BEFORE THE NATIONAL GREEN TRIBUNAL (SZ) CHENNAI
(Under Section 16(h) read with Section 18(1) of the National Green Tribunal Act, 2010)

Appeal No. 7 **OF 2025**

Janardhan P Mesta and Anr. ....Appellants

Vs.

State Environment Impact Assessment Authority (SEIAA), Karnataka and Anr. ... Respondents

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//Certified to be true copies of the respective originals//
Dated at Chennai on this the 27th day of January, 2025

Y (1421/2011)

Through
A.Yogeshwaran
Counsel for the Applicant
Ph : 9566254546
Email : yogeshwaranadv@gmail.com

ANNEXURE A20

HONNAVAR PORT PRIVATE LIMITED (HPPL)

Environment and CRZ Clearance for Development of Barge/Vessel Loading Facility for 4.9 MTPA at Honnavar Port

ToR File No: SEIAA 02 IND 2024 dated 12/08/2024

7(e): Ports, Harbours, Breakwaters, Dredging

Study Period :Winter 2023

Final EIA/EMP Report

EIA Consultant

Assystem India Limited

NABET/EIA/2326/ RA 0299 (Rev.02)

C1241301
RP02 Rev. 0

HONNAVAR PORT (P) LTD.

Undertaking by the Project Proponent

1 M/s Honnavar Port Private Limited (HPPL) has carried out an Environmental Impact Assessment (EIA/EMP) study for the Proposed Development of Barge/Vessel Loading Facility for 4.9 MTPA at Honnavar, Uttara Kannada, Karnataka.

2 As per MoEF&CC Office Memorandum No. J-11013/41/2006-IA. II (I) dated October 05, 2011, HPPL herewith declares the ownership of contents (information and data) of this EIA/EMP Report.

For Honnavar Port Pvt. Ltd.
For HONNAVAR PORT PRIVATE LIMITED
G. Raghu Reddy
G. Raghavendra Reddy-Executive Director
Authorised Signatory

Port Office : Kasarkod Tonka, Honnavar Taluk, Uttar Kannada District, Karnataka - 581 342.

Regd. Office : #103, Lalehzar Apartments, 45/1-2, Palace Road, Bangalore - 560 001, Karnataka, India.
Ph : +91-80-2235 3670, 4149 4960 Fax : +91-80-2235 3671 Email : info@honnavarport.com

Declaration by Experts contributing to EIA for Environment &CRZ Clearance for Development of Barge/Vessel Loading Facility for 4.9 MTPA at Honnavar, Uttara Kannada

I, hereby, certify that I was a part of the EIA team in the following capacity that developed the above EIA.

	EIA Coordinator	Supporting EIA Coordinator
Name:	Ratheesh B	Subramanyam VRM Nambaru
Signature:		
Date:	As on date	

Period of Involvement: 2024

Contact Information: 6-3-348, Midtown Complex,
Road No. 1, Banjara Hills,
Hyderabad-500034
Email: balaramanr@assystem.com

Functional Area Experts

S. No	Functional Areas	Name of the Expert/s	Involvement (Period & Task)	Signature
1	**AP**	Ratheesh Balaraman	Period: 2024 Task: Reviewed baseline ambient air and meteorological data. Identified likely impacts and suggesting appropriate mitigation measures.	
		Y. Kavitha		Kavitha
2	**WP**	Ratheesh Balaraman	Period: 2024 Task: Review of monitoring data, assessment of water quality, identifying likely impacts, suggesting appropriate mitigation measures, framed EMP	
		Y. Kavitha		Kavitha
		With Support From: • Injeti Ratan Reddy (TM) • Saithra P J (FAA)		
3	**SHW**	Ratheesh Balaraman (SW only)	Period: 2024 Task: solid waste generation at project site, suggested solid waste management mitigation measures	
		Kundan Ajudiya (HW only)	Period: 2024 Task: Identified hazardous waste likely generated at project site, suggested HW management mitigation measures	
		With Support From: • Y. Kavitha (TM) – HW only & SW (FAE)		

