826
29	Scianids	562	362	153	320	540
30	Leoignathus	742	491	2329	1147	1325
31	Black Pomfrets	985	409	3618	1921	1628
32	Silver Pomfrets	729	524	285	363	251
33	Sole (flat fish)	662	219	303	358	421
34	P.monodon	1148	497	453	612	750
35	P.indicus	967	677	538	419	520
36	Meta peneaus	3707	1817	1125	4230	4829
37	Non peneaid prawn	1037	4188	7214	6120	5650
38	Mannecrustaceans	3341	1266	2299	2231	2310
39	Other crustaceans	14	34	49	56	46
40	Lobsters	410	220	17	5	11
41	Molluscans	471	380	41	96	100
42	Squids & cuttlefish	2468	688	2019	931	805
43	Mischallaneous Fish	12202	16983	13496	11110	15986
	Total	**67712**	**75351**	**81832**	**89896**	**97355**

4.8.9 Endangered Species

Based on the data collected and the survey conducted no endangered/threatened/endemic plant /animal species were found in and around proposed plant area and surrounding 10 km radius was not recorded. There were no critically threatened species.

Although,Olive ridley nesting was recorded at few places along the coast in Andhra Pradesh during the 1980s (Kar 1983, Subba Rao et al 1987). Their sporadic and high intensity nesting was recorded in the north coastal region (Priyadarshini 1998, Rajasekar and Subba Rao 1993). Only sporadic nesting was reported across the Andhra Pradesh coast during intensive beach studies of GOI-UNDP 2000-2001 sea turtle project. Sporadic nesting was also documented in Sriharikota of southern coast (S. Sivakumar 2010).

Records of turtle mortality along the Andhra Pradesh coast (Rao 1984, Tripathy et al 2003) and exploitation of sea turtle meat and eggs in northern Andhra Pradesh coast has been reported by Rajasekar and Subba Rao (1993), and Tripathy et al (2006). During the present studies there

were no Olive ridley turtle found in and aoround the project area. Details of Potential nesting locations of Olive ridley turtle and their coordinates in Andhra Pradesh are shown in Table-4.31.

Table-4.31: Details of Potential nesting locations and their coordinates

Area		Latitude	Longitude
Northern Andhra Pradesh	Jeedupalam	18°07'08"N	83°44'08"E.
	Muthiyavanipalem	17°32'10"N	83°05'35"E.
	Hope Island	16°58'16"N	82°20'47"E.
Central Andhra Pradesh	Sacremento Island	16°35'12"N	82°18'59"E.
	Lankavanidibba	15°42'58"N	80°49'21"E.
	Elichetladibba	15°43'25"N	80°54'03"E.
	Isakapalle	14°44'22"N	80°06'19"E.
Southern Andhra Pradesh	Ramachandrapuram	14°39' 25"N	80°09'35"E.
	Lakhsmipuram	14°41'44"N	80°08'59"E.
	Mypadu	14°30' 22"N	80°10'43"E

The nearest identified nesting grounds at Muthiyavanipalem is 30 km south and Jeedupalam 75 kms North of the proposed project location. Thus, it can be concluded that nesting grounds are not reported in the project as well as study area.

4.8.10 Kambalakonda wildlife sanctuary

As per Ministry of Environment & Forests Notifications and local forest notifications, there are no national parks/ biospheres reserves in 10 km radius from plant site. However, Kambalakonda wildlife sanctuary is situated in the Eastern Ghats on the outskirts of Visakhapatnam city. The sanctuary is located between latitudes of 17.34° N to 17.47° N and longitudes of 83.04° E to 83.20° E. Total area of Kambalakonda Wildlife Sanctuary with a total area 71.39 Km^2 and sanctuary is situated about 6 km north west of proposed project site . is situated in the Eastern Ghats overlooking the Bay of Bengal.

Kambalakonda wildlife sanctuary is situated about 6 km north west of proposed project site. Its topography is a steep and undulating terrain of rolling hills, thickly vegetated gorges and valleys with an average altitude of 200–300 m, thickly vegetated gorges and valleys with an average altitude of 200–300 m. The Sanctuary maintains very rich bio-diversity comprising 73 tree species, 39 species of herbs and shrubs, and 18 species of climbers, 2 species of Bamboos and 7 species of grasses, 23 mammal species, 7 species of reptiles and more than 90 species of birds have been documented from the Sanctuary. Sanctuary harbours large variety of flora and is characterised by a scrub jungle the major tree species of the area are Ficus banghalensis, Acacia lucophloea

Kambalakonda Wildlife Sanctuary supports three broad categories of vegetation viz.

- Tropical semi-evergreen,
- Tropical moist-deciduous and
- Tropical dry- deciduous.

There are 319 species of plants in 252 genera and 73 families, bringing out the genus and species ratio as 1:1.26. The dominant families were Fabaceae (23), Euphorbiaceae (22), Poaceae (21), Rubiaceae and Acanthaceae (13 each).

The dominant species being *Acacia auriculiformis, A. nilotica, Albizia procera, Tectona grandis, Tamarindus indicus, Terminalia catappa, T. tomentosa, Syzygium cumini, Borassus flabellifer, Azardirachta indica, Mangifera indica, Anacardium occidentalis, Bauhinia vahlii, Dendrocalamus strictus, Phoenix sylvistris, Ziziphus oenopli*. The forest in the sanctuary also support variety like leopard, barking deer, wild boat, spotted deer, sambar and monkeys. Owing to its close proximity to the city, the flora and fauna in the forest are subjected to high degree of biotic interference.

The fauna present in the sanctuary is Porcupine (*Hystrix indica*), Black–napped hare (*Lepus niricollis*) , Russell's Viper (*Daboia russelii*), Indian Cobra (*Naja naja*), Chameleon, Asian Paradise-flycatcher (*Terpsiphone paradisi*), Treepie, quails, partridges, Indian Leopard (*Panthera pardus fusca*), Indian Muntjac (*Muntiacus muntjak*), Indian Pangolin (*Manis crassicaudata*), Chital (*Axis axis*), Indian Jackal (*Canis aureus indicus*), Indian tree shrew (*Anathana ellioti*), Indian civet (*Viverricula indica*) and Palm civet (*Paradoxurus hermaphroditus*) etc.

4.9 SHORELINE CHANGES

The shoreline is an intersection of sea and land surfaces. In the remote sensing context, a shoreline is dividing line between land and water that is visibly discernible in coastal imagery (Elizabeth et al, 2005). The shoreline is understood as the dynamic boundary between land and sea for all practical purposes. Shoreline is fundamental element in defining the Exclusive Economic Zone (EEZ). Shoreline change study for Visakhapatnam-Gangavaram was carried out by Coastal Oceanography Division of National Remote Sensing Centre based on the satellite data from 1998 to 2008.

Gangavaram-Visakhapatnam shoreline changes were studied in two stages, firstly decadal changes on regional scale and secondly short- term changes at cell level with IRS-IDIP6, LISS III/IV and PAN merged and resampled data to 5 metres.

Based on the sediment transport boundaries, study area is divided into four cells. Study of each cell is carried out at an interval of two/three years in 10,000 scales. The studies include coastal morphology and shoreline changes and beach profiling. At each cell, beach widths were calculated for 1998-2001, 2001-03, 2003-05 and 2005-08 and compared with summer 2009 beach profiles. This helped to ascertain shoreline changes in the field with respect to satellite-derived shoreline. The overall accuracy of this investigation estimate around 75 to 85% with 5-meter resolution resampled data acquired during low tide provided reasonably good details about significant locations of shoreline changes and associated morphodynamics.

The short-term shoreline changes at each coastal cell were carried out. The results show that over a decade, the regional shoreline changes follow the normal long shore transport with the net sediment drift to the north. The estimated change in the beach with computed in the satellite data at critical transects is as follows:

- 82 in southern Gangavaram Coastal Cell,
- 30.84 in southern tip of RK beach,
- 17.69 in Bhimunipatnam
- 5.98 in north Rishigonda
- 15.90 in south Rishigonda

In Rishigonda coastal cell, at places, the beach has completely eroded (100) with negligible recovery. However, short-term changes are subjective of local activities such as construction of new port, cultivation of coastal plantations and amusement parks mostly along Gangavaram and Rishigonda coast.

The Bhimunipatnam beach (width) had moderately decreased during 1998-2005, but recovered later in 2008. The southern RK and northern Rishigonda beach width have moderately decreased from 1998-2008. The northern part of RK-beach remained stable than southern part during 2005-2008. The beach in the south part of Visakhapatnam port at Yerrada shows developments such as beach resorts and cultivation of vegetation.

4.10 SOCIO-ECONOMIC ASPECTS

The aim of the socio-economic study is to assess the overall impact on various facets of socio-economic environment due to establishment of the project and consequent land acquisition in the affected villages and its population in general and the project affected families (PAFs) in particular, whose livelihood would be affected. The baseline socio-economic scenario of the district and sub districts in which the proposed project is located has been discussed. Thereafter

the socio-economic status of the PAFs is described followed by the impacts of the proposed project on the socio-economic environment has be elucidated.

The proposed project, because of its sheer size, will bring direct as well as indirect benefits to the population of District Visakhapatnam. Affecting four subdistrict namely Visakhapatnam (Rural), Visakhapatnam (Urban),Pedagantayada and Gajuwaka.

The following sections highlight the overall socio-economic status prevailing in the affected villages as well as the study area.

4.10.1 Population and Demographic Profile

As mentioned the proposed project is located in the District Vishakapatnam. The study area or the Project Influence Area comprises of about 77 wards in 4 Subdistricts. The total population in the study area or the project influence area is of the order of 27247 persons as per Census of India 2011. The distribution of population and demographic profile in the study area villages is outlined in Table-4.32 and Figure-4.45.

Table-4.32: Demographic profile in the study area villages

S.No	Name of the Wards	Total Household	Total Population	Total Male	Total Female	Population<6yrs	Average Family size	Sex Ratio
	Visakhapatnam (Rural)Subdistrict							
1	GVMC (Part) WARD NO.-0001	6049	24995	12899	12096	2702	4	938
2	GVMC (Part) WARD NO.-0002	5416	21904	10966	10938	2405	4	997
3	GVMC (Part) WARD NO.-0003	8002	31387	15878	15509	3421	4	977
4	GVMC (Part) WARD NO.-0004	7082	27132	13590	13542	2780	4	996
5	GVMC (Part) WARD NO.-0005	11400	43744	21803	21941	4893	4	1006
6	GVMC (Part) WARD NO.-0006	6903	26227	13292	12935	2455	4	973
7	GVMC (Part) WARD NO.-0066	7446	28579	14533	14046	2928	4	966
8	GVMC (Part) WARD NO.-0067	3427	13190	6607	6583	1175	4	996
9	GVMC (Part) WARD NO.-0068	6738	26102	13082	13020	2360	4	995
10	GVMC (Part) WARD NO.-0069	237	876	438	438	65	4	1000
11	GVMC (Part) WARD NO.-0072	3873	16056	8389	7667	1424	4	914
	Total (A)	**66573**	**260192**	**131477**	**128715**	**26608**	**4**	**979**
Visakhapatnam (Urban)								

S.No	Name of the Wards	Total Household	Total Population	Total Male	Total Female	Population<6yrs	Average Family size	Sex Ratio
1	GVMC (Part) WARD NO.-0007	6435	25102	12630	12472	2388	4	987
2	GVMC (Part) WARD NO.-0008	6513	25118	12254	12864	1958	4	1050
3	GVMC (Part) WARD NO.-0009	7178	27697	13966	13731	2440	4	983
4	GVMC (Part) WARD NO.-0010	7013	26952	13458	13494	2496	4	1003
5	GVMC (Part) WARD NO.-0011	4838	18093	8980	9113	1380	4	1015
6	GVMC (Part) WARD NO.-0012	5539	21078	10524	10554	1636	4	1003
7	GVMC (Part) WARD NO.-0013	4636	18309	9135	9174	1600	4	1004
8	GVMC (Part) WARD NO.-0014	5351	21106	10625	10481	2113	4	986
9	GVMC (Part) WARD NO.-0015	5595	21878	10821	11057	1766	4	1022
10	GVMC (Part) WARD NO.-0016	7055	27305	14020	13285	2536	4	948
11	GVMC (Part) WARD NO.-0017	6731	26262	12969	13293	2662	4	1025
12	GVMC (Part) WARD NO.-0018	4198	15605	7788	7817	1242	4	1004
13	GVMC (Part) WARD NO.-0019	6617	25527	12752	12775	2129	4	1002
14	GVMC (Part) WARD NO.-0020	5469	22039	10542	11497	1618	4	1091
15	GVMC (Part) WARD NO.-0021	4640	18632	9281	9351	1763	4	1008
16	GVMC (Part) WARD NO.-0022	4718	20013	10027	9986	2223	4	996
17	GVMC (Part) WARD NO.-0023	5019	19897	10043	9854	1834	4	981
18	GVMC (Part) WARD NO.-0024	4149	16597	8468	8129	1481	4	960
19	GVMC (Part) WARD NO.-0025	4624	18679	9392	9287	1662	4	989
20	GVMC (Part) WARD NO.-0026	5779	23576	11976	11600	2484	4	969
21	GVMC (Part) WARD NO.-0027	4831	19385	9683	9702	1614	4	1002
22	GVMC (Part) WARD NO.-0028	5003	19401	9632	9769	1732	4	1014
23	GVMC (Part) WARD NO.-0029	4227	17426	8672	8754	1829	4	1009
24	GVMC (Part) WARD NO.-0030	3195	12696	6276	6420	1125	4	1023
25	GVMC (Part) WARD NO.-0031	5578	21393	10704	10689	1734	4	999
26	GVMC (Part) WARD NO.-0032	6810	26164	13174	12990	2396	4	986
27	GVMC (Part) WARD NO.-0033	5552	21689	10826	10863	2056	4	1003
28	GVMC (Part) WARD NO.-0034	6113	24265	12271	11994	1914	4	977
29	GVMC (Part) WARD NO.-0035	7880	31336	15808	15528	2830	4	982
30	GVMC (Part) WARD NO.-0036	4238	16780	8325	8455	1471	4	1016
31	GVMC (Part) WARD NO.-0037	6660	26513	13596	12917	2719	4	950
32	GVMC (Part) WARD NO.-0038	6644	25681	12910	12771	2424	4	989
33	GVMC (Part) WARD NO.-0039	7525	29287	14899	14388	2656	4	966
34	GVMC (Part) WARD NO.-0040	6550	25987	13337	12650	2353	4	948
35	GVMC (Part) WARD NO.-0041	6250	24239	12250	11989	2190	4	979

S.No	Name of the Wards	Total Household	Total Population	Total Male	Total Female	Population<6yrs	Average Family size	Sex Ratio
36	GVMC (Part) WARD NO.-0042	6042	23719	11743	11976	1953	4	1020
37	GVMC (Part) WARD NO.-0043	3262	12434	6327	6107	1298	4	965
38	GVMC (Part) WARD NO.-0044	4211	16443	8092	8351	1513	4	1032
39	GVMC (Part) WARD NO.-0045	7378	33133	18996	14137	3843	4	744
40	GVMC (Part) WARD NO.-0046	4553	17957	9052	8905	1776	4	984
41	GVMC (Part) WARD NO.-0047	6355	24923	12664	12259	2597	4	968
42	GVMC (Part) WARD NO.-0048	6643	25883	13210	12673	2568	4	959
43	GVMC (Part) WARD NO.-0049	6895	27234	13785	13449	2757	4	976
44	GVMC (Part) WARD NO.-0067	3670	14338	7132	7206	1178	4	1010
	Total (B)	**248162**	**977771**	**493015**	**484756**	**89937**	**4**	**983**
Pedagantyada Subdistrict								
1	GVMC (Part) WARD NO.-0050	5371	22221	11317	10904	2428	4	964
2	GVMC (Part) WARD NO.-0051	5519	21725	11087	10638	2065	4	960
3	GVMC (Part) WARD NO.-0052	4379	17422	8994	8428	1533	4	937
4	GVMC (Part) WARD NO.-0055	3622	14021	7291	6730	1439	4	923
5	GVMC (Part) WARD NO.-0061	860	3428	1786	1642	329	4	919
6	GVMC (Part) WARD NO.-0062	4274	16474	8322	8152	1726	4	980
	Total (C)	**24025**	**95291**	**48797**	**46494**	**9520**	**4**	**953**
Gajuwaka Subdistrict								
1	GVMC (Part) WARD NO.-0045	757	3125	1640	1485	301	4	905
2	GVMC (Part) WARD NO.-0046	66	185	99	86	10	3	869
3	GVMC (Part) WARD NO.-0050	2528	10387	5387	5000	1178	4	928
4	GVMC (Part) WARD NO.-0052	1596	6334	3261	3073	624	4	942
5	GVMC (Part) WARD NO.-0053	5500	21749	11055	10694	2323	4	967
6	GVMC (Part) WARD NO.-0054	3819	15095	7634	7461	735	4	977
7	GVMC (Part) WARD NO.-0056	4616	18063	9065	8998	1897	4	993
8	GVMC (Part) WARD NO.-0057	2405	9325	4712	4613	1089	4	979
9	GVMC (Part) WARD NO.-0058	5398	20965	10623	10342	2118	4	974
10	GVMC (Part) WARD NO.-0059	4393	17335	8751	8584	1705	4	981
11	GVMC (Part) WARD NO.-0060	6930	26775	13749	13026	2755	4	947
12	GVMC (Part) WARD NO.-0061	7012	27580	14095	13485	2740	4	957
13	GVMC (Part) WARD NO.-0062	1731	7062	3602	3460	805	4	961
14	GVMC (Part) WARD NO.-0063	5406	21449	10988	10461	2162	4	952
15	GVMC (Part) WARD NO.-0064	6410	24575	12483	12092	2586	4	969
16	GVMC (Part) WARD NO.-0065	5221	20419	10433	9986	1970	4	957

S.No	Name of the Wards	Total Household	Total Population	Total Male	Total Female	Population<6yrs	Average Family size	Sex Ratio
	Total (D)	**63788**	**250423**	**127577**	**122846**	**24998**	**4**	**963**
	Total(A+B+C+D)	**402548**	**1583677**	**800866**	**782811**	**151063**	**4**	**977**

Source: Primary Census Abstract, 2011

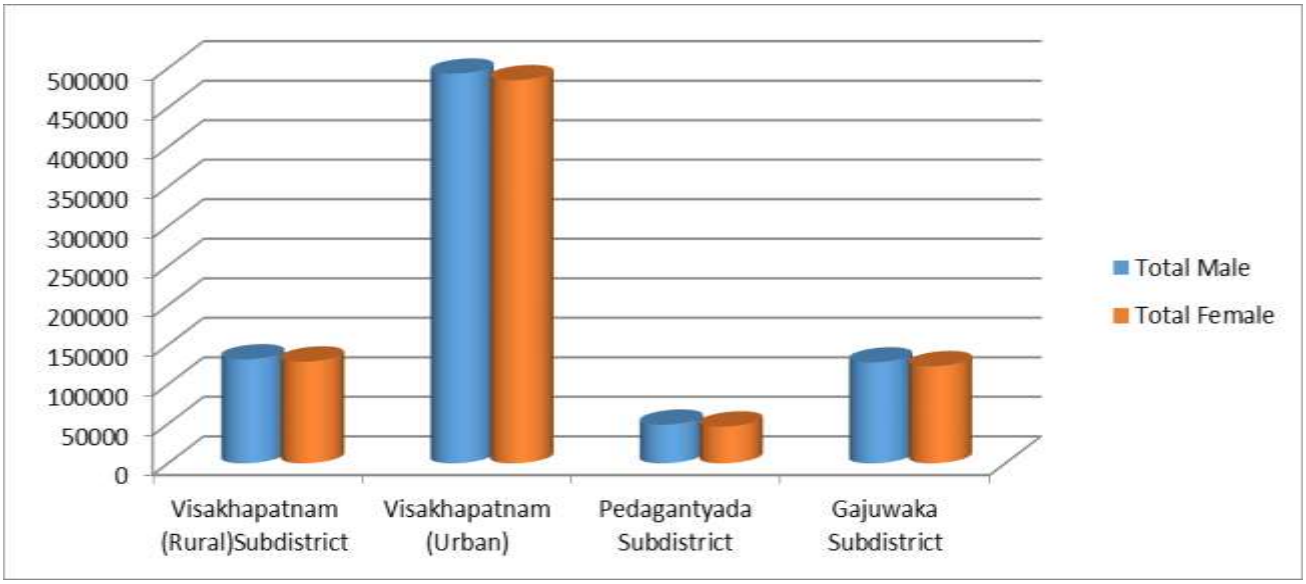


Figure-4.45: Demographic profile in the study area villages

The distribution of male and female population in study area villages comprises of about 50.6% and 49.4% respectively. The population comprising of infants and children below the age of 6 years constitute about 9.5% of the total population in the study area villages. The sex ratio and average family size in the study area villages is 977 and 4 persons per family respectively.

4.10.2 Caste Profile

The distribution of population in study area villages on the basis of caste is depicted in Table-4.33 and Figure-4.46. As per this table, it is observed that General Caste is dominant in the study area with 90.1% of the total population followed by Schedule Caste 8.7% and Schedule Tribe 1.2%.

Table-4.33: Caste profile in the study area villages

S.No	Name of the Wards	Total Population	Population Schedule Caste	Population Schedule Tribe	Population General Caste
	Visakhapatnam (Rural)Subdistrict				
1	GVMC (Part) WARD NO.-0001	24995	2792	706	21497
2	GVMC (Part) WARD NO.-0002	21904	1456	306	20142
3	GVMC (Part) WARD NO.-0003	31387	3877	323	27187
4	GVMC (Part) WARD NO.-0004	27132	2309	376	24447
5	GVMC (Part) WARD NO.-0005	43744	3548	658	39538
6	GVMC (Part) WARD NO.-0006	26227	2153	799	23275
7	GVMC (Part) WARD NO.-0066	28579	1596	255	26728
8	GVMC (Part) WARD NO.-0067	13190	2647	62	10481
9	GVMC (Part) WARD NO.-0068	26102	3345	162	22595
10	GVMC (Part) WARD NO.-0069	876	35	5	836
11	GVMC (Part) WARD NO.-0072	16056	707	416	14933
	Total (A)	**260192**	**24465**	**4068**	**231659**
	Visakhapatnam (Urban)				
1	GVMC (Part) WARD NO.-0007	25102	612	554	23936
2	GVMC (Part) WARD NO.-0008	25118	994	114	24010
3	GVMC (Part) WARD NO.-0009	27697	2348	276	25073
4	GVMC (Part) WARD NO.-0010	26952	899	267	25786
5	GVMC (Part) WARD NO.-0011	18093	643	138	17312
6	GVMC (Part) WARD NO.-0012	21078	417	66	20595
7	GVMC (Part) WARD NO.-0013	18309	1211	289	16809
8	GVMC (Part) WARD NO.-0014	21106	2696	435	17975
9	GVMC (Part) WARD NO.-0015	21878	1984	115	19779
10	GVMC (Part) WARD NO.-0016	27305	2080	272	24953
11	GVMC (Part) WARD NO.-0017	26262	1487	231	24544
12	GVMC (Part) WARD NO.-0018	15605	2035	187	13383
13	GVMC (Part) WARD NO.-0019	25527	2777	59	22691
14	GVMC (Part) WARD NO.-0020	22039	2253	195	19591
15	GVMC (Part) WARD NO.-0021	18632	3855	62	14715
16	GVMC (Part) WARD NO.-0022	20013	2775	71	17167
17	GVMC (Part) WARD NO.-0023	19897	2997	62	16838
18	GVMC (Part) WARD NO.-0024	16597	129	4	16464
19	GVMC (Part) WARD NO.-0025	18679	367	73	18239
20	GVMC (Part) WARD NO.-0026	23576	1005	154	22417

S.No	Name of the Wards	Total Population	Population Schedule Caste	Population Schedule Tribe	Population General Caste
21	GVMC (Part) WARD NO.-0027	19385	1435	45	17905
22	GVMC (Part) WARD NO.-0028	19401	907	136	18358
23	GVMC (Part) WARD NO.-0029	17426	2280	59	15087
24	GVMC (Part) WARD NO.-0030	12696	1210	123	11363
25	GVMC (Part) WARD NO.-0031	21393	1591	111	19691
26	GVMC (Part) WARD NO.-0032	26164	718	71	25375
27	GVMC (Part) WARD NO.-0033	21689	1006	111	20572
28	GVMC (Part) WARD NO.-0034	24265	2548	1044	20673
29	GVMC (Part) WARD NO.-0035	31336	9154	500	21682
30	GVMC (Part) WARD NO.-0036	16780	1121	138	15521
31	GVMC (Part) WARD NO.-0037	26513	5955	226	20332
32	GVMC (Part) WARD NO.-0038	25681	2460	275	22946
33	GVMC (Part) WARD NO.-0039	29287	3637	435	25215
34	GVMC (Part) WARD NO.-0040	25987	2610	413	22964
35	GVMC (Part) WARD NO.-0041	24239	2759	333	21147
36	GVMC (Part) WARD NO.-0042	23719	2755	321	20643
37	GVMC (Part) WARD NO.-0043	12434	1021	388	11025
38	GVMC (Part) WARD NO.-0044	16443	2900	148	13395
39	GVMC (Part) WARD NO.-0045	33133	2516	364	30253
40	GVMC (Part) WARD NO.-0046	17957	1256	63	16638
41	GVMC (Part) WARD NO.-0047	24923	1482	223	23218
42	GVMC (Part) WARD NO.-0048	25883	3540	250	22093
43	GVMC (Part) WARD NO.-0049	27234	3239	271	23724
44	GVMC (Part) WARD NO.-0067	14338	1297	142	12899
	Total (B)	**977771**	**92961**	**9814**	**874996**
	Pedagantyada Subdistrict				
1	GVMC (Part) WARD NO.-0050	22221	441	383	21397
2	GVMC (Part) WARD NO.-0051	21725	1548	80	20097
3	GVMC (Part) WARD NO.-0052	17422	992	254	16176
4	GVMC (Part) WARD NO.-0055	14021	270	316	13435
5	GVMC (Part) WARD NO.-0061	3428	92	0	3336
6	GVMC (Part) WARD NO.-0062	16474	522	93	15859
	Total (C)	**95291**	**3865**	**1126**	**90300**
	Gajuwaka Subdistrict				
1	GVMC (Part) WARD NO.-0045	3125	20	7	3098
2	GVMC (Part) WARD NO.-0046	185	2	0	183

S.No	Name of the Wards	Total Population	Population Schedule Caste	Population Schedule Tribe	Population General Caste
3	GVMC (Part) WARD NO.-0050	10387	428	97	9862
4	GVMC (Part) WARD NO.-0052	6334	163	367	5804
5	GVMC (Part) WARD NO.-0053	21749	1439	746	19564
6	GVMC (Part) WARD NO.-0054	15095	2598	1101	11396
7	GVMC (Part) WARD NO.-0056	18063	881	142	17040
8	GVMC (Part) WARD NO.-0057	9325	590	44	8691
9	GVMC (Part) WARD NO.-0058	20965	1872	230	18863
10	GVMC (Part) WARD NO.-0059	17335	1372	389	15574
11	GVMC (Part) WARD NO.-0060	26775	1438	246	25091
12	GVMC (Part) WARD NO.-0061	27580	1202	463	25915
13	GVMC (Part) WARD NO.-0062	7062	532	16	6514
14	GVMC (Part) WARD NO.-0063	21449	965	81	20403
15	GVMC (Part) WARD NO.-0064	24575	1122	77	23376
16	GVMC (Part) WARD NO.-0065	20419	1701	92	18626
	Total (D)	**250423**	**16325**	**4098**	**230000**
	Total(A+B+C+D)	**1583677**	**137616**	**19106**	**1426955**

Source: Primary Census Abstract, 2011

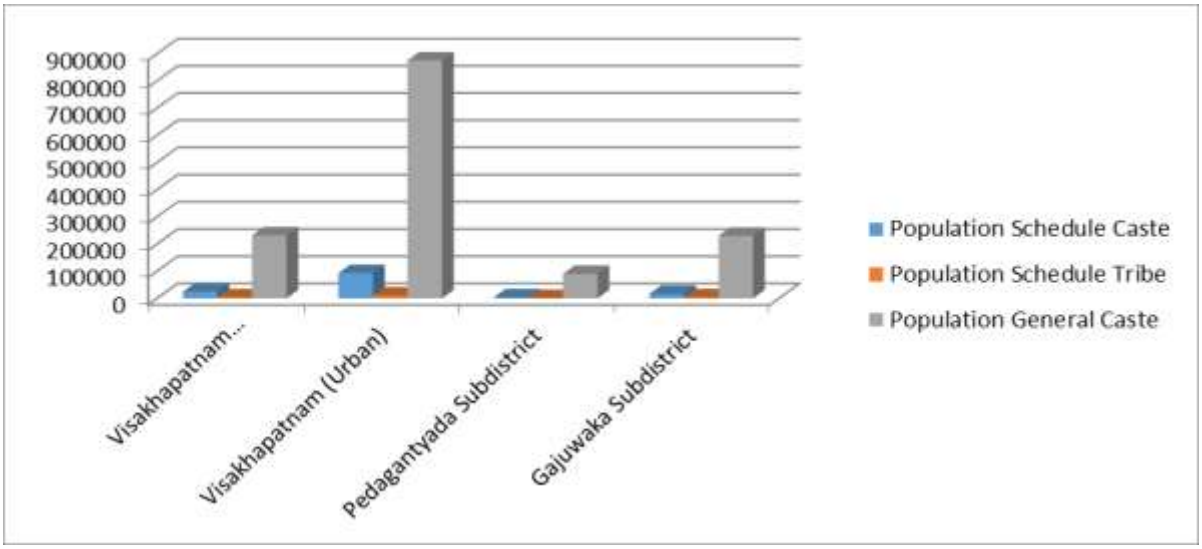


Figure-4.46: Caste profile in the study area villages

4.10.3 Literacy Levels

The details of literate and illiterate population amongst the total population of study area villages are shown in Table-4.34 and depicted in Figure-4.47. As per this table, it is observed that about 74.0% of the total population in the study area villages is literate, while about 26.0% are illiterate. Among the literate population, males and females comprise about 78.8% and 69.1% of the total literate population. Further, among the illiterate population, males and females comprise about 21.2% and 30.9% of the total illiterate population.

Table-4.34: Distribution of literate and illiterate population in the study area villages

S. No.	Name of the Wards	Total Population	Population Literate	Sr.No	Female Literate	Population Illitetrate	Male Illiterate	Female Illiterate
	Visakhapatnam (Rural)Subdistrict							
1	GVMC (Part) WARD NO.-0001	24995	16719	9321	7398	8276	3578	4698
2	GVMC (Part) WARD NO.-0002	21904	14734	8007	6727	7170	2959	4211
3	GVMC (Part) WARD NO.-0003	31387	22628	12204	10424	8759	3674	5085
4	GVMC (Part) WARD NO.-0004	27132	19110	10117	8993	8022	3473	4549
5	GVMC (Part) WARD NO.-0005	43744	28694	15346	13348	15050	6457	8593
6	GVMC (Part) WARD NO.-0006	26227	19431	10468	8963	6796	2824	3972
7	GVMC (Part) WARD NO.-0066	28579	20211	11307	8904	8368	3226	5142
8	GVMC (Part) WARD NO.-0067	13190	10295	5424	4871	2895	1183	1712
9	GVMC (Part) WARD NO.-0068	26102	19872	10563	9309	6230	2519	3711
10	GVMC (Part) WARD NO.-0069	876	770	388	382	106	50	56
11	GVMC (Part) WARD NO.-0072	16056	12235	6907	5328	3821	1482	2339
	Total (A)	**260192**	**184699**	**100052**	**84647**	**75493**	**31425**	**44068**
	Visakhapatnam (Urban)							
1	GVMC (Part) WARD NO.-0007	25102	17897	9446	8451	7205	3184	4021
2	GVMC (Part) WARD NO.-0008	25118	20763	10487	10276	4355	1767	2588
3	GVMC (Part) WARD NO.-0009	27697	21425	11290	10135	6272	2676	3596
4	GVMC (Part) WARD NO.-0010	26952	20719	10831	9888	6233	2627	3606
5	GVMC (Part) WARD NO.-0011	18093	15271	7765	7506	2822	1215	1607
6	GVMC (Part) WARD NO.-0012	21078	17332	8965	8367	3746	1559	2187
7	GVMC (Part) WARD NO.-0013	18309	14201	7501	6700	4108	1634	2474
8	GVMC (Part) WARD NO.-0014	21106	14727	7984	6743	6379	2641	3738
9	GVMC (Part) WARD NO.-0015	21878	17311	8977	8334	4567	1844	2723
10	GVMC (Part) WARD NO.-0016	27305	20374	11164	9210	6931	2856	4075
11	GVMC (Part) WARD NO.-0017	26262	17607	9271	8336	8655	3698	4957
12	GVMC (Part) WARD NO.-0018	15605	13160	6800	6360	2445	988	1457
13	GVMC (Part) WARD NO.-0019	25527	20508	10621	9887	5019	2131	2888
14	GVMC (Part) WARD NO.-0020	22039	17968	8961	9007	4071	1581	2490
15	GVMC (Part) WARD NO.-0021	18632	12942	6971	5971	5690	2310	3380

S. No.	Name of the Wards	Total Population	Population Literate	Sr.No	Female Literate	Population Illitetrate	Male Illiterate	Female Illiterate
16	GVMC (Part) WARD NO.-0022	20013	12296	6720	5576	7717	3307	4410
17	GVMC (Part) WARD NO.-0023	19897	14982	7956	7026	4915	2087	2828
18	GVMC (Part) WARD NO.-0024	16597	13105	6953	6152	3492	1515	1977
19	GVMC (Part) WARD NO.-0025	18679	12932	7032	5900	5747	2360	3387
20	GVMC (Part) WARD NO.-0026	23576	15376	8471	6905	8200	3505	4695
21	GVMC (Part) WARD NO.-0027	19385	15663	8164	7499	3722	1519	2203
22	GVMC (Part) WARD NO.-0028	19401	14983	7857	7126	4418	1775	2643
23	GVMC (Part) WARD NO.-0029	17426	10850	5944	4906	6576	2728	3848
24	GVMC (Part) WARD NO.-0030	12696	9755	5129	4626	2941	1147	1794
25	GVMC (Part) WARD NO.-0031	21393	17775	9161	8614	3618	1543	2075
26	GVMC (Part) WARD NO.-0032	26164	20279	10724	9555	5885	2450	3435
27	GVMC (Part) WARD NO.-0033	21689	15902	8413	7489	5787	2413	3374
28	GVMC (Part) WARD NO.-0034	24265	18055	9738	8317	6210	2533	3677
29	GVMC (Part) WARD NO.-0035	31336	22692	12389	10303	8644	3419	5225
30	GVMC (Part) WARD NO.-0036	16780	13039	6923	6116	3741	1402	2339
31	GVMC (Part) WARD NO.-0037	26513	19254	10590	8664	7259	3006	4253
32	GVMC (Part) WARD NO.-0038	25681	19683	10435	9248	5998	2475	3523
33	GVMC (Part) WARD NO.-0039	29287	23205	12289	10916	6082	2610	3472
34	GVMC (Part) WARD NO.-0040	25987	20795	11275	9520	5192	2062	3130
35	GVMC (Part) WARD NO.-0041	24239	18970	10175	8795	5269	2075	3194
36	GVMC (Part) WARD NO.-0042	23719	19097	9879	9218	4622	1864	2758
37	GVMC (Part) WARD NO.-0043	12434	8492	4700	3792	3942	1627	2315
38	GVMC (Part) WARD NO.-0044	16443	12164	6369	5795	4279	1723	2556
39	GVMC (Part) WARD NO.-0045	33133	26501	16073	10428	6632	2923	3709
40	GVMC (Part) WARD NO.-0046	17957	13311	7186	6125	4646	1866	2780
41	GVMC (Part) WARD NO.-0047	24923	18070	9813	8257	6853	2851	4002
42	GVMC (Part) WARD NO.-0048	25883	19445	10638	8807	6438	2572	3866
43	GVMC (Part) WARD NO.-0049	27234	19103	10638	8465	8131	3147	4984
44	GVMC (Part) WARD NO.-0067	14338	11435	5978	5457	2903	1154	1749
	Total (B)	**977771**	**739414**	**394646**	**344768**	**238357**	**98369**	**139988**
	Pedagantyada Subdistrict							
1	GVMC (Part) WARD NO.-0050	22221	13325	7619	5706	8896	3698	5198
2	GVMC (Part) WARD NO.-0051	21725	14675	8376	6299	7050	2711	4339
3	GVMC (Part) WARD NO.-0052	17422	12907	7224	5683	4515	1770	2745
4	GVMC (Part) WARD NO.-0055	14021	8575	5082	3493	5446	2209	3237
5	GVMC (Part) WARD NO.-0061	3428	2724	1463	1261	704	323	381
6	GVMC (Part) WARD NO.-0062	16474	10900	6081	4819	5574	2241	3333
	Total (C)	**95291**	**63106**	**35845**	**27261**	**32185**	**12952**	**19233**
	Gajuwaka Subdistrict							
1	GVMC (Part) WARD NO.-0045	3125	1901	1139	762	1224	501	723
2	GVMC (Part) WARD NO.-0046	185	174	91	83	11	8	3
3	GVMC (Part) WARD NO.-0050	10387	7111	3959	3152	3276	1428	1848
4	GVMC (Part) WARD NO.-0052	6334	3975	2224	1751	2359	1037	1322
5	GVMC (Part) WARD NO.-0053	21749	15651	8510	7141	6098	2545	3553

S. No.	Name of the Wards	Total Population	Population Literate	Sr.No	Female Literate	Population Illitetrate	Male Illiterate	Female Illiterate
6	GVMC (Part) WARD NO.-0054	15095	13792	7102	6690	1303	532	771
7	GVMC (Part) WARD NO.-0056	18063	12035	6803	5232	6028	2262	3766
8	GVMC (Part) WARD NO.-0057	9325	6229	3481	2748	3096	1231	1865
9	GVMC (Part) WARD NO.-0058	20965	16010	8549	7461	4955	2074	2881
10	GVMC (Part) WARD NO.-0059	17335	13094	7082	6012	4241	1669	2572
11	GVMC (Part) WARD NO.-0060	26775	19669	10722	8947	7106	3027	4079
12	GVMC (Part) WARD NO.-0061	27580	20825	11169	9656	6755	2926	3829
13	GVMC (Part) WARD NO.-0062	7062	4805	2690	2115	2257	912	1345
14	GVMC (Part) WARD NO.-0063	21449	16364	8916	7448	5085	2072	3013
15	GVMC (Part) WARD NO.-0064	24575	17501	9446	8055	7074	3037	4037
16	GVMC (Part) WARD NO.-0065	20419	15711	8625	7086	4708	1808	2900
	Total (D)	**250423**	**184847**	**100508**	**84339**	**65576**	**27069**	**38507**
	Total(A+B+C+D)	**1583677**	**1172066**	**631051**	**541015**	**411611**	**169815**	**241796**

Source: Census of India 2011

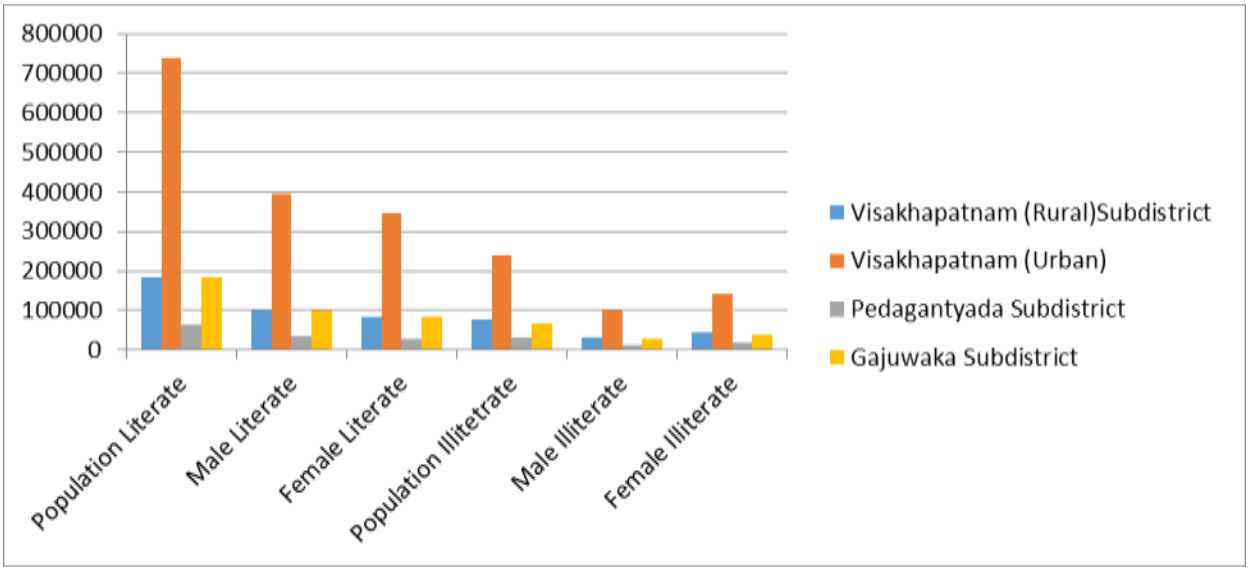


Figure-4.47: Literacy profile in the study area villages

4.10.4 Occupational profile

The details on occupational profile in the study area villages are given in Table-4.35 and Figure-4.48. As per this table it is observed that 35.5% of the total population is engaged in some form of economically productive activity or vocational activity, and have been designated as Total Working population. On the other hand, the Non-workers or persons who are dependent on the population, which is engaged in economically productive work accounts for about 64.5% of the

total population. Among the population that is working about 30.3% has been designated as Main workers while the remaining 5.2% has been designated as Marginal workers.