S. No	Functional Areas	Name of the Expert/s	Involvement (Period & Task)	Signature
		• Jani Basha Shaik (TM) – SW only • R Priyanka (FAA)		
4	**SE**	Y. Kavitha	Period: 2024 Task: SIA, stakeholder consultations	Kavitha
		With Support From: • Subramanyam VRM Nambaru (TM)		
5	**EB**	Subramanyam VRM Nambaru	Period: 2024 Task: Conducting primary flora & fauna survey, review of baseline data, identification of impacts and suggesting mitigation methods	
		With support from: Pavan Kumar Verma		
6	**HG**	Nageswara Rao Peddi	Period: 2024 Task: Reviewed the surface hydrological data, storm water drainage plan, identification of impacts and suggesting mitigation methods.	
		With Support From: Jani Basha Shaik (TM)		
7	**GEO**	Nageswara Rao Peddi	Period: 2024 Task: Analysis of geology and geomorphology aspects, review of maps.	
8	**SC**	Reji Baby Varghese	Period: 2024 Task: Reviewed secondary data for soil quality, analysis of baseline soil quality data, suggested mitigation measures	
		With Support From: Subramanyam VRM Nambaru (TM)		
9	**AQ**	Ratheesh Balaraman	Period: 2024 Task: Review of secondary data on meteorology. Air Quality modelling using AERMOD. Representation of GLCs using isopleths for different scenarios.	
		With Support From: Saithra P J (FAA)		
10	**NV**	Rajasekharan Elangovan	Period: 2024 Task: Reviewed the baseline noise monitoring data, Identified probable noise and vibration impacts of the proposed sectors. Suggested mitigation measures	

S. No	Functional Areas	Name of the Expert/s	Involvement (Period & Task)	Signature
		Reji Baby Varghese	Period: 2024 Task: Identified impacts of noise from proposed development activities, noise propagation modelling, suggesting noise mitigation measures.	
11	**LU**	Yeddula Ramamohan	Period: 2024 Task: Generated data related to land use pattern. Contribution to EIA documentation.	
		With Support From: • Sridhar Achari Karumoju L N (TM)		
12	**RH**	Aprup Anant Adwadkar	Period: 2024 Task: Identified hazardous processes and risks in proposed development due to liquid cargo handling.	
13	**EIA (TM)**	Kavitha	Period: 2024 Task: Supported coordinator in preparation of the report .	Kavitha

Declaration by the Head of the Accredited Consultant Organization

I, **Ratheesh Balaraman**, hereby, confirm that the above-mentioned experts prepared the **EIA Report for Environment &CRZ Clearance for Development of Barge/Vessel Loading Facility for 4.9 MTPA at Honnavar, Uttara Kannada.** I also confirm that the Consultant Organization shall be fully accountable for any misleading information mentioned in this statement.

Signature:
Name: Ratheesh Balaraman
Designation: Business Unit Head, Urban Planning
Name of the EIA Consultant Organization: Assystem India Limited (Formerly known as L&T Infrastructure Engineering Limited)
NABET Certificate Number & Issue Date: NABET/EIA/2326/RA 0299 (Rev.02) valid till March 04, 2026

ASSYSTEM INDIA LIMITED

Client:	**Honnavar Port Private Limited** (HPPL)		
Project:	Environment and CRZ Clearence for Development of Barge/Vessel Loading Facility for 4.9 MTPA at Honnavar, Uttara Kannada, Karnataka	**Project No.:** C1241301	
Title:	Final EIA/EMP Report	**Document No.:** RP002	**Rev.:** 0

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Revision Details:

Rev.	Date	Details	Prepared Init.	Prepared Sign.	Checked Init.	Checked Sign.	Approved Init.	Approved Sign.
0	25.10.2024	First Submission	SNV SJB		YKA		BRT	

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Acronyms

AADT	Annual Average Daily Traffic
AAQ	Ambient Air Quality
AE	Auxiliary Engine
ASI	Archaeological Survey of India
BG	Broad Gauge
BOD	Biological Oxygen Demand
CCR	Certified Compliance Report
CD	Chart Datum
CESS	Centre for Earth Science Studies
CFE	Consent for Establishment
COD	Chemical Oxygen Demand
CPCB	Central Pollution Control Board
CPHEEO	Central Public Health and Environmental Engineering Organization
CRZ	Coastal Regulation Zone
CSR	Corporate Social Responsibility
CZMA	Coastal Zone Management Authority
CZMP	Coastal Zone Management Plan
DEIA	Detailed Environmental Impact Assessment
DIPP	Department of Industrial Policy and Promotion
DMP	Disaster Management Plan
DO	Dissolved Oxygen
EC	Environmental Clearance
EIA	Environmental Impact Assessment
EMC	Environmental Management Cell
EMP	Environmental Management Plan
FY	Financial Year
GO	Government Order
GoI	Government of India
GoK	Government of Karnataka
GVPR	GVPR Engineers Limited
ha	Hectare
HD	Hydrodynamic
HPPL	Honnavar Ports Private Limited
HTL	High Tide Line
IRC	Indian Roads Congress
ISO	International Organization for Standardization
km	Kilo meter
KRCL	Konkan Railway Corporation Ltd.
KSPCB	Karnataka State Pollution Control Board
LDPE	Low Density Polyethylene
LTL	Low Tide Line
MCM	Million Cubic Meter
ME	Main Engine
MH	Metal Halide
MoEF&CC	Ministry of Environment Forest & Climate Change
MoM	Minutes of Meeting
MSDS	Material Safety Data Sheet