Table-4.35: Occupational profile in the study area villages

S. No.	Name of the Wards	Total Population	Total Working Population	Main Workers	Marginal Workers	Non Workers
	Visakhapatnam (Rural)Subdistrict					
1	GVMC (Part) WARD NO.-0001	24995	9013	7739	1274	15982
2	GVMC (Part) WARD NO.-0002	21904	7922	6446	1476	13982
3	GVMC (Part) WARD NO.-0003	31387	11254	10031	1223	20133
4	GVMC (Part) WARD NO.-0004	27132	9898	8075	1823	17234
5	GVMC (Part) WARD NO.-0005	43744	16881	13637	3244	26863
6	GVMC (Part) WARD NO.-0006	26227	8902	8104	798	17325
7	GVMC (Part) WARD NO.-0066	28579	9935	8471	1464	18644
8	GVMC (Part) WARD NO.-0067	13190	4569	4080	489	8621
9	GVMC (Part) WARD NO.-0068	26102	9176	7998	1178	16926
10	GVMC (Part) WARD NO.-0069	876	253	236	17	623
11	GVMC (Part) WARD NO.-0072	16056	5636	5019	617	10420
	Total (A)	**260192**	**93439**	**79836**	**13603**	**166753**
	Visakhapatnam (Urban)					
1	GVMC (Part) WARD NO.-0007	25102	10350	7524	2826	14752
2	GVMC (Part) WARD NO.-0008	25118	9242	7513	1729	15876
3	GVMC (Part) WARD NO.-0009	27697	10386	8717	1669	17311
4	GVMC (Part) WARD NO.-0010	26952	10151	7789	2362	16801
5	GVMC (Part) WARD NO.-0011	18093	6508	5732	776	11585
6	GVMC (Part) WARD NO.-0012	21078	7348	6739	609	13730
7	GVMC (Part) WARD NO.-0013	18309	6477	5167	1310	11832
8	GVMC (Part) WARD NO.-0014	21106	7915	6574	1341	13191
9	GVMC (Part) WARD NO.-0015	21878	8208	7056	1152	13670
10	GVMC (Part) WARD NO.-0016	27305	9917	8004	1913	17388
11	GVMC (Part) WARD NO.-0017	26262	9603	8928	675	16659
12	GVMC (Part) WARD NO.-0018	15605	5855	5083	772	9750
13	GVMC (Part) WARD NO.-0019	25527	9318	8446	872	16209
14	GVMC (Part) WARD NO.-0020	22039	7624	7161	463	14415
15	GVMC (Part) WARD NO.-0021	18632	6711	5923	788	11921
16	GVMC (Part) WARD NO.-0022	20013	6917	5847	1070	13096
17	GVMC (Part) WARD NO.-0023	19897	6870	5896	974	13027
18	GVMC (Part) WARD NO.-0024	16597	5757	5256	501	10840
19	GVMC (Part) WARD NO.-0025	18679	6351	5619	732	12328
20	GVMC (Part) WARD NO.-0026	23576	8982	7904	1078	14594
21	GVMC (Part) WARD NO.-0027	19385	7108	6555	553	12277
22	GVMC (Part) WARD NO.-0028	19401	7104	6066	1038	12297
23	GVMC (Part) WARD NO.-0029	17426	6436	4884	1552	10990
24	GVMC (Part) WARD NO.-0030	12696	4744	4180	564	7952
25	GVMC (Part) WARD NO.-0031	21393	7326	6961	365	14067

S. No.	Name of the Wards	Total Population	Total Working Population	Main Workers	Marginal Workers	Non Workers
26	GVMC (Part) WARD NO.-0032	26164	9028	8269	759	17136
27	GVMC (Part) WARD NO.-0033	21689	7321	6427	894	14368
28	GVMC (Part) WARD NO.-0034	24265	8290	7441	849	15975
29	GVMC (Part) WARD NO.-0035	31336	10052	9194	858	21284
30	GVMC (Part) WARD NO.-0036	16780	5823	5044	779	10957
31	GVMC (Part) WARD NO.-0037	26513	9346	8073	1273	17167
32	GVMC (Part) WARD NO.-0038	25681	8589	7973	616	17092
33	GVMC (Part) WARD NO.-0039	29287	9884	9315	569	19403
34	GVMC (Part) WARD NO.-0040	25987	8747	7330	1417	17240
35	GVMC (Part) WARD NO.-0041	24239	8171	7345	826	16068
36	GVMC (Part) WARD NO.-0042	23719	8174	6900	1274	15545
37	GVMC (Part) WARD NO.-0043	12434	4364	3722	642	8070
38	GVMC (Part) WARD NO.-0044	16443	5442	4721	721	11001
39	GVMC (Part) WARD NO.-0045	33133	13928	13037	891	19205
40	GVMC (Part) WARD NO.-0046	17957	6205	5634	571	11752
41	GVMC (Part) WARD NO.-0047	24923	8745	7170	1575	16178
42	GVMC (Part) WARD NO.-0048	25883	8582	7600	982	17301
43	GVMC (Part) WARD NO.-0049	27234	9497	8864	633	17737
44	GVMC (Part) WARD NO.-0067	14338	4818	4310	508	9520
	Total (B)	**977771**	**348214**	**303893**	**44321**	**629557**
	Pedagantyada Subdistrict					
1	GVMC (Part) WARD NO.-0050	22221	7691	6219	1472	14530
2	GVMC (Part) WARD NO.-0051	21725	7415	6119	1296	14310
3	GVMC (Part) WARD NO.-0052	17422	5877	4371	1506	11545
4	GVMC (Part) WARD NO.-0055	14021	4910	4006	904	9111
5	GVMC (Part) WARD NO.-0061	3428	1144	828	316	2284
6	GVMC (Part) WARD NO.-0062	16474	5533	3461	2072	10941
	Total (C)	**95291**	**32570**	**25004**	**7566**	**62721**
	Gajuwaka Subdistrict					
1	GVMC (Part) WARD NO.-0045	3125	1108	1093	15	2017
2	GVMC (Part) WARD NO.-0046	185	79	79	0	106
3	GVMC (Part) WARD NO.-0050	10387	3805	3312	493	6582
4	GVMC (Part) WARD NO.-0052	6334	2277	1642	635	4057
5	GVMC (Part) WARD NO.-0053	21749	7418	5593	1825	14331
6	GVMC (Part) WARD NO.-0054	15095	4947	4203	744	10148
7	GVMC (Part) WARD NO.-0056	18063	6609	4701	1908	11454
8	GVMC (Part) WARD NO.-0057	9325	3441	3055	386	5884
9	GVMC (Part) WARD NO.-0058	20965	7370	6068	1302	13595
10	GVMC (Part) WARD NO.-0059	17335	5722	5118	604	11613
11	GVMC (Part) WARD NO.-0060	26775	9451	7855	1596	17324
12	GVMC (Part) WARD NO.-0061	27580	9484	7611	1873	18096
13	GVMC (Part) WARD NO.-0062	7062	2392	2211	181	4670
14	GVMC (Part) WARD NO.-0063	21449	7444	5985	1459	14005
15	GVMC (Part) WARD NO.-0064	24575	8800	7239	1561	15775

S. No.	Name of the Wards	Total Population	Total Working Population	Main Workers	Marginal Workers	Non Workers
16	GVMC (Part) WARD NO.-0065	20419	7308	5100	2208	13111
	Total (D)	**250423**	**87655**	**70865**	**16790**	**162768**
	Total(A+B+C+D)	**1583677**	**561878**	**479598**	**82280**	**1021799**

Source: Census of India 2001

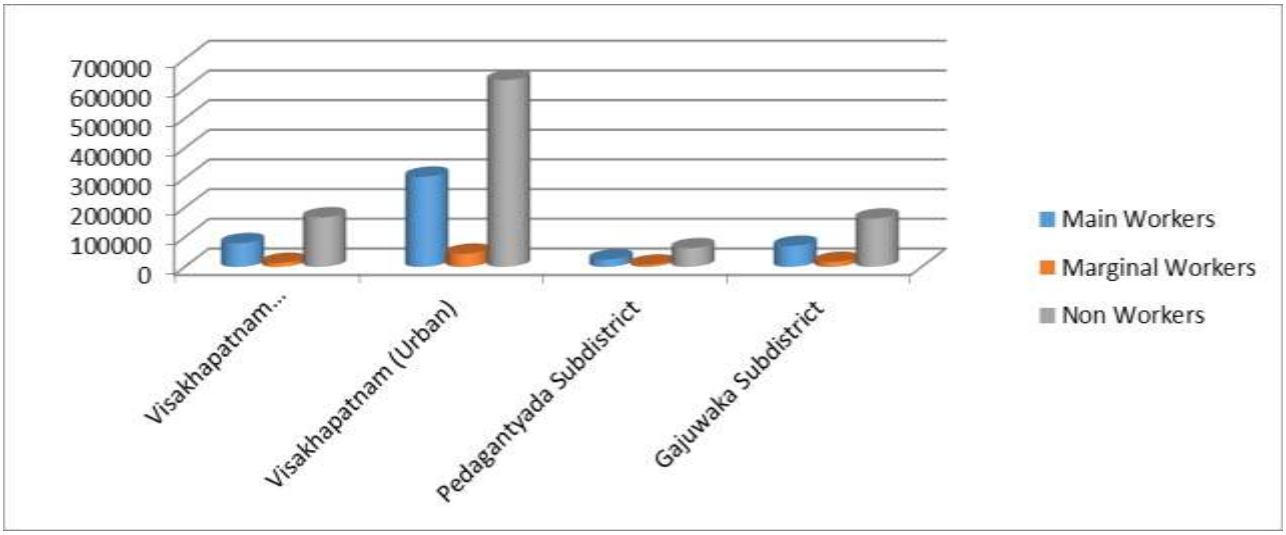


Figure-4.48: Occupational profile in the study area villages

4.11 MEDICAL FACILITIES

Visakhapatnam Port Trust has 80 beded hospital equieped with emergeny medical facilities and ambulances. Total 5 nos of First-Aid Centers are operating in three shifts at working area. Branch Dispensary is operating for 24 hours in the Port. Hospital has two Operation Theatres equipped with medical facilities to deal with an emergency. Clinical laboratory facilities for conducting the Hematological, serological, Bio-chemical and pathological tests. Prevalent disese reported in the Hospital during 2015 is Gastro Entritis (259 cases), Malaria (31 cases), T.B (76 cases). Details of the Medical experts /Doctores at VPT Hospital are given as below:

No of Medical experts / Doctors:

1. Dy.C.M.O (Specialists) 5
2. Sr.C.M.O 5
3. Medical Officers 4
4. M.O (Consolidated) 7

Details of the prevalent diseses as per the records during the year 2014 by District Medical and Health Office Visakhapatnam are given in Table -4.36.

Table 4.36 : Details of the prevalent diseses in Visakhapatnam during the year 2014

Diseases	No. of cases recorded for various diseases at Visakhapatnam												
	Jan 14	Feb14	Mar 14	Apr 14	May 14	June 14	July 14	Aug 14	sep 14	Oct 14	Nov 14	Dec 14	Total
Acute Diarrhoeal Diseases	-	1394		1201	1646	1658	1194	1461	1227	840	1506	1227	13354
Bronchitis	746	627	627	587	702	514	546	1752	746	176	838	781	8642
Emphysema	177	31	31	85	37	38	12	5	177	67	29	29	718
Asthma	1237	1215	1215	1405	1350	1601	1505	1415	1237	179	1756	1801	15916
Pulmonary Tuberculosis	87	-	30	9	27	39	95	53	87	1	90	84	602
Malaria	55	-	10	-	116	899	101	154	55	1	495	473	2359
Dengue Fever	18	-	-	-	-	1	-	12	18	-	48	52	149
Chikun Gunya	32	-	35	-	-	-	-	2	17	-	25	7	118
Helminthiasis	628	-	144	-	643	580	572	570	628	148	598	668	5179
Amoebiasis	319	-	0	-	133	470	373	489	319	76	497	508	3184
Acute Respiratory Infection(Ari)	-	2678	3174	3561	2510	3358	2872	3636	4425	1302	4747	3934	36197
Pneumonia	-	58	41	38	27	7	36	69	32	12	23	21	364
Enteric Fever	-	105	126	160	128	289	165	238	480	27	219	337	2274

4.12 ARCHEOLOGICALLY IMPORTANT SITES

Vishakapatnam has quite a few historically significant places. The ruling regimes in the region broadly fall into Hindu- Buddhist dynasties from 200BC to 1500AD, Mughal period from 1501 to 1700 AD, Native-Colonial rule from 1701 to 1900 AD and British era from 1901 to 1947 AD (Rao, 1925). Based on the relevant nomenclatures adopted by UNESCO universal value to cultural heritages is adopted.

In order to identify various architectural styles among the heritage sites in the inventory, seven relevant architectural styles, viz., British Colonial, Buddhist, Hindu, Indo-Saracenic, Islamic, Lighthouses, and Scientific categories were adopted from among the many common styles prevalent in India (Gupta, 2007). As a result of the inventory, a total of 39 significant heritage sites could be located from Visakhapatnam area and their salient features are summarised in Table-4.37. Visakhapatnam City has about 39 heritage buildings, some of which are being used for Hospitals, Churchs, Schools, Colleges and also for government office. Visakhapatnam Port is in operation since year 1933 and same heritage and residential buildings are located very close to the port. There is no direct evidence of any impact of Port operations on these buildings.

Table 4.37: Details of Heritage sites in Visakhapatnam

S. No	Heritage sites	Heritage typology	Architectural style
Hindu-Buddhist dynasties: 200BC-1500AD			
1.	Sri Varaha Lakshmi Narasimha Swami Temple	Religious architecture	Hindu
Mughal period: 1501-1700AD			
2.	Dutch Cemetery	Religious-cum-commemorative architecture	British Colonial
3.	Hazarat Syed Ali Ishak Madani Dargah	Religious-cum-commemorative architecture	Islamic
Native-Colonial rule: 1701-1900AD			
4.	District Collector's Office	Public buildings	
5.	Guard Post	Military architecture	Indo-Saracenic
6.	Jagannadha Swamy Temple	Religious architecture	Hindu
7.	M.S.V. Regimental Lines Cemetery	Religious-cum-commemorative architecture	British Colonial
8.	Mrs. A.V.N. College	Educational institutions Residences	Indo-Saracenic
9.	Railway Bungalows	Residences	British Colonial
10.	Railway Guest House	Residences	British Colonial

S. No	Heritage sites	Heritage typology	Architectural style
11.	Sri Kasi Visweswara Swamy Temple	Religious architecture	Hindu
12.	Sri Sitarama Swamy Temple	Religious architecture	Hindu
13.	St. Ann's Cathedral	Religious architecture	British Colonial
14.	St. John's Church	Religious architecture	British Colonial
15.	St. Joseph's Church	Religious architecture	British Colonial
16.	St. Joseph's Girls High School	Educational institutions	British Colonial
17.	St. Paul's Church	Religious architecture	British Colonial
18.	Visakha Museum	Residences	British Colonial
British era: 1901-1947AD			
19.	District Court	Public buildings	British Colonial
20.	Hamilton Memorial Masonic Temple	Public buildings	British Colonial
21.	Hawa Mahal	Residences	British Colonial
22.	J.V.D. College of Science and Technology	Educational institutions	British Colonial
23.	King Edward VII Market	Trade	British Colonial
24.	King George Hospital	Public buildings	British Colonial
25.	Kurupam Tomb	Commemorative architecture	Indo-Saracenic
26.	Light House (Park Hotel)	Transport systems	Lighthouses
27.	Light House (Sand Hill)	Transport systems	Lighthouses
28.	Light House (St. Aloysius)	Transport systems	Lighthouses
29.	M.S.G. Row Hindu Reading Room	Developing knowledge	Indo-Saracenic
30.	Municipal Office	Public buildings	British Colonial
31.	Queen Victoria Pavilion	Commemorative architecture	Indo-Saracenic
32.	Rani Chandramani Devi Palace	Palaces	British Colonial
33.	Sacred Heart Church	Religious architecture	British Colonial
34.	St. Aloysius Church	Religious architecture	British Colonial
35.	Sun Dial (Andhra University)	Developing technologies	Scientific
36.	T.L.N. Reddy Sabha	Developing knowledge	British Colonial
37.	Turner's Choultry	Domestic habitat	Indo-Saracenic British
38.	Victoria Jubilee Town Hall	Public-cum-Recreational buildings	British Colonial
39.	Waltair Club	Recreational architecture	British Colonial

CHAPTER-5
ASSESSMENT OF IMPACTS

CHAPTER-5
ASSESSMENT OF IMPACTS

5.1 INTRODUCTION

Based on the project details and the baseline environmental status, potential impacts that are expected to accrue as a result of the proposed project have been identified. The assessment for quite a few disciplines is subjective in nature and cannot be quantified. Wherever possible, the impacts have been quantified. However, for non-tangible impacts, a qualitative assessment has been done so as to formulate appropriate management measures for them as well. This Chapter deals with anticipated positive as well as negative impacts due to the construction and operation of the proposed works in Visakhapatnam Port. As a part of the study, impacts on various aspects of environment have been assessed. The impacts have been categorised for construction as well as operation phases.

5.2 IMPACTS DUE TO UP-GRADATION OF EXISTING FACILITY AND CREATION OF NEW FACILITY

5.2.1 Construction Phase

a) Impacts due to quarrying operation

The proposed project would require significant amount of construction material. The fine and the coarse aggregates required for the construction activities are proposed to be excavated from local quarries or borrow pits. During construction phase, runoff from these sites would increase soil erosion from such sites. If such sites are left untreated after excavation of construction material, then rainwater is likely to get stored in these sites, which are then likely to serve as breeding habitats for mosquitoes. This can lead to increased incidence of malaria in and around these sites.

b) Impacts due to effluents from labour camps

During construction phase, peak labour requirement has been estimated as 250 workers, of which 50% are likely to reside near the project site and rest will come from nearby villages. A small labour camp/colony needs to be constructed for about 125 labour families. Considering family size as 4, the increase in the population is expected to be of the order of 500. The total water requirement has been estimated as 73.12m^3/day. The details are given in Table-5.1.

Table-5.1: Domestic water requirements at labour camps

Category	Per capita water requirement (lpd)	Population	Total water requirement (m^3/day)
Population at labour camp	135(	500	67.50
Staff	45	125	5.62
Total			**73.12**

The sewage generated is normally taken as 80% of the total water requirement. Thus, the sewage generated would be of the order of (0.8 x 73.12) 58.50 m^3/day. The disposal of sewage without treatment could lead to significant problems related to water pollution and public health.

The disposal of sewage without treatment can cause problems of odour and water pollution. The typical composition of untreated sewage is given in Table-5.2.

Table-5.2: Typical composition of untreated sewage

Parameters	**Value**
Total Solids, mg/l	720
Total Dissolved Solids, mg/l	500
Total Suspended Solids, mg/l	220
BOD mg/l	220
Oil and grease, mg/l	100
Alkalinity (as $CaCO_3$), mg/l	100
Total Phosphorus, mg/l	80
Total Nitrates, mg/l	40
Bicarbonates, mg/l	100
Carbonates, mg/l	10
Nitrates, mg/l	40
Phosphates, mg/l	40
Chlorides, mg/l	50
Sulphates, mg/l	30
Calcium, mg/l	40
Magnesium, mg/l	40
Potassium, mg/l	15
Sodium, mg/l	70

It is clear from Table-5.2 that BOD is the major pollutant, as far as sewage is concerned. Normally untreated sewage would find its way to natural drainage system which ultimately confluences into the sea. However, these natural drains are seasonal in nature and are likely to remain dry in the non-monsoon months. During this period, the flow of untreated sewage from the labour colonies in these drains can lead to development of anaerobic conditions, with associated odour problems.

VPT is operating a 10 mld sewage treatment plant to treat the sewage generated from the city. The sewage generated from labour camps and construction site shall be transported to the STP and treated along with the city's sewage.

c) Impacts due to Dredging

The total quantity of dredged material likely to be generated in the proposed project has been estimated as 8,66,249 m^3 of which 1,84,000 m^3 will be generated due to up-gradation of existing facility and creation of new facilities. The potential environmental effects of dredging can be categorized as impacts due to dredging process itself and those due to disposal of the dredged

material. During the dredging process, adverse impacts are anticipated on account of excavation of sediments at the bed, loss of material during transport to the surface, overflow from the dredger whilst loading and loss of material from the dredger and/or pipelines during transport.

The evaluation of the environmental effects of dredging and disposal must take account of both the short-term and long-term effects that may occur both at the site of dredging or disposal (near field) and the surrounding area (far field). Near field effects are simply defined as 'phenomena occurring within the geographic bounds of the activity, or less than approximately 1 km from the activity', and far field effects as 'occurring more than approximately 1 km from the activity'.

Impacts on Suspended sediments and turbidity levels

When dredging and disposing of non-contaminated sediments, the key impacts are the increase in suspended sediments and turbidity levels. Any dredging method releases suspended sediments into the water column, during excavation itself and during the flow of sediments from hoppers and barges. In many cases, locally increased suspended sediments and turbidity associated with dredging and disposal is obvious from the turbidity 'plumes' which may be seen trailing behind dredgers or disposal sites.

Increase in suspended sediments and turbidity levels from dredging and disposal operations may under certain conditions have adverse effects on marine animals and plants by reducing light penetration into the water column and by physical disturbance.

Increased suspended sediments can affect young fish, if suspended sediments become trapped in their gills Increased fatalities of young fish have been observed in highly turbid water. Adult fish are likely to move away from or avoid areas of high suspended solids, such as dredging sites, unless food supplies are increased as a result of increases in organic material. The increase in turbidity could marginally affect the fisheries in the area.

The increase in turbidity results in a decrease in the depth that light is able to penetrate the water column which may affect submerged plants, by temporarily reducing productivity and growth rates. Since, benthic fauna is not well developed in the areas, hence impacts on this account is not expected to be significant. The degree of resuspension of sediments and turbidity during dredging and disposal depends on:

- sediments being dredged (size, density and quality of the material)
- method of dredging (and disposal)
- hydrodynamic regime in the dredging and disposal area (current direction and speed, mixing rate, tidal state) and

- existing water quality and characteristics (background suspended sediment and turbidity levels).

In most cases, sediment suspension is only likely to present a potential problem if it is moved out of the immediate dredging location by tidal processes. In general, the effects of suspended sediments and turbidity are generally short term (<1 week after activity) and near-field (<1km from activity). These are of concern only, if sensitive species are located in the vicinity of the maintained channel. Since, no sensitive species are observed in the areas to be dredged, hence, no adverse impacts are anticipated.

Impacts on marine water quality

Redox potential (eH) and pH are two variables that control the characteristics of chemicals and heavy metals in water and sediment. As long as the pH remains around 8 and eH < 150 mV, most of the chemicals and metals will remain bound to the solid phase without being released into the surrounding water. Only anoxic conditions reduce the eH below this level and hence if dissolved oxygen level is normal no leaching of chemicals and heavy metals will occur.

In the present survey sites pH ranged from 8.1 to 8.5 and Dissolved Oxygen ranged from 3.8 to 5.2 mg/l. At sampling station VPT 3, the DO level was observed to be 3.8 mg/l in surface and 4.0 mg/l in sub-surface water samples. Moreover, sediment samples collected from all the sites were uncontaminated. The causes for low DO level need to be ascertained at the project site and suitable mitigation measures be undertaken. As such no adverse impact due to dredging or dumping on the chemical characteristics of water or sediment is expected.

d) Impacts due to dredging and disposal of organic matter and nutrients

The release of organic rich sediments during dredging or disposal can result in the localised removal of oxygen from the surrounding water. Depending on the location and timing of dredging, this may lead to the suffocation of marine animals and plants within the localised area or may deter migratory fish or mammals from passing through. However, removal of oxygen from the water is only temporary, as tidal exchange would quickly replenish the oxygen supply. Therefore, in most cases where dredging and disposal is taking place in open coastal waters, this localized removal of oxygen has little, if any, effect on marine life. The dispersion modelling for proposed dumping site has been carried out by the CWPRS and shall be discussed in the EMP chapter.

e) Impacts due to contaminated sediments

Another possible impact is the release of toxicants from the sediment if the sediment is contaminated. In the case of contaminated sediment acute toxicity, chronic toxicity and bioaccumulation are the possible effects. But all these are short term and insignificant and no serious effects have been reported from any earlier instances or experimental studies.

In various sampling locations covered as a part of the study, sediment samples analyzed did not show the presence of any appreciable levels of contamination and hence may not pose any such problems. In addition to that the radio-active tracer study has been conducted by Babha Atomic Research Centre (BARC) and shall be discussed in the EMP Chapter.

f) Impacts due to increase in noise levels

The major sources of noise during construction phase are due to operation of various construction equipments. The noise levels generated by various construction equipment are given in Table-5.3. Under the worst case scenario, considered for prediction of noise levels during construction phase, it has been assumed that equipment required during construction phase is operating at a common point. Likewise, to predict the worst case scenario, attenuation due to various factors too has not been considered during noise modelling.

Table-5.3 : Average noise levels generated by the operation of various construction equipment

Equipment	Noise level (dB(A))
Batching Plant	90
Transit mixer	75
Winch-7.5 t capacity	75
Generator	85
Hydraulic Rig	85
Compressor	80
Hydra 12/15t	80
Wibro hammer	80
Bentonite pump	85
Concrete mixer	75
JCB-3D	85
Trailor	85
Excavator	80
Dumper	85
EoT cranes	80
Ordinary cranes	75

Modeling studies were conducted to assess the increase in noise level due to operation of various construction equipment, and the results of this exercise are given in Table-5.4. It would be worthwhile to mention here that in absence of the data on actual location of various construction equipment, all the equipment have been assumed to operate at a common point.

This assumption leads to over-estimation of the increase in noise levels. Also, it is a known fact that there is a reduction in noise level as the sound wave passes through a barrier.

Table-5.4: Predicted noise levels due to the operation of various construction equipment

Distance (m)	Ambient noise level (dB(A))	Increase in noise level due to construction activities (dB(A))	Noise level due to construction activities (dB(A))	Increase in ambient noise level due to construction activities (dB(A))
30	45	70	70	25
50	45	66	66	21
100	45	60	60	15
200	45	54	55	10
500	45	46	49	4
1000	45	36	46	1
1500	45	36	45.5	0.5
2000	45	34	45	-

Walls of various houses or other structure will attenuate at least 30 dB(A) of noise. In addition there is noise attenuation due to the following factors.

- Air absorption
- Rain
- Atmospheric inhomogeneties.
- Vegetal cover

Thus, no increase in noise levels are anticipated as a result of various activities, during the project construction phase due to the following:

- assumption that all equipment are operating from a common point leads to over-estimation of increase in noise level
- attenuation of 30 dB(A) of noise by wall of any structure
- noise attenuation due to various factors.

Impacts of noise on labour population

The effect of high noise levels on the operating personnel, has to be considered as this may be particularly harmful. It is known that continuous exposures to high noise levels above 90 dB(A) affects the hearing acuity of the workers/operators and hence, should be avoided. To prevent these effects, it has been recommended by Occupational Safety and Health Administration (OSHA) that the exposure period of affected persons be limited as in Table-5.5.

Table-5.5: Maximum Exposure Periods specified by OSHA

Maximum equivalent continuous Noise level dB(A)	Unprotected exposure period per day for 8 hrs/day and 5 days/week
90	8
95	4
100	2

Maximum equivalent continuous Noise level dB(A)	Unprotected exposure period per day for 8 hrs/day and 5 days/week
105	1
110	½
115	¼
120	No exposure permitted at or above this level

The noise levels during various construction activities have been compared to various standards prescribed by Occupational Safety and Health Administration (OSHA), which are being implemented in our country through rules framed under Factories Act. It can be observed (Refer Table-5.5) that for an 8 hour duration, equivalent noise level exposure should be less than 90 dB(A).

g) Impacts on air quality

Impacts due to operation of construction equipment

The major pollutant in the construction phase is SPM being air-borne due to various construction activities. The vehicular movement generates pollutants such as NOx, CO and HC. But, the vehicular pollution is not expected to lead to any major impacts. The fugitive emissions due to vehicular movement will be 8 to 12 kg/km travelled by the vehicle. The soils in the project area are sandy in texture, and are likely to generate substantial quantities of dust. However, the fugitive emissions generated due to vehicular movement are not expected to travel beyond a distance of 50 to 100 m. The wind blown dust is also likely to be substantial of the project site, hence especially during the summer months.

The combustion of diesel in various construction equipment could be one of the possible sources of incremental air pollution during the construction phase.

The quantum of diesel consumed is not high to cause any significant impact on ambient air quality. Thus, the operation of construction equipment is not expected to have any major impact on the ambient air quality as a result of the project.

Impacts due to transportation of construction materials

Vehicular movement from the transportation of construction material in the area is likely to increase temporarily during the construction period. The increase in number of trucks carrying construction material is expected to be in the range of 25 to 30 per day. The quantum of increased vehicular traffic is not expected to cause any significant impact on ambient air quality. However, it is a common practice that many a times, the trucks carrying construction materials are plying uncovered, leading to generator of emissions as they travels. This activity can lead to entrainment of fugitive emissions. However, impact on this account is not expected to be significant and is likely to effect a small strip along both the sides of road network, over which

the trucks carrying construction materials are plying. Appropriate management measures have been suggested as a part of Environmental Management Plan outlined in Chapter-6 of this report.

h) Impacts on marine ecology

The project area has moderate productivity. There are no sites of ecological significance in and around the project area. Likewise, no spawning ground was observed near proposed sites. There will be large scale dredging in the area to increase the width and depth of the navigation channel. As a result of dredging, significant impacts on marine ecology are anticipated. In the areas to be dredged, the existing marine life would be adversely affected. The area to be dredged recolonizes in short duration, after the cessation of dredging activities. However, these areas would have regular ship traffic, which leads to significant disturbance as compared to the pre-project status. This means that though the dredged stretches are likely to get recolonized, the ecology is not expected to develop upto the pre-project levels.

Impacts on benthic organisms

The dredging and dumping generally affect the benthos. These are related to removal of the benthic organisms from the dredging site and burial of benthic organisms at the dumping site. The dredged material takes away most of the benthos along with it and while dumping it most of the organisms present are buried under the deposited material. This will result in reduced number and diversity of benthic organisms at the dumping site. However, earlier studies show that the dredged site and dumping sites will be colonized by benthic organisms within a very short time. Moreover biomass and diversity of benthos will also be restored to the earlier level within a very short time.

During all dredging operations, the removal of material from the sea bed also removes the animals living on and in the sediments (benthic animals). With the exception of some deep burrowing animals or mobile surface animals that may survive a dredging event through avoidance, dredging may initially result in the complete removal of animals from the excavation site. Since, the significant macro-and meio-fauna is not developed in the area, hence dredging is not expected to lead to significant adverse impacts.

The density of macro-benthos ranged from 950 to 1850 No./10 cm^2. 40 species of macro-benthos were present in the sediment samples collected from various sites. Macro-benthos was dominated by Polychaetes followed by Crustaceans and gastropods. The abundance of meio-benthos ranged from 278 to 380 no./10 cm^2. The meio-benthos were dominated by Foraminiferaces followed by Nematodae.

The recovery of disturbed habitats following dredging ultimately depends upon the nature of the new sediment at the dredge site, sources and types of re-colonising animals, and the extent of the disturbance. In soft sediment environments recovery of animal communities generally occurs relatively quickly and a more rapid recovery of communities has been observed in areas exposed to periodic disturbances, such as maintained channels. Thus, in area under maintenance dredging in subsequent years, the recovery of benthic organisms is not expected to be significant.

A review of dredging works in coastal areas world-wide showed that the rates of recovery of benthic communities following dredging in various habitats varied greatly and the details are given in Table-5.6.

Table-5.6: Rates of recovery of benthic communities in various coastal areas

Location	Habitat type	Recovery time
Coos Bay, Oregon	Disturbed Muds	4 weeks
Gulf of Cagaliari, Sardinia	Channel muds	6 months
Mobile Bay, Alabama	Channel muds	6 months
Goose Creek, Long Island	Lagoon muds	>11 months
Klaver Bank, North Sea	Sands-gravels	1-2 years
Chesapeake Bay	Muds-sands	18 months
Lowestoft, Norfolk	Gravels	>2 years
Dutch coastal waters	Sands	3 years
Boca Ciega Bay, Florida	Shells-sands	10 years

Recovery rates were most rapid in highly disturbed sediments in estuaries that are dominated by opportunistic species. In general, recovery times increase in stable gravel and sand habitats dominated by long-lived components with complex biological interactions controlling community structure. Thus, in the dredging sites of the proposed project, texture of the sediments is mainly clayey, hence, recovery time is expected to be relatively quick.

Sediments dispersed during maintenance dredging and disposal may resettle over the seabed and the animals and plants that live on and within it. This blanketing or smothering of benthic animals and plants, may cause stress, reduced rates of growth or reproduction and in the worse cases the effects may be fatal. Generally sediments settle within the vicinity of the dredged area, where they are likely to have little effect on the recently disturbed communities, particularly in areas where dredging is a well-established activity. Benthic fauna did not contain any rare or endangered species and consisted of common species only. It can be expected that these species will colonize within a short time from dislodging.

Hence, impacts on this account are not expected to be significant in areas to be covered under maintenance dredging. However, in other areas to be dredged, too, settlement of suspended

sediments will be just after they have been freshly disturbed, hence, adverse impacts on this account are not anticipated.

Impact on phytoplankton and primary productivity

Biomass of phytoplankton depends mainly on the availability of light in nutrient rich waters. Dredging and disposal may lead to increased turbidity and consequent reduction of light penetration for short periods. This may affect primary productivity and plankton biomass. However, turbidity due to dredging and dumping will be observed only in a localised area and only for a very short duration. Hence these impacts are not of any concern.

i) Impacts on fisheries

The most important impact on fishes may be suspended solid load or changes in the food chain. The high turbidity due to heavy suspended solid load during dredging or disposal of dredged materials results in clogging of gills of fishes thereby causing asphyxiation. But since fishes are free swimming they very well avoid such areas and move to safer areas. Once the turbidity is over due to currents, they come back to the area. Due to this capability of the fishes there is virtually no impact on fishes and fisheries by dredging and disposal. The study also did not show the existence of breeding grounds for fisheries.

J) Impacts on Land use Pattern of the Area

All the project activities envisaged in the present project are located within the existing Visakhapatnam Port. No additional land is proposed to be acquired for the project. However, during construction phase, lot of ancillary developments like shops, restaurant, repair shops, etc. would develop around the Visakhapatnam port area. This will lead to conversion of barren land into commercial use. However, since, the proposed project activities are located in an existing port, the extent of impacts on this account shall be marginal.

h) Impacts on Socio-Economic Environment

The role of any industrial development is to be evaluated not only by its impact on the ecosystem but also by its contribution to the improvement in the quality of life. Economic benefits of a port are manifold significant positive impacts are expected during construction phase of the proposed project, as it will lead to mushrooming of allied business activities, which provide an impetus to overall development of the area. Some of the locals will get direct employment in project construction activities or indirect employment due to mushrooming of allied business activities.

Impacts due to labour camps

The construction phase of the port is likely to expand over a period 24 months and will require good amount of labour force. There might be pressure on the local resources and other

infrastructure facility due to the migrant labourers. Some of locals would be employed, mainly in unskilled or semi-skilled category, however, in case of labourers with specific skills, from outside the region is recruited, it would be in limited number. During construction phase, about 250 workers are likely to reside near the project site. Labour camps will be constructed for the migrant labourers. It is proposed to provide basic amenities like safe drinking water and sanitation facilities in the labour camps. Therefore no significant pressure on local infrastructure is envisaged.

Impact on local economy

The construction phase would lead to generation of temporary employment opportunities such as requirement of manpower/vessels to trans-ship the materials, ground clearing, road laying works etc. These activities would temporarily increase the income levels of the local population.

5.2.2 Impacts during Project Operation Phase

a) Entrainment of fugitive emissions

The following additional solid cargo is proposed to be handled at the facilities being developed in the Visakhpatnam port:

- Iron ore
- Container cargo
- Bulk Cargo

The cargo to be handled in proposed port will not generate significant amount of fugitive emission. The entire operation would be handled in dry state is closed conveyor system. Thus, no air pollution is envisaged.

b) Generation of Garbage at Port

The other problem envisaged during operation phase could be the disposal of garbage. This could comprise floating materials, packaging, polythene or plastic materials. Garbage accumulated on the deck is also problematic and should be suitably disposed.

The solid waste in the proposed project could also be generated mainly from three sources viz. institutional/ office waste, domestic waste and waste from cargo handling etc.

The office waste in the proposed project could be in the form of packing material, cardboard, etc. which is not expected to be significant. The same is proposed to be routinely collected and are disposed as per the prescribed Municipal Solid Waste (MSW) Rules.

c) Environmental impact from ship traffic

During the operational phase with additional facilities there will be increased activities of ship movement in the region. All these activities may have impacts on marine lives. Possible sources of such impacts on marine environment would be from;

- Accidental Oil Spill from the calling ships
- Ballast water
- Illegal tank washing
- Ship grounding, physical damage of bottom community
- Anchoring
- Discharges of sewage from vessels
- Discharge from solid waste

Ship traffic poses a risk of oil pollution from the following sources:

- Small spills caused by the accidental or international release of oil-contaminated bilge water from freights
- Minor spills caused by release of bunker oil during terminal operations
- Major spills caused by the rupture of a bunker oil tank in a bulk/cargo vessel collision, ship wreck of a bulk/cargo vessel

Marine environmental implications during routine operations at the harbour could be due to the following cases.

- Escapement of cargo during loading/unloading operations
- Release of wastes generated from the ships including garbage, solid waste, oily ballast and bilge water as well as swage
- Wastes generated at the port terminal such as domestic wastewater, effluent from the grit/oil separator and garbage

d) Material handling

The present system of iron ore handling through semi mechanized process has the capacity to handle less than 12000 Tonnes of iron ore. The Port has a commitment to Andhra Pradesh Pollution Control Board (APPCB) to mechanize the iron ore handling system. Further, the bulk handling is to be done in a phased manner to address environmental concerns**.** . A receiving conveyor system with a rated capacity of 3000 TPH compatible with the wagon unloading from tippler house to the stockyard is proposed as a part of the project. The proposed system will reduce the fugitive emissions. Hence, the proposed expansion and modernisation is not expected to cause any significant adverse impacts and will be beneficial for the environment.

e) Impacts due to noise on project staff

No adverse impacts on noise environment are anticipated due to the proposed project. During construction phase, there could be high noise levels due to operation of various construction equipments. Fitting of exhaust mufflers and intake mufflers could reduce the noise from air compressors. It is very useful for reducing the low frequency noise levels. Chassis and engine structural vibration noise can be dealt with by isolating the engine from the chassis and by the fitting of covers over various sections of engines.

During project operation phase also, the major source of noise could be due to operation of various equipment. As a part of the environment protection activities, trees and ornamental horticultural trees and shrubs have been developed around the project area, which will attenuate noise levels to a certain extent. It is recommended that workers operating various equipments during project construction and operation phases are provided with ear plugs.

f) Impacts due to noise on fisheries

There are very few studies on the impact of aquatic noise on the marine animals. The marine animals can sense the noise in the infrasonic range between 5 and 35 cycles/second which is much different from the human audible range (20-20,000 cycles/second). Most of the work on noise pollution has been done in the audible frequencies. However, US Navy have done some work on the detection of submarines through the movement of Dolphins and fish species. However, most of the data is classified. It is more or less certain that quite a few of the aquatic animals, especially Dolphins, communicate amongst themselves in the infrasonic range. The articulation of fishes, sharks, etc. have not been much studied but it is likely that some of them can communicate in the same range. Noise generated by ship movement may interfere with their communication lines. It has been reported that ship movement may scare some of the fishes and their immediate reaction is restricted to avoid the area. However, as soon as the ship passes that area, they return. Therefore, it is apparent that the impact of ship movement on noise levels is purely temporary and may cause only marginal impact on the marine fauna especially fish. Quantification of such impact is not possible mainly because of our lack of knowledge on the effect of noise on fishes and the noise level measurement is carried out in the audible and ultrasonic range.

g) Spillage of solid cargo

The impact of accidental release of solid cargo, particularly during rough weather, can take place. However, it would have limited impact on the environment. However, the port operations may be hampered if the ship is damaged or the cargo goes overboard that could risk navigation. The escapement of bulks such as iron ore, bulk cargo and container cargo during unloading is not expected to cause any serious impact, as they are non-toxic. Thus, no major impact on marine ecology is anticipated on account of spillage of solid cargo.

h) Ships generated wastes

The four basic categories of wastes generated by ships are as follows:

- Oily waste which usually consists of some oil mixed with larger quantities of sea water, but also fuel residues and sludges.

- Remains of noxious liquid substances carried in bulk in parcel tankers, dry bulk carriers or in portable containers.
- Sewage generated by crew.
- Garbage originating from the crew, the maintenance of the ship, cargo etc.

The International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 (MARPOL 73/78) prohibit all ships from discharging wastes at sea which could result in pollution of the marine environment. MARPOL 73/78 applies to oil tankers, cruise ships, general cargo and container vessels, tugs, ferries, yachts and small pleasure craft.

MARPOL 73/78 requires that ships retain all the wastes on board until reaching port. However, certain wastes can be discharged under certain conditions such as the distance from shore, the type of waste and the condition of the waste (e.g., ground foodstuffs). Plastics of any kind cannot be discharged anywhere. The vessels must be equipped with dedicated holding tanks for sewage and oily wastes and have the capacity to compact and store garbage.

5.3 IMPACTS DUE TO DEVELOPMENT OF WEST QUAY NORTH (WQ-7 & WQ-8)

5.3.1 Construction Phase

a) Impacts due to quarrying operation

The proposed project would require significant amount of construction material. The fine and the coarse aggregates required for the construction activities are proposed to be excavated from local quarries or borrow pits. During construction phase, runoff from these sites would increase soil erosion from such sites. If such sites are left untreated after excavation of construction material, then rainwater is likely to get stored in these sites, which are then likely to serve as breeding habitats for mosquitoes. This can lead to increased incidence of malaria in and around these sites.

b) Impacts due to effluents from labour camps

During construction phase, peak labour requirement has been estimated as 150 workers, of which 50% are likely to reside near the project site and rest will come from nearby villages. A small labour camp/colony needs to be constructed for about 75 labour families. Considering family size as 4, the increase in the population is expected to be of the order of 300. The total water requirement has been estimated as 44 m^3/day. The details are given in Table-5.7.

Table-5.7: Domestic water requirements at labour camps

Category	Per capita water requirement (lpd)	Population	Total water requirement (m^3/day)
Population at labour camp	135	300	40.50
Staff	45	75	3.37
Total			**43.87 say 44 m^3/day**

The sewage generated is normally taken as 80% of the total water requirement. Thus, the sewage generated would be of the order of (0.8 x 44) 35.20 m^3/day. The disposal of sewage without treatment could lead to significant problems related to water pollution and public health. The sewage generated from labour camps and construction site shall be transported to the STP and treated along with the city's sewage.

c) Impacts due to Dredging

The total quantity of dredged material likely to be generated in the proposed project has been estimated as 8,66,249 m^3 of which 1,86,225 m^3 will be generated due to Development of Water Quay 7&8 berths**.** The potential environmental effects of dredging can be categorized as impacts due to dredging process itself and those due to disposal of the dredged material. During the dredging process, adverse impacts are anticipated on account of excavation of sediments at the bed, loss of material during transport to the surface, overflow from the dredger whilst loading and loss of material from the dredger and/or pipelines during transport.

The evaluation of the environmental effects of dredging and disposal must take account of both the short-term and long-term effects that may occur both at the site of dredging or disposal (near field) and the surrounding area (far field). Near field effects are simply defined as 'phenomena occurring within the geographic bounds of the activity, or less than approximately 1 km from the activity', and far field effects as 'occurring more than approximately 1 km from the activity'. The dumping site for the dredged material has been selected based on the Radio-Active Tracer (RAT) study carried out by Bhabha Atomic research Centre (BARC) and CWPRS

Impacts on Suspended sediments and turbidity levels

When dredging and disposing of non-contaminated sediments, the key impacts are the increase in suspended sediments and turbidity levels. Any dredging method releases suspended sediments into the water column, during excavation itself and during the flow of sediments from hoppers and barges. In many cases, locally increased suspended sediments and turbidity associated with dredging and disposal is obvious from the turbidity 'plumes' which may be seen trailing behind dredgers or disposal sites.

Increase in suspended sediments and turbidity levels from dredging and disposal operations may under certain conditions have adverse effects on marine animals and plants by reducing light penetration into the water column and by physical disturbance.

Increased suspended sediments can affect young fish, if suspended sediments become trapped in their gills Increased fatalities of young fish have been observed in highly turbid water. Adult fish are likely to move away from or avoid areas of high suspended solids, such as dredging

sites, unless food supplies are increased as a result of increases in organic material. The increase in turbidity could marginally affect the fisheries in the area.

The increase in turbidity results in a decrease in the depth that light is able to penetrate the water column which may affect submerged plants, by temporarily reducing productivity and growth rates. Since, benthic fauna is not well developed in the areas, hence impacts on this account is not expected to be significant. The degree of resuspension of sediments and turbidity during dredging and disposal depends on:

- sediments being dredged (size, density and quality of the material)
- method of dredging (and disposal)
- hydrodynamic regime in the dredging and disposal area (current direction and speed, mixing rate, tidal state) and
- existing water quality and characteristics (background suspended sediment and turbidity levels).

In most cases, sediment resuspension is only likely to present a potential problem if it is moved out of the immediate dredging location by tidal processes. In general, the effects of suspended sediments and turbidity are generally short term (<1 week after activity) and near-field (<1km from activity). These are of concern only, if sensitive species are located in the vicinity of the maintained channel. Since, no sensitive species are observed in the areas to be dredged, hence, no adverse impacts are anticipated.

Impacts on marine water quality

Redox potential (eH) and pH are two variables that control the characteristics of chemicals and heavy metals in water and sediment. As long as the pH remains around 8 and eH < 150 mV, most of the chemicals and metals will remain bound to the solid phase without being released into the surrounding water. Only anoxic conditions reduce the eH below this level and hence if dissolved oxygen level is normal no leaching of chemicals and heavy metals will occur.

In the present survey sites pH ranged from 8.1 to 8.5 and Dissolved Oxygen ranged from 3.8 to 5.2 mg/l. At sampling station VPT 3, the DO level was observed to be 3.8 mg/l in surface and 4.0 mg/l in sub-surface water samples. There is no possibility of any of the chemicals or metals being leached into the water. Moreover, sediment samples collected from all the sites were uncontaminated. As such, no adverse impacts due to dredging or dumping on the chemical characteristics of water or sediment is expected.

d) Impacts due to dredging and disposal of organic matter and nutrients

The release of organic rich sediments during dredging or disposal can result in the localised removal of oxygen from the surrounding water. Depending on the location and timing of dredging, this may lead to the suffocation of marine animals and plants within the localised area

or may deter migratory fish or mammals from passing through. However, removal of oxygen from the water is only temporary, as tidal exchange would quickly replenish the oxygen supply. Therefore, in most cases where dredging and disposal is taking place in open coastal waters, this localized removal of oxygen has little, if any, effect on marine life. The dispersion modelling for dumping the dredging materials has been carried out by the CWPRS based on the survey conducted in the year 2015.

e) Impacts due to contaminated sediments

Another possible impact is the release of toxicants from the sediment if the sediment is contaminated. In the case of contaminated sediment acute toxicity, chronic toxicity and bioaccumulation are the possible effects. But all these are short term and insignificant and no serious effects have been reported from any earlier instances or experimental studies.

In various sampling locations covered as a part of the study, sediment samples analyzed did not show the presence of any appreciable levels of contamination and hence may not pose any such problems. Babha Atomic Research Centre (BARC) has carried out Radio-Active Tracer study and concluded that the site is suitable for the dumping of dredged material.

f) Impacts due to increase in noise levels

The major sources of noise during construction phase are due to operation of various construction equipments. The noise levels generated by various construction equipment are given in Table-5.8. Under the worst case scenario, considered for prediction of noise levels during construction phase, it has been assumed that equipment required during construction phase is operating at a common point. Likewise, to predict the worst case scenario, attenuation due to various factors too has not been considered during noise modelling.

Table-5.8 : Average noise levels generated by the operation of various construction equipment

Equipment	Noise level (dB(A))
Floating pontoon with mixer machine and crane	70
Winch machine	80
Transit mixer	75
Dumpers	75
Generators	85
Batching plant	90
Dredger	85
Booster pumps	85

Modelling studies were conducted to assess the increase in noise level due to operation of various construction equipment, and the results of this exercise are given in Table-5.9. It would be worthwhile to mention here that in absence of the data on actual location of various construction equipment, all the equipment have been assumed to operate at a common point.

This assumption leads to over-estimation of the increase in noise levels. Also, it is a known fact that there is a reduction in noise level as the sound wave passes through a barrier.

Table-5.9. Predicted noise levels due to the operation of various construction equipment

Distance (m)	Ambient noise level (dB(A))	Increase in noise level due to construction activities (dB(A))	Noise level due to construction activities (dB(A))	Increase in ambient noise level due to construction activities (dB(A))
30	45	70	70	25
50	45	66	66	21
100	45	60	60	15
200	45	54	55	10
500	45	46	49	4
1000	45	36	46	1
1500	45	36	45.5	0.5
2000	45	34	45	-

Walls of various houses or other structure will attenuate at least 30 dB(A) of noise. In addition there is noise attenuation due to the following factors.

- Air absorption
- Rain
- Atmospheric inhomogeneties.
- Vegetal cover

Thus, no increase in noise levels are anticipated as a result of various activities, during the project construction phase due to the following:

- assumption that all equipment are operating from a common point leads to over-estimation of increase in noise level
- attenuation of 30 dB(A) of noise by wall of any structure
- noise attenuation due to various factors.

Impacts of noise on labour population

The effect of high noise levels on the operating personnel, has to be considered as this may be particularly harmful. It is known that continuous exposures to high noise levels above 90 dB(A) affects the hearing acuity of the workers/operators and hence, should be avoided. The exposure period for the labourers and staff will be regulated as per the recommendations of Occupational Safety and Health Administration (OSHA).

The noise levels during various construction activities have been compared to various standards prescribed by Occupational Safety and Health Administration (OSHA), which are being implemented in our country through rules framed under Factories Act. It can be observed (Refer

Table-5.5) that for an 8 hour duration, equivalent noise level exposure should be less than 90 dB(A).

g) Impacts on air quality

Impacts due to operation of construction equipment

The major pollutant in the construction phase is particulate matter, being air-borne due to various construction activities. The vehicular movement generates pollutants such as NOx, CO and HC. But, the vehicular pollution is not expected to lead to any major impacts. The fugitive emissions due to vehicular movement will be 8 to 12 kg/km travelled by the vehicle. The soils in the project area are sandy in texture, and are likely to generate substantial quantities of dust. However, the fugitive emissions generated due to vehicular movement are not expected to travel beyond a distance of 50 to 100 m. The windblown dust is also likely to be substantial of the project site, hence especially during the summer months. Since, there is no habitation with 50 m to 100 m in the vicinity of the site, the major impact on air environment during the construction phase is not expected to be significant as far as air pollution is concerned.

The combustion of diesel in various construction equipment could be one of the possible sources of incremental air pollution during the construction phase. The quantum of fuel utilisation in various equipment is not expected to be significant Thus, the operation of construction equipment is not expected to have any major impact on the ambient air quality as a result of the project.

Impacts due to transportation of construction materials

Vehicular movement from the transportation of construction material in the area is likely to increase temporarily during the construction period. The increase in number of trucks carrying construction material is expected to be in the range of 15 to 20 per day. The quantum of increased vehicular traffic is not expected to cause any significant impact on ambient air quality. However, it is a common practice that many a times, the trucks carrying construction materials are plying uncovered, leading to generator of emissions as they travels. This activity can lead to entrainment of fugitive emissions. However, impact on this account is not expected to be significant and is likely to effect a small strip along both the sides of road network, over which the trucks carrying construction materials are plying. Appropriate management measures have been suggested as a part of Environmental Management Plan outlined in Chapter-6 of this report.

h) Impacts on marine ecology

The project area has moderate productivity. There are no sites of ecological significance in and around the project area. Likewise, no spawning ground was observed. There will be large scale

dredging in the area to increase the width and depth of the navigation channel. As a result of dredging, significant impacts on marine ecology are anticipated. In the areas to be dredged, the existing marine life would be adversely affected. The area to be dredged recolonizes in short duration, after the cessation of dredging activities. However, these areas would have regular ship traffic, which leads to significant disturbance as compared to the pre-project status. This means that though the dredged stretches are likely to get recolonized, the ecology is not expected to develop upto the pre-project levels.

Impacts on benthic organisms

The dredging and dumping generally affect the benthos. These are related to removal of the benthic organisms from the dredging site and burial of benthic organisms at the dumping site. The dredged material takes away most of the benthos along with it and while dumping it most of the organisms present are buried under the deposited material. This will result in reduced number and diversity of benthic organisms at the dumping site. However, earlier studies show that the dredged site and dumping sites will be colonized by benthic organisms within a very short time. Moreover biomass and diversity of benthos will also be restored to the earlier level within a very short time.

During all dredging operations, the removal of material from the sea bed also removes the animals living on and in the sediments (benthic animals). With the exception of some deep burrowing animals or mobile surface animals that may survive a dredging event through avoidance, dredging may initially result in the complete removal of animals from the excavation site.

Benthic fauna did not contain any rare or endangered species and consisted of common species only. It can be expected that these species will colonize within a short time from dislodging. Hence, impacts on this account are not expected to be significant in areas to be covered under maintenance dredging. However, in other areas to be dredged, too, settlement of suspended sediments will be just after they have been freshly disturbed, hence, adverse impacts on this account are not anticipated.

Impact on phytoplankton and primary productivity

Biomass of phytoplankton depends mainly on the availability of light in nutrient rich waters. Dredging and disposal may lead to increased turbidity and consequent reduction of light penetration for short periods. This may affect primary productivity and plankton biomass. However, turbidity due to dredging and dumping will be observed only in a localised area and only for a very short duration. Hence these impacts are not of any concern.

ii) Impacts on fisheries

The most important impact on fishes may be suspended solid load or changes in the food chain. The high turbidity due to heavy suspended solid load during dredging or disposal of dredged materials results in clogging of gills of fishes thereby causing asphyxiation. But since fishes are free swimming they very well avoid such areas and move to safer areas. Once the turbidity is over due to currents, they come back to the area. Due to this capability of the fishes there is virtually no impact on fishes and fisheries by dredging and disposal. The study also did not show the existence of breeding grounds for fisheries.

J) Impacts on Land use Pattern of the Area

All the project activities envisaged in the present project are located within the existing Visakhapatnam Port. No additional forest or private land is proposed to be acquired for the project. However, during construction phase, lot of ancillary developments like shops, restaurant, repair shops, etc. would develop around the Visakhapatnam port area. This will lead to conversion of barren land into commercial use. However, since, the proposed project activities are located in an existing port, the extent of impacts on this account shall be marginal.

h) Impacts on Socio-Economic Environment

The role of any industrial development is to be evaluated not only by its impact on the ecosystem but also by its contribution to the improvement in the quality of life. Economic benefits of a port are manifold significant positive impacts are expected during construction phase of the proposed project, as it will lead to mushrooming of allied business activities, which provide an impetus to overall development of the area. Some of the locals will get direct employment in project construction activities or indirect employment due to mushrooming of allied business activities.

Impacts due to labour camps

The construction phase of the port is likely to expand over a period 24 months and will require good amount of labour force. Total 150 labourers are likely to get the employment during construction phase. Which might create some pressure on the local resources and other infrastructure facility due to the migrant labourers. Apart from labourers some locals would be employed, mainly in unskilled or semi-skilled category. Labour camps will be constructed for the migrant labourers. It is proposed to provide basic amenities like safe drinking water and sanitation facilities in the labour camps. Therefore no significant pressure on local infrastructure is envisaged.

5.3.2 Impacts during Project Operation Phase

a) Entrainment of fugitive emissions

The propose project envisages the development of west quay north (WQ-7 & WQ-8). The details of the equipment's proposed to be used during operation phase are given in Table 5.9.

Table 5.9 Details of the equipment proposed for West Quay-7 & 8 berths

S.No	Equipment	Nos.	Size/Capacity
1	Harbour Mobile Crane	2 No.	100 T/ hr
2	Mobile Hoppers	3 No	
3	Conveyor system	2 Nos	2 KM each
4	Stacker of	1 No.	No. 1200 TPH
5	pay loader	8 Nos.	10 T
6	Electrical works		
7	Dumpers	10 Nos.	

b) Generation of Garbage at Port

The other problem envisaged during operation phase could be the disposal of garbage. This could comprise floating materials, packaging, polythene or plastic materials. Garbage accumulated on the deck is also problematic and should be suitably disposed.

The solid waste in the proposed project could also be generated mainly from three sources viz. institutional/ office waste, domestic waste and waste from cargo handling etc.

The office waste in the proposed project could be in the form of packing material, cardboard, etc. which is not expected to be significant. The same is proposed to be routinely collected and are disposed as per the prescribed Municipal Solid Waste (MSW) Rules.

c) Environmental impact from ship traffic

During the operational phase with additional facilities there will be increased activities of ship movement in the region. All these activities may have impacts on marine lives. Possible sources of such impacts on marine environment would be from;

- Accidental Oil Spill from the calling ships
- Ballast water
- Illegal tank washing
- Ship grounding, physical damage of bottom community
- Anchoring
- Discharges of sewage from vessels
- Discharge from solid waste

Ship traffic poses a risk of oil pollution from the following sources:

- Small spills caused by the accidental or international release of oil-contaminated bilge water from freights
- Minor spills caused by release of bunker oil during terminal operations

- Major spills caused by the rupture of a bunker oil tank in a bulk/cargo vessel collision, ship wreck of a bulk/cargo vessel

Marine environmental implications during routine operations at the harbour could be due to the following cases.

- Escapement of cargo during loading/unloading operations
- Release of wastes generated from the ships including garbage, solid waste, oily ballast and bilge water as well as swage
- Wastes generated at the port terminal such as domestic wastewater, effluent from the grit/oil separator and garbage

d) Material handling

Solid bulk cargoes will be handled at West Quay North (WQ-7 and WQ-8) berths. Though adequate anti spillage mechanisms are in place, minor spillages can take place. However, in the unlikely event of any spillage, the material lumps and dust may increase the turbidity temporarily over a small patch of water. The severity of impact is expected to be marginal. Fishing activities in the proposed port are absent. Hence, marginal increase in turbidity level is not expected to cause any significant adverse impacts.

e) Impacts due to noise on project staff

No adverse impacts on noise environment are anticipated due to the proposed project. During construction phase, there could be high noise levels due to operation of various construction equipment. Fitting of exhaust mufflers and intake mufflers could reduce the noise from air compressors. It is very useful for reducing the low frequency noise levels. Chassis and engine structural vibration noise can be dealt with by isolating the engine from the chassis and by the fitting of covers over various sections of engines.

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

f) Impacts due to noise on fisheries

There are very few studies on the impact of aquatic noise on the marine animals. The marine animals can sense the noise in the infrasonic range between 5 and 35 cycles/second which is much different from the human audible range (20-20,000 cycles/second). Most of the work on noise pollution has been done in the audible frequencies. However, US Navy have done some work on the detection of submarines through the movement of Dolphins and fish species.

However, most of the data is classified. It is more or less certain that quite a few of the aquatic animals, especially Dolphins, communicate amongst themselves in the infrasonic range. The articulation of fishes, sharks, etc. have not been much studied but it is likely that some of them can communicate in the same range. Noise generated by ship movement may interfere with their communication lines. It has been reported that ship movement may scare some of the fishes and their immediate reaction is restricted to avoid the area. However, as soon as the ship passes that area, they return. Therefore, it is apparent that the impact of ship movement on noise levels is purely temporary and may cause only marginal impact on the marine fauna especially fish. Quantification of such impact is not possible mainly because of our lack of knowledge on the effect of noise on fishes and the noise level measurement is carried out in the audible and ultrasonic range.

g) Spillage of solid cargo

The impact of accidental release of solid cargo, particularly during rough weather, can take place. However, it would have limited impact on the environment. However, the port operations may be hampered if the ship is damaged or the cargo goes overboard that could risk navigation. The escapement of bulks such as iron ore, bulk cargo and container cargo during unloading is not expected to cause any serious impact, as they are non-toxic. Thus, no major impact on marine ecology is anticipated on account of spillage of solid cargo.

h) Ships generated wastes

The four basic categories of wastes generated by ships are as follows:

- Oily waste which usually consists of some oil mixed with larger quantities of sea water, but also fuel residues and sludges.
- Remains of noxious liquid substances carried in bulk in parcel tankers, dry bulk carriers or in portable containers.
- Sewage generated by crew.
- Garbage originating from the crew, the maintenance of the ship, cargo etc.

The International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 (MARPOL 73/78) prohibit all ships from discharging wastes at sea which could result in pollution of the marine environment. MARPOL 73/78 applies to oil tankers, cruise ships, general cargo and container vessels, tugs, ferries, yachts and small pleasure craft.

MARPOL 73/78 requires that ships retain all the wastes on board until reaching port. However, certain wastes can be discharged under certain conditions such as the distance from shore, the type of waste and the condition of the waste (e.g., ground foodstuffs). Plastics of any kind

cannot be discharged anywhere. The vessels must be equipped with dedicated holding tanks for sewage and oily wastes and have the capacity to compact and store garbage.

5.4 IMPACTS DUE TO EXTENSION OF EXISTING CONTAINER TERMINAL

5.4.1 Construction Phase

a) Impacts due to quarrying operation

The proposed project would require significant amount of construction material. The fine and the coarse aggregates required for the construction activities are proposed to be excavated from local quarries or borrow pits. During construction phase, runoff from these sites would increase soil erosion from such sites. If such sites are left untreated after excavation of construction material, then rainwater is likely to get stored in these sites, which are then likely to serve as breeding habitats for mosquitoes. This can lead to increased incidence of malaria in and around these sites.

b) Impacts due to effluents from labour camps

During construction phase, peak labour requirement has been estimated as 100 workers, of which 50% are likely to reside near the project site and rest will come from nearby villages. A small labour camp/colony needs to be constructed for about 50 labour families. Considering family size as 4, the increase in the population is expected to be of the order of 200. The total water requirement has been estimated as 44 m^3/day. The details are given in Table-5.10.

Table-5.10: Domestic water requirements at labour camps

Category	Per capita water requirement (lpd)	Population	Total water requirement (m^3/day)
Population at labour camp	135	200	27.00
Staff	45	50	2.25
Total			**29.25 say 30 m^3/day**

The sewage generated is normally taken as 80% of the total water requirement. Thus, the sewage generated would be of the order of (0.8 x 30) 24 m^3/day. The disposal of sewage without treatment could lead to significant problems related to water pollution and public health. The sewage generated from labour camps and construction site shall be transported to the STP and treated along with the city's sewage.

c) Impacts due to Dredging

The total quantity of dredged material likely to be generated in the proposed project has been estimated as 8,66,249 m^3 of which 5,96,024 m^3 will be generated due to extension of existing Container Terminal. The potential environmental effects of dredging can be categorized as impacts due to dredging process itself and those due to disposal of the dredged material. During the dredging process, adverse impacts are anticipated on account of excavation of sediments at

the bed, loss of material during transport to the surface, overflow from the dredger whilst loading and loss of material from the dredger and/or pipelines during transport.

The evaluation of the environmental effects of dredging and disposal must take account of both the short-term and long-term effects that may occur both at the site of dredging or disposal (near field) and the surrounding area (far field). Near field effects are simply defined as 'phenomena occurring within the geographic bounds of the activity, or less than approximately 1 km from the activity', and far field effects as 'occurring more than approximately 1 km from the activity'.

Impacts on Suspended sediments and turbidity levels

When dredging and disposing of non-contaminated sediments, the key impacts are the increase in suspended sediments and turbidity levels. Any dredging method releases suspended sediments into the water column, during excavation itself and during the flow of sediments from hoppers and barges. In many cases, locally increased suspended sediments and turbidity associated with dredging and disposal is obvious from the turbidity 'plumes' which may be seen trailing behind dredgers or disposal sites.

Increase in suspended sediments and turbidity levels from dredging and disposal operations may under certain conditions have adverse effects on marine animals and plants by reducing light penetration into the water column and by physical disturbance.

Increased suspended sediments can affect young fish, if suspended sediments become trapped in their gills Increase fatalities of young fish have been observed in highly turbid water. Adult fish are likely to move away from or avoid areas of high suspended solids, such as dredging sites, unless food supplies are increased as a result of increases in organic material. The increase in turbidity could marginally affect the fisheries in the area.

The increase in turbidity results in a decrease in the depth that light is able to penetrate the water column which may affect submerged plants, by temporarily reducing productivity and growth rates. Since, benthic fauna is not well developed in the areas, hence impacts on this account is not expected to be significant. The degree of resuspension of sediments and turbidity during dredging and disposal depends on:

- sediments being dredged (size, density and quality of the material)
- method of dredging (and disposal)
- hydrodynamic regime in the dredging and disposal area (current direction and speed, mixing rate, tidal state) and
- existing water quality and characteristics (background suspended sediment and turbidity levels).

In most cases, sediment resuspension is only likely to present a potential problem if it is moved out of the immediate dredging location by tidal processes. In general, the effects of suspended sediments and turbidity are generally short term (<1 week after activity) and near-field (<1km from activity). These are of concern only, if sensitive species are located in the vicinity of the maintained channel. Since, no sensitive species are observed in the areas to be dredged, hence, no adverse impacts are anticipated.

Impacts on marine water quality

Redox potential (eH) and pH are two variables that control the characteristics of chemicals and heavy metals in water and sediment. As long as the pH remains around 8 and eH < 150 mV, most of the chemicals and metals will remain bound to the solid phase without being released into the surrounding water. Only anoxic conditions reduce the eH below this level and hence if dissolved oxygen level is normal no leaching of chemicals and heavy metals will occur.

d) Impacts due to dredging and disposal of organic matter and nutrients

The release of organic rich sediments during dredging or disposal can result in the localised removal of oxygen from the surrounding water. Depending on the location and timing of dredging, this may lead to the suffocation of marine animals and plants within the localised area or may deter migratory fish or mammals from passing through. However, removal of oxygen from the water is only temporary, as tidal exchange would quickly replenish the oxygen supply. Therefore, in most cases where dredging and disposal is taking place in open coastal waters, this localized removal of oxygen has little, if any, effect on marine life. The dispersion modelling for dumping the dredging materials has been carried out by the CWPRS and shall be discussed in the EMP chapter.

e) Impacts due to contaminated sediments

Another possible impact is the release of toxicants from the sediment if the sediment is contaminated. In the case of contaminated sediment acute toxicity, chronic toxicity and bioaccumulation are the possible effects. But all these are short term and insignificant and no serious effects have been reported from any earlier instances or experimental studies. In various sampling locations covered as a part of the study, sediment samples analyzed did not show the presence of any appreciable levels of contamination and hence may not pose any such problems.

f) Impacts due to increase in noise levels

The major sources of noise during construction phase are due to operation of various construction equipments. The noise levels generated by various construction equipment are given in Table-5.18.

It would be worthwhile to mention here that in absence of the data on actual location of various construction equipment, all the equipment have been assumed to operate at a common point. This assumption leads to over-estimation of the increase in noise levels. Also, it is a known fact that there is a reduction in noise level as the sound wave passes through a barrier.

Walls of various houses or other structure will attenuate at least 30 dB(A) of noise. In addition there is noise attenuation due to the following factors.

- Air absorption
- Rain
- Atmospheric inhomogeneties.
- Vegetal cover

Thus, no increase in noise levels are anticipated as a result of various activities, during the project construction phase due to the following:

- assumption that all equipment are operating from a common point leads to over-estimation of increase in noise level
- attenuation of 30 dB(A) of noise by wall of any structure
- noise attenuation due to various factors.

The effect of high noise levels on the operating personnel, has to be considered as this may be particularly harmful. It is known that continuous exposures to high noise levels above 90 dB(A) affects the hearing acuity of the workers/operators and hence, should be avoided. The exposure period for the labourers and staff will be regulated as per the recommendations of Occupational Safety and Health Administration (OSHA).

The noise levels during various construction activities have been compared to various standards prescribed by Occupational Safety and Health Administration (OSHA), which are being implemented in our country through rules framed under Factories Act. It can be observed (Refer Table-5.5) that for an 8 hour duration, equivalent noise level exposure should be less than 90 dB(A).

g) Impacts on air quality

Impacts due to operation of construction equipment

The major pollutant in the construction phase is SPM being air-borne due to various construction activities. The vehicular movement generates pollutants such as NOx, CO and HC. But, the vehicular pollution is not expected to lead to any major impacts. The fugitive emissions due to vehicular movement will be 8 to 12 kg/km travelled by the vehicle. The soils in the project area are sandy in texture, and are likely to generate substantial quantities of dust. However, the fugitive emissions generated due to vehicular movement are not expected to travel beyond a

distance of 50 to 100 m. The windblown dust is also likely to be substantial of the project site, hence especially during the summer months. Since, there is no habitation with 50 m to 100 m in the vicinity of the site, the major impact on air environment during the construction phase is not expected to be significant as far as air pollution is concerned.

The combustion of diesel in various construction equipment could be one of the possible sources of incremental air pollution during the construction phase. The fuel utilisation rates of various equipment expected to be in operation during construction phase is given in Table-5.6. Under the worst case scenario, it has been considered that equipment used for construction of berth and earthwork at each site, are operating at a common point.

The short-term increase in concentration has been predicted using Gaussian plume dispersion model. The maximum short-term increase in SO_2 is observed as 0.00119 $\mu g/m^3$, which is at a distance of 200 m from the emission source. The maximum SPM concentration was 1.15 $\mu g/m^3$ which is at a distance of 400 m from the emission source. The incremental concentration is so low that it does not need any specific control measure. Thus, the operation of construction equipment is not expected to have any major impact on the ambient air quality as a result of the project.

Impacts due to transportation of construction materials

Vehicular movement from the transportation of construction material in the area is likely to increase temporarily during the construction period. The increase in number of trucks carrying construction material is expected to be in the range of 15 to 20 per day. The quantum of increased vehicular traffic is not expected to cause any significant impact on ambient air quality. However, it is a common practice that many a times, the trucks carrying construction materials are plying uncovered, leading to generator of emissions as they travels. This activity can lead to entrainment of fugitive emissions. However, impact on this account is not expected to be significant and is likely to effect a small strip along both the sides of road network, over which the trucks carrying construction materials are plying. Appropriate management measures have been suggested as a part of Environmental Management Plan outlined in Chapter-6 of this report.

h) Impacts on marine ecology

The project area has moderate productivity. There are no sites of ecological significance in and around the project area. Likewise, no spawning ground was observed. There will be large scale dredging in the area to increase the width and depth of the navigation channel. As a result of dredging, significant impacts on marine ecology are anticipated. In the areas to be dredged, the existing marine life would be adversely affected. The area to be dredged recolonizes in short

duration, after the cessation of dredging activities. However, these areas would have regular ship traffic, which leads to significant disturbance as compared to the pre-project status. This means that though the dredged stretches are likely to get recolonized, the ecology is not expected to develop up to the pre-project levels.

i) Impacts on benthic organisms

The dredging and dumping generally affect the benthos. These are related to removal of the benthic organisms from the dredging site and burial of benthic organisms at the dumping site. The dredged material takes away most of the benthos along with it and while dumping it most of the organisms present are buried under the deposited material. This will result in reduced number and diversity of benthic organisms at the dumping site. However, earlier studies show that the dredged site and dumping sites will be colonized by benthic organisms within a very short time. Moreover biomass and diversity of benthos will also be restored to the earlier level within a very short time.

During all dredging operations, the removal of material from the sea bed also removes the animals living on and in the sediments (benthic animals). With the exception of some deep burrowing animals or mobile surface animals that may survive a dredging event through avoidance, dredging may initially result in the complete removal of animals from the excavation site.

Benthic fauna did not contain any rare or endangered species and consisted of common species only. It can be expected that these species will colonize within a short time from dislodging. Hence, impacts on this account are not expected to be significant in areas to be covered under maintenance dredging. However, in other areas to be dredged, too, settlement of suspended sediments will be just after they have been freshly disturbed, hence, adverse impacts on this account are not anticipated.

j) Impact on phytoplankton and primary productivity

Biomass of phytoplankton depends mainly on the availability of light in nutrient rich waters. Dredging and disposal may lead to increased turbidity and consequent reduction of light penetration for short periods. This may affect primary productivity and plankton biomass. However, turbidity due to dredging and dumping will be observed only in a localised area and only for a very short duration. Hence these impacts are not of any concern.

k) Impacts on fisheries

The most important impact on fishes may be suspended solid load or changes in the food chain. The high turbidity due to heavy suspended solid load during dredging or disposal of dredged materials results in clogging of gills of fishes thereby causing asphyxiation. But since fishes are

free swimming they very well avoid such areas and move to safer areas. Once the turbidity is over due to currents, they come back to the area. Due to this capability of the fishes there is virtually no impact on fishes and fisheries by dredging and disposal. The study also did not show the existence of breeding grounds for fisheries.

l) Impacts on Landuse Pattern of the Area

All the project activities envisaged in the present project are located within the existing Visakhapatnam Port. No additional forest or private land is proposed to be acquired for the project. However, during construction phase, lot of ancillary developments like shops, restaurant, repair shops, etc. would develop around the Visakhapatnam port area. This will lead to conversion of barren land into commercial use. However, since, the proposed project activities are located in an existing port, the extent of impacts on this account shall be marginal.

m) Impacts on Socio-Economic Environment

The role of any industrial development is to be evaluated not only by its impact on the ecosystem but also by its contribution to the improvement in the quality of life. Economic benefits of a port are manifold significant positive impacts are expected during construction phase of the proposed project, as it will lead to mushrooming of allied business activities, which provide an impetus to overall development of the area. Some of the locals will get direct employment in project construction activities or indirect employment due to mushrooming of allied business activities.

n) Impacts due to labour camps

The construction phase of the port is likely to expand over a period 24 months and will require good amount of labour force. Total 100 labourers are likely to get the employment during construction phase. Which might create some pressure on the local resources and other infrastructure facility due to the migrant labourers. Apart from labourers some locals would be employed, mainly in unskilled or semi-skilled category. Labour camps will be constructed for the migrant labourers. It is proposed to provide basic amenities like safe drinking water and sanitation facilities in the labour camps. Therefore no significant pressure on local infrastructure is envisaged.

5.4.2 Impacts during Project Operation Phase

a) Entrainment of fugitive emissions

The propose project envisages the extension of existing Container Terminal. The details of the equipment's proposed to be used during operation phase are given in Table 5.11.

Table 5.11 Details of equipment for extension of existing Container Terminal

S.No	Equipment
1	Ship to Shore Cranes
2	Rubber Tyred Gantry Cranes
3	Tractor/Traiers
4	Reach Stackers
5	Top Lift Trucks

b) Generation of Garbage at Port

The other problem envisaged during operation phase could be the disposal of garbage. This could comprise floating materials, packaging, polythene or plastic materials. Garbage accumulated on the deck is also problematic and should be suitably disposed.

The solid waste in the proposed project could also be generated mainly from three sources viz. institutional/ office waste, domestic waste and waste from cargo handling etc.

The office waste in the proposed project could be in the form of packing material, cardboard, etc. which is not expected to be significant. The same is proposed to be routinely collected and are disposed as per the prescribed Municipal Solid Waste (MSW) Rules.

c) Environmental impact from ship traffic

During the operational phase with additional facilities there will be increased activities of ship movement in the region. All these activities may have impacts on marine lives. Possible sources of such impacts on marine environment would be from;

- Accidental Oil Spill from the calling ships
- Ballast water
- Illegal tank washing
- Ship grounding, physical damage of bottom community
- Anchoring
- Discharges of sewage from vessels
- Discharge from solid waste

Ship traffic poses a risk of oil pollution from the following sources:

- Small spills caused by the accidental or international release of oil-contaminated bilge water from freights
- Minor spills caused by release of bunker oil during terminal operations
- Major spills caused by the rupture of a bunker oil tank in a bulk/cargo vessel collision, ship wreck of a bulk/cargo vessel

Marine environmental implications during routine operations at the harbour could be due to the following cases.

- Escapement of cargo during loading/unloading operations

- Release of wastes generated from the ships including garbage, solid waste, oily ballast and bilge water as well as swage
- Wastes generated at the port terminal such as domestic wastewater, effluent from the grit/oil separator and garbage

d) Material handling

Solid bulk cargoes will be handled at extended container Terminal. Though adequate anti spillage mechanisms are in place, minor spillages can take place. However, in the unlikely event of any spillage, the material lumps and dust may increase the turbidity temporarily over a small patch of water. The severity of impact is expected to be marginal. Fishing activities in the proposed port are absent. Hence, marginal increase in turbidity level is not expected to cause any significant adverse impacts.

e) Impacts due to noise on project staff

No adverse impacts on noise environment are anticipated due to the proposed project. During construction phase, there could be high noise levels due to operation of various construction equipments. Fitting of exhaust mufflers and intake mufflers could reduce the noise from air compressors. It is very useful for reducing the low frequency noise levels. Chassis and engine structural vibration noise can be dealt with by isolating the engine from the chassis and by the fitting of covers over various sections of engines.

During project operation phase also, the major source of noise could be due to operation of various equipment. As a part of the environment protection activities, trees and ornamental horticultural trees and shrubs have been developed around the project area, which will attenuate noise levels to a certain extent. It is recommended that workers operating various equipments during project construction and operation phases are provided with ear plugs.

f) Impacts due to noise on fisheries

There are very few studies on the impact of aquatic noise on the marine animals. The marine animals can sense the noise in the infrasonic range between 5 and 35 cycles/second which is much different from the human audible range (20-20,000 cycles/second). Most of the work on noise pollution has been done in the audible frequencies. However, US Navy have done some work on the detection of submarines through the movement of Dolphins and fish species. However, most of the data is classified. It is more or less certain that quite a few of the aquatic animals, especially Dolphins, communicate amongst themselves in the infrasonic range. The articulation of fishes, sharks, etc. have not been much studied but it is likely that some of them can communicate in the same range. Noise generated by ship movement may interfere with their communication lines. It has been reported that ship movement may scare some of the

fishes and their immediate reaction is restricted to avoid the area. However, as soon as the ship passes that area, they return. Therefore, it is apparent that the impact of ship movement on noise levels is purely temporary and may cause only marginal impact on the marine fauna especially fish. Quantification of such impact is not possible mainly because of our lack of knowledge on the effect of noise on fishes and the noise level measurement is carried out in the audible and ultrasonic range.

g) Spillage of solid cargo

The impact of accidental release of solid cargo, particularly during rough weather, can take place. However, it would have limited impact on the environment. However, the port operations may be hampered if the ship is damaged or the cargo goes overboard that could risk navigation. The escapement of bulks such as iron ore, bulk cargo and container cargo during unloading is not expected to cause any serious impact, as they are non-toxic. Thus, no major impact on marine ecology is anticipated on account of spillage of solid cargo.

h) Ships generated wastes

The four basic categories of wastes generated by ships are as follows:

- Oily waste which usually consists of some oil mixed with larger quantities of sea water, but also fuel residues and sludges.
- Remains of noxious liquid substances carried in bulk in parcel tankers, dry bulk carriers or in portable containers.
- Sewage generated by crew.
- Garbage originating from the crew, the maintenance of the ship, cargo etc.

The International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 (MARPOL 73/78) prohibit all ships from discharging wastes at sea which could result in pollution of the marine environment. MARPOL 73/78 applies to oil tankers, cruise ships, general cargo and container vessels, tugs, ferries, yachts and small pleasure craft. MARPOL 73/78 requires that ships retain all the wastes on board until reaching port. However, certain wastes can be discharged under certain conditions such as the distance from shore, the type of waste and the condition of the waste (e.g., ground foodstuffs). Plastics of any kind cannot be discharged anywhere. The vessels must be equipped with dedicated holding tanks for sewage and oily wastes and have the capacity to compact and store garbage.

CHAPTER–6
MITIGATION MEASURES & ENVIRONMENTAL MANAGEMENT PLAN

CHAPTER–6

MITIGATION MEASURES & ENVIRONMENTAL MANAGEMENT PLAN

6.1 GENERAL

The objective of the Environmental Management Plan (EMP) is to ensure that the stress/load on the ecosystem is within its carrying capacity. The most reliable way to achieve the above objective is to incorporate the Environmental Management Plan (EMP) into the overall planning and implementation of the project.

The Environmental Management Plan (EMP) for the proposed project is classified into the following categories:

- EMP During project construction phase
- EMP during project operation phase

Proposed developments in Visakhapatnam Port envisage the following:

- Up-gradation of Existing Facility and creation of new facility at VPT for Iron ore handling.
- Development of West Quay North (WQ-7 & WQ-8) berth with mechanized handling facilities for handling bulk cargoes
- Extension of Existing Container Terminal in the outer harbour of Visakhapatnam Port

6.2 EMP FOR UP-GRADATION OF EXISTING FACILITY AND CREATION OF NEW FACILITY AT VPT FOR IRON ORE HANDLING

6.2.1 Construction Phase

This project envisages up up-gradation of the Iron ore handling system by providing closed conveyor with in-built dust suppression system and to replace the ship loader so as to improve the handling efficiency resulting in modernized equipment for dust control at all the transfer points

A) Land Environment

Proposed activities are proposed within the present project are located within the existing Visakhapatnam Port. No additional land is proposed to be acquired for the project. However, during construction phase, lot of ancillary developments like shops, restaurant, repair shops, etc. may develop around the Visakhapatnam port area. This may lead to additional load on the existing infrastructure in the area.

It shall be made mandatory for the contractor to remove all signs of haul roads, storage areas, temporary structures, labour colonies, etc, on completion of construction activities. Extraneous

material and objects shall be removed from the site. These aspects will be made mandatory as a part of the contract agreement.

On completion of construction activities, roads shall be resurfaced completely. Material excavated during construction or a part of the material generated due to dismantling of existing facility will be utilized for this purpose.

Sanitation Facilities in Labour Camps

The major source of water pollution in the construction phases is the sewage generated by the workers and employees. During construction phase total increase in the population is expected to be of the order of 500. The total water requirement for 500 persons has been estimated as 73.12m^3/day. Thus, the sewage generated would be of the order of (0.8 x 73.12) 58.50 m^3/day. It is proposed to construct 25 Nos. of community toilets with septic tanks within labour camps. An amount of **Rs. 1.00 million** has been earmarked for this purpose. The sewage generated form the labour camps shall be conveyed to the existing STP. There is sufficient unutilized capacity in the sewage treatment plant.

Sewage Collection System

Sewage collection is presently carried out through pipelines, which is finally connected to two canals namely Gangulagadda and Yerrigadda, which convey the sewage at the STP located near the ore handling facility. The total handling capacity of the STP is 10 mld. At present 6-7 mld of sewage is treated in the sewage treatment plant. The sewage is treated through a clarifier, aerator and finally disinfected and used for sprinkling on the roads, ore handling complexes and stacking areas. Thus, the additional sewage generated during construction phases can be treated through soak pits etc. Effluent from workshops, oil storage etc. The effluent from workshops, oil storage, etc. will contain oil and grease particles which shall be treated .The collected oily matter shall be stored in cans, etc. and disposed at landfill or any other site designated by the authority.

Effluent from workshops, oil storage etc.

The effluent from workshops, oil storage, etc. will contain oil and grease particles which shall be treated in an oil skimmer and suitably disposed after treatment. The collected oily matter shall be stored in cans, etc. and disposed at landfill or any other site designated by the authority. district administration. An amount of **Rs. 1.0 million** has been earmarked for this purpose.

B) Air Environment

Control of Pollution due to increased vehicles

The major source of air pollution in the proposed project is the increased vehicular movement during project construction phases. The movement of other vehicles is likely to increase during construction phase would lead to increase in air pollution. Thus, as a control measure, vehicles emitting pollutants above the standards should **n**ot be allowed to ply either in the project construction or in the operation phases.

All the roads in the vicinity of the project site should be paved or black topped to minimize the entrainment of fugitive emissions. If any of the road stretches cannot be blacktopped or paved due to some reason or the other, then adequate arrangements must be made to spray water on such stretches of the road.

C) Noise Control Measures

The construction phases are likely to increase the vehicular traffic in the area, which can lead to increase in the ambient noise levels mainly along the road alignment. It is proposed to develop a greenbelt along the road stretches near to the habitation sites. Three rows of trees will be planted.

During construction phase, use of various construction equipment is the major source of noise. However, based on the modeling studies, the noise due to operation of various construction equipment is not likely to have any adverse impact on the habitations in nearby villages. However, efforts need to be made to reduce the noise generated by the various construction equipment. The various measures that could be implemented are as follows:

- Noise from air compressors could be reduced by fitting exhaust mufflers and intake mufflers.
- Chassis and engine structural vibration noise can be dealt by isolating the engine from the chassis and by covering various sections of the engines.
- Noise levels from the drillers can be reduced by fitting of exhaust mufflers and the provision of damping on the steel tool.
- Exposure of workers near the high noise levels areas can be minimized. This can be achieved by job rotation/automation, use of ear plugs, etc.

The effect of exposure of high noise levels on the workers operating the various construction equipment is likely to be harmful. It is known that continuous exposure to high noise levels above 90 dB(A) affects the hearing acuity of the workers/operators and hence, has to be avoided. To prevent the adverse impacts, the exposure to high noise levels should be restricted as per the

exposure period outlined in Table-6.1. Workers operating in the high noise areas shall be provided with ear plugs.

Table-6.1: Maximum Exposure Periods specified by Occupational Safety and Health Administration (OSHA)

Maximum equivalent continuous Noise level dB(A)	Unprotected exposure period per day for 8 hrs/day and 5 days/week
90	8
95	4
100	2
105	1
110	½
115	¼
120	No exposure permitted at or above this level

D) Marine Ecology

In this proposed development, total quantity of capital dredging for the proposed project has been estimated about 5,96,024 m^3 and annual maintenance dredging requirement would be of the order of 2.56 Lakh M^3 In this proposed up-gradation 1,84,000 m^3 of dredged material is likely to be generated, which is substantial and hence, it is necessary to evolve an environment friendly Dredging Plan, where the depth of cut is engineered on sound scientific principles and steps taken to minimise the turbidity cloud in the vicinity of the drag/cutter head.

The following recommendations are made which require to be adopted for amelioration of adverse impacts to the extent possible:

- Dredger operators should follow proper safety procedures to avoid accidents and spills.
- Authorities should ensure that all the ships moving in proximity to the area to be dredged or disposal sites do not affect such activities or vice-versa.
- To reduce the potential for error on the part of the Contractor, endeavor should be made to regularly monitor the activities during dredging and disposal activities.
- The timing of dredging and disposal activities could be planned, where practical, to avoid and reduce any adverse impacts on sensitive marine flora and fauna. Measures could be considered in terms of the local hydro and soil dynamics with the aim of minimizing sediment suspension and extent of the area affected and ecology of the system to avoid sensitive periods.

The entire dredged material shall be disposed at designated disposal sites selected based on the Radio-Active Tracer (RAT) study carried out by Bhabha Atomic research Centre (BARC) and modeling studies by CWPRS.

Bhabha Atomic research Centre (BARC) has carried out to investigation to assess the suitability of a proposed disposal site for dredged sediment at Vishakhapatnam Port. The investigation showed that the general direction of movement of sediment is predominantly towards South-West direction of injection point over a period of 74 days of tracking (January to March, 2010). The maximum longitudinal distance travelled by tracer was about 1000 m towards the east and 800 m towards west of the injection point. However, the maximum concentration of tracer was confined between 200 m to east to 600 m west of injection point. Similarly maximum transverse movement of tracer was about 340 meters. The average velocity of sediment transport over a period of 74 days was found to be 4 meters/day.

Based on the investigation, it was concluded that the general direction of movement tracer is away from the shipping channel and may not find its way to the shipping channel. Hence, the proposed site was found suitable for dumping of dredged sediment during the period of the investigation. Copy of the Radio- Active Tracer (RAT) study carried out by BARC is given in Appendix-3.

The proposed dumping site is located in the deeper contours beyond -40m, with more offset distance of 1.45 km from the port approach channel. The total area of the proposed dumping site is 2.6 sq. km. CWPRS has conducted the survey in the year 2015 to assess the suitability of the proposed dumping site and concluded that proposed dumping site is suitable for the disposal of dredged material likely to be generated due to the implementation of the proposed project. The proposed dumping site suggested by BARC and CWPRS is shown in Figure-6.1. Copy of the CWPRS regarding the suitability of dumping site is given in Appendix-4.

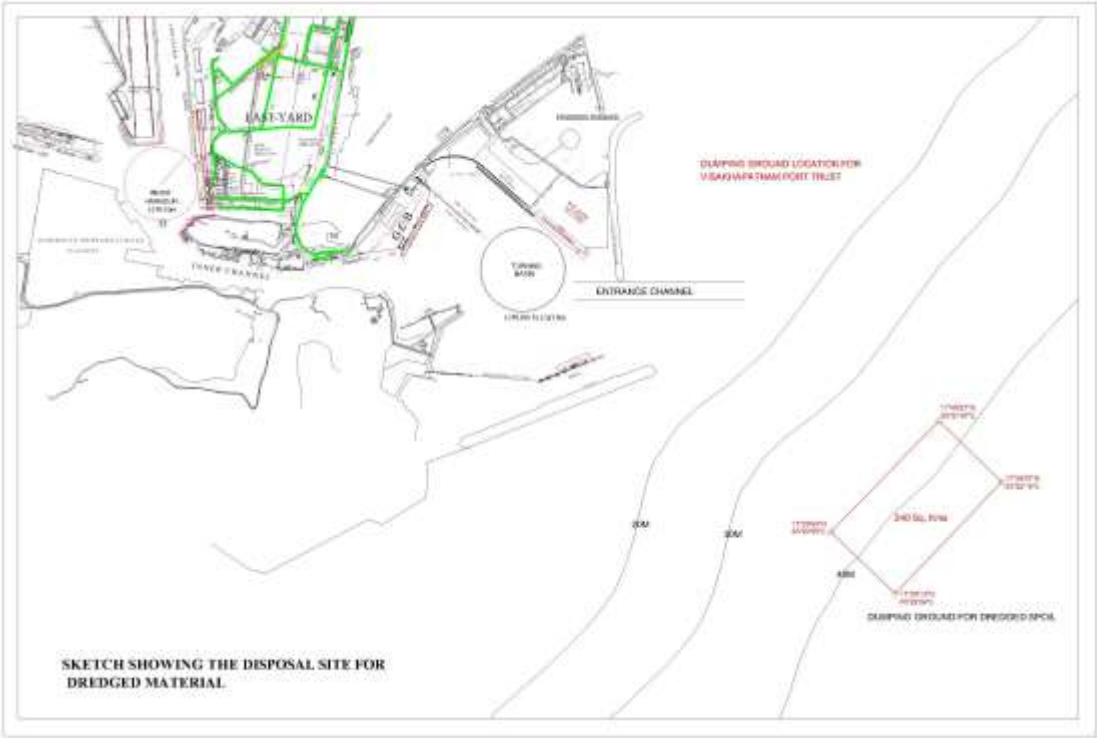


Figure-6.1: Dredged material disposal site based on the RAT study

E) Management of solid waste

At present, collection of Solid waste us done by VPT through the sanitary department and disposed through closed vans to the Kappulapadda located in the off limits of the city where the GVMC. During construction and operation phases, the solid wastes generated will contain mainly vegetable matter followed by paper, cardboard, packaging materials, wood boards, polythene, etc. The solid waste generated during project construction and operation phases will be collected and disposed in closed vans to existing site at Kappulapadda.

6.2.2 Operation Phase

A) Air Environment

During project operation phase of the new facility at VPT, major activity would be handling of iron ore, bulk and container cargoes. The present system of iron ore handling through semi mechanized means has led to serious environmental concerns. The Port has a commitment to Andhra Pradesh Pollution Control Board (APPCB) to mechanize the iron ore handling system to address environmental concerns. Twin wagon tippler system with a rated capacity of 20 tips /hour has been proposed as a part of the proposed project. A receiving conveyor system with a rated capacity of 3000 TPH compatible with the wagon unloading from tippler house to the

stockyard is proposed. Conversion of iron ore handling system from manual to mechanical will reduce the fugitive emissions. However during project operation phase, a large portion of cargo would be handled through road. The following measures are recommended to control air pollution due to road traffic:

- Excessive soil on paved areas will be sprayed will be swept with water.
- Excessive soil on unpaved areas will be sprayed with water.
- Trucks carrying cargo shall be covered with tarpaulin, or maintain at least two feet of freeboard. –
- Effective traffic management at site shall be ensured in the port. The number of trucks/vehicles to move in the port shall be regulated.
- Port area and vicinity (access roads, and working areas) shall be swept with water on a daily basis or as necessary to ensure there is no visible dust.

VPT is implementing the following dust pollution control measures:

The Coal stack yards at GCB, WOB, North and South of S4 Conveyor are provided with mechanical dust suppression system at a cost of Rs. 8.0 crores, covering an area of 4,75,000 m^2 commissioned in the year 2002 and the same is effective and water sprinkling is done continuously round the clock. Similar practice is proposed in OHC and WQ1

- Wetting of cargo stacks at R-4 & R-10 by sprinkling of water with water tankers where Mechanised Water Sprinkling System was not installed.
- Wetting of roads through water tankers continuously round the clock to prevent emission of dust during movement of vehicles. A total of 275 trips of water (about 4.0 MLD) is being sprinkled every day through tankers and 3.0 MLD is being sprinkled in stacking areas through Mechanical Dust Suppression System.
- Covering of trucks with tarpaulins.
- Manual sweeping of the roads.

The above measures will be implemented at present project sites as well. The cost for implementation of the measures is included in the overall cost. Hence, separate budget has not been earmarked for this purpose under implementation of Environmental Management Plan. Details of the other projects at VPT, wherein mechanization has been completed are given as below:

Remedial Measures Proposed to Contain the Dust Pollution at VPT:

i. Proposed Mechanization of Cargo Handling

- Mechanisation of coal handling facilities at GCB in the Outer Harbour of VPT at an estimated cost of Rs. 444.10 Crores.
- Development of EQ-1 for handling steam coal is completed at an estimated cost of Rs.323.18 & EQ1A for handling thermal coal with fully mechanised means in the inner harbour for Rs.313.39 crores is in progress..
- Mechanisation of iron ore handling facilities in the Inner Harbour and upgradation of iron ore handling facilities at OHC at a cost of Rs. 845 crores
- Mechanisation of fertiliser handling facilities at EQ-7 in the Inner Harbour of VPT at an estimated cost of Rs. 217.58 Crores has been taken up.

ii. Re-organization of Stack yards

VPT is having 9 (nine) notified stack yards for open storage of dusty cargoes within the port area such as GCB (coal) / East Yard (coal), R-4 & R-10 area (coal), S-4 Conveyor area (coal), Ore Handling Complex (iron ore), opposite to M/s ESSAR (iron ore), West Ore Berth (coal). The total area of the 9(nine) stack yards is about 9.65 lakh square meters. Presently the stack yards, which are scattered, and the stack yards at GCB and East yard are close to the city and the movement of the vehicular traffic with cargo from the berth to the stack yard are causing concern.

As a part of the mechanisation of handling of coal, it is proposed that the entire coal will be shifted to East Yard and transportation of coal to East Yard from GCB and EQ-1 and 1A will be done through closed conveyor system. The other stack yards are proposed to be utilised for stacking clean cargos.

The implementation of the above schemes will results in reduction in vehicular traffic (approximately 4690 trips /day) and the dust levels will be reduced drastically.

iii. Insulation of Coal Stack Yard (East Yard and R-4 & R-10 areas)

- A High-rise wall of 7.5 mts height was constructed on the eastern and northern side of the east yard at a cost of Rs.2.0 crores where there is a city interface.
- Proposed installation of Mechanized Dust Suppression System at the East Yard covering an area of about 200,000 m^2.
- Construction of dust barrier of about 4m. over high-rise wall as mentioned above on Eastern and Northern side of the east yard to contain pollution within the stack yards in

progress. The work on east side of East yard is already completed. With this total height of barrier will be 11.5m.

- Construction of high rise walls at R-11 area near convent junction is completed and Opposite ESSAR is in progress.
- Mechanical dust suppression system at R-4 & R-10 areas at a cost of 1 Crore is completed and is in operation.

The implementation of the above schemes will results in reduction in vehicular traffic (approximately 4690 trips /day) and the dust levels will be reduced drastically.

B) Water Environment

The major sources of wastewater generation in the port area could be the sewage are effluent from works shops, truck parking areas, etc. Sewage Treatment Plant with an installed capacity of 10 mld is installed at VPT. At present 6-7 mld of sewage is treated in the sewage treatment plant. Thus, the additional sewage generated during operation phases can be treated through the existing Sewage Treatment Plant. Provision for the construction of sewerage network for conveyance of untreated sewage from community toilets to sewage treatment plant has been kept as a part of Environmental Management Plan for construction phase.

C) Control of Water Pollution from Marine Transportation

The other major source of water pollution is oil spills which may occur during bunkering operations. To combat oil pollution near the port, portable oil skimmers should be available at the berth. A clean sweep oil recovery unit consisting of a power pack and the recovery unit mounted on a system can be utilized for this purpose. The recovery unit generally consists of a recovery drum, collecting trough, screw conveyor, discharge housing and wiper assembly. In addition, the berths should have chemical dispersants with spray pumps, catamarans for collection of debris and recovery of oil and tanker carriers of 5 kl capacity for recovering sludge/bilge water.

The International Convention for the Prevention of Pollution from Ships, 1973, as modified by the protocol of 1978 (MARPOL, 73/78), has issued guidelines for prevention of Marine Pollution. These are listed in subsequent paragraphs and should be strictly adhered to for prevention of marine pollution.

- ships are prohibited to discharge oil or oily water such as oily bilge water containing more than 15 ppm of oil within 19 km (12 miles) of land;
- chemicals are evaluated for environmental hazard which may cause environmental hazards if discharged into the sea (categories A, B, C and D). Discharge into the sea of

the most harmful chemicals (category A) is prohibited. Tank washings and other residues of less harmful substances (categories B, C and D) may only be discharged keeping in mind certain conditions e.g. total quantity of discharge, distance from the shore, depth of water prescribed depending on the hazards. There are no restrictions on substances such as water, wine, acetone, etc;

- harmful substances in the packaged form should not be disposed into the sea;
- sewage generated at the ship should not be disposed off into the sea, unless it is treated or it is disposed off at a certain distance from land;
- garbage produced on ship must be kept on board and discharged either ashore or into the sea under certain conditions, such as distance from the land; discharge of all plastics is prohibited.

D) Spillage of solid cargo

Comprehensive and easy to implement Standard Operating Procedure (SOP) will be made for each category of cargo in order to avoid spillages. SOPs will address safe conditions of wind, tide, visibility etc under which operations would be permissible. The operating staff at the berth will be trained in such operations and also to handle emergencies. Transfer of bulks to the stack yards will be through closed conveyors. Water sprinkling will be done at stack yards prone to generate wind-blown dust.

E) Green Belt Development

In the proposed project, Green belt will be developed over an area of about 10 Acre. A horticulture department, nursery will be set up to start the development of green belt from the time of commencement of the project. A double ring design is proposed for effective fugitive emission & noise amelioration. The green belt will be on a 8m internal width and 15m external width. Plantation will be done at 2.5m x 2.5m with gap filling with ground flora. Road side plantation will also be carried out.

Plants selected will be evergreen, indigenous, ecologically compatible, low water requirement, minimum care and having high pollutants absorption, tolerance and resistant capacity. Also the height, spread, canopy, growth rate and aesthetic effect will be considered. A budget of 2.5 million has been earmarked in Environmental Management Plan for development of the green belt. The details of the species recommended for the green belt area given in Table 6.1.

Table 6.1 Species Recommended for Green Belt Development

S. No.	Region	Botanical Name	Local Name
1	Outer Boundary	*Casurina equisetifolia*	Whistling pine
2		*Polyalthealongifolia*	Ashoka
3		*Alistonia scholaris*	Saptaparni
4		*Eucalyptus* sp.	Safeda
1	Middle fringe	*Azadirachta indica*	Neem
2		*Albizia procera*	Shirish
3		*Ficus religiosa*	Pipal
1	Inner area	*Delonix regia*	Gulmohur
2		*Mangifera indica*	Mango
3		*Pongamia pinnata*	Karanj
4		*Michelia champaca*	Champa
5		*Cassia siamea*	Kasood
1	Other shrubs	*Calotropis* spp.	Madar
2		*Thevetia peruviana*	Pili kaner
3		*Lantana camera*	Raimuniya
4		*Nerium indicum*	Kaner

6.3 EMP FOR THE DEVELOPMENT OF WEST QUAY NORTH (WQ-7 & WQ-8) BERTH WITH MECHANIZED HANDLING FACILITIES FOR HANDLING BULK CARGOES

6.3.1 Construction Phase

This project envisages development of West Quay North (WQ-7 & WQ-8) berth with mechanized handling facilities for handling bulk cargoes

A) Land Environment

The proposed project would require significant amount of construction material. The fine and the coarse aggregates required for the construction activities are proposed to be excavated from local quarries or borrow pits. During construction phase, runoff from these sites would increase soil erosion from such sites. Hence, on completion of construction activities, it shall be made mandatory for the contractor to annihilate all signs of haul roads, storage areas, temporary structures, labour colonies, etc. Extraneous material and objects shall be removed from the site. These aspects will be made mandatory as a part of the contract agreement.

The major impacts on land environment are expected during construction phase only. The borrow pit areas are generally left untreated. During monsoon months, these untreated borrow areas get filled up with water and these can serve as potential breeding sites for mosquitoes. During construction phase, significant amount of construction material will be generated due to dismantling of existing structures. The usable debris shall be utilized.

It is recommended that only existing approved quarries will be used for the purpose. Thus, the project proponents, i.e. Visakhapatnam Port Trust are not expected to get involved in the quarry reclamation process, as it is proposed to extract the construction material from the approved quarries.

Sanitation Facilities in Labour Camps

The major source of water pollution in the construction phases is the sewage generated by the workers and employees. During construction phase total increase in the labor population is expected to be of the order of 300. The total water requirement for 500 persons has been estimated as 44 m^3/day. Thus, the sewage generated would be of the order of (0.8 x 44) 35.20 m^3/day. It is proposed to construct 15 Nos. of community toilets with septic tanks within labour camps. An amount of **Rs. 0.6 million** has been earmarked for this purpose. The sewage generated form the labour camps shall be conveyed to the existing STP. There is sufficient unutilized capacity in the sewage treatment plant.

Sewage Collection System

The major source of water pollution in the construction and operation phases is the sewage generated by the workers and employees. During construction phase about 35.20 m^3/day of sewage is expected to be generated. It is proposed to construct community toilets within labour camps. An amount of **Rs. 0.5 million** has been earmarked for this purpose. The sewage from the labour camps shall be conveyed to the existing STP. There is sufficient unutilized capacity in the sewage treatment plant.

Sewage collection is presently carried out through pipelines, which is finally connected to two canals namely Gangulagadda and Yerrigadda, which convey the sewage at the STP located near ore handling facility. The total handling capacity of the STP is 10 mld. At present 6-7 mld of sewage is treated in the sewage treatment plant. The sewage is treated through a clarifier, aerator and finally disinfected and used for sprinkling on the roads, ore handling complexes and stacking areas. Thus, additional sewage generated during operation and construction phases can be treated through the existing Sewage Treatment Plant.

Effluent from workshops, oil storage etc.

The effluent from workshops, oil storage, etc. will contain oil and grease particles which shall be treated in an oil skimmer and suitably disposed after treatment. The collected oily matter shall be stored in cans, etc. and disposed at landfill or any other site designated by the authority. district administration. An amount of **Rs. 1.00 million** has been earmarked for this purpose.

B) Air Environment

Control of Pollution due to increased vehicles

The major source of air pollution in the proposed project is the increased vehicular movement in the project construction phases. The movement of other vehicles is likely to increase as the commissioning of the project would lead to significant development in the area. Thus, as a control measure, vehicles emitting pollutants above the standards should not be allowed to ply either in the project construction or in the operation phases. Vehicles and construction equipment shall be fitted with internal devices i.e. catalytic converters to reduce CO and HC emissions.

All the roads in the vicinity of the project site and the roads connecting the quarry sites to the construction site should be paved or black topped to minimize the entrainment of fugitive emissions. If any of the road stretches cannot be blacktopped or paved due to some reason or the other, then adequate arrangements must be made to spray water on such stretches of the road.

C) Noise Control Measures

The construction and operation phases are likely to increase the vehicular traffic in the area, which can lead to increase in the ambient noise levels mainly along the road alignment. It is proposed to develop a greenbelt along the road stretches near to the habitation sites. Three rows of trees will be planted.

During construction phase, use of various construction equipment is the major source of noise. However, based on the modeling studies, the noise due to operation of various construction equipment is not likely to have any adverse impact on the habitations in nearby villages. However, efforts need to be made to reduce the noise generated by the various construction equipment. The various measures that could be implemented are as follows:

- Noise from air compressors shall be reduced by fitting exhaust mufflers and intake mufflers.
- Chassis and engine structural vibration noise can be dealt by isolating the engine from the chassis and by covering various sections of the engines.
- Noise levels from the drillers can be reduced by fitting of exhaust mufflers and the provision of damping on the steel tool.
- Exposure of workers near the high noise levels areas can be minimized. This can be achieved by job rotation/automation, use of ear plugs, etc.

The effect of exposure of high noise levels on the workers operating the various construction equipment is likely to be harmful. It is known that continuous exposure to high noise levels above 90 dB(A) affects the hearing acuity of the workers/operators and hence, has to be avoided. To prevent the adverse impacts, the exposure to high noise levels should be restricted as per the exposure period outlined in Table-6.1. Workers operating in the high noise areas shall be provided with ear plugs.

D) Marine Ecology

In this proposed development, dredging envisaged is about 1, 86,225 m^3 which might increase the turbidity during dredging operations. Hence, environment friendly Dredging Plan will be followed to minimise the turbidity cloud in the vicinity of the project site.

The following recommendations are made which require to be adopted for amelioration of adverse impacts to the extent possible:

- Dredger operators should follow proper safety procedures to avoid accidents and spills.
- Authorities should ensure that all the ships moving in proximity to the area to be dredged or disposal sites do not affect such activities or vice-versa.
- To reduce the potential for error on the part of the Contractor, endeavor should be made to regularly monitor the activities during dredging and disposal activities.
- The timing of dredging and disposal activities could be planned, where practical, to avoid and reduce any adverse impacts on sensitive marine flora and fauna. Measures could be considered in terms of the local hydro and soil dynamics with the aim of minimizing sediment suspension and extent of the area affected and ecology of the system to avoid sensitive periods.

E) Management of solid waste

At present, collection of Solid waste us done by VPT through the sanitary department and disposed through closed vans to the Kappulapadda located in the off limits of the city where the GVMC. During construction and operation phases, the solid wastes generated will contain mainly vegetable matter followed by paper, cardboard, packaging materials, wood boards, polythene, etc. The solid waste generated during project construction and operation phases will be collected and disposed in closed vans to existing site at Kappulapadda.

6.3.2 Operation Phase

A) Air Environment

During project operation phase of the West Quay North (WQ-7 & WQ-8) berth with mechanized handling facilities for handling bulk cargoes, major activity would be handling of bulk cargo. This specific project is to plan, design and construct 280m length of berth to cater to the berthing

requirements of vessels up to 230m LOA, 32.5m Beam,12.5m draft initially and 14.0m draft ultimately.

There will not be much of fugitive emissions during the operation phase of the west quay berth. However, the equipment deployed for cargo handling are expected to generate gaseous dust or contribute to fugitive dust emissions. The following measures are recommended to control air pollution due to road traffic:

- Excessive soil on paved areas will be sprayed (wet) and/or swept and unpaved areas will be sprayed
- Trucks carrying cargo shall be covered with tarpaulin, or maintain at least two feet of freeboard.
- Effective traffic management at site shall be ensured in the port. The number of trucks/vehicles to move in the port shall be regulated.
- Port area and vicinity (access roads, and working areas) shall be swept with water sweepers on a daily basis or as necessary to ensure there is no visible dust.

The above measures will be implemented at present project sites as well. The cost for implementation of the measures is included in the overall cost. Hence, separate budget has not been earmarked for this purpose under implementation of Environmental Management Plan. Part from the above suggested measures VPT is implementing the following dust pollution control measures, which will help control the air pollution during construction phase:

- The Coal stack yards at GCB, WOB, North and South of S4 Conveyor are provided with mechanical dust suppression system at a cost of Rs. 8.00 Crores, covering an area of 4,75,000 m^2 commissioned in the year 2002 and the same is effective and and water sprinkling is done continuously round the clock.
- Wetting of cargo stacks at R-4 & R-10 by sprinkling of water with water tankers where Mechanised Water Sprinkling System was not installed.
- Wetting of roads through water tankers continuously round the clock to prevent emission of dust during movement of vehicles. A total of 275 trips of water (about 4.0 MLD) is being sprinkled every day through tankers and 3.0 MLD is being sprinkled in stacking areas through Mechanical Dust Suppression System.
- Tucks will be covered with tarpaulins.
- Manual sweeping of the roads.

B) Water Environment

The major sources of wastewater generation in the port area could be the sewage are effluent from works shops, truck parking areas, etc. Sewage Treatment Plant with an installed capacity of 10 mld is installed at VPT. At present 6-7 mld of sewage is treated in the sewage treatment plant. Thus, the additional sewage generated during operation phases can be treated through the existing Sewage Treatment Plant. Provision for the construction of sewerage network for conveyance of untreated sewage from community toilets to sewage treatment plant has been kept as a part of Environmental Management Plan for construction phase.

C) Control of Water Pollution from Marine Transportation

The other major source of water pollution is oil spills which may occur during bunkering operations. To combat oil pollution near the port, portable oil skimmers should be available at the berth. A clean sweep oil recovery unit consisting of a power pack and the recovery unit mounted on a system can be utilized for this purpose. The recovery unit generally consists of a recovery drum, collecting trough, screw conveyor, discharge housing and wiper assembly. In addition, the berths should have chemical dispersants with spray pumps, catamarans for collection of debris and recovery of oil and tanker carriers of 5 kl capacity for recovering sludge/bilge water.

The International Convention for the Prevention of Pollution from Ships, 1973, as modified by the protocol of 1978 (MARPOL, 73/78), has issued guidelines for prevention of Marine Pollution.

D) Berth related wastes

The wastes generated at berths in normal operations include domestic effluent, garbage and solid wastes (debris, leftover plastic items, boxes, containers etc). Sufficient number of toilets and bathrooms will be provided to the operational staff. The sewage will be collected and treated the existing STP. The treated sewage shall used for greenbelt development. A site in the vicinity of berths will be cordoned and mark as solid waste collection site. The waste so collected will disposed to the existing solid waste disposal site at Kappulapadda.

E) Green Belt Development

VPT is undertaking the plantation programme on a Continuous basis for the last 2 decades for continual improvement and addition of Green Belt in and around Port area. So, far 4,30,000 sampling has been planted over an area of 630 acres at different areas including port operational areas, residential and city areas. It is proposed to develop the green belt on the periphery of the area proposed to be developed for WQ-North (WQ-7 & WQ-8) berth in the Inner Harbour of Visakhapatnam Port.

A double ring design is proposed for effective fugitive emission & noise amelioration. The green belt will be on a 8m internal width and 15m external width. Plantation will be done at 2.5m x 2.5m with gap filling with ground flora. Road side plantation will also be carried out.

Plants selected will be evergreen, indigenous, ecologically compatible, low water requirement, minimum care and having high pollutants absorption, tolerance and resistant capacity. Also the height, spread, canopy, growth rate and aesthetic effect will be considered. The species recommended for greenbelt development are given in Table-6.1. A budget of Rs. 2.5 million has been earmarked for the development of the green belt.

6.4 EMP FOR EXTENSION OF EXISTING CONTAINER TERMINAL IN THE OUTER HARBOUR OF VISAKHAPATNAM PORT

6.4.1 Construction Phase

This project envisages the extension of Existing Container Terminal in the outer harbour of Visakhapatnam Port to enhance capacity handling to the tune of 0.54 MTEUs. Proposed extension envisages the construction of berth 395mX34m, 200t capacity mooring dolphin, container storage yards, Terminal roads and administrative buildings. Water supply and storm water drainage system will also be provided as a part of the proposed extension. Construction of berth will lead to the increase in traffic and ship movement at VPT. The total Environmental Management measures proposed for the control of pollution during operation phase are summarised as below:

A) Land Environment

Proposed activities are proposed within the present project are located within the existing Visakhapatnam Port. No additional land is proposed to be acquired for the project. However, during construction phase, lot of ancillary developments like shops, restaurant, repair shops, etc. may develop around the Visakhapatnam port area. This may lead to additional load on the existing infrastructure in the area.

It shall be made mandatory for the contractor to annihilate all signs of haul roads, storage areas, temporary structures, labour colonies, etc, on completion of construction activities. Extraneous material and objects shall be removed from the site. These aspects will be made mandatory as a part of the contract agreement.

On completion of construction activities, roads shall be resurfaced completely. Material excavated during construction or a part of the material generated due to dismantling of existing facility will be utilized for this purpose.

Sanitation Facilities in Labour Camps

The major source of water pollution in the construction phases is the sewage generated by the workers and employees. During construction phase total increase in the population is expected to be of the order of 200. The total water requirement for 500 persons has been estimated as 30 m^3/day. Thus, the sewage generated would be of the order of (0.8 x 30) 24 m^3/day. It is proposed to construct 10 Nos. of community toilets with septic tanks within labour camps. An amount of **Rs. 0.5 million** has been earmarked for this purpose. The sewage generated form the labour camps shall be conveyed to the existing STP. There is sufficient unutilized capacity in the sewage treatment plant.

Sewage Collection System

Sewage collection is presently carried out through pipelines, which is finally connected to two canals namely Gangulagadda and Yerrigadda, which convey the sewage at the STP located near the ore handling facility. The total handling capacity of the STP is 10 mld. At present 6-7 mld of sewage is treated in the sewage treatment plant. The sewage is treated through a clarifier, aerator and finally disinfected and used for sprinkling on the roads, ore handling complexes and stacking areas. Thus, the additional sewage generated during construction phases can be treated through the existing Sewage Treatment Plant. An amount of **Rs. 0.5 million** has been earmarked for construction of sewerage network for conveyance of untreated sewage from community toilets to sewage treatment plant.

Effluent from workshops, oil storage etc.

The effluent from workshops, oil storage, etc. will contain oil and grease particles which shall be treated in an oil skimmer and suitably disposed after treatment. The collected oily matter shall be stored in cans, etc. and disposed at landfill sites designated by the district administration.. This facility can be utilized for treatment of effluents carrying high level of Oil & Grease from other sources in the Visakhapatnam port area. An amount of **Rs. 1.00 million** has been earmarked for this purpose.

B) Air Environment

Control of Pollution due to increased vehicles

The major source of air pollution in the proposed project is the increased vehicular movement in the project construction and operation phases.

The movement of other vehicles is likely to increase as the commissioning of the project would lead to significant development in the area. Thus, as a control measure, vehicles emitting pollutants above the standards should not be allowed to ply either in the project construction or

in the operation phases. Vehicles and construction equipment should be fitted with internal devices i.e. catalytic converters to reduce CO and HC emissions.

All the roads in the vicinity of the project site and the roads connecting the quarry sites to the construction site should be paved or black topped to minimize the entrainment of fugitive emissions. If any of the road stretches cannot be blacktopped or paved due to some reason or the other, then adequate arrangements must be made to spray water on such stretches of the road.

C) Noise Control Measures

The construction and operation phases are likely to increase the vehicular traffic in the area, which can lead to increase in the ambient noise levels mainly along the road alignment. It is proposed to develop a greenbelt along the road stretches near to the habitation sites. Three rows of trees will be planted.

During construction phase, use of various construction equipment is the major source of noise. However, based on the modeling studies, the noise due to operation of various construction equipment is not likely to have any adverse impact on the habitations in nearby villages. However, efforts need to be made to reduce the noise generated by the various construction equipment. The various measures that could be implemented are as follows:

- Noise from air compressors could be reduced by fitting exhaust mufflers and intake mufflers.
- Chassis and engine structural vibration noise can be dealt by isolating the engine from the chassis and by covering various sections of the engines.
- Noise levels from the drillers can be reduced by fitting of exhaust mufflers and the provision of damping on the steel tool.
- Exposure of workers near the high noise levels areas can be minimized. This can be achieved by job rotation/automation, use of ear plugs, etc.

The effect of exposure of high noise levels on the workers operating the various construction equipment is likely to be harmful. It is known that continuous exposure to high noise levels above 90 dB(A) affects the hearing acuity of the workers/operators and hence, has to be avoided. To prevent the adverse impacts, the exposure to high noise levels should be restricted as per the exposure period outlined in Table-6.1. Workers operating in the high noise areas shall be provided with ear plugs.

D) Marine Ecology

In this proposed development, dredging envisaged is about 5,96,024 m^3 which is substantial and hence, it is necessary to evolve an environment friendly Dredging Plan, where the depth of cut is engineered on sound scientific principles and steps taken to minimise the turbidity cloud in the vicinity of the drag/cutter head. The dredged material will be used for land reclamation purpose.

The following recommendations are made which require to be adopted for amelioration of adverse impacts to the extent possible:

- Dredger operators should follow proper safety procedures to avoid accidents and spills.
- Authorities should ensure that all the ships moving in proximity to the area to be dredged or disposal sites do not affect such activities or vice-versa.
- To reduce the potential for error on the part of the Contractor, endeavor should be made to regularly monitor the activities during dredging and disposal activities.
- The timing of dredging and disposal activities could be planned, where practical, to avoid and reduce any adverse impacts on sensitive marine flora and fauna. Measures could be considered in terms of the local hydro and soil dynamics with the aim of minimizing sediment suspension and extent of the area affected and ecology of the system to avoid sensitive periods.

E) Management of solid waste

At present, collection of Solid waste us done by VPT through the sanitary department and disposed through closed vans to the Kappulapadda located in the off limits of the city where the GVMC. During construction and operation phases, the solid wastes generated will contain mainly vegetable matter followed by paper, cardboard, packaging materials, wood boards, polythene, etc. The solid waste generated during project construction and operation phases will be collected and disposed in closed vans to existing site at Kappulapadda.

F) Disposal of Dredged Material

The total quantity of dredged material likely to be generated in the proposed project has been estimated as 8,66,249 m^3 of which 5,96,024 m^3 will be generated due to extension of existing Container Terminal. The entire dredged material shall be disposed at designated disposal sites based on the RAT study and no reuse of the dredged material is envisaged. The dredged material disposal site based on the RAT study is shown in Figure-6.1.

6.4.2 Operation Phase

A) Air Environment

Project envisages the extension of Existing Container Terminal in the outer harbour of Visakhapatnam Port to enhance capacity handling to the tune of 0.54 MTEUs. There will not be any bulk/loose cargo on the proposed berth. Hence there will not be much of fugitive emissions during the operation phase of the proposed Container Terminal. However, the equipment deployed for Container handling are expected to generate gaseous emissions. The following measures are recommended to control air pollution due to road traffic:

- Excessive soil on paved areas will be sprayed (wet) and/or swept and unpaved areas will be sprayed
- Effective traffic management at site shall be ensured in the port. The number of trucks/vehicles to move in the port shall be regulated.
- Port area and vicinity (access roads, and working areas) shall be swept with water sweepers on a daily basis or as necessary to ensure there is no visible dust.

The above measures will be implemented at present project sites as well. The cost for implementation of the measures is included in the overall cost. Hence, separate budget has not been earmarked for this purpose under implementation of Environmental Management Plan.

B) Water Environment

The major sources of wastewater generation in the port area could be the sewage are effluent from works shops, truck parking areas, etc. Sewage Treatment Plant with an installed capacity of 10 mld is installed at VPT. At present 6-7 mld of sewage is treated in the sewage treatment plant. Thus, the additional sewage generated during operation phases can be treated through the existing Sewage Treatment Plant. Provision for the construction of sewerage network for conveyance of untreated sewage from community toilets to sewage treatment plant has been kept as a part of Environmental Management Plan for construction phase.

C) Control of Water Pollution from Marine Transportation

The other major source of water pollution is oil spills which may occur during bunkering operations. To combat oil pollution near the port, portable oil skimmers should be available at the berth. A clean sweep oil recovery unit consisting of a power pack and the recovery unit mounted on a system can be utilized for this purpose. The recovery unit generally consists of a recovery drum, collecting trough, screw conveyor, discharge housing and wiper assembly. In addition, the berths should have chemical dispersants with spray pumps, catamarans for collection of debris and recovery of oil and tanker carriers of 5 kl capacity for recovering

sludge/bilge water. The International Convention for the Prevention of Pollution from Ships, 1973, as modified by the protocol of 1978 (MARPOL, 73/78), has issued guidelines for prevention of Marine Pollution.

D) Berth related wastes

Project envisages to enhance the of capacity for container handling and there will not be any bulk cargo. Hence, solid waste generation is not anticipated during operation phase. However dust bins will be provided for the collection of domestic solid waste The waste so collected will disposed to the existing solid waste disposal site at Kappulapadda.

E) Green Belt Development

VPT is undertaking the plantation programme on a Continuous basis for the last 2 decades for continual improvement and addition of Green Belt in and around Port area. So, far 4,30,000 sampling has been planted over an area of 630 acres at different areas including port operational areas, residential and city areas. The status on Plantation programme of VPT is given as under:

- Plantation of 13,500 completed in Western sector of Port area and is under maintenance.
- 28,280 plants are planted in 2012 at a cost of Rs. 75 lakhs.
- Plantation of 4000 plants at a cost of Rs. 18 lakhs in the old town area was entrusted to GVMC.
- Plantation work of 2000 plants in BRTS road leading to Mudasarlova is in progress by a voluntary organization Jain International society for which VPT consented to pay Rs. 2 lakhs.
- Plantation of 13,350 plants is entrusted to VUDA at a cost of Rs.37 lakhs.
- Plantation of 27,000 plants is entrusted to Social forestry department, A.P. State Government at a cost of Rs. 1.20 Cr.
- Tenders being invited for plantation of another 27,000 plant**.**

It is proposed to develop the green belt on the periphery of the area proposed to be developed for WQ-North (WQ-7 & WQ-8) berth in the Inner Harbour of Visakhapatnam Port. In the proposed project, Green belt will be developed over an area of about 10 Acre. A horticulture department, nursery will be set up to start the development of green belt from the time of commencement of the project. A double ring design is proposed for effective fugitive emission & noise amelioration. The green belt will be on a 8m internal width and 15m external width.

Plantation will be done at 2.5m x 2.5m with gap filling with ground flora. Road side plantation will also be carried out.

Plants selected will be evergreen, indigenous, ecologically compatible, low water requirement, minimum care and having high pollutants absorption, tolerance and resistant capacity. Also the height, spread, canopy, growth rate and aesthetic effect will be considered. The species recommended for Greenbelt Development are given in Table-6.1. A budget of Rs. 2.5 million has been earmarked for the development of the green belt.

6.5 EXISTING POLLUTION CONTROL MEASURES

Visakhapatnam Port Trust being a bulk cargo handling port and in order to address the dust generation problem, as a continual improvement, apart from mechanization of bulk cargoes handling viz. Coal, Iron ore, Fertilizers etc. through BOT/PPP operators, port has taken up various other pollution control measures and are being monitored through a mechanism as mentioned below:

Source of Dust Generation

In conventional coal handling, dust generation is mainly due to multiple handling such as unloading the coal from ship using grabs and placed on the berth, from berth loading in to dumpers, dumpers transport the coal to stackyards, stacking of coal at stack yards, from stack yard loading in to railway wagons etc.

Mitigation Measures for Coal Handling

In order to address the dust generation problem, mechanization of cargo handling is the major solution, where in bulk cargo / coal unloaded from ship falls in a hopper, from hopper passed on to closed conveyor, conveyor to stack yard, from stack yard to silo with bucket wheel reclaimer / conveyor arrangement, loading in to railway wagons from silo etc. and transportation to the destination. In the said process, it can be seen that transport to stack yards through dumpers by road is avoided and conventional handling as mentioned above is avoided. Also environmental measures viz. sprinkling and dry fogging at unloading points, transfer houses in conveyor system are also essential and there by dust generation is minimized.

Mitigation Measures for Mechanized Coal Handling

Mitigation Measures in other Areas

A) The very first step in controlling and managing the dust generated by Coal handling is the Mechanical Dust Suppression System (MDSS), which was commissioned in 2002 with capital cost of Rs. 7.89 Crores. This system sprinkles water over the Coal stacks at the stack yards so that the Coal stacks are wet and the dust does not rise into the air.

B) To reduce the spread of dust on to areas beyond the Port, a dust barrier was constructed at the R11 area in the North at a height of 7.5 meters for a length of 500m. at a cost of Rs.1.50 Crores. Another dust barrier of height 11.5 metres for a length of 1000m was constructed on the Eastern and Northern side of the East Yard at a cost of Rs.2.50 Crores.

C) 90% of the coal is being evacuated by rail avoiding road movement and thereby to minimize dust emissions. However, the roads in the Visakhapatnam Port are being wetted by water tankers round the clock to prevent emission of dust during movement of vehicles. A total of 275 trips i.e. about 4.0 MLD of treated water is sprinkled per day through tankers and a about 3.0 MLD is sprinkled through MDSS.

D) Covering of trucks, railway wagons and stacks with tarpaulins.

E) A comprehensive environment management system is set up to remove floating matter from Geddas, desilting of drains, manual sweeping of roads, etc. at the cost of Rs.6.38 Crores. Work order issued during July 2015 for a period of two years and the work is in progress.

F) In order to reduce fugitive dust, agents are covering the coal stacks with tarpaulins. However, whenever the agents are not covering the stacks as mentioned above, Visakhapatnam port is taking up covering of the such stacks, for which an agency is in place for Supply of Tarpaulins and manpower for covering of Coal and other Cargo stacks with Tarpaulins at yearly cost of Rs.0.85 Crores.

G) Two Truck Mounted Fog Canons deployed to suppress the dust while loading / unloading cargo at berth and stack yards at a cost of Rs.0.90 Crores.

H) Construction and operation of Truck Tyre Cleaning System at B Ramp i.e. at the interface of port and city roads, at a cost of Rs.0.81 Crores for which work order issued on 14.09.2015 and work is in progress and targeted to be completed by March 2016.

I) The reorganization of the stack yards is in progress so that the dust generating stacks such as Coal is being shifted to the inner side of the Harbour and non-dusty cargos at the periphery. Initially shifting of cargo to designated stacks is targeted to be completed by March 2016.

J) Repairs / modifications to existing sprinkling systems at S4 and WOB areas at a cost of Rs. 1.60 crores is in progress and targeted to be completed by end of March 2016.

K) Supply, operation & maintenance of Continuous online ambient air quality monitoring (CAAQM) stations at three identified areas of Port of Visakhapatnam for a period of 5 years at a cost of Rs. 2.71 crores is under progress and expected to be completed by end of April 2016.

Mitigation measures for bulk cargo handling other than coal:

Summary of existing Environment Management System for other bulk cargo handling other than coal is given in Table- 6.2.

Table- 6.2. - Summary of existing Environment Management System

S.No.	Berth	Cargo	EMS in place
1	EQ-3	Pet Coke, Steel, Food grains, Container cargo	1. Mechanical handling with respect to Iron ore and semi mechanical handling of Fertilizers and Fertilizer raw materials. 2. Manual sweeping and Sprinkling of water on wharfs to minimize surface dust emissions. 3. Covering of cargo carrying trucks with tarpaulins while moving to and from berths w.r.t. bulk cargo. 4. Provision of save wall nets along berth for preventing spillages into the sea. 5. Maintaining the minimum drop height while unloading from ships onto the berth where there is no feasibility of wetting of cargo. 6. Covering of stacks with tarpaulins and maintaining the height under permissible limit. 7. Deployment of Mobile fog cannons for spraying the water for preventing the spreading the of air emissions while unloading from ship to berth and loading into trucks/wagons etc.
2	EQ-4		
3	EQ-5		
4	EQ-6	Anthracite coal, BF Slag, Fertilizers, Phosphoric acid, Fertilizer Raw Materials	
5	EQ-7	Finished Fertilizers	
6	EQ-10	Liquid cargo	
7	WQ-2	Iron Ore, granite	
8	WQ-3	Steel, Soya, Pet coke & Iron Ore.	
9	WQ-4	Iron Ore, Iron ore pellets, lime stone & Steel.	
10	WQ-5	Alumina, granite & caustic soda.	
11	WQ-6	Dry Bulk Cargo (CP Coke, LAM Coke, Steel, Granite blocks)	
12	Fertilizer Berth	Fertilizer Raw material and Finished Fertilizers.	

6.6 PROPOSED ENVIRONMENTAL MITIGATION MEASURES FOR UPCOMING PROJECTS:

A) SHORT TERM PLANS (DURING 2015-17):

(a) Under continual improvement program, another dust barrier of 7.50m height and 1.70KM long i.e. from the Sea Horse Junction to Convent Junction at the city interface is under construction at a cost of Rs.9.75 Crores. Work order was already released and the work is under progress and expected to be completed by May 2016.

(b) Sweeping of roads within the Port by mechanical sweeping machine at a cost of Rs.2.81 Crores. Tenders have been floated.

(c) Up-gradation and strengthening of BT and CC Blocks for Operational Roads including drains and Berms (East Zone) at a cost of Rs.16.31 Crores. Tenders have been floated.

(d) Strengthening and up-gradation of BT and CC Blocks for roads including drains and berms (Convent Junction to PCR Junction) at a cost of Rs.18.32 Crores. Tenders have been floated.

(e) Refurbishment of STP to handle 10MLD with proper quality output as per APPCB norms at an estimated cost of about Rs. 1.50 crores. At estimate stage and targeted to be completed by end of June 2016.

B) LONG TERM PLANS (DURING 2015-18):

(a) Re-organization of stack yards duly providing Environmental safeguards viz. Service road, raised kerb wall around stacks, sprinkling system, Plantation around stacks etc.

(b) Dismantling and re-construction of West Quay berths i.e from part of WQ-2 to WQ-5 for handling 14.50m draft vessels with fully mechanized handling facilities for handling bulk cargoes.

(c) Dismantling and re-construction of part of EQ5 and EQ-6 berths for handling 14.50m draft vessels with fully mechanized handling facilities for handling bulk cargoes. Mechanization of cargo handling at EQ6 berth.

(d) Development of multipurpose terminal by replacement of existing EQ2 to EQ5 berths to cater to 14.50m draft vessels with fully mechanized handling facilities for handling bulk cargoes in inner harbour of Visakhapatnam Port.

(e) Development of West Quay North (WQ-7 & WQ-8) berth with mechanized handling facilities for handling bulk cargoes.

6.7 MONITORING O F EXISTING ENVIRONMENTAL MANAGEMENT SYSTEMS:

(a) As a proactive measure and to achieve continual improvement, Visakhapatnam Port has engaged the services of the Administrative Staff College of India, Hyderabad for the preparation of "Environmental Management and Monitoring Plan" (EMMP). The said report was submitted in January 2015 and the Port is implementing the same.

(b) Port has engaged the services of Administrative Staff College of India, Hyderabad for monitoring the implementation of identified EMPs under EMMP.

(c) The Port has engaged the services of the Jawaharlal Technological University, Kakinada to come up with an "Assessment of Effectiveness of existing air pollution management plan of Public Private Partnership partners and other areas of Visakhapatnam Port". The said report is expected to be submitted by December 2015.

(d) The Visakhapatnam Port has engaged the services of the National Environment Engineering Research Institute (hereinafter referred to as NEERI) for the preparation of "Disaster Management Plan". The said plan was submitted in July 2014 and has been in force.

(e) The ambient air quality monitoring at three locations of the surrounding areas of the Visakhapatnam Port has been entrusted to the Andhra University.

(f) The STP water quality and Ambient Air Quality monitoring at three locations of the area around the Visakhapatnam Port is entrusted to the APPCB and same is in progress.

6.8 ENVIRONMENTAL MANAGEMENT CELL

Visakhapatnam Port is accredited with ISO Certification (ISO 14001) by the Indian Register of Quality Systems for the Environmental Management System standards in all its activities including related support services.

An Environmental Monitoring Committee (EMC) headed by renowned Environmentalist Prof. S. Rama Krishna Rao as Chairman of the Committee is in place with members representing Citizen Welfare Associations, NGOs, Academic Institutions, Industries/Defense, Trade, Observers from Andhra Pradesh Pollution Control Board (APPCB), Government Organisations and Senior Officers of the Port. The Committee reviews the implementation of long term and short-term directives issued by APPCB and also reviews the environmental activities to be implemented by the Port. The Committee also inspects various operational areas of the Port and advises improvements on the Environmental activities carried out and gives suggestions for additional Environmental pollution mitigative measures as may be necessary based on the requirements from time to time.

* Three Sub-Committees are constituted to review and monitor AAQ (Ambient Air Quality), Green Belt Development and Hazard Management. The EMC reviews the findings of the Sub-Committees and advises suitably on the environmental improvement measures.

Environmental Cell has been established to monitor the environmental activities of the Port, duly appointing persons qualified in the field of Environment Management.

The measures taken by the Port to mitigate Environmental Pollution include:

- Monitoring of Ambient Air Quality at six locations in and around the Port area by Port and third parties like Andhra University Development Center and APPCB.
- Monitoring of harbour water quality at regular intervals through Andhra University Development Center.
- Monitoring of STP waters before and after treatment at regular intervals.
- Regular monitoring of pollution control measures in and around Port area and residential areas.
- Preparation of Environmental Management Action Plan and Comprehensive Environmental zoning and land use plan for all occupied and unoccupied areas for the next ten years through M/s. MECON, Ranchi.
- Distribution of pamphlets and display of message boards on Environmental Management.
- Development of Environmental Parks/ Nurseries and maintenance of Islands in and around Port areas.
- Continuous development of Greenbelt in and around port area.
- Mechanisation of cargo handling operations in phases.
- Monitoring effluent of Port based industries before discharging into Port Waters and ensuring that they posses consent of APPCB for their activities.

The Port is taking all possible measures to contain the pollution and to maintain the ambient air quality within permissible limits. In addition to the above measures, the Port is (i) modernizing the cargo handling facilities for coal, iron ore, fertilizers etc., (ii) re organizing stack yards (iii) insulating coal stack yards by providing high rise walls along with dust suppression system as long term measure to avoid dust pollution.

CHAPTER-7
OIL AND CHEMICAL SPILL CONTINGENCY PLAN

CHAPTER-7
OIL AND CHEMICAL SPILL CONTINGENCY PLAN

7.1 OIL SPILL CONTNGENCY PLAN IN OPERATION

Once the cargo operations are initiated correctly, main bulk of transfer takes place at a steady rate, though the rate will have to be brought down when a receiving tank is about to be filled and a new tank is to be lined up. Absence of reliable and continuous communication between the ship and shore can cause overflow, spillage, contamination, etc.

Modern cargo handling operations involve a great deal of dependence on instrumentation for indication and warning, on board as well as a shore. Failure of instrumentation, especially due to inadequate maintenance or lack of spares, have been a cause of serious damage.

While the cargo operations are underway, entry by unauthorized persons into the oil terminal area, jetties and vessels, smoking and prohibited zones have also led to accidents.

7.2 OIL/CHEMICAL SPILL

A well-integrated emergency plan for oil/chemical spill is absolutely essential in a port. A number of accidents have occurred world over due to accidental discharge/leakage of Cargo. In India Arabian Sea at Mumbai it occurred twice in 2010 and 2011. The possible accidental leak/release scenarios of oil/chemical spill occurs due to collision, grounding, barging/ banking during handling of petroleum products, loading & discharge of liquid cargo,' incorrect sequence of operations and during commencement/ completion of cargo operations. If cargo tanks are ruptured during collision followed by heavy spark, causes fire due to ignition of oil. On the basis of hazard study, the following scenarios are considered for oil/chemical spill in Inner and at Outer harbour.

7.2.1 Scenario Development

The following scenario's which are possible due to failure while loading/discharge of the petroleum products that may result in leak/release at the OSTT, LPG Jetty, Oil Wharf, FB and at Northern arm (EQ6, EQ7,WQ1 & WQ1 RE, WQ5). The cause of common failure is due to incorrect line up of ship/shore valves, Host failure, Gasket failure, Piping failure, over pressure in the line, damage to the hose by parting of mooring and striking of the tanker by passing vessel.

On the basis of hazard study, the following events are considered for consequence analysis of oil/chemical spill.

- Leak/release of crude at OSTT from vessel or transfer pipe line
- Leak/release of High Speed diesel at LPG jetty

- Leak/release of flammable liquids (IB & Ie) and combustible liquids at OR1, OR2 from vessel/transfer pipeline
- Leak release of Bio diesel at OIL Wharf and Northern arm berths from vessel & pipeline
- Leak/release of styrene monomer at OR1 &OR 2 from vessel/transfer pipeline
- Leak of sulphuric acid at WQ1 & WQ1 RE and phosphoric acid at EQ6/EQ7 of northern arm from vessel/ transfer pipeline
- Leak of caustic lye at EQ6/EQ7, WQ5 from vessel/transfer pipeline
- Spill over of Ammonia Nitrate at Northern arm berths (EO &WO) during handling
- Leak/release of molten Sulphur from vessel/transfer pipeline at FB
- Leakage of Alumina from vessel/transfer pipeline at WQ5 berth

7.3 OBJECTIVES OF OIL CHEMICAL SPILL CONTINGENCY PLAN

The objective oil/chemical spill contingency plan are to:

- Develop appropriate and effective systems for the detection and reporting of oil spill.
- Ensure that appropriate response techniques are employed to prevent, control and combat pollution and dispose off recovered material in an environmentally acceptable manner.
- Ensure adequate protection to public health, welfare and the marine environment.
- Ensure that complete and accurate records are maintained for all expenditure to facilitate cost recovery.

7.4 RESPONSE PLANS

Chairman, VPT is the chief emergency controller in onsite/offsite emergency situations and Deputy Conservator of the Port will be emergency coordinating officer. A guideline or response plan is delineated as shown in Table-7.1.

Table-7.1: Oil Spill Response Plan Guidelines

1. Introduction 1. Authorities & responsibilities Committee 2. Statutory requirement, relevant agreements. 3. Dimensions of plans 4. Interfaces with other plans	**6. Communication & Control** 1. Incident control room & facilities 2. Field communications and equipment logs 3. Reports, manuals, maps, charts and incident
2. Oil Spill Risks 1. Identification of activities and risks 2. Types of oil likely to be spilled	**7. Actions & operations - Initial procedure:** 1. Reporting incident preliminary estimate of emergency

3. Probable fate of spilled oil 4. Development of oil spill scenarios 5. Shoreline resources protection priorities 6. Shoreline sensitivity mapping . 7. Special local considerations	2. Notifying key team members/ authorities 3. Establishing and staffing control room 4. Collecting information - oil type, sea/wind forecasts, aerial. surveillance, beach report 5. Estimating fate of slice 24h-48h-72h 6. Identifying resources at risk inform parties immediately .. 7. Deciding whether to escalate response
3.Spill Response Strategies 1. Philosophy and objectives 2. Limiting and adverse conditions 3. Strategy for sea zones 4. Strategy for coastal zones 5. Strategy for shoreline zones 6. Strateqy for oil waste storage & disposal	**8.Operations Planning & Mobilization** 1. Assembling full response team 2. Identifying immediate response priorities 3. Mobilising immediate response 4. Preparing initial press statement 5. Planning medium term operations-24h-28h-72h 6. Mobilising/ placing on standby resources 7. Establishing field command post and communications.
4. Equipment. Supplies & Service 1. Primary oil spill equipment 2. Inspection maintenance arid testing 3. Auxiliary equipment, supplies and services. 4. Support equipment, supplies and service	**9. Control Operations**: 1. Establishing a managerial team with experts 2. Updating weather information as in 7.4 3. Reviewing and planning operations 4. Obtaining additional equipment, supplies and manpower 5. Preparing daily incident log & management report 6. Preparing operations accounts and financing reports 7. Preparing releases for public & press conferences 8. Brief local and Govt, officials
5. Management-manpower &training 1. Crisis manager & financial authorities 2. Incident organization chart 3. Manpower availability-on site/ on call 4. Availability of additional labour. 5. Advisors and consultants	**10. Termination of operations** 1. Deciding final and optimal levels of beach clean-up 2. Standing down equipment, cleaning, maintenance and replacement 3. Preparing formal detailed report

6. Training, safety schedules and emergency exercises	4. Reviewing plans and procedures

To combat oil/chemical pollution responsibility of organization has to be identified as in line with Fire-explosion, to deal with following components.

- Organisational structure of Emergency
- Port risk evaluation
- Area risk evaluation
- Notification and Communication

7.5 ACTION PLAN

On the basis of direct information through incident controller, immediate response is to implement action plan to take preventive measures for spill on land as well as on water. In case of oil spill accidents within Port limits, the Master as representative of the owner of the vessel and the cargo owner will take immediate action to inform the Port authorities and also to alert the concerned oil company representative onboard ship and immediately inform the oil terminal manager of the concerned oil company. The responsibility of the Port! user Agency / industry is to protect the Harbour water, fisheries and maintenance of .the ecology of the Port area. Hence full cooperation between all the parties concerned is required expeditiously and that as far as possible division of responsibility is to be delineated in principle, and accepted by all the parties.

7.5.1 Preventive Measures

Preventive measures are aimed at reducing the chance of error as far as possible and to ensure that only best materials are used and maintained. The entire accident prevention is constantly concerned with the elimination of mistakes, and although complete success is probably an unattainable target, the use of a checklist system goes a long way to minimize errors, and is particularly valuable when two different parties, the shore and ship personnel, are required to work together. Approved safety checklist as contained in the International Safety Guide for Oil Tankers and Terminals may be used (As per IMDG guide lines).

Prompt action In the event of accidental spillage is essential and it is advised strongly that throughout the period of loading and discharging, the following steps are to be followed:

- A responsible officer from the ship should be on watch on board and an adequate crew should remain on board to deal with emergencies.
- A responsible member of the ship's crew should be stationed near the ships main oil cargo control valves.

- Responsible member of the shore personnel should stand by the shore control valves at the shore end of the flexible hoses.
- Telephonic or other recognised communication systems between berth and pump house(s) or other point should be in working condition.
- At the commencement of operations and at each change of watch or shift, the responsible ship's officer and the responsible member of the shore personnel should confirm with each other that the "stand by", start loading", "stop loading", "slow down", "start discharging", "stop discharging" and any other necessary signals are properly understood and agreed.

At each jetty there should be an arrangement for stopping the flow of oil immediately in the event of failure of a manifold or hose on the ship or jetty. If the loading pumps are located away from the jetty (say more than 90m (295ft) away) remote-control arrangements at the loading berth and at another location, at a safe distance from the berth should be provided to stop the pumps immediately. In recent years, considerable progress has been made towards handling jetty equipment and in standardizing tanker manifold design to take full advantage of the improvement in hose-handling techniques and of the installation ofall oil booms. These arrangements have many variations to suit local needs. But in brief, the joining of a ship's manifold flanges and the jetty pipeline can be achieved by the following basic methods.

- Flexible hoses, the handling of which may be assisted by simple derricks/cranes.
- Booms terminating in flexible hoses.
- All metal swivel-jointed loading arms.

Flexible hoses are made of reinforced oil-resisting rubber to the specification of BS 1435: 1975 [3] and as recommended by the Oil Companies International Marine Forum "Buoy mooring forum standard".

However, a boat has been hired for keeping channel water in the Port clean, which works under the direction of Deputy Conservator. Chief Officer (pollution) takes necessary action to ensure that the Port waters are to be kept clean and initiates action to spray chemical for oil dispersion. Oil booms are also being placed around tankers.

7.5.2 Containment Measures

The containment measures must be capable of capturing oil that may discharge from a primary storage system (i.e., tank or pipe) such that the oil will not escape to the environment before cleanup occurs. Compliance requires the use of dykes, berms, retaining walls, curbing, spill diversion or retention ponds, absorbent materials or other equivalent measures. Under different

sections of the rule, a quick drainage system is required for tank car or tank truck loading/unloading racks and secondary containment is required for all bulk storage containers.

Bulk storage containers must be constructed with secondary means of containment for the entire capacity of the largest single container and sufficient freeboard to contain precipitation. Secondary containment of bulk storage containers is .typically accomplished by concrete or steel dikes, earth berms, double-wall tanks or remote impoundments. Examples of common appropriate containment measures for operational equipment include the following methods:

1. Absorbent material

In the case of indoor hydraulic reservoirs (e.g., elevators, vehicle hoists, dock levelers, machinery etc.) appropriate containment may be achieved by placing absorbent materials around equipment to prevent spilled oil from reaching a floor drain or other drainage inlet. Absorbent materials are readily available in a variety of shapes and sizes.

2. Concrete curbing

In the case of outdoor electrical equipment, appropriate containment may be achieved by constructing concrete curbing around the equipment to prevent the lateral migration of oil from reaching a drainage inlet before cleanup occurs. Curbing needs to be constructed around common outdoor pad.

3. Drainage inlet cover

These are placed over drainage inlet structures to prevent spilled oil from entering the drainage system and discharging into the environment. This option required keeping the drainage inlet covered for all the time. The drainage inlet operations should be properly supervised and inspected in consistent with the rules. Drainage inlet covers are most effective when the surrounding surface is conducive to a tight seal and the area is free of debris.

Loading / Unloading Rack containment

According to loading/ unloading rack containment procedures "where loading / unloading area drainage does not flow into a catchment's basin or treatment facility designed to handle discharges, use a quick drainage system for tank car or truck loading and unloading areas. It is necessary to design any containment system to hold at least the maximum capacity of any single compartment of a tank car or truck loaded or unloaded at the facility". The requirement for loading/ unloading rack containment applies to all bulk storage facilities, whether they are above ground or completely underground containers. This requirement does not apply to operational equipment.

7.5.3 Combat Pollution - Equipment

Equipment needed to combat oil pollution are booms, skimmers, transfer pumps, vacuum trucks, absorbents and dispersants. Apart from fire fighting and protective equipments boats, small crafts are also needed along with supportive equipment. Available resources to combat oil spill with VPT and pollution control equipment along with equipment to be procured is listed in Tables-7.2 and 7.3.

Table-7.2: Available Resources for Combating Oil Spills

Organization	Equipment Type	Size	Location	Supply Delay	Contact Tel/Mob
Port Trust	Rigid Boom w/crew	450m	Oil wharf Marine com.	--	--
	Inflatable type				
Coast Guard	Boom	200m	Vizag	1 hr.	568875/79
Coast Guard	Skimmer				
Port Trust	Dispersant	1000 L	MF		
Coast Guard	Dispersant	800 L	Vizag	1 hr.	
Port Trust	Spray units				
Coast Guard	Spray units		Vizag		
Port Trust	Absorbent pads				
Coast Guard	Absorbent		Vizag		
Port Trust	Plastic bags				
Port Trust	Disposal truck	1 x1 Ot	FS		
Port Trust	VHF-Radio	2 units	FS		
Coast Guard	VHF-Radio	2 units	Vizag		
Port Trust	Tugs	1 No.	MF		
Port Trust	Launch/workboat	1	MF		
Port Trust	Protective clothing		FS		
Coast Guard	Survl aircraft	Donier	Chennai	2/3 hrs.	
	Aircraft fuel				
	Portable	1	Vizag	1 hr.	
	Floodlights				

Table-7.3: Pollution Control Equipment with VPT • Oil Pollution

S.No.	Equipment	Quantity
1	Oil Recovery and Pollution Control Vessel	300 m PI boom
2	Dispersant chemicals	1000 Ltr
3	Rigid Type Oil Booms	500 m
4	Masonry Tank to store the oily water(cap 100 m3)	1 No

S.No.	Equipment	Quantity
5	Hired Launch for collecting Floating debris & Oil slicks	1 No
6	Absorbent Materials(waste Cotton Raqs)	12 Bags
7	Buckets Non-sparking(15 Itrs capacity)	4 Nos
8	Scoops	8 Nos
9	Portable Sprayers	4 Nos
10	Moping/Oil absorb pads	48 Nos
11	Protective Clothing (Body Glove Hand) System/Rubberized	4 Sets
12	Saw Dust	6 Bags

7.6 APPLICABLE DOMESTIC AND INTERNATIONAL AGREEMENTS

Memorandum of Understanding (MOU) has been signed with M/s. Hindustan Petroleum Corporation Limited (HPCL) – Visakh Refinery, HPCL-Visakh Terminal, Bharat Petroleum Corporation Limited (BPCL) and Indian Oil Corporation Limited (IOCL) on 07-08-2012for a period of 5 years, to meet the requirement of providing Tier-I Oil Spill Response facility to combat oil spill at Visakhapatnam Port.

7.7 COMAND POST (Policy and procedures for establishing Staffing/Supplies)

Chairman/Dy. Chairman is the Chief Emergency, Controller in onsite/off-site Emergency situations and have Authority for establishing staffing/supplies.

7.8 DATA COLLECTION

- Receipt of initial report Tracking spill movement(aircraft, spill models)
- Person discovering the pollution will inform Port Control on VHF channel 16 or Telephone No. 2562135/2564841 Extn. 2875569,2875570 or COT/MF on 2555980, 2875194/2875086
- The Port Control immediately inform the Action Group, which consists of H.M., Duty Pilot, F&ASO, Inspector (ClSF), RMO/GJH, E.E.(Mech.- MCC), E.E.(Civil), E.E.(E/I1) & Dy.T.M

7.9 OPERATIONAL ADMINISTRATION

A close watch is being kept on spills of Oil from vessels visiting VPT for discharging/loading Oils. On receiving information of erring vessels, C.O. (POL) along with his team, visit the area and initiate immediate and necessary steps to minimize the effect of Oil spilled. The used chemical dispersants, equipment and personnel deployed to remove/minimize the effect of Oil slicks will be assessed to arrive at the expenditure incurred on the particular incident, and the same will be levied on the vessel involved.

7.10 LOGISTICS

Permits required, Personnel and personnel report, Trans-boundary movement of equipment and personnel, Information recourse hardware

The issue of required Permits/Pass system to enable trans-boundary movement of Personnel and equipment is being supervised by Central Industrial Security Force (CISF)/VPT unit.

7.11 MECHANICAL RESPONSE STRATEGIES

(Containment, Protection, Shoreline Clean up, On-water recovery Mitigation at source, Salvage, Tanker off-loading, etc.)

7.12 NON-MECHANICAL RESPONSE STRATEGIES : DISPERSANTS, CHEMICAL AGENTS, IN-SITU BURNING AND OTHERSPILL MITIGATING SUBSTANCES, DEVICES OR TECHNOLOGY

Equipment for combating oil spills

1. Dispersant Chemicals	1000 litres
2. Oil Boom (Swastik brand)	450 metres
3. Masonry tank to store oily water (100 rn^3)	1 No.
4. Launch for spraying dispersant chemicals	1 No.
5. Scoops	30 No's
6. Sprayers portable	4 No's
7. Absorbent pads	30 No's.
8. Saw dust	50 kgs

In addition to the above, one Oil Recovery Craft

The crisis Management Response sheet outlining Response Time in the event of oil spill for Tanker is given in Figure-7.1.

7.13 SITE HEALTH AND SAFETY PLAN

Since VPT is accredited with occupational Health and safety (OHSAS:18001-1999) Certificate, Site Health and safety will be achieved through the enumerated OH&S Policy and procedures.

7.14 TRANSPORT; STORAGE AND DISPOSAL OF WASTE

- A Boat(launch) has been hired for keeping a watch in the port waters, which works under the direction of the Deputy conservator, chief officer(pollution)takes rounds to ensure the Port Waters are kept clean and initiates action to spray chemical on oil slick, which are found in the port Waters.

  The Chief officer(Pollution) will also take action to mitigate the pollution due to inletting of storm waters containing traces of oil from the drained waters through effluent channel of HPCL, Municipal drains etc.
- Oil boom is also being placed around tankers berthed at OR-1 and OR-2berths to prevent pollution.
- Bilge waters/oil slicks are being collected and stored at reception tank near SS-II Jetty for safe disposal of the same through licensed contractors.

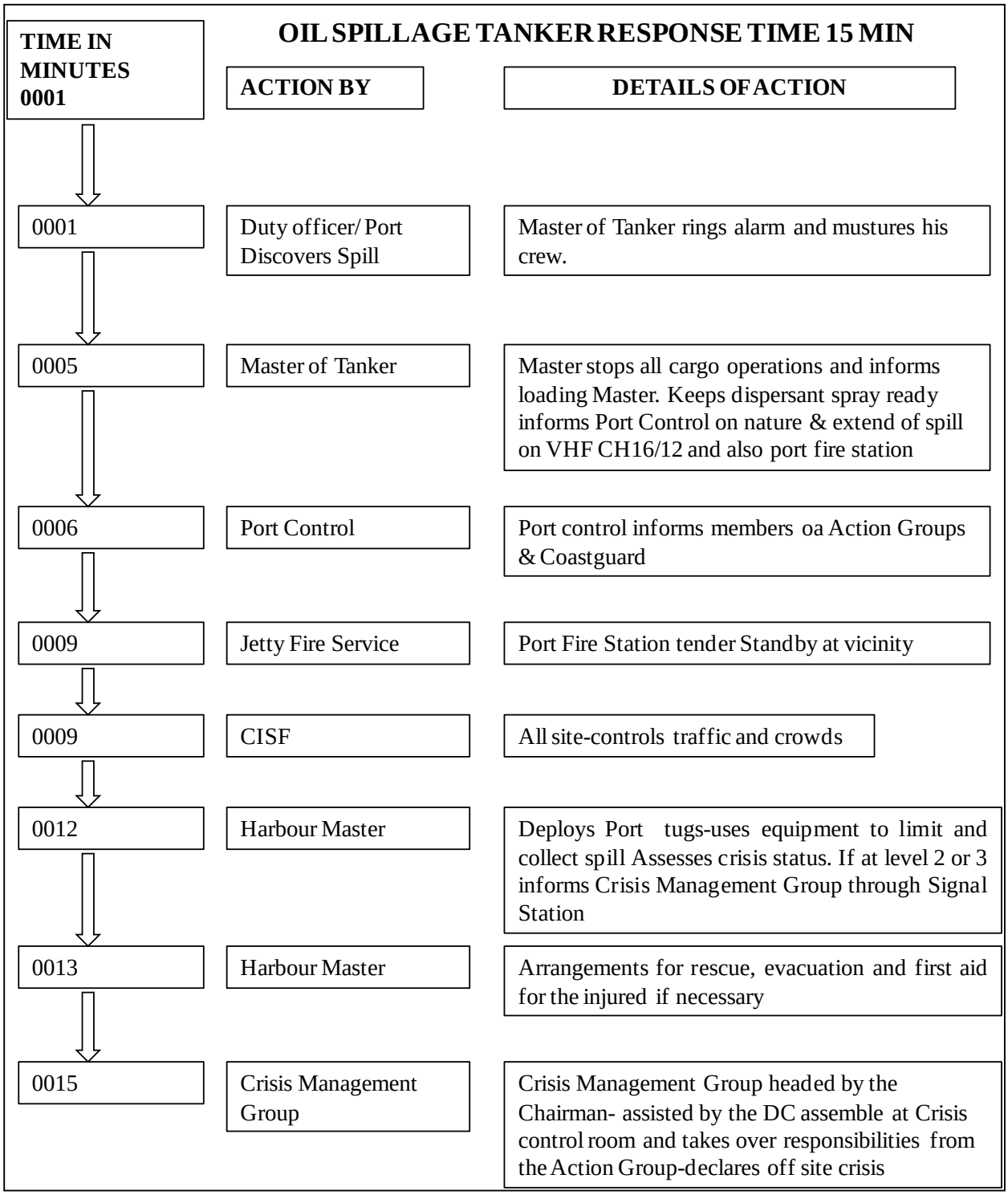


Figure-7.1: Crisis Management Response Sheet

7.15 FUNDING AND COST DOCUMENTATION

The Chairman will have requisite authority level to draw adequate funds in order to meet the additional resource requirements of the crisis, subject to approval of the Board of Trustees.

7.16 PUBLIC AND MEDIA RELATIONS

Crisis Management Group will get in touch with Public and Media, if the incident moves to level 2 or 3

7.17 DEACTIVATION OF THE PLAN

The steps in deactivation of the plan recovery-reentry-restoration are depicted in Figure-7.2.

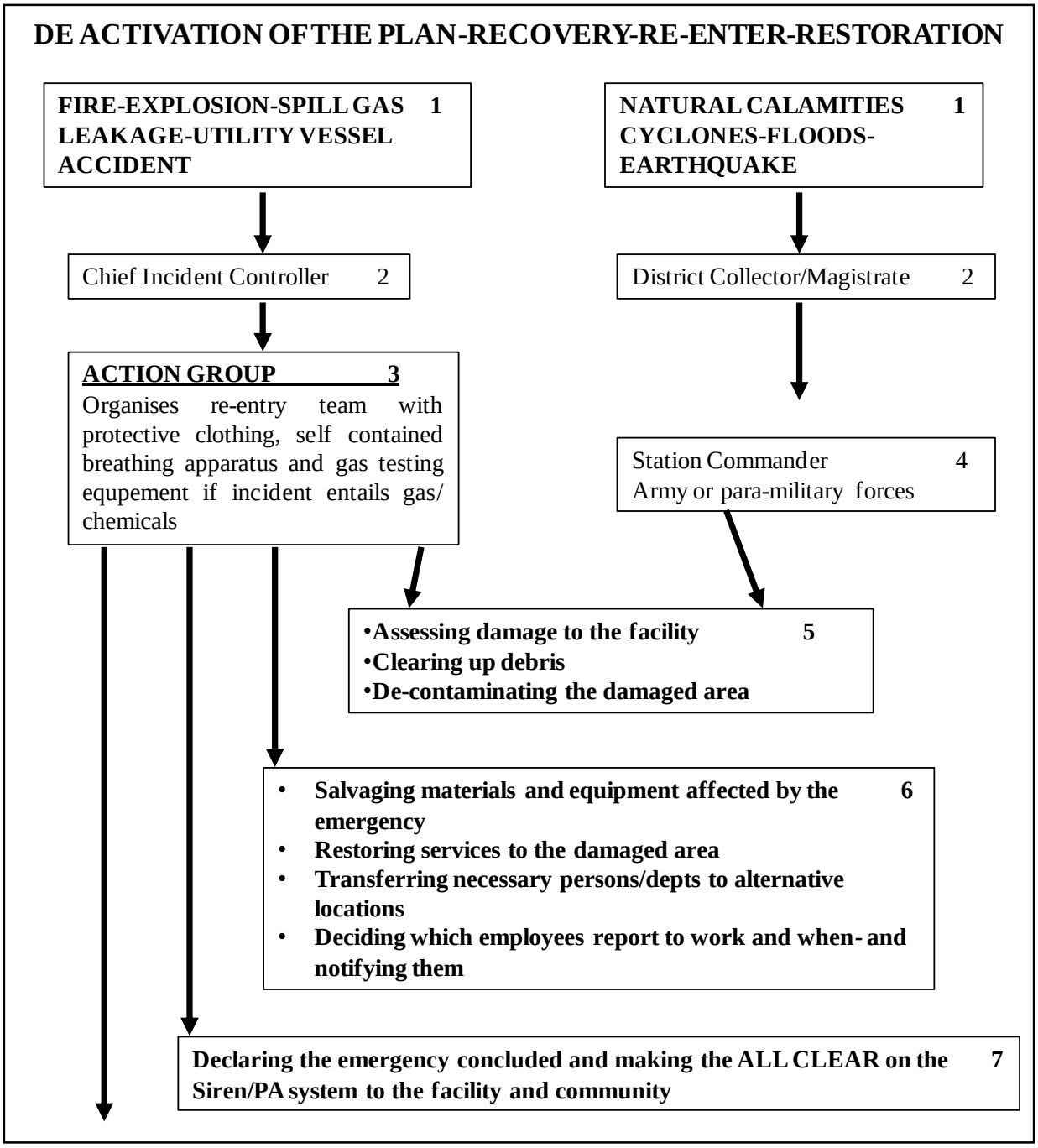


Figure-7.2: De-activation plan for recovery-reentry-restoration

7.18 CHEMICAL SPILL (CONTINGENCY PLAN)

In VPT, apart from petroleum products, hazardous chemicals are also handled in Inner Harbour at FB and in Northern arm at EQ6, EQ7, and WQ1, WQ1 RE &WQ5 berths by Cll., IMC, NAlCO and EIPl. The identified hazardous substances are Ammonia, molten sulphur, caustic lye, alumina, Ammonium nitrate, phosphoric acid and sulphuric acid including styrene monomer.

Ammonia leak/release is considered as toxic gas dispersion whereas styrene monomer is toxic as well as flammable liquid. Fertilizer grade Ammonium nitrate (more than 0.2 of combustible material) is possibly explodable in certain conditions. In recent times, accident occurred due to explosion are reported of Ammonium nitrate (fertilizer grade). Responsibility of first response team with coordinating action team, preventive methods (spill disposal methods) on the basis of its reactivity and its combustibility with other chemicals have to be considered.

7.18.1 Response Plan

First Responder Operations level

First responders at. the operations level are individuals who respond to releases or potential releases of hazardous substances as part of the initial response at the site for the purpose of protecting nearby persons, property, or the environment from the effects of the release. The first responder should know how to select and use proper personal protective equipment provided to the first responder at operational level,perform basic control, containment and/or confinement operations within the capabilities of the resources and personal protective equipment *available* with their unit and implement basic decontamination procedures.

The following absorbents can be used successfully to control chemical spill.

- Universal spill absorbent-1:1:1 mixture of Flor-Dri (or unscented kitty litter), sodium bicarbonate, and sand. This all-purpose absorbent is good for most chemical spills including solvents, acids (not good for hydrofluoric acid), and bases.
- Acid spill neutralizer-Sodium bicarbonate, Sodium carbonate or calcium carbonate .
- Alkali (base) Neutralizer-sodium bisulfate.
- Alkali Metals-Dry sand or a Class "D" Fire Extinguisher.
- Solvents/organic liquid absorbent - Inert absorbents such as vermiculite, clay, sand, Flor-Ori, and Oil-Dri.
- Ammonium Nitrate - Early stages of fire use flooding amount of water.
- Alumina - Moisten first to prevent dusting and wash away with plenty of water.

7.18.2 Personnel Protective Equipment (PPE)

The purpose of personnel protective clothing and equipment (PPE) is to shield or isolate individuals from the chemical, physical, and biological hazards that may be encountered. Careful selection and use of adequate PPE is necessary to protect the respiratory system, skin, eyes, face, hands, feet, head, body, and hearing. No single combination of protective equipment and clothing is capable of protecting against all hazards. Thus PPE should be used In conjunction with other protective methods. The use of PPE can itself create significant worker mobility, and communication. For any given situation, equipment and clothing should be elected

so it provides an adequate level of protection. Over protection as well as under-protection can be hazardous and should be avoided.

Few common Personal Protective Equipments (PPE) are:

- Goggles and Face Shield.
- Heavy Neoprene Gloves.
- Disposable Lab Coat and Corrosive Apron.
- Plastic Vinyl Booties.
- Dust Mask/Respirator.

7.18.3 Chemical Protective Clothing

Chemical Protective Clothing (CPC) is available in a variety of materials that offer a range of protection against different chemicals. The most appropriate clothing material will depend on the chemicals present and the task to be accomplished. Ideally, the chosen material resists permeation, degradation, and penetration. Permeation is the process by which a chemical dissolves in and/or moves through a protective clothing material on a molecular level. Degradation is the loss or change in the fabric's chemical resistance or physical properties due to exposure to chemicals or ambient conditions (e.g., sunlight). Penetration is the movement of chemicals through zippers, stitched seams or imperfections (e.g., pinholes) in a protective clothing material.

Selection of chemical-protective clothing is a complex task and should be performed by personnel with training and experience. Under all conditions, clothing is selected by evaluating the performance characteristics of the clothing against the requirements and limitations of the site and task specific conditions. If possible, representative garments should be inspected before purchase and their use and performance discussed with someone who has experience with the clothing under consideration. In all cases, the employer is responsible for ensuring that the personal protective clothing (and all PPE) necessary to protect employees from injury or illness that may result from exposure to hazards at the work site is adequate and are of safe design and fabrication for the work to be performed.

7.19 CHEMICAL SPILL RESPONSE PROCEDURES

In the event of chemical spill, response teams depend on risks involving the release of a type or quantity of a chemical, i.e., immediate risk to health and involve chemical contamination to the body:

- Notify the personnel in the neighbouring accident area
- Alert people in immediate area of the spill
- Determine the chemical nature of the spill and check the Met Sheet.
- Isolate the area, and evacuate the people immediately(if necessary depends on risk)

- Keep away ignition sources and disconnect power.
- Use a fire extinguisher to extinguish any flames if applicable.
- Choose appropriate personal protective equipment (goggles, face shield, impervious gloves, lab coat, apron, etc.)
- Confine, and contain spill. Cover with appropriate absorbent material. If the absorbent material is acid or base it should be neutralized prior to cleanup.

If people are asked to evacuate

- Do so immediately
- Stay tuned to a radio or television for information on evacuation, temporary shelters and procedures.
- Follow the routes recommended by the authorities shorten & safe
- If you have time minimize the contamination in the house by closing windows and all vents and turning of all fans

CHAPTER-8
DISASTER MANAGEMENT PLAN FOR NATURAL AND MANMADE HAZARDS

CHAPTER – 8

DISASTER MANAGEMENT PLAN FOR NATURAL AND MANMADE HAZARDS

8.1 COMPONENTS OF A PORT AREA EMERGENCY RESPONSE PLAN

The typical components of a port Area Emergency Response plan to be implemented in case of natural and manmade disasters are listed as below:

1. Port Emergency organizational needs

- Designated person in charge/alternatives
- Linkages and co-ordination between port and maritime authorities
- Proper communication with the Action Group
- List of functions of each key individual
- List of key telephone numbers for key people/alternatives

2. Port Risk Evaluation

- Quantities and location of hazardous substance.
- Properties of each hazardous substance-first aid and antidotes
- Location of isolation valves
- Special fire fighting procedures, if any
- Special handling requirements

3. Area Risk Evaluation

- Evaluate existing procedures and modify or establish new ones as required
- Establish procedures for notification of spills or other incidents in port waters
- Establish procedures for notification of emergencies with or onboard vessels
- Inter-relationship of port facilities with nearby hazardous industrial facilities
- Nearby population and residential centres
- contact names and telephones numbers at other industrial facilities ;
- Existing procedures for notification of hazardous chemical release nearby industrial facilities

4. Notification procedures and communication systems

- Central reporting offices(Action Group Centre, Harbour Master's office, Port Emergency Centre)
- Names and telephone numbers with alternates of officials, local officials
- Nearby residents and criteria developed for public contact
- communication equipment-radios-mobiles-hotlines-pagers
- Designated person for media contact
- Procedure for notifying families of injured employees

5. Emergency equipment & Facilities

- Specialized craft, salvage and towing boats, anti-pollution boats
- Small craft launching and mooring facilities
- Helicopters, availability, landing sites and refueling capability
- Equipment for combating pollution e.g. booms, skimmers, transfer pumps, vacuum trucks, absorbents, dispersants
- Firefighting equipment

- Local or regional weather forecasting office
- Emergency medical supplies
- Wind direction/speed indicators
- Self contained breathing apparatus
- Protective clothing
- Other on site equipment as necessary-electric generators
- Containment capabilities and waste disposal arrangements

6. Procedure for returning to normal Operations

- Inspection of site and adjacent areas by Action Group
- Designated Emergency Centre to inform all notifiable contacts within the port area to stand down
- Lines of communication with notifiable contacts outside the port area

7. Training and Drills

- Possible scenarios for accidents involving oil spills
- Passenger and crew evacuation from vessels involved in or adjacent to an accident or incident
- Other accidents on board the vessel
- Evacuation of personnel from port and surrounding area
- Knowledge of hazard-toxicity-flammability-first aid-antidotes
- Procedures for reporting emergencies
- Knowledge of alarrn systems
- Location and use of firefighting equipment
- Location and use of protective equipment(respirators, air cylinders, protective clothing etc.)
- Decontamination procedures, protective clothing and equipment
- Evacuation procedures
- Frequent, documented simulated emergencies

8. Regular tests of emergency organizational procedures

- Simulated emergencies
- Alarm systems-tests to be frequent and documented
- Frequent tests of fire fighting and other response equipment
- Test communication systems
- Evacuation practice
- Ongoing emergency preparedness committee

9. Emergency Response procedures

- Activation of the plan
- Definition of command authority
- Communications
- Transfer from one, planning level to another
- Co-ordinated application of land and maritime equipment and other resources
- Evacuation or safe havens
- Medical including handling of multiple injuries
- De-activation of the Plan

8.2 CRITERIA FOR EMERGENCY CLASSIFICATION

The criteria for establishing the level of crisis during emergency is given in Table-8.1. Likewise, criteria to establish the offsite plan are given in Table-8.2.

Table-8.1: Criteria to establish level of the crisis during emergency

Risk Assessment	**Level 0**	**Level 1**	**Level 2**	**Level 3**
Risk Level	Negligible	Marginal	Critical	Catastrophe
Amount spilt	<1 ton	1-10 tons	10-1000 tons	1000 to 10000 tons
Chemical properties	Flammable ph 6-7 inert	Flash pt 23C ph 4-6 or 8-10	Flash pt 18C ph 2-4 or 10-12	Flash pt 18 C explosive-spont combustion
Disruption	<1 day	Few days	>1 month	Widespread
Monetary damage	<$100,000	<S 1mn	$ 1-$10 mn	<$10 mn
Resources required	Minimum	On site sampling, -ing evaluation cleaning	On site monitor –ing and local contractors	24 h monitoring specialized resources
Safety	Minor	2 months lost	1 person dead	>10 persons dead
Ecosystem Damage	Slight	Temporary	Moderate	Irreversible
Legal liability	Low	Moderate	High	Very high
Political interest	Local	State	National	International
Media coverage	None	Local Press	National	International

Table-8.2: Criteria to establish level of the off site plan

Tier1	Terminal	Ship-terminal
Tier2	Port	Ship + Terminal +port
Tier3	City/State	Ship+Terminal +port +city
Tier4	National	Ship+Terminal +port+National
Tier5	International	Ship+Tenninal+port+International

Natural hazards due to cyclones, earth quake,tsunami and manmade hazards due to the terrorist threat, war, Bomb threat/Suspicious objects. explosion/Detonation, Hostage situation, pollution response and civil disturbance are also considered for the study.

The Hazards for which Port Area Response Plan has been outlined in this Chapter can be categorized into:

- Natural Hazards
- Man-made Hazards

8.3 NATURAL HAZARDS

Crisis/Disaster occurrence due to following natural calamities have been prepared in this section:

- Cyclone
- Earthquake
- Tsunami

8.3.1 Cyclone

Cyclone is the generic term for a non-frontal synoptic scale low-pressure system over tropical or sub-tropical waters with organized connection and gefinite cyclonic surface wind circulations. Cyclones are classified mainly as tropical cyclones and Hurricanes. If maximum surface wind speed is less than 17m/sec it is considered! as tropical cyclone, whereas in the case of Hurricane maximum Surface wind speed reaches 33 m/sec. In India, most of the cyclones are tropical one and occurring very frequently in eastern coast. From 1970, thousands of people living in low lying areas were died due to cyclones in the east coast. Notable incidents are:

- September 1971 Orissa State 10,000 people
- November 19th 1977, Krishna Dist, Andhra Pradesh, 20,000 of people
- October 19th 1999, Orissa State, 9573 of people

Cyclone emergency preparedness plan is delineated as shown in Figure-8.1 and VPT has delineated emergency response procedure in case of cyclones as mentioned below:

- A cyclone station will come into operation at Emergency Control Centre as soon as the storm warning slg.Na.5 is hoisted or a cyclone threat is close and imminent.
- Harbour Master will initiate action so that vessels double up moorings and securely move Port or· ft to protected areas. Vessels at vulnerable berths to be shifted to safe berth/roads.
- All other departments will open their respective cyclone coordination rooms to function round the clock. These room will only be closed after obtaining orders from the Chairman VPT.
- Safety of personnel and the men engaged in relief activities will be looks after by the relief units set up the respective departments.
- Dy. Commandant, CISF will keep extra vigil on General Stores Complex and other important buildings. A special task force is to be set up by the CISF for the rescue operations and llase with local police.
- Civil Engineering Department will arrange sand bags for field working teams and transfer important plans/documents to safer places.
- Chief Incident Controller (DC) will assess the situation and reports to Chief Emergency Controller (Chairman).
- The Engineering services (E/M) will remain alert on duty for any electrical isolation of the areas/substations.
- The Chief Emergency Controller (Chairman) will liase with District authorities and declare offsite emergency if required.

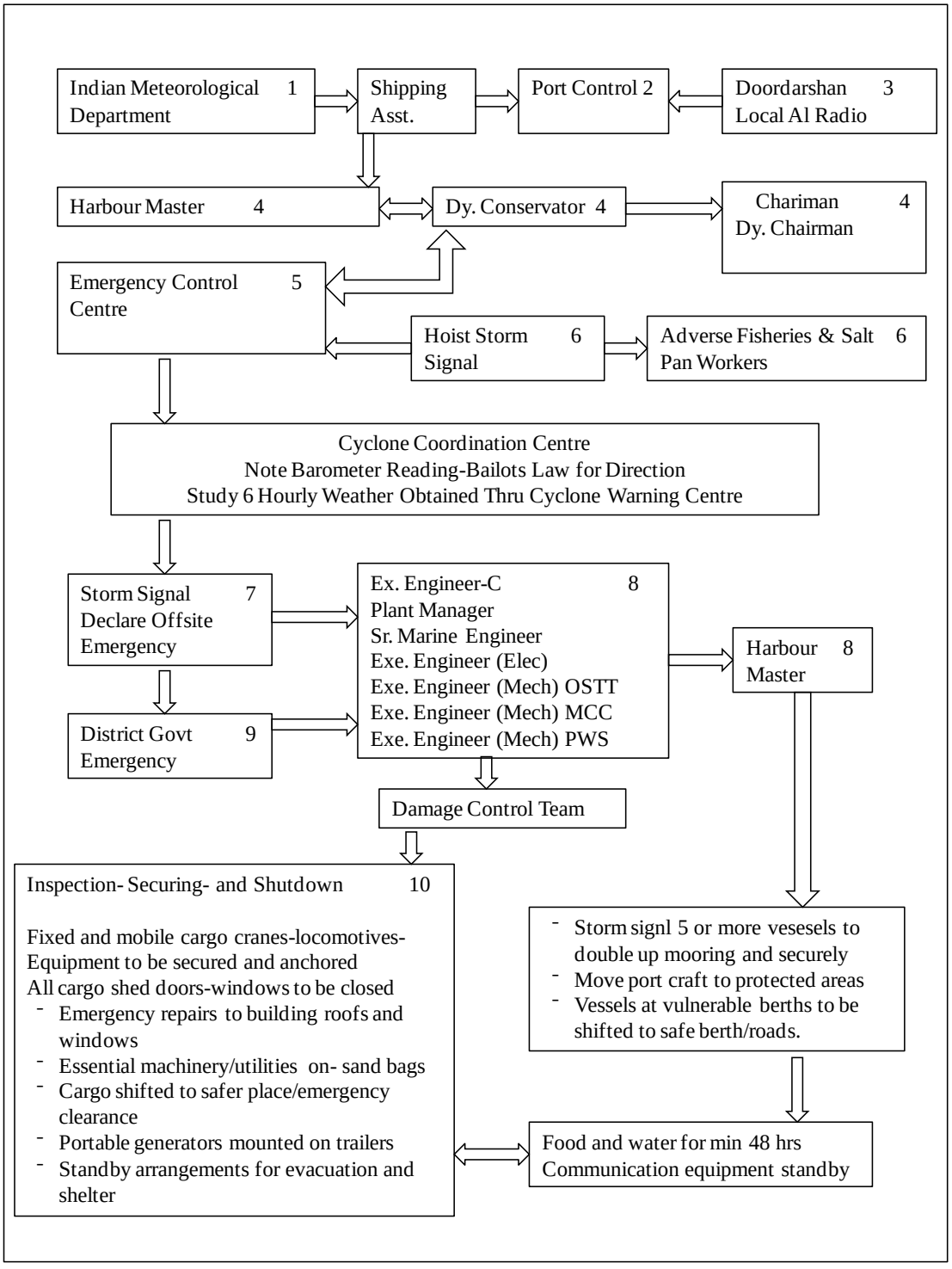


Figure-8.1: Cyclone Emergency Preparedness Plan

8.3.2 Earthquake

Crises/Disaster management plan for earth quake is necessary in view of the past with regards to heavy loses to human life and property. VPT is slightly effected (handling operation of

vessels) by the recent earth quake in Indian Ocean (Tsunami). To combat emergency situation due to earth quake, response procedure and corresponding action plan is delineated as below:

- Crises Management Group will activate the Emergency Control Centre.
- Crises Management Group will initiate onsite Management as per Crisis Management and Disaster Preparedness Plan Manual.
- Incident con roller (H.M) will initiate Emergency Operations at site and reports to Chief Incident Controller
- Evacuate on zones which are effected with the help of Warden Team.
- Chief Incident Controller (Dy.Conservator) will assess the situation and report to Chief Emergency Controller (Chairman),
- Chief Emergency Controller (Chairman) will establish Communication with District Crisis Group for the assistance if required
- Chief Medical Officer of VPT along with the District Administration has to facilitate Infection Control Program in the event of natural disaster.

8.3.3 Tsunami

Tsunami often improperly called "tidal waves," tsunamis or seismic sea waves are usually caused by earthquakes that occur near or under the ocean. These waves created by the shifting of the ground creates an intense energy that can result in a destructive wave. The principal generation mechanism (or cause) of a tsunami is the displacement of a substantial volume of water or perturbation of the sea. This displacement of water is usually attributed to either earthquakes, landslides, volcanic eruptions, glacier calvings or more rarely by meteorites and nuclear tests.

Tsunamis generally consist of a series of waves ranging from minutes to hours, arriving in a so-called "wave train". Wave heights of tens of meters can be generated by large events. Although the impact of tsunamis is limited to coastal areas, their destructive power can be enormous and they can affect entire ocean basins. In 2004 Indian Ocean tsunami was among the deadliest natural disasters in human history with over 230,000 people killed in 14 countries. bordering the Indian Ocean. About 80 of tsunamis occur in the Pacific Ocean, but they are possible wherever there are large bodies of water.

A typical wave period for a damaging tsunami is about 12 minutes. This means that if the drawback phase is the first part of the wave to arrive, the sea will recede, with areas well below sea level exposed after 3 minutes. During the next 6 minutes the tsunami wave trough builds into a ridge, and during this time the sea is filled in and destruction occurs on land. During the next 6 minutes, the tsunami wave changes from a ridge to a trough, causing flood waters to drain and drawback to occur again. This may sweep victims and debris some distance from land. The process repeats as the next wave arrives

A tsunami cannot be precisely predicted, even if the magnitude and location of an earthquake is known. Geologists. oceanographers, and seismologists analyse each earthquake and based on many factors mayor may not issue a tsunami warning.

Japan has built many tsunami walls of up to 12 metres (39 ft) high to protect populated coastal areas. Other localities have built floodgates of up to 15.5 metres (51 ft) high and channels to redirect the water from incoming tsunami.

However, their effectiveness has been questioned, as tsunami often overtop the barriers. For instance, the Okushiri, Hokkaid6 tsunami which struck Okushiri Island of Hokkaid6 within two to five minutes of the earthquake on July 12, 1993 created waves as much as 30 metres (100 ft) tall as high as a 10-story building. The port town of Aonae was completely surrounded by a tsunami wall, but the waves washed right over the wall and destroyed all the wood-framed structures in the area. The wall may have succeeded in slowing down and moderating the height of the tsunami, but it did not prevent major destruction and loss of life. The 2011 tsunami toppled more than 50 of the walls and caused many damages.

VPT has to be delineated Emergency Preparedness Plan for Tsunami and respective action plan considering crisis level (Tier 3/ Tier 4)with local and state government including Mutual Aid Partners. For preparation of Crisis Management Plan the following precautions and response procedure are taken into account.

Precautions Measures and Response

The action plan to be taken in the event that tsunami is likely to make landfall is shown in Figure-8.2.

Actions (society) shall include:

- Immediate movement away from the coast & lagoons
- Move inland and to high ground
- Climb high - sturdy and solid bulldlng/ sturdy tree

React quickly if you are caught up in the water. If you did. not manage to evacuate but find yourself caught up in the tsunami for one reason or another, there are things that you can do to try and survive

- Abandon belonging
- Keep away until the "aII cIear" signal is broadcast
- Try to get reliable Information.
- Wait for local authorities to issue an All Clear
- Realize that concentrating on survival continues after abatement of the tsunami

Food, Clean water, 1 First Aid kit - per family or group, Dry, warm Clothing and a waterproof coat if possible or ponchos - per person, Medicines needed by any person on a regular basis such as an asthma inhaler or heart medication. Flashlight and batteries - per family or group,

Emergency food and water supplies, Clothes -,two pairs - per person, Pair of powerful magnets per family or group, Battery or crank-operated radio - per family or group, Pillow (inflatable type) - per person, Cell Phone/ mobile phone, Blankets and Utility Knife (Army Knife)

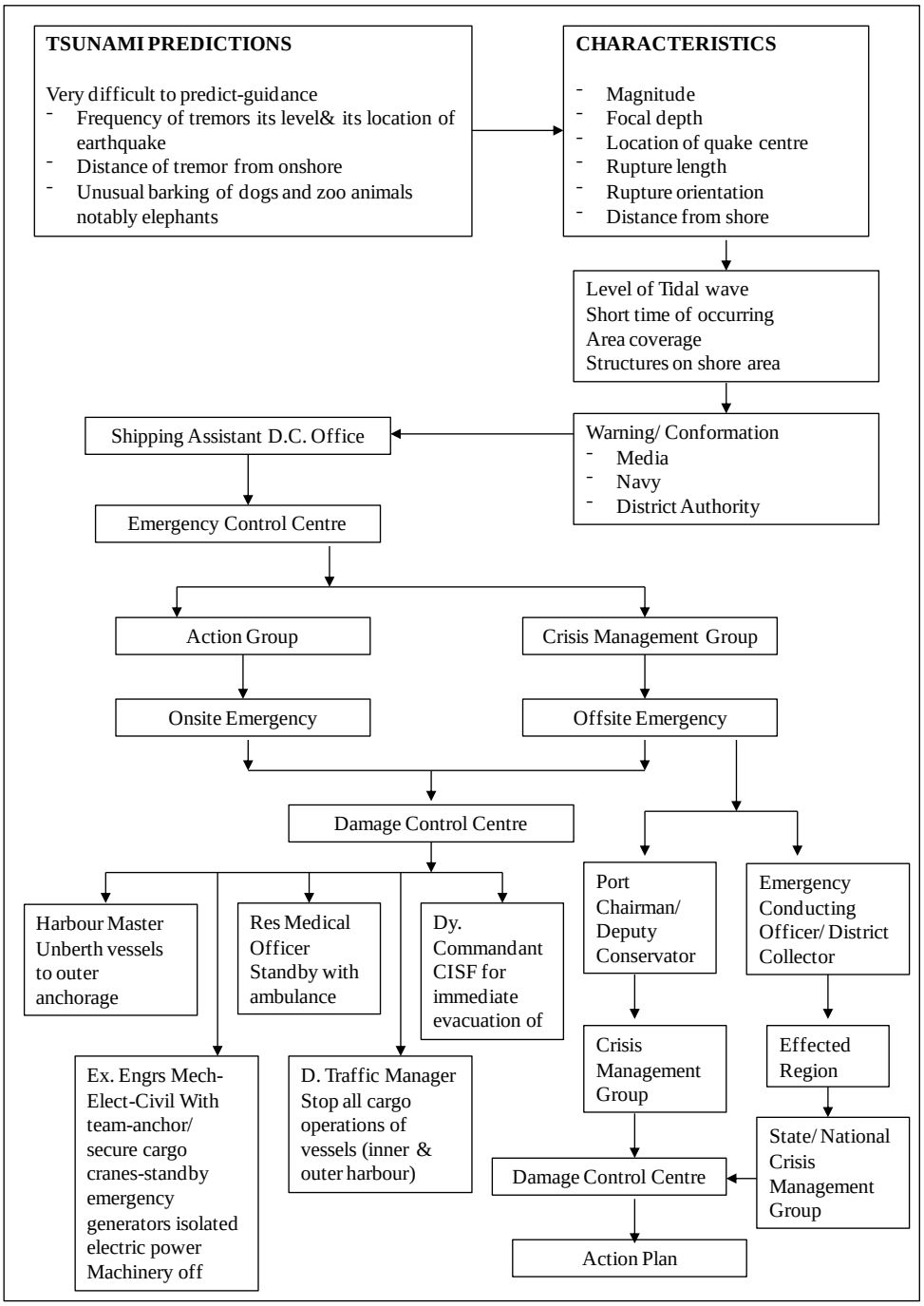


Figure-8.2: Action Plan to be taken in the event that Tsunami is likely to make Landfall

8.4 MAN - MADE HAZARDS

Emergency procedures due to manmade threat to the VPT installations or Port users will cause damage to Port and affect Port users. Hence, the following emergency response procedures are formulated.

- Emergency Response procedure for terrorist threat
- Bomb threat/Suspected object.
- Explosion or detonation.
- Pollution Response
- Hostage situation.
- Disturbance/ Labour dispute.
- Emergency Evacuation

8.4.1 Emergency Response Procedure for Terrorist Threat

The action to be taken in the above conditions are as under:

1. Any person coming across any suspected terrorist act will hide/protect himself and immediately report the matter to Shipping Assistant on 25630291 ~5627911 2875505 or CISF Control 28730801 2875251 or send message to a nearby security post through a responsible person.
2. Person suspecting such act should pass the information like:
    - Location
    - Sex
    - Accompanied by
    - Weapons he is holding
    - Estimated age
    - Any other relevant information
    - Type of dress
    - Language used etc.,
3. Person noticing the terrorist act should watch the movements of the terrorist and alert personnel in the vicinity without the notice of terrorist.
4. Person noticing the terrorists should not react on his own and not allow others to do so, till the arrival of security forces.
5. If any conversation between the finder and terroris/suspect will also be reported.
6. CISF will mobilize the staff for appropriate action.
7. If required CISF authorities may take the help of Police, Navy etc.

8.4.2 Emergency Response Procedure for Bomb Threat/Suspicious Object

The following actions needs to be taken:

1. Person finding the bomb/suspicious object will take action to avoid personnel to go nearby.

2. Person noticing the bomb will be standby at a safe distance and alert all personnel till security in charge comes and takes charge of the Situation.
3. Cell phones or non-intrinsically safe VHF Sets should not be used to pass messages at the suspected bomb area
4. Immediately report the matter to CISF Control Room on 2873080 / 2875251 Port Control on 2875569 / 2875500 or send message to nearby security post duly indicating the location.
5. Person noticing the bomb/suspected object should give accurate information like:
    a) Why it is suspected?
    b) Colour of the object! bomb.
    c) Physical appearance.
    d) Markings of the bomb/ object
    e) Size of the bomb etc.
6. If the bomb/object is in the dark area, focusing of light or using matches is not permitted.

8.4.3 Emergency Response during Explosion or Detonation

The following actions needs to be taken:

1. Inform CISF Control on 28130 0 / 2875261 and Shipping Assistant 2875505 / 2563029 / 2562791 or send me s 9 to a nearest security post.
2. Send information about:
    a. The location and time of explosion.
    b. Type of bomb exploded, if any.
    c. No. of casualties, if any.
    d. Damage occurred
    e Anything suspicious further
3. Whether informed to Fire Service
4. Whether the Siren of that particular zone was blown for indicating emergency (Rapid blow of Siren continuously).
5. CISF to divert the traffic away from the area
6. Inform Ambulance on 2569411 /2552178, IT Te1.No.100 /101

8.4.4 Pollution Response

The following actions needs to be taken in the event of discovery of pollution:

1. Person discovering the pollution will inform Port Control on 2875569 / 5570 COT/MF on 2010245 Shipping Assistant on 2875505/2563029/2562791
2. HM will use the pollution prevention team to locate the source of leak an, orqanise Floating Oil booms to contain the Oil/Chemicalleak
3. All bunkering/Cargo operations in the leak area will be teased.
4. Fire risk will be assessed and inform fire control on IT. Tel.No.; 100/101, 2569411/ 2552178 (or) Port VHF Channel 4. For arranging Fire float/Fire vehicles. COT will arrange cleaning p/collection of oil.
5. Crisis Management group will get into action if the incident moves to Level 2 or 3.
6. Zone evacuation measures will be initiated in case of excessive toxic/Flammable

7. External agencies like Coast Guard / Navy / APPCB / District Authorities to be informed when situation demand. However, Crisis Management and Disaster Preparedness Manual will be followed.
8. All bunkering/Cargo operations in the leak area will be ceased

8.4.5 Emergency Response Procedure for Hostage Situation

The following response are recommended in hostage situation:

1. Any Port employee on receipt of information of Hostage will inform PFSO Oil/Tel.No. (Office 2565042/2875500/2563716 (Mob) 98481 90796 and CISF Control on TeI.No.2873080/ 28752511 2568932 immediately. PSFO to give necessary instructions to HM/CISF/ for getting 1 st hand information.
2. PFSO to inform Chairman about the situation after getting 1 st hand information from HM/ CISF.
3. To set up emergency Control Room at appropriate location.
4. PFSO to request Chairman to alert District Central authorities if the situation 9.1S warrants.
5. Collect information about:
    a. Demands
    b. Nationality
    c. Male/Female
    d. Possession of arms/explosives
    e. State of mind
    f. Accent of Language/Language used
    g. No. of Hostages, whether any children/Ladies
    h. Strength
6. Inform Navy/Coast Guard for arranging boarding party with arms at D.C. Jetty if too incident occurs at anchorage.
7. The Shipping Asst. on receipt of information from PFSO/HM ShOYld give the following information to in charge boarding party from Navy/Police/Coast Guard/CISF.
    a. Identity and position of victim ship/Location.
    b. Nature of attempt reported and time.
    c. Action already initiated and agencies involved.
    d. Present situation on the scene.
    e. Any other information.
8. Inform Police if incident occurs on land.
9. Establish Communication between boarding party and PFSO on cell phone.
10. Medical Team and Ambulance to be kept stand by for any emergency

8.4.6 Emergency Response Procedure for Civil Disturbance/ Labour Dispute

The following actions are recommended:

1. Whenever Intelligence Wing of CISF gathers any information with regard to civil disturbance/ labour dispute, the same will be informed to Chairman and PFSO.
2. DIG/CISF will depute additional security forces at the sensitive areas
3. All restricted areas including AOB have to raise the level of security as per PFSP
4. All Labour Officers/Public Relations Officers will arrange to prevent spreading of rumour duly liaisoning with Employees/Workers.
5. CISF Unit Commander will assess the situation and appraise the same to Chairman and PFSO.
6. DIG, CISF will coordinate with Police for additional assistance if required. However, Crisis Management and Disaster Preparedness Plan Manual will be followed.

8.4.7 Response Procedure for Emergency Evacuation

The response procedure for Emergency Evacuation is as under:

1. Incident controller (HM) classifies incident, emergency level, coordinate with all functional heads at field operation and reports to Chief incident controller (DC).
2. The Chief Incident Controller (DC) will advice Chief Emergency Controller (Chairman) in the event of impending disaster likely to spread out of VPT for declaring offsite emergency.
3. Warden / Dy. Warden or sector Warden will blow the siren of respective Zone to indicate Zone emergency.
4. Warden Team will go around the particular zone needs to be evacuated and stop all on going works duly announcing with megaphones.
5. The warden team will evacuate all personal to assembly area through emergency evacuation routes (route' plans are displayed at various zone of VPT) and carry out head counting.
6. CISF will not allow the traffic to deviate emergency escape routes.
7. All evacuated employees will be made to assemble at assembly point as directed.
8. A Fire van fitted with PA system will go on announcing Type of incident, wind direction, guiding personnel to avoid panic in affected zone.
9. 'All clear' siren will be given if the onsite emergency situation becomes normal.

CHAPTER-9
CORPORATE SOCIAL RESPONSIBILITY PLAN

CHAPTER - 9
CORPORATE SOCIAL RESPONSIBILITY PLAN

9.1 INTRODUCTION

As a part of the Corporate Social Responsibility Plan, Visakhapatnam Port Trust is involved in the following activities:

- Sewage treatment of Visakhapatnam city
- Development of sports and cultural complex
- Development of Road Network
- Measures being implemented alongwith Municipality
- Beach Nourishment

The activities being implemented as a part of CSR Plan are briefly described in the following sections.

9.2 SEWAGE TREATMENT OF VISAKHAPATNAM CITY

Major drains originating from the upper reaches of the city are discharging the drainage water at different locations into the Port area before they finally discharge into sea. These reaches of drains in Port area are being maintained regularly by Visakhapatnam Port to ensure free flow of water and to keep clean environment of harbour waters. One 10 mld sewage treatment plant is in operation to treat the sewage and sullage entering into port waters from the city.

An annual expenditure of about 70.00 lakh is being incurred for maintenance of drains, geddas and culverts etc.

9.3 SPORTS AND CULTURAL COMPLEX

In line with the policies of the Government of India for upliftment of Sports and Cultural developments and keeping in view the interest of the city public at large a large Sports complex with various facilities for Sports and Cultural activities was developed by the Port in the early 1990s at a cost about Rs. 20.00 crores. This Sports and Cultural Complex was completed in VPT's own land of about 45 acres.

The complex is provided with an Outdoor Stadium of 10,000 spectators capacity and an Indoor Stadium of 3000 spectators capacity, an auditorium of 1400 audience capacity for theatrical performances and Open Air Theatre of 3500 audience capacity including ancillary facilities.

A Volley ball Academy, open courts for volleyball, basketball etc., have also been developed in open air places. Training in batches to 60 people annually is being given by Sports Authority of India in Boxing, volleyball and basketball games and hostel facility is available for the trainers in the Sports Complex.

9.4 DEVELOPMENT OF ROAD NETWORK

Theroad running within the port area was commonly being used historically over a long period by the port cargo traffic and the city public between Port area up to NH-5.

Due to enormous increase in the traffic and numerous road, rail and river crossings, traffic congestion has increased causing serious concern on safety, time and inconvenience by the public and port cargo traffic.

Realizing the need to ease congestion of the traffic and to provide alternative route including improving the travel time, a port connectivity road from Visakhapatnam port to nh-5 with a total length of 12.5 km comprising of 4.9 km of flyovers and ramps at a total project cost of rs. 114.00 crores was developed and commissioned as a joint venture project with national highways authority of india, wherein the contribution of the port was Rs. 30.00 crores.

to benefit the common public, two wheelers and three wheelers are permitted to use this facility free of toll fee. this port connectivity road is serving public, industries, defence and many others enabling a unhindered smooth flow by relieving congestion on the other road and reducing the travel distance by about 6 km saving the time and fuel, thus also helping the environment.

9.5 MEASURES ADOPTED IN TANDEM WITH MUNICIPALITY

Entire Port area is being maintained by the Port itself duly taking care of these civic amenities. As such the Municipal Corporation in true sense is not spending any amount out of the Property Tax collected from Visakhapatnam Port Trust for the aforesaid purpose.

As per the Visakhapatnam Municipal Corporation Act 1979, an amount of about Rs. 20 crores per annum is required to be paid by VPT towards Property Tax to the Visakhapatnam Municipal Corporation.

Upon request made by the Port, the A.P. State Government issued an order that “51% of the taxes collected by the Visakhapatnam Municipality from the Visakhapatnam Port Trust be spent on works which will benefit the Port Trust area”.

Accordingly the following developmental and important schemes useful for the city and common public in the vicinity of the Port are taken up with mutual consent by both Visakhapatnam Port Trust and Municipal Corporation:

- Construction and maintenance of the roads commonly used by both the city public and the Port traffic at the interface of the city
- Maintenance of drains discharging city drainage water into Port area and street lighting along these roads and flyovers.
- Improvement of hospitals serving the poor people
- Development and improvement of school buildings, colleges, library, museum etc.

9.6 BEACH NOURISHMENT

Visakhapatnam Port Trust is discharging its responsibility as a corporate citizen in keeping the city clean and green, healthy and aesthetic and contributing significantly for better civic amenities for the people of Visakhapatnam.

In consonance with the development of Visakhapatnam Outer Harbour in the early 1970s the need for protection of the beach North of Visakhapatnam Port from the adverse affect of erosion due to the natural phenomena on account of sea wave/current action was realized.

A quantity of about 4 lakhscu.m of sand is being pumped for the beach nourishment every year by incurring an expenditure of about Rs. 6.00 crores.

The beach nourishment being carried out for over the last 3 decades shows the firm commitment of the port towards the social obligation for the city public, visitors and fishermen community.

9.7 ONGOING PROPOSALS UNDER CORPORATE SOCIAL RESPONSIBILITY (CSR)

Visakhapatnam Port Trust has undertaken various developmental activities as a part of Corporate Social Responsibility (CSR). The details of ongoing activities are given in Table 9.1.

Table 9.1. Details of ongoing activities under Corporate Social Responsibility

S. No.	Proposals	Sanctioned Amount/ Rs. Lakh
1.	Development of KGH i.e., construction of multi-storeyed building/procurement of life saving equipment - KGH, Visakhapatnam	100.00
2. 3	Financial assistance to Green Vision, Visakhapatnam, towards integrated health project for fisher folk communities, in the coastal areas of Visakhapatnam	19.50
3.	Establishment of Mechanical Engineering Laboratories at College of Engineering for Women, Andhra University.	8.39
4.	Financial assistance for development of Park at Central Revenue Quarters, Sand Hills, Visakhapatnam, under CSR funds	15.00
5	Financial assistance for purchase of latest and updated model Kerato Analyzer EKA – 10 Specular Microscope to Mohsin Eye Bank, Visakhapatnam	10.00
6.	Financial assistance for procurement of food carrying vehicle to ISKCON Food Relief, Rishikonda, Visakhapatnam.	5.30
7.	Financial assistance for development of certain amenities in Govt. Queen Mary Primary School, Visakhapatnam.	10.20

9.8 NEW PROPOSALS UNDER CORPORATE SOCIAL RESPONSIBILITY (CSR)

Visakhapatnam Port Trust has initiated various developmental works as a part of Corporate Social Responsibility (CSR). The details of new proposals under Corporate Social Responsibility are given in Table 9.2.

Table 9.2. Details of new proposalsunder Corporate Social Responsibility

S.No	Proposal	Sanctioned Amount/ Rs. Lakh
1.	Request to provide funds for sanction of Solar Electrification System for SrikakulamVayodikulaSangam, Prasanthi Old Age Home, Srikakulam	6.48
2.	Financial assistance to attend repair works for replacement of roofing and for toilet renovation work at Chemistry Lab and face-lifting work of Chemistry Lab of A.V.N. College, Visakhapatnam	20.00
3.	Development of Indo German Institute of Advanced Technology (IGIAT) at GayatriVidyaParishad, College for Degree and P.G. Courses, Visakhapatnam for conducting Skill Development programmes i.e. Welding Technology, Tailoring / sewing, Fitter course, Under Water Diving course, Computer Hardware & Networking for unemployed men and women residing nearby localities of Visakhapatnam Port	166.59
4.	Financial assistance for maintenance of toilets and towards electricity charges to Govt. Queen Mary Primary School, Visakhapatnam	3500/- p.m.
5.	Financial assistance towards plantation and watering at port affected areas as requested by Lakshya Foundation, Malkajgiri, Hyderabad.	6.24
6.	Financial assistance to provide study material and model papers for the 350 DSC candidates (orphan, semi-orphan and poorest of the poor) attending to the coaching being conducted by HOPE Trust Society, Hyderabad	2.80
7.	Construction of 2 sick rooms & 2 class rooms at JawaharNavodayaVidyalaya, Kommadi.	37.87
8.	Procurement of Water purifying systems, water coolers, dining steel plates, uniforms, shoes, socks, belt, tie and D. Link modem for the use of children studying in Port Schools as requested by President of Visakhapatnam Port Educational Society.	1.23
9.	Development of toilet facilities in Sacred Heart High School at Gnanapuram	15.26

9.9 ACTIVITIES PROPOSED AS PART OF SWATCHH BHARAT ABHIYAN FROM 2014 – 2019

Visakhapatnam Port Trust is committed to the social cause and apart from developmental activities undertaken as a part of Corporate Social Responsibility (CSR), various other activities have also been proposed as a part of Swatchh Bharat Abhiyan from 2014 – 2019. The Summary of the proposed activities proposed as part of Swatchh Bharat Abhiyanare given in Table- 9.3. The Item wise details of these activities area covered in Table-9.4 to 9.10.

Table- 9.3 Summary of the proposed activities proposed as part of Swatchh Bharat Abhiyan

S.No	Activity	Expenditure in 2014-15	Expenditure in 2015-16	Expenditure in 2016-17	Expenditure in 2017-18	Expenditure in 2018-19	Total expenditure
1	Construction & Maintenance of School Toilets	3,36,200	26,28,000	28,62,000	24,42,000	23,42,000	1,06,10,200
2	Construction & Maintenance of Community/Public Toilets.	NIL	40,00,000	43,00,000	12,00,000	26,30,000	1,21,30,000
3	Maintenance of parks & gardens	15,50,000	31,00,000	31,00,000	31,00,000	31,00,000	1,39,50,000
4	Safe Drinking water facility	NIL	6,81,000	3,85,000	2,60,000	2,60,000	15,86,000
5	Cleaning & maintenance of Roads & drains	26,35,000	2,09,00,000	2,53,00,000	1,90,00,000	1,56,00,000	8,34,35,000
6	Recycling of Waste Water through STP	NIL	25,00,000	75,00,000	5,00,000	5,00,000	1,10,00,000
7	Solid Waste Management at Colonies	NIL	9,00,000	6,00,000	6,00,000	6,00,000	27,00,000
	Total	**45,21,200**	**3,47,09,000**	**4,40,47,000**	**2,71,02,000**	**2,50,32,000**	**13,54,11,200**

Table- 9.4 Details of the construction & maintenance of toilets at schools

S. No	Name of work	Expenditure in 2014-15	Target for 2015-16	Target for 2016-17	Target for 2017-18	Target for 2018-19
1	Modification of Toilets and maintenance at Queen Mary's Girls Primary School at Old Town	1,70,000	30000	30000	30000	30000
2	Providing of continuous water supply provision to toilets at Queen Mary's Girls Primary School at Old Town	66,200	12000	12000	12000	12000
3	Repairing & maintenance of toilets at Port High	1,00,000	60,000	30000	30000	30000

S. No	Name of work	Expenditure in 2014-15	Target for 2015-16	Target for 2016-17	Target for 2017-18	Target for 2018-19
	School, Salagramapuram					
4	Construction of new toilet block & maintenance at Sacred Heart High School, Gnanapuram with 20 seating capacity		12,50,000	30000	30000	30000
5	Repairing & maintenance of Toilets at RC Aided Girls Primary School, Gnanapuram.		2,76,000	30000	30000	30000
6	Construction & maintenance of toilet block at St. Peters High School, Gnanapuram with 20 sitting facility.		10,00,000	30000	30000	30000
7	Construction of toilet block & maintenance at VMC Fort Basic School at Old town with 3 sitting facility.			2,50,000	30000	30000
8	Construction of toilet & maintenance block at GVMC Primary School, RP Peta with Five seating capacity.			3,50,000	30000	30000
9	Construction & maintenance of toilet block at GVMC High School, K.Colony, Kancharapalem with 9 seating facility.			6,50,000	30000	30000
10	Construction & maintenance of toilet block at GVMC High School, Kancharapalem with 18 seating capacity.			5,50,000	30000	30000
11	Construction & maintenance of toilet block at ZP High School, Vepagunta 15 seating capacity.			5,00,000	30000	30000
12	Construction & maintenance of toilet block at ZP High School, Rampuram with Three seating capacity.			4,00,000	30000	30000
13	Construction & maintenance of toilet block at C.B.M. High School at Head Post Office Seven seating capacity,				4,00,000	30000
14	Construction & maintenance of toilet block at MVDM (GVMC) School with 08 seating capacity.				5,00,000	30000
15	Construction				4,00,000	30000

S. No	Name of work	Expenditure in 2014-15	Target for 2015-16	Target for 2016-17	Target for 2017-18	Target for 2018-19
	&maintenance of toilet block at ZP High School, Chidigummala, GolugondMandalam, Narsipatnam with 10 seating capacity.					
16	Construction & maintenance of toilet at ZP High School, Yarravaram, NathavaramMandalam, Narsipatnam with 10 seating capacity.				4,00,000	30000
17	Construction & maintenance of toilet at ZP Primary School, Yarravaram, NathavaramMandalam, Narsipatnam with 09 seating capacity.				4,00,000	30000
18	Construction & maintenance of Toilet block at ZP High School, Makavarapalem, Tamaram of Narsipatnam with 26 seating capacity.					4,00,000
19	Construction & maintenance of toilet block at MGM High school, Dabagardens with 10 seating capacity.					4,00,000
20	Construction & maintenance of toilet block at MVD School ,Dandu Bazar with 10 seating capacity.					4,00,000
21	Construction & maintenance of toilet block at GVMC High School, PrakashraoPeta with 10 seating capacity.					4,00,000
22	Construction & maintenance of toilet block at GVMC primary School,Prasad Gardens with Three seating capacity.					2,50,000
	Total	**3,36,200**	**26,28,000**	**28,62,000**	**24,42,000**	**23,42,000**

Table- 9.5 Details of the construction & maintenance of community/public toilets

S No	Name of work	Expenditure in 2014-15	Target for 2015-16	Target for 2016-17	Target for 2017-18	Target for 2018-19
1	Construction& maintenance of public toilets at Fishing Harbour with 20 seating capacity.		20,00,000	1,50,000	1,50,000	1,50,000

S No	Name of work	Expenditure in 2014-15	Target for 2015-16	Target for 2016-17	Target for 2017-18	Target for 2018-19
2	Construction & maintenance of Public toilets block at Alankararea i.e. open land of Police Comminssionerate with 10 seating capacity.		20,00,000	1,50,000	1,50,000	1,50,000
3	Construction & maintenance of Public toilets block at Convent Junction with 20 seating capacity.			20,00,000	1,50,000	1,50,000
5	Construction & maintenance of toilets block at East Quay, Port Area 15 seating capacity.			20,00,000	1,50,000	1,50,000
4	Construction & maintenance of Public toilets block VPT Sports Complex near Kalavani/Indoor Stadium with 08 seating capacity.				6,00,000	30,000
6	Construction & maintenance of toilets block at West Quay, Port Area 10 seating capacity.					20,00,000
	Total		**40,00,000**	**43,00,000**	**12,00,000**	**26,30,000**

Table- 9.6 Details of the maintenance of parks & gardens

S No	Name of work	Expenditure in 2014-15	Target for 2015-16	Target for 2016-17	Target for 2017-18	Target for 2018-19
1	Maintenance of parks & gardens at Sports & Cultural complex	8,50,000	17,00,000	17,00,000	17,00,000	17,00,000
2	Maintenance of parks & gardens at Harbour park	4,00,000	8,00,000	8,00,000	8,00,000	8,00,000
3	Maintenance of parks & gardens at other Port housing colonies	3,00,000	6,00,000	6,00,000	6,00,000	6,00,000
	Total	**15,50,000**	**31,00,000**	**31,00,000**	**31,00,000**	**31,00,000**

Table- 9.7 Details of the safe drinking water facility

S No	Name of work	Expenditure in 2014-15	Target for 2015-16	Target for 2016-17	Target for 2017-18	Target for 2018-19
1.	Installation of RO plant at Port High School.		31,000	5000	5000	5000
2	Providing RO plant for 300 bedded Golden Jubilee Hospital, Salagramapuram		3,50,000	25000	25,000	25000
3	Providing Dining hall facility at Port School with proper hand wash facility		3,00,000	5000	5000	5000
4	Providing RO plant for			3,50,000	25000	25000

S No	Name of work	Expenditure in 2014-15	Target for 2015-16	Target for 2016-17	Target for 2017-18	Target for 2018-19
	Sports & Cultural Complex and Kalyanamandapams.					
5	Different work locations/offices/schools				2,00,000	2,00,000
	Total		**6,81,000**	**3,85,000**	**2,60,000**	**2,60,000**

Table- 9.8 Details of the cleaning & maintenance of roads & drains

S No	Name of work	Expenditure in 2014-15	Target for 2015-16	Target for 2016-17	Target for 2017-18	Target for 2018-19
1	Deploying Mechanical Sweeping machines for cleaning of port interface road at a stretch of 10 km including flyover.		50,00,000	80,00,000	80,00,000	58,00,000
	Total		**50,00,000**	**80,00,000**	**80,00,000**	**58,00,000**

Table- 9.9 Details of the solid waste managementat housing colonies

S No	Name of work	Expenditure in 2014-15	Target for 2015-16	Target for 2016-17	Target for 2017-18	Target for 2018-19
1	Construction & Maintenance of Solid Waste Management system at Port Housing Colony.(Modification of existing SGP Old Dispensary, Procurement of Dust Bins for Dry & Wet wastes, Trolleys etc).		9,00,000	6,00,000	6,00,000	6,00,000
	Total		**9,00,000**	**6,00,000**	**6,00,000**	**6,00,000**

Table- 9.10 Details of the recycling of waste water through STP

S No	Name of work	Expenditure in 2014-15	Target for 2015-16	Target for 2016-17	Target for 2017-18	Target for 2018-19
1	Refurbishing of existing 10 MLD Sewage Treatment Plant		25,00,000	75,00,000	5,00,000	5,00,000
2	Providing Truck Tyre Wash facility to port users		35,00,000	19,00,000	19,00,000	14,00,000
3	Cleaning of Housing Colonies at Harbour park, Maharanipeta, Sports Complex, GJ Hospital, SG Puram, CHD & CISF colonies	4,35,000				
4	Cleaning of R&D Yard, OHC and western sector areas	5,00,000				
5	Providing Manual Road Sweeping at Port Roads		90,00,000	1,20,00,000	57,00,000	50,00,000
6	Solid waste	17,00,000	34,00,000	34,00,000	34,00,000	34,00,000

S No	Name of work	Expenditure in 2014-15	Target for 2015-16	Target for 2016-17	Target for 2017-18	Target for 2018-19
	management at Port Housing Colonies					
	Total	**26,35,000**	**2,09,00,000**	**2,53,00,000**	**1,90,00,000**	**1,56,00,000**

CHAPTER-10
ENVIRONMENTAL MONITORING PROGRAMME

CHAPTER-10

ENVIRONMENTAL MONITORING PROGRAMME

10.1 THE NEED

Monitoring is an essential component for sustainability of any developmental project. It is an integral part of any environmental assessment process. Any development project introduces complex inter-relationships in the project area between people, various natural resources, biota and the many developing forces. Thus, a new environment is created. It is very difficult to predict with complete certainty the exact post-project environmental scenario. Hence, monitoring of critical parameters is essential during project construction and operation phases.

Monitoring of environmental indicators signal potential problems and facilitate timely prompt implementation of effective remedial measures. It will also allow for validation of the assumptions and assessments made in the present study.

Monitoring becomes essential to ensure that the mitigation measures planned for environmental protection function effectively during the entire period of project operation. The data so generated also serves as a data bank for prediction of scenarios during construction and operation phases in similar projects.

10.2 EXISTING MONITORING SYSTEM

At present, a detailed monitoring programme is being implemented by the Visakhapatnam Port. The summary of the existing Environmental Programme is given in Table-10.1.

Table-10.1: Summary of Environment Monitoring Programme at VPT

S. No.	Name of Work	Description of work/sampling areas	Parameters
1	Continuous online Ambient Air quality monitoring (CAAQM)	Monitoring of ambient air quality in Residential and Port operational areas is being carried out by GITAM University as a pilot study • St. Aloysius School • R&D Yard • CISF tower near S6 Conveyor	$PM_{2.5}$, PM_{10}, SO_2 and NOx
2	Monitoring of ambient air quality	Monitoring of ambient air quality in Industrial & Residential areas is being carried out by AUDC/AU weekly twice at following three locations in three shifts: • ONGC Building • R&D yard • DLB Canteen	$PM_{2.5}$, PM_{10}, SO_2 and NOx

S. No.	Name of Work	Description of work/sampling areas	Parameters
3	Monitoring of Harbour water quality	Analysis of water samples collected during low tide and high tide for assessing the Harbour water quality by AUDC/AU quarterly at 9 locations (Inner & Outer Harbour)	PH, Color, Odor, TSS, DO, BOD, Oil& Grease, Sulphide, Ammonical Nitrogen, Free Ammonical Nitrogen, Total Kjeldahl Nitrogen, Cyanide, Fluoride, heavy metals and faecal Coliform
4	Monitoring of harbour water quality for the assessment of dredging impact	Bed samples and water samples are being collected during dredging and analyzed by GITAM University, parameters concerned are physico-chemical parameters Sampling points: Northern Arm Western arm Outer harbour	DO, Turbidity, Phosphate, Sulphate, Ammonia, and heavy metals.

10.3 AREAS OF CONCERN

From the monitoring point of view, the important parameters are resettlement and rehabilitation of project-affected persons, marine water quality, ambient air quality, noise, etc. An attempt is made to establish early warning system which indicate the stress on the environment. Suggested monitoring parameters and programmes are described in the subsequent sections.

10.4 MARINE WATER & SEDIMENT QUALITY

Construction phase

The chemical characteristics of marine water quality shall be monitored once in three months during project construction phase, close to the major construction sites. Both surface and bottom waters should be sampled and analysed. The parameters to be monitored are as follows:

Marine Water

Physico-chemical parameters

- pH
- Salinity
- Conductivity
- TDS
- Turbidity
- D.O.
- BOD
- Phosphates
- Nitrates
- Sulphates

- Chlorides

Biological parameters

- Light penetration
- Chlorophyll
- Primary Productivity
- Phytoplanktons (No. of species and their density)
- Zooplanktons (No. of species and their density)

Sediments

Physio-chemical parameters

- Texture
- pH
- Total Kjeldahl Nitrogen
- COD
- Sodium
- Potassium
- Phosphates
- Chlorides
- Sulphates

Biological Parameters

- Benthic Meio-fauna
- Benthic Macro-fauna

The marine water and sediment sampling and analysis be conducted by an external agency. A provision of Rs.1.8 million/year has been earmarked for this purpose. Assuming construction phase is to last for 2 years and considering as escalation of 10%, an amount of Rs. 3.78 million can be earmarked…

Operation Phase

The chemical characteristics of marine water quality should be monitored once in three months and biological parameters once a year during project operation phase. Both surface and bottom waters should be sampled and analysed. The parameters to be monitored are as follows:

Marine Water

Physico-chemical parameters

- pH
- Salinity
- Conductivity
- TDS
- Turbidity
- D.O.

- BOD
- Phosphates
- Nitrates
- Sulphates
- Chlorides

Biological parameters

- Light penetration
- Chlorophyll
- Primary Productivity
- Phytoplanktons (No. of species and their density)
- Zooplanktons (No. of species and their density)

Sediments

Physio-chemical parameters

- Texture
- pH
- Total Kjeldahl Nitrogen
- COD
- Sodium
- Potassium
- Phosphates
- Chlorides
- Sulphates

Biological Parameters

- Benthic Meio-fauna
- Benthic Macro-fauna

The marine water and sediment sampling and analysis be conducted by an external agency. A provision of Rs.1.8 million/year has been earmarked for this purpose.

10.5 AMBIENT AIR QUALITY

Construction Phase

Ambient air quality monitoring is recommended to be monitored at six stations close to the construction sites. The monitoring can be conducted for three seasons. For each season monitoring can be conducted twice a week for 4 consecutive weeks. The monitoring is to be carried out two locations of each of the following sites.

- New facility at VPT for Iron ore handling on DBFOT basis (OHC & WQ-l)
- Existing Container Terminal in the Outer Harbour
- West Quay North (WQ-7 & WQ-8)

One station each in the upwind and downwind directions shall be monitored for each site. The parameters to be monitored are PM_{10}, $PM_{2.5}$, SO_2 and NO_2. An amount of Rs. 0.72 million/year would be required. Considering, construction phase of two years and escalation of 10%, an

amount of Rs. 1.51 million/year can be earmarked for this purpose. The ambient air quality monitoring during project operation phase can be conducted by the agency which at present is involved in ambient air quality monitoring or any other agency approved by Andhra Pradesh Pollution Control Board.

Operation phase

The ambient air quality monitoring will have to be conducted at six locations. Air quality could be monitored for twice a week seasons in a year. High volume samplers can be used for this purpose. The frequency of monitoring shall be twice a week for 24 hours for four consecutive weeks. The parameters to be monitored are PM_{10}, $PM_{2.5}$, SO_2 and NO_2. The ambient air quality monitoring during project operation phase can be conducted by an agency approved by Andhra Pradesh Pollution Control Board. An amount of Rs. 0.72 million/year can be earmarked for this purpose.

10.6 NOISE

Personnel involved in work areas, where high noise levels are likely to be observed during project construction and operation phases. For such in-plant personnel, audiometric examination should be arranged at least once a year.

The noise level monitoring during construction and operation phases will be carried out by the project staff and a noise meter can be purchased. An amount of Rs.0.15 million has been earmarked for this purpose.

Neighbourhood (upto radius of 1 km)

It is recommended that during project operation phase, monitoring of sensitive areas like schools and medicare centres be conducted within a distance of 1 km radius of the harbour to ascertain noise levels at receptors, taking note of any excessive build-up in any particular direction.

10.7 GREENBELT DEVELOPMENT

Sites of greenbelt development should be monitored once in every month during project operation phase to study the growth of various species and to identify the needs if any, such as for irrigation, fertilizer dosing, pesticides, etc. The monitoring can be conducted by project staff.

10.8 SUMMARY OF ENVIRONMENTAL MONITORING PROGRAMME

The summary of Environmental Monitoring Programme for implementation during project construction and operation phases is given in Tables-10.2 and 10.3 respectively.

Table-10.2: Summary of Environmental Monitoring Programme for implementation during project construction phase

S. No.	Aspects	Parameters to be monitored	Frequency of monitoring	Location
1.	**Marine water**			
	Physico-chemical parameters	pH, Salinity, EC, TDS, Turbidity, Phosphates, Nitrates, Sulphates, Chlorides.	Once in three months	9 sites
	Biological parameters	Light penetration, Chlorophyll, Primary Productivity, Phytoplanktons, Zooplanktons	Once in three months	9 sites
2.	**Sediments**			
	Physico-chemical parameters	Texture, pH, Sodium, Potassium, Phosphate, Chlorides, Sulphates	Once in three months	9 sites
	Biological parameters	Benthic Meio-fauna, Benthic Macro-fauna	Once in three months	9 sites
3.	Ambient air quality	PM_{10}, $PM_{2.5}$, SO_2 and NO_2	- Summer, Post-monsoon and Winter seasons. - Twice a week for four consecutive weeks per season.	6 sites Close to construction site(s)
4.	Noise	Equivalent Noise Level	During peak construction activities	Construction Site(s)

Table-10.3 : Summary of Environmental Monitoring Programme for implementation during project operation phase

S. No.	Aspects	Parameters to be monitored	Frequency of monitoring	Location
1.	**Marine water**			
	Physico-chemical parameters	pH, Salinity, EC, TDS, Turbidity, Phosphates, Nitrates, Sulphates, Chlorides.	Once in three months	9 sites
	Biological parameters	Light penetration, Chlorophyll, Primary Productivity, Phytoplanktons, Zooplanktons	Once in three months	9 sites
2.	**Sediments**			

S. No.	Aspects	Parameters to be monitored	Frequency of monitoring	Location
	Physico-chemical parameters	Texture, pH, Sodium, Potassium, Phosphate, Chlorides, Sulphates	Once in three months	9 sites
	Biological parameters	Benthic Meio-fauna, Benthic Macro-fauna	Once in three months	9 sites
3.	Ambient air quality	PM_{10}, $PM_{2.5}$, SO_2 and NO_2	- Summer, Post-monsoon & Winter seasons. - Twice a week for four consecutive weeks per season.	6 sites near project works
4.	Noise	Equivalent Noise Level	Once per month	Project area and sites within 1 km of the project area
5.	Greenbelt Development	Rate of survival and growth of various species	Once per month	Various plantation sites.

10.9 INTEGRATED ENVIRONMENTAL MONITORING PROGRAMME

The Integrated Environmental Monitoring Programme for implementation during project operation phase is given in Table-10.4.

Table-10.4: Summary of Integrated Environment Management Programme

S. No.	Name of Work	Description of work/sampling areas	Parameters
1	Continuous online Ambient Air quality monitoring (CAAQM)	Monitoring of ambient air quality in Residential and Port operational areas is being carried out by GITAM University as a pilot study St. Aloysius School R&D Yard CISF tower near S6 Conveyor	$PM_{2.5}$, PM_{10}, SO_2 and NOx
2	Monitoring of ambient air quality	Monitoring of ambient air quality in Industrial & Residential areas is being carried out by AUDC/AU weekly twice at following three locations in three shifts: ONGC Building R&D yard	$PM_{2.5}$, PM_{10}, SO_2 and NOx

S. No.	Name of Work	Description of work/sampling areas	Parameters
		DLB Canteen 2 locations near 3 project sites being developed as a part of the present proposal	
3	Monitoring of Harbour water quality	Analysis of water samples collected during low tide and high tide for assessing the Harbour water quality by AUDC/AU quarterly at: 9 locations (Inner & Outer Harbour) 2 locations near 3 project sites being developed as a part of the present proposal	PH, Color, Odor, TSS, DO, BOD, Oil& Grease, Sulphide, Ammonical Nitrogen, Free Ammonical Nitrogen, Total Kjeldahl Nitrogen, Cyanide, Fluoride, heavy metals and faecal Coliform
4	Monitoring of harbour water quality for the assessment of dredging impact	Bed samples and water samples are being collected during dredging and analyzed by GITAM University, parameters concerned are physico-chemical parameters Sampling points: Northern Arm Western arm Outer harbor 2 locations near 3 project sites being developed as a part of the present proposal	DO, Turbidity, Phosphate, Sulphate, Ammonia, and heavy metals.
5	Noise	Equivalent Noise Level near 2 locations near each of the 3 project sites	Once per month
6	Greenbelt Development	Rate of survival and growth of various species	Once per month

CHAPTER-11
PUBLIC HEARING PROCEEDINGS

CHAPTER-11
PUBLIC HEARING PROCEEDINGS

11.1 GENERAL

The Visakhapatnam Port Trust proposes to upgrade the existing facilities and creation of new facility for iron to ore handling extension of existing container terminal in the outer berth and development of West Quay North (WQ-7 & WQ-8) berth with mechanized handling facilities for bulk cargoes. The proposed project activities are briefly described in the following paragraphs.

a. **Extension of container terminal**: the Project envisages predominant rail evacuation of the cargo from the terminal in closed containers would reduce open handling of cargo and truck movement leading to considerable reduction in pollution levels.

b. Up-gradation of Existing Facility and creation of new facility at VPT for Iron ore handling on DBFOT basis (OHC & WQ-I)

c. **Mechanization of WQ-7 & WQ-8 berths**: The project envisages mechanization of existing handling mechanism by replacing the existing equipment with state of art equipment which results in considerable reduction of pollution levels

d. The EIA report has been prepared as per the TOR suggested by the MoEF&CC. Environmental Management Plan (EMP), Risk Assessment (RA) and Disaster Management Plan (DMP) too has also been formulated for the project.

11.2 BACKGROUND

The Notice for the public hearing was issued in two news papers on 9-3-15 i.e. “The Hindu” (English daily) national newspaper and Telugu local newspaper Eenadu” for Public. The copy of the notice for Public Hearing are enclosed as Attachment-I, Public Hearing for proposed modernisation of existing facility and addition of new facilities entailing capacity was conducted on 10thApril 2015by Andhra Pradesh Pollution Control Board (APPCB),near Visakhapatnam Port Trust Administrative Building, Visakhapatnam Port Trust, Visakhapatnam.

The Public Hearing was organised by Andhra Pradesh Pollution Control Board (APPCB). Environmental Engineer from Regional Office of APPCB. The Joint Collector and Additional District Magistrate, Visakhapatnam chaired the meeting. The Environmental Engineer, Andhra Pradesh Pollution Control Board, Visakhapatnam welcomed the Chairman of the meeting and apprised the participants about the process of public hearing and requested the chairman of the meeting, Joint Collector & Additional district Magistrate Visakhapatnamto start the meeting. The Environmental Engineer explained briefly about the project and stated that the public hearing is

mandatory for obtaining environmental clearance for MoEF&CC. He also mentioned that as per the norms of EIA Notification 2006, the intimation of the public hearing was given in 2 widely circulated newspapers with project details for inviting suggestions, views, comments and objections from the public.

The Joint Collector & ADM also extended warm greetings to all the persons attending the public hearing. He explained briefly about the project and invited the VPT officials to make a detailed presentation of the project. Chairman, VPT made an elaborate presentation regarding the proposed project and findings of the EIA report. The representatives of the public attending the public hearing were requested to express their suggestions, opinions and objections in respect of the project after the presentation. They were also requested to furnish their objections and suggestions through a written petition if they wish so, either to the Joint Collector& ADM or to the Environmental Engineer, Andhra Pradesh Pollution Control Board, Regional Office, Visakhapatnam.

11.3 ISSUES RAISED BY THE PARTICIPANTS DURING PUBLIC HEARING

The proposed project envisages modernisation of existing facility and addition of new facilities entailing capacity at Visakhapatnam Port Trust with an investment of Rs. 2569 Crores. The copy of public hearing proceedings including written reply to the questions raised during public hearing and attendance sheet of participants is enclosed as Appendix-5.

The summary of the key issues raised during public hearing and response by project proponent are given in Table 11.1. The response and Action Plan for compliance of the issues raised during public hearing is given in Table-11.2.

Table- 11.1. Details of response of VPT to the issues raised during public hearing and budgetary allocations

S. No	Petitioner	Comments	Response by VPT
1.	**Sri J.T. Rama Rao,** Utthar Andhralkya Vedika	Expressed that he is not against the modernization and expansion of the Port but questioned the implementation of the dust pollution control measures so far. He also raised concern about dust pollution problems faced by the residents of Kotaveedhi and Granapuram areas.	VPT is conducting health monitoring regularly in coordination with Indian Red Cross, health camps for the residents of the 1Town Area as a part of CSR activities' and also regular health check-ups of all the VPT employees who are working in the field are being conducted. There is

S. No	Petitioner	Comments	Response by VPT
			no evidence/correlation of any illness caused due to dust pollution amongst employees. The proposed expansion project of VPT is not in any way related to the R.K. Beach erosion.
		He informed that R K Beach is regularly getting eroded due to port dredging activities.	
2.	**Sri Paka Satya Narayana,** Backward Rights society,	Raised his concern regarding the drainage system and health related issues of the people residing in the surroundings of the Port.	VPT is taking utmost care regarding the health of the local population and regularly conducting the health check-ups in coordination with Indian Red Cross. Health camps for the residents of the Town Area as a part of CSR activities and regular health checkups are being conducted of all the VPT employees who are working in the field are being conducted. No evidence/correlation of any illness caused due to dust pollution to the employees has been observed.
3.	**Sri Mohamed Sadhik,** President, Yuva Bharat Force,	He requested that details of the budget allocation for pollution control measures should have been informed to the public.	V.P.T. would invest Rs.200 crores in the next three to four years to make Vishakha-patnam Port, a Green Port. Works amount to a cost of Rs.70 crores have already been sanctioned
4.	**Sri Alikhan,** One-Town Area	Raised his concern about the pollution problems and indicated that the Health of the people residing in and around port is adversely affected and suffered	VPT would invest Rs.200for Improving the environment in and around port area. Following measures are

S. No	Petitioner	Comments	Response by VPT
		with respiratory diseases. The Port should take up dust pollution control measures on war- footing basis.	proposed for control of Air pollution: • Decrease in vehicular traffic in the Port area due to mechanisation. • Shifting of coal stack yard by providing proper environmental safeguards viz. construction of high rise walls, drainage system, MDSS and Plantation which is targeted to be completed by end of year 2015 VPT has also taken the following measures: • Mechanical dust suppression system has been provided at coal stack yards at GCB, WOB, North, South of S4 Conveyor covering an area of 4,75,000 m^2 commissioned in the year 2002,at a cost of RS.8.00 Crores, and the same is effective and water sprinkling is done continuously round the clock. • Recently the MOSS was also developed in East Yard, S-6 Area and West of ESSAR covering an area of 3,58,116 sq.m. • Wetting of cargo stacks and roads by sprinkling' of water with water tankers
5.	**Sri AJ Stalin,** City secretary, CPI (M)	Complained about dust pollution due to open storing and stacking of coal.	
6.	**Sri Abdul Gaphar,** Kotaveedhi	Informed that the people residing in and around port are adversely affected and suffering with respiratory diseases. He opined that the Port can take up the expansion project after addressing the pollution problems on top priority .	
7.	**Sri V.Bosanna, Sampradaya Matsakarula society**	Raised his concern regarding the air pollution problems due to coal handling and storage.	
8.	**Sri L.F.Raghuram,** Visakhapatnam	Informed that the Port authorities invited the people for participating in environmental public hearing by Dandora (Tom -Torn arrangement) and the present chairman- VPT, earlier was worked as Joint Collector, Visakhapatnam knows all the circumstances in the area. He also opined that VPT has become coal cargo hub, if seen through aerial view and the people would have feel that they have landed in the coal mining area. He expressed that handling of huge quantity of coal cargo leading to dust problems in the city and informed the Government officials not to permit any coal based industries in Visakhapatnam area. Finally he opined that they want development but not at the cost of life of the people.	

S. No	Petitioner	Comments	Response by VPT
			where mechanised. Water Sprinkling System was not installed. • Dedicated storage tanks, separate pumps and pipelines are provided for each filling station to ensure continuous water supply for carrying out round the clock water sprinkling through MOSS? and tankers. • Manual sweeping of roads • All cargo stacks are covered with tarpaulins and a separate task force is appointed directly reporting to Chairman to go around all the Port operational areas daily for monitoring the implementation of pollution control measures and for identification of the shortfalls if any. Basing on the task force reports necessary action is being initiated at the respective ends dully addressing the prevailing pollution problems.
9..	**Sri Abdul Anif,** TDP Minority Cell President	He opined that the Port should not take up the project at the cost of risk to the life of the people residing in and around port due to aggravation of the pollution problems. He expressed that if the Govt.	VPT has taken various measures for control of dust emissions in port area by mechanisation and installed MDSS at

S. No	Petitioner	Comments	Response by VPT
		officials residing in their area, then they would know about the pollution problems facing due to port activity.	all the stocking areas. Regarding health issues the port is conducting health check-ups regularly in coordination with Indian Red Cross, health camps for the residents of the 1 Town Area
10.	**Sri M.A.Rasool, Kotaveedhi**	Raised his voice against proposed land acquisition for the Port in kotavedhi village.	There are no plans at VPT to acquire lands in Kotaveedhi village
11.	**Smt.A.Vimala,**AndhraPradeshMahilaSamakhyaVisakha City Secretary	Expressed her concern about the health issues related to women in the port area and reported that women are facing abortion due to pollution. She finally opined that port should not take up modernization and expansion project unless taking the concrete and permanent pollution control measures.	The port is conducting regular health checkups in coordination with Indian Red Cross. Regular health checkups of all the VPT employees who are working in the field are being conducted. There is no evidence/ correlation of any illness caused due to pollution to the employees and there are no evidences of abortions due to pollution.
12.	**Sri J.D.Naidu, Visakha** Fishing Harbour Matsakarula Society Secretary	Informed mentioned the problems in fish drying due to port pollution and also raised health issues. He opined that the historical churches, Masque, temples constructed by British people are losing their heritage due to port pollution. He expressed that the people are declared suffering with respiratory diseases when they consulted doctors.	VPT has no immediate plans to shift Fishing harbour. Regarding health issues VPT is regularly conducting health checkups in coordination with Indian Red Cross as a part of CSR activities. Regular health checkups are being conducted of all the VPT employees who are working in the field. There is no

S. No	Petitioner	Comments	Response by VPT
			evidence/correlation of any illness caused due to pollution to the employees, those who are exposed directly in the port activities
13.	**Sri T.Sankar, PedaJalaripeta,**Matsakarula Society Secretary	He raised his concerns that fish catch is depleting due to construction of jetties by usage of explosives in the beneath of the sea and finally he opined that the port should address pollution problems first and then start the expansion project.	The fish catch is not related to any construction of jetties and VPT has taken various measures for control of dust emissions in port area by mechanization and installed MDSS at all the stacking areas.
14.	**Sri P.Venkata Rao,** Ex-Corporator	He said that the historical churches, Masque, temples constructed by British people are losing their heritage due to port pollution. He expressed people are declared suffering with respiratory diseases when they consulted doctors.Hence, port should not take up modernization and expansion project unless taking the concrete and permanent pollution control measures	As a part of CSR activities VPT is regularly conducting, health camps in coordination with Indian Red Cross for the residents of the 1Town Area and as a part of CSR activities. Regular health check-ups are being conducted for all the VPT employees who are working in the field and there is no evidence/correlation of any illness caused due to pollution to the employees
15.	**Dr. Sharin Rahman,** ChaitanyaSravanthi Organization	Informed that the EIA report prepared by WAPCOS is in-correct and baseless. She opined that as per WAPCOS report, there is no pollution due to port activity, whereas APPCB reports are showing there is pollution due to port activities. She opined that WAPCOS is misleading the public and given favorable report to VPT and also mentioned that there are no Historical monuments and habitat places in the Port area which is not really true. She informed that there are historical	M/s. WAPCOS Ltd has prepared the EIA report as per required standards after proper scientific analysis of Environmental data. WAPCOS Ltd is NABET Accredited agency for conducting the EIA studies in Ports and harbour sector

S. No	Petitioner	Comments	Response by VPT
		churches, Masques; temples constructed by British people are existing in that area. She expressed that there is vast difference between the EIA report submitted by the Andhra University in the year 1997 and the present report submitted by the WAPCOS. She also opined that there is no similarity between the report submitted by VPT to the Parliamentary standing committee and the present EIA report for expansion project. She informed that they already filed an appeal in National Green Tribunal, Chennai against the port and people would fight against port if expansion is not done in proper way.	
16.	**Sri Chowdhari Apparao**	Appealed the gathering not to obstruct the development. He also appealed the Port Authorities to address the pollution issues in amicable way	------
17.	**Shri Rajsekhar Varma** of Lok Satta party	Informed that there would be employment where there is development, but it is not fair in development without considering the environment. The report of WAPCOS & A.P. Pollution Control Board are the quite contrary. He opined that if the capacity of the Port increases then pollution levels would also be increased proportionately.	VPT has entrusted the work to EIA accredited agency, M/s. WAPCOS and prepared the EIA report as per required standards after proper scientific analysis of Environmental Management data. Suitable Environmental Plan has been suggested as a part of the EIA study to minimise the adverse impacts including air pollution.
19	**Prof. S. Ramakrishna Rao,** GITAM University	Informed that the Chairman of Visakhpatnam Port trust has started initiation for control of pollution immediately after taking charge as Chairman. He opined that, pollution levels would be reduced to greater extent due to	--

S. No	Petitioner	Comments	Response by VPT
		introduction of Container cargo operations and other mechanized initiatives by December 2017.	
20	**Residents of Kota street**	Opined that the Port shall adopt the systems those are being implemented in developed countries and there is no development without industrial growth. He requested the public not to oppose the port modernization and expansion activities.	---
21.	**Sri Vasupalli Ganesh Kumar,** Hon'ble M.L.A for Visakhapatnam (South)	Concern regarding Environmental issues.	The present proposal of VPT is to seek Environmental clearance in respect of the following three projects only viz.,. a) Extension of existing Container Terminal in the Outer Harbour' of VPT on DBFOT basis(Rs.633.11 Crores). b)Development of West Quay North (WQ-7&WQ-8) berth with mechanized handling facilities for handling dry bulk/break bulk cargo on DOFOT basis in Inner Harbour of VPT (Rs.376Crores) c) Up-gradation of existing facility and creating of New facility at VPT for Iron Ore handling on DBFOT basis (OHC&WQ-1) (Rs.845.41 Crores) The expansion and modernisation involving three projects have been taken up with an intention of controlling and minimizing the

S. No	Petitioner	Comments	Response by VPT
			pollution in VPT. Proposed upgradation and mechanization including enhancing containerization operations will improve environment and reduce pollution

Table 11.2 Response and Action Plan for compliance of the issues raised during public hearing

S.NO	Query raised	Reply	Action plan
		Queries related to Air pollution	
1	Sri J.T.RamaRao, Uttharandhra Ikya Vedika	V.P.T. would invest Rs.200 Crores in the next three to four years to make V.P.T' a Green Port. Out of which works at a cost of Rs.70 crores were already sanctioned and in the process of tender finalization for award of work in due course of time. Improving the environment and reducing vehicular traffic movement within the Port area due to 'the mechanisation. Re-organization of stack yards is proposed by shifting the present location of coal stack to inside from periphery by providing proper environmental safeguards viz. construction of high rise walls, drainage system, MDSS and Plantation which is targeted to be completed by end of year 2015	**<u>Works in Operation</u>:** 1. **Mechanical Dust Suppression System** (MDSS), which was commissioned in 2002 in Coal stacking areas Capital cost of **Rs.7.89 Crores**. 2. Construction of **dust barrier** at R-11 area and East yards at a cost of Rs.**4.0 crores** 3. A **comprehensive environment management system** cleaning of Geddas, desilting of drains, manual sweeping of roads, etc the cost of project is **Rs.6.38 Crores.** 4. **Covering of Coal and other Cargo stacks with Tarpaulins at cost of Rs.0.85 Crores** per **annum** 5. Two **Truck Mounted Fog Canons** deployed to suppress the dust while loading / unloading cargo at berth and stack yards cost of the project is **Rs.0.90 Crores**. **<u>Works under progress:</u>** • Construction and operation of **Truck Tyre Cleaning System** at B-Ramp i.e. at the interface of port and city roads Targeted to be completed by March 2016. Cost of the project is **Rs.0.81 Crores** • **Repairs / modifications to existing sprinkling systems** at S4 and WOB areas is in progress Targeted to be completed by March 2016. Cost of project is **Rs. 1.60 crores** **Future plans categorized as**
2	Sri Mohamed Sadhik, President,Yuva Bharath Force		
3	Sri Alikhan, One-Town Area		
4	Sri A.J.Stalin, City secretary, CPI (M),		
5	Sri Abdul Gaphar, Kotaveedhi		
6	Sri D. Markendaya, CPI (M),		
7	Sri V.Bosanna, Sampradaya Matsakarula society		
8	Sri Abdul Anif, TDP Minority Cell President		
9	Sri Mohamed Irfan," Captain of Merchant ship, Kotaveedhi		
10	Sri T.Sankar, PedaJalaripeta, Matsakarula Society Secretary		
11	Sri P.Jagga Rao, Visakhapatnam		
12	Sri P.Venkata Rao, Ex-Corporator		
13	Sri Syam Prasad, HRC member		
14	Sri L.F.Raghuram, Visakhapatnam,		

S.NO	Query raised	Reply	Action plan
15	Sri Chowdhari Apparao		**A) Short term plans (2015:17)** **1. Dust barrier of 7.50m height and 1.70KM long i.e. from the Sea Horse Junction to Convent Junction** at the city interface is under construction at a cost of **Rs.9.75 Crores**. **2.** Sweeping of roads within the Port by **mechanical sweeping machine** at a cost of Rs.2.81 Crores. **3. Up-gradation and strengthening of BT and CC Blocks** for Operational Roads including drains and Berms (**East Zone**) at a cost of **Rs.16.31 Crores** **4. Strengthening and up-gradation of BT and CC Blocks** for roads including drains and berms (**Convent Junction to PCR Junction**) at a cost of **Rs.18.32 Crores**. **5. Refurbishment of STP** to handle 10MLD with proper quality output as per APPCB norms at an estimated cost of about **Rs. 1.50 crores.** **B) LONG TERM PLANS (DURING 2015-18):** **1. Reorganization of stackyards , Dismantling and construction of old berths like WQ2 to WQ5, EQ 5 and EQ 6** **2. Development of multipurpose terminal by replacing EQ2 to EQ5 and WQ 7 &WQ 8 with mechanization facilities**
16	Sri Rajasekhar Varma of Loksatta Party		
17	Sr,i Brahmaswaroop, an electi'ical engineer		
	Queries related to Health and Medical facilities		
1	Sri Paka Satya Narayana, Backward Rights society	With regard to the Health, VPT is conducting regularly in coordination with lndian Red Cross, health camps for the residents of the 1 Town Area as a part of CSR activities and also regular health checkups are being conducted of all the VPT employees who are working in the field and there	1. Green Vision-Health project for fishermen folk on communicable diseases and health awareness Project Expenditure: Rs.**9,75,000.00** 2. Sankar Foundation to perform Cataract Surgeries. Project Expenditure : Rs.**25,00,000.00**
2	Sri A.J.Stalin, City secretary, CPI (M),		
3	Sri Abdul Gaphar, Kotaveedhi		

S.NO	Query raised	Reply	Action plan
4	Smt. A.Vimala, Andhra Pradesh Mahila Samakhya Visakha City secretary	is no evidence/correlation of any illness caused due to pollution to the employees.	3. Indian Red Cross Society for procuring medical equipment. Project Expenditure: Rs.**50,00,000.00** 4. Govt. ENT Hospital –OTO Acoustic Emission medical equipment. Project Expenditure : Rs.**2,94,000.00**
5	Expansion and other Miscellaneous problems		
6	Sri M.A.Rasool, Kotaveedhi,		
7	**Sri Mariadas, A voluntary activist**		
	Miscellaneous and other problems (Beach Erosion, Shifting of Fishing harbour, EIA report prepared by WAPCOS)		
1	Sri Mohamed Irfan," Captain of Merchant ship, Kotaveedhi	Covering of coal stack yards with tarpaulins, deployment of mobile fog cannons for preventing the spreading of dust in air during loading and unloading operations	In order to reduce fugitive dust, agents are covering the coal stacks with tarpaulins. However, whenever the agents are not covering the stacks as mentioned above, Visakhapatnam port is taking up covering of the such stacks, for which an agency is in place for Supply of Tarpaulins and manpower for **covering of Coal and other Cargo stacks with Tarpaulins** **at cost of Rs.0.85 Crores** per **annum**
2	Sri J.D.Naidu, Visakha Fishing Harbour Matsakarula Society Secretaryr	No immediate plans to shift the Fishing harbour.	**-----**
3	Sri T.Sankar, PedaJalaripeta, Matsakarula Society Secretary	The fish catch cannot be related to the construction activity of any jetties.	**-----**
4	Dr. Sharin Rahman, Chaitanya Sravanthi Organization,	The EIA report is prepared by accredited agency M/S WAPCOS as per required standards after proper scientific	Additional information as sought by EAC are submitted

S.NO	Query raised	Reply	Action plan
5	Sri J.T.RamaRao, Uttharandhra Ikya Vedika	The proposed expansion project of VPT is not in any way related to the R.K.Beach erosion.	As a responsible corporate Citizen VPT have realized the problem of erosion in the early 1970s which is mainly due to the natural phenomena on account of Sea wave/current hence taken up the beach nourishment activity for past 3 decades . A quantity of about 4 lakhs cu.m of sand is being pumped for the beach nourishment at a cost of about 6.00 crores

CHAPTER-12
COST ESTIMATES

CHAPTER-12

COST ESTIMATES

12.1 BUDGET FOR EMP

The cost estimates for implementing EMP shall be Rs. 337.94 million. The details are given in Table-12.1. An amount of Rs.318.4 million has been earmarked for the implementation of dust suppression system and installation of firefighting equipment in the overall cost of the project.

Table-12.1: Summary of cost estimate for implementing Environmental Management Plan (EMP) (Unit :Rs. million)

S. No.	Parameter	Project No.-I	Project No.-II	Project No.-III	Total	Remarks
1.	Sanitary facilities at labour camps	1.00	0.60	0.50	2.1	
2.	Construction of sewage network to convey untreated sewage from community toilets	0.5	0.5	0.5	1.5	
3.	Treatment of effluent from workshops	1.00	1.00	1.00	3.00	
4.	Greenbelt Development	2.5	2.5	2.2	7.2	
5.	Purchase of noise meter	0.15	0.15	0.15	0.45	
6.	Dust suppression and Pollution Control and Firefighting system	183.4	115	20	318.4	Included in the overall project cost
7.	Implementation of Environmental Monitoring Programme during construction phase (Refer Table-12.2)	1.77	1.76	1.76	5.29	
	Total	**190.32**	**121.51**	**26.11**	**337.94**	

12.2 ENVIRONMENTAL MONITORING PROGRAMME

The cost required for implementation of Environmental Monitoring Programme during construction phase is Rs.5.29 million. The details are given in Table-12.2.

Table-12.2 : Summary of cost estimates required for implementation during project construction phase

S. No.	Parameter	Cost (Rs. million)
1.	Marine Ecology	3.78
2.	Ambient air quality	1.51
	Total	**5.29**

The cost required for implementation of Environmental Monitoring Programme during operation phase is Rs.2.52 million/year. The details are given in Table-12.3.

Table-12.3: Summary of cost estimate for implementing Environmental Monitoring Programme during operation phase

S. No.	Parameter	Cost (Rs. million/year)
1.	Marine water quality	1.80
2.	Ambient air quality monitoring	0.72
	Total	**2.52**

CHAPTER-13
PROJECT BENEFITS

CHAPTER-13
PROJECT BENEFITS

13.1 PROJECT OVERVIEW

The Port of Visakhapatnam situated on the East Coast of India is one of the pre-eminent Major Ports of the country. The Port has two harbour basins viz., the Inner Harbour and the Outer Harbour. Presently, the inner harbour can accommodate vessels having maximum LOA of 210 mtrs, 32.5 meters beam and 11 mtrs draft on rising tide of 1.05m and also panamax vessels with a beam of 32.5 meters and draft 10.90 mtrs on 0.94 meters tide. The outer harbour on the other hand, can accommodate vessels up to 150,000 DWT size with draft up to 17 meters on rising tide of 0.5 meters. At present the Port has taken up a number of developmental schemes which include, deepening of outer harbour channel and turning circle to cater to 200,000 DWT vessels and deepening of inner harbour entrance channel and turning circle to cater to panamax vessels up to 14 mtrs draft.

13.2 PROPOSED PROJECTS AND BENEFITS

The Visakhapatnam Port proposes to upgrade the existing facilities and creation of new facility at VPT for iron to ore handling extension of existing container terminal in the outer berth and development of West Quay North (WQ-7 & WQ-8) berth with mechanized handling facilities for bulk cargoes.

The proposed project activities and their benefits are briefly described in the following paragraphs.

a. **Up-gradation of Existing Facility and creation of new facility at VPT for Iron ore handling on DBFOT basis (OHC & WQ-I)**

   This project envisages up-gradation of existing conveyor system constructed during 1970s' which has outlived its economic life and causing dust emissions during cargo handling and the Andhra Pradesh Pollution Control Board (APPCB) has directed port to provide closed conveyor system and to replace the existing ship loader. Therefore, VPT has taken up up-gradation of the Iron ore handling system by providing closed conveyor with in-built dust suppression system and to replace the ship loader so as to improve the handling efficiency resulting in modernized equipment for dust control at all the transfer points.

MoEF has accorded environment clearance for these projects including deepening of the outer harbour vide lr. No.10-11/2006-IA-III, dt. 29-11-2006 and MoEF was requested for renewal of

the same. Further, a portion of iron ore is presently handled at WQ1 berth with semi mechanized method which is now proposed to be converted to a fully mechanized system under this project.

The present system of iron ore handling through semi mechanized means has led to serious environmetnal concerns. With the output rate achieved at the inner harbour, which is less than 12000 Tonnes, Port would not be able to retain the customers in the long run, in the wake of developments that are taking place in the hinterland.

The Port has a commitment to Andhra Pradesh Pollution Control Board (APPCB) to mechanize the iron ore handling system. Further, the bulk handling is to be done in a phased manner to address environmental concerns and accordingly, a need has arisen to mechanize iron ore handling at inner harbour.

The vessel size deployed at iron ore handling ranged between 40,000 DWT to 1,70,000 DWT. There is a need to lower the boom of the ship loader frequently to align with the hatch in order to handle Handymax vessels and Super Handymax vessels at outer harbour berth, which is designed to cater to large size vessels,. Also there is a need to place the spacers to adjust boom length of the loader in the respective hatches, resulting in dust pollution, thus causing much inconvenience to the habitants staying close by. Owing to this technological and environmental limitations, it is proposed to handle vessels of 65,000 DWT above at outer harbour, leaving the handling of Handymax and Super Handymax vessels at inner harbour. Accordingly, Port has taken a view to create a new facility at inner harbour for iron ore handling in addition to upgradation of the existing mechanized facility at Outer Harbour on DBFOT basis. The creation of new facility would not only lead increased cargo handling but would also reduce the pollution due to entrainment of dust.

b. Extension of Existing Container Terminal in the Outer Harbour of Visakhapatnam Port on DBFOT basis

This project envisages extension of the existing container terminal along with streamlining the transportation activities of the container handling hither to being carried through trucks up-to the Container Freight Station (CFS) destination, situated at a far-off place. The present proposal envisages transportation of containers by rail movement / shuttling operations with a contiguous rail line. The Rail share of the evacuation which is currently Zero would be slowly improved with the active participation of all the stake holders The extension of existing container terminal in the outer harbour of Visakhapatnam Port will enhance capacity handling to 0.54 MTEUs.”.

The use of rail transport would reduce the road traffic resulting in reduced traffic congestion and air pollution.

In order to enhance capacity handling to the tune of 0.54 MTEUs, VPT propose for extension of existing container terminal in the outer harbour of Visakhapatnam Port.

c. **Development of West Quay North (WQ-7 & WQ-8) berth with mechanized handling facilities for handling bulk cargoes on DBFOT basis**

Presently, the cargo such as blast furnace slag, gypsum and ores other than iron ore proposed under this project (WQ-7 & WQ-8), which are already being handled in a semi-mechanized method elsewhere in port and is now proposed to be changed to fully mechanized handling system..

This project envisages as follows:

i) Under Phase-I, Development of West quay north WQ7 - berth of 560m long would be taken up through internal resources for which the proposal is submitted to the Ministry for approval.

ii) While the development of this berth is under progress, during next phase, it is proposed to take up **mechanization** of cargo handling facilities **through PPP mode.**

The dry bulk trade at VPT is increasing year after year. To cater to the handling of such cargoes, the port is developing new berths and mechanizing existing berths on DBFOT basis. To cater to the needs of other import dry bulk cargoes such as gypsum, bauxite, other dry bulk (excluding all types of coal, coke and finished fertilizers), ores (other than iron ore), etc, the present proposal is envisaged.

The fully mechanized operations would not only increase the cargo handled at the port, but would also reduce the entrainment of fugitive emissions.

CHAPTER-14
SUMMARY AND CONCLUSIONS

CHAPTER – 14

SUMMARY AND CONCLUSIONS

14.1 INTRODUCTION

The Port of Visakhapatnam situated on the East Coast of India is one of the pre-eminent Major Ports of the country. The Port has two harbour basins viz., the Inner Harbour and the Outer Harbour. Presently, the inner harbour can accommodate vessels having maximum LOA of 210 m, 32.5 m beam and 11 m draft on rising tide of 1.05m and also panamax vessels with a beam of 32.5 m and draft 10.90 m on 0.94 m tide. The outer harbour on the other hand, can accommodate vessels up to 150,000 DWT size with draft up to 17 m on rising tide of 0.5 m. At present the Port has taken up a number of developmental schemes which include, deepening of outer harbour channel and turning circle to cater to 200,000 DWT vessels and deepening of inner harbour entrance channel and turning circle to cater to panamax vessels up to 14 mtrs draft. The Port of Visakhapatnam handled 59.04 million tonnes of cargo throughput during the year 2012-13 and is consistently making relentless efforts in enhancing its capacity and productivity in consonance with changing requirements of the trade.

14.2 PROPOSED PROJECTS

The Visakhapatnam Port proposes to upgrade the existing facilities and creation of new facility at VPT for iron to ore handling extension of existing container terminal in the outer berth and development of West Quay North (WQ-7 & WQ-8) berth with mechanized handling facilities for bulk cargoes. The proposed developments in Visakhapatnam Port envisage the following:

- Up-gradation of Existing Facility and creation of new facility at VPT for Iron ore handling
- Development of West Quay North (WQ-7 & WQ-8) berth with mechanized handling facilities for handling bulk cargoes
- Extension of Existing Container Terminal in the outer harbour of Visakhapatnam Port

a. Up-gradation of Existing Facility and creation of new facility at VPT for Iron ore handling on DBFOT basis (OHC & WQ-I)

This project envisages up-gradation of existing conveyor system constructed during 1970s' which has outlived its economic life and causing dust emissions during cargo handling and the Andhra Pradesh Pollution Control Board (APPCB) has directed port to provide closed conveyor system and to replace the existing ship loader. Therefore, VPT has taken up up-gradation of the Iron ore handling system by providing closed conveyor with in-built dust suppression system

and to replace the ship loader so as to improve the handling efficiency resulting in modernized equipment for dust control at all the transfer points.

Development of West Quay North (WQ-7 & WQ-8) berth with mechanized handling facilities for handling bulk cargoes on DBFOT basis.

Presently, the cargo such as blast furnace slag, gypsum and ores other than iron ore proposed under this project (WQ-7 & WQ-8), which are already being handled in a semi-mechanized method elsewhere in port and is now proposed to be changed to fully mechanized handling system. This project envisages as follows:

- Under Phase-I, Development of West quay north WQ7 - berth of 560m long would be taken up through internal resources for which the proposal is submitted to the Ministry for approval.
- While the development of this berth is under progress, during next phase, it is proposed to take up mechanization of cargo handling facilities through PPP mode.

b. Extension of Existing Container Terminal in the Outer Harbour of Visakhapatnam Port on DBFOT basis

This project envisages extension of the existing container terminal along with streamlining the transportation activities of the container handling hither to being carried through trucks up-to the Container Freight Station (CFS) destination, situated at a far-off place. The present proposal envisages transportation of containers by rail movement / shuttling operations with a contiguous rail line.***The Rail share of the evacuation which is currently Zero would be slowly improved with the active participation of all the stake holders".***

In order to enhance capacity handling to the tune of 0.54 MTEUs, VPT propose for extension of existing container terminal in the outer harbour of Visakhapatnam Port.

14.3 KEY RECOMMENDATIONS

14.3.1 Impacts during Construction Phase and their Mitigation

- The proposed project would require significant amount of construction material. During construction phase, runoff from these sites would increase soil erosion from such sites. If such sites are left untreated after excavation of construction material, then rainwater is likely to get stored in these sites, which are then likely to serve as breeding habitats for mosquitoes.
- During construction phase, labour would migrate in the project area. Adequate arrangements for potable water supply, sewage treatment and disposal, solid waste management have been suggested as a part of the study to mitigate pollution due to labour camps.

- Sewage from the labour camps shall be conveyed to the existing STP. There is sufficient unutilized capacity in the sewage treatment plant. The total handling capacity of the STP is 10 mld. At present 6-7 mld of sewage is treated in the sewage treatment plant.
- A total quantity of dredged material likely to be generated in the proposed project has been estimated as 8,66,249 m^3 of which 1,84,000 m^3 will be generated due to up-gradation of existing facility and creation of new facilities. The dredged material would be disposed at designated site.
- Major sources of noise during construction phase are due to operation of various construction equipment. Modeling studies were conducted to assess the increase in noise level due to operation of various construction equipments, and no increase in noise levels were anticipated as a result of various activities, during the project construction phase.
- Vehicular movement for the transportation of construction material and operation of construction equipment in the area is likely to increase temporarily during the construction period. However, the vehicular pollution is not expected to lead to any major impacts on ambient air qualitycould be one of the possible sources of incremental air pollution during the construction phase.
- Appropriate measures to control air pollution have been recommended as a part of Environmental Management Plan.
- Proposed project is likely to have adverse impacts of marine ecology and benthic flora fauna. The project area has moderate productivity. Area to be dredged recolonizes in short duration, after the cessation of dredging activities. This means that though the dredged stretches are likely to get recolonized, the ecology is not expected to develop upto the pre-project levels.
- There are no sites of ecological significance in and around the project area. Likewise, no spawning ground was observed.
- High turbidity due to heavy suspended solid load during dredging or disposal of dredged materials results in clogging of gills of fishes thereby causing asphyxiation. But since fishes are free swimming they very well avoid such areas and move to safer areas. Once the turbidity is over due to currents, they come back to the area.
- Economic benefits of a port are manifold and significant positive impacts are expected during construction phase of the proposed project, as it will lead to mushrooming of allied business activities, which provide an impetus to overall development of the area.

- Some of the locals will get direct employment in project construction activities or indirect employment due to mushrooming of allied business activities.

14.3.2 Impacts during Project Operation Phase and their Mitigation

- Vehicular movement for the transportation of cargo is likely to increase during the operation phase. The entire operation would be handled in dry state is closed conveyor system. Thus, no major impact on air pollution is envisaged.
- Solid waste in the proposed project could be generated mainly from three sources viz. institutional/ office waste, domestic waste and waste from cargo handling etc. This could comprise floating materials, packaging, polythene or plastic materials. It is proposed to be routinely collected and are disposed at a designated solid waste disposal site.
- The present system of iron ore handling through semi mechanized process has the capacity to handle less than 12000 Tonnes of iron ore. A receiving conveyor system with a rated capacity of 3000 TPH compatible with the wagon unloading from tippler house to the stockyard is proposed as a part of the project. The proposed system will reduce fugitive emissions. Hence, the proposed expansion and modernisation is not expected to cause any significant adverse impacts and will be beneficial for the environment.
- Impact of accidental release of solid cargo, particularly during rough weather, can take place. It would have limited impact on the environment. However, the port operations may be hampered if the ship is damaged or the cargo goes overboard that could risk navigation.
- Escapement of bulks such as iron ore, bulk cargo and container cargo during unloading is not expected to cause any serious impact, as they are non-toxic.
- Recommendations of the International Convention for the Prevention of Pollution from Ships, 1973, as modified by the Protocol of 1978 (MARPOL 73/78), shall be implemented to prohibit all ships from discharging wastes at sea. MARPOL 73/78 requires that ships retain all the wastes on board until reaching port.
- Vessels shall be equipped with dedicated holding tanks for sewage and oily wastes and have the capacity to compact and store garbage.
- Effluent from workshops, oil storage, etc. will contain oil and grease particles which shall be treated in an oil skimmer and suitably disposed after treatment. The collected oily matter is stored in cans, etc. and disposed at landfill sites designated by the district administration.

14.4 GREENBELT DEVELOPMENT

Greenbelt was developed around the stack yards. Plantation programme is being pursued by VPT on a Continuous basis for the last 2 decades for continual improvement and addition of Green Belt in and around Port area. So, far 4,30,000 sampling has been planted over an area of 630 acres at different areas including port operational areas, residential and city areas. Similarly, greenbelt will be developed as a part of development of the proposed berths. Plantation of 36,000 No. of plants has been 2015-16 and another 16000 saplings will be planted in the year 2016-17.

14.5 PORT AREA EMERGENCY RESPONSE PLAN

A detailed plan for oil and chemical spill is being implemented at Vishakhapatnam Port. Likewise, a Disaster Management Plan for implementation in the event of various natural and manmade hazards too has been formulated and is under implementation. The same shall be implemented for the proposed projects as well.

14.6 ENVIRONMENTAL MONITORING PROGRAMME

Monitoring is an essential component for sustainability of any developmental project.The summary of Environmental Monitoring Programme for implementation during project construction and operation phases is given in Chapter-10 of this Report.

14.7 CONCLUSIONS

The project is likely to entails impacts on various aspects of environment during construction and operation phases. A comprehensive Environmental Management outlining various measures for amelioration of adverse impacts has been suggested. Likewise, a detailed Disaster Management Plan for implementation in the event of various emergencies and hazards too is under implementation at Vishakhapatnam Port. Thus, it can be concluded through the project may lead to adverse impacts, detailed management measures have been recommended for their amelioration.

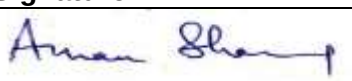
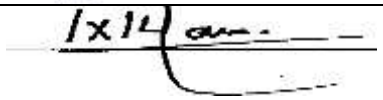
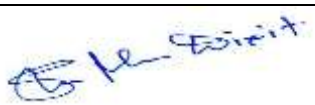
CHAPTER – 15
DISCLOSURE OF CONSULTANTS INVOLVED IN THE EIA STUDY

CHAPTER – 15

DISCLOSURE OF CONSULTANTS INVOLVED IN THE EIA STUDY

The EIA study has been conducted by WAPCOS Ltd., a government of India Undertaking under Ministry of Water Resources, River Development and Ganga Rejuvenation. WAPCOS Ltd., has a full-fledged Centre for Environment who has conducted the EIA study. The list of the Experts involved in the EIA study is given in Table-15.1.

Table-15.1: List of Experts involved in the CIEA study

S. No.	Name	Expertise	Signature
1.	Dr. Aman Sharma	EIA Coordinator and Water Quality Expert	
2.	Mr. A. S. Leo	Air Pollution Expert	
3.	Dr. S.K. Tyagi	Ecology and Bio-diversity Expert	
4.	Mr. R.V. Ramana	Noise Expert	
5.	Dr. K.K. Gaur	Social Expert	
6.	Mr.S.A. Bandyopadhyaya	Risk Analysis Expert	
7.	Mr. S.M. Dixit	Air Quality Expert	
8.	Mrs. Moumita Mondal Ghosh	Landuse Expert