MSL	Mean Sea Level
MT	Million Tons
MTPA	Million Ton Per Annum
MV	Mercury Vapour
NAAQS	National Ambient Air Quality Standards
NABL	National Accreditation Board for Testing and Calibration Laboratories
NCS	North Canara Seaports
NCSCM	National Centre for Sustainable Coastal Management
NDZ	No Development Zone
NH	National Highway
NHAI	National Highways Authority of India
NIO	National Institute of Oceanography
OES	Occupational Exposure Standard
PCU	Passenger Car Unit
PIA	Project Influenced Area
PIL	Public Interest Litigation
PPEs	Personal protective Equipments
PUC	Pollution Under Control
PWD	Public Works Department
R&R	Rehabilitation and Resettlement
RA	Risk Analysis
RCC	Reinforced cement Concrete
RO	Reginal Office
RoW	Right of Way
SCZMA	State Coastal Zone Management Authority
SEIAA	State Environment Impact Assessment Authority
SIA	Social Impact Assessment
SIC	Site Incident Controller
SMC	Site Main Controller
SSC	Suspended Sediment concentration
ST	Sediment Transport
STP	Sewage Treatment Plant
TAC	Tariff Advisory Committee
ToR	Terms of Reference
TSDF	Treatment, Storage and Disposal Facility
TSS	Total Suspended Solid
WA	Writ Appeal
WP	Want of Prosecution or Writ Petition

Chapter 1
Introduction

Chapter 1 Introduction

1.1 Background

Sea ports are important gateways for trading of commodities between regions. The ports form a major infrastructure in the logistic chain of activities.

The state of Karnataka has a coastline of ~150 nautical miles (~320 km). At present, The New Mangalore Port is only one Major Port in the Karnataka state and it is located at the southern end of the coastline and hence is predominantly being utilized by the southern districts of the State. It has a total of 13 non-major ports including Karwar Port in the north and Old Mangalore Port in the South with a combined capacity of ~52 MTPA. New Mangalore port total capacity is 41.8 MTPA and other minor ports is 10.7 MTPA.

Presently, the state of Karnataka is responsible for handling ~4.5% of India's total port cargo. The Indian Non-Major Ports have handled about ~600 MT of cargo in FY 2022, out of which Karnataka's Non-Major Ports have handled ~1.2 million ton (which is 0.2%).

In view of the fact that ships of large sizes are used in transportation for economies of scale in the internationals trade, port would be developed with the required drafts, berthing facilities and efficient mechanical handling facilities so as to reduce waiting period of ships and saving in the Cargo handling expenses. Major aim of developing ports in Karnataka is to promote regional development. Port based industrial estates would be encouraged along the coastline to facilitate import of raw material and export of finished goods. As a greater number of Mega projects are coming up in the State, Industrial development shall be synchronized with the port development and the infrastructure development.

Honnavar, situated 90 km south of Karwar and 180 km north of Mangalore has a long history as a place of trade and commerce and a naval base for several armies since 3rd century AD. Honnavar is one of the five coastal talukas of Uttar Kannada District. It has a total area of 754.8 sq km. Honnavar was a port and fortified town. Honnavar has also a history of having the name "Honnupura" (Kannada) which might have been a major market and export hub for gold and related things.

In line with the objective and strategy of the Karnataka Port policy, the Directorate of Ports and Inland Water Transport Department, GoK signed a lease agreement with Honnavar Ports Private Limited (HPPL), a consortium formed by GVPR Engineers Limited (GVPR) and North Canara Seaports Private Limited (NCS) to develop Honnavar port located near mouth of Sharavati River in Uttara Kannada district of Karnataka. The consortium also signed a lease agreement for the use of Portland to develop port related activities at Honnavar.

Government of Karnataka had sanctioned port land to Honnavar Port for the Development of Barge/Vessel loading facility to handle 4.9 MTPA cargo vide GO No. PWD 190 PSP 2009, dated March 18, 2010 & GO No. PWD 119 PSP 2010, dated September 22, 2010.

GVPR Engineers Limited is an ISO 9001:2015, ISO45001:2018, ISO14001:2015 certified company that has extensive experience in Infrastructure project, designing, construction, operation and maintenance management. The organisation is involved in constructing world class infrastructure projects in Irrigation, transportation, power, buildings and ports. The company has joint venture and consortium tie up with reputed national and international companies to tender large scale projects.

1.2 Proposed Development

As per the EC&CRZ clearance M/S. Honnavar Port Pvt. Ltd., have proposed for development of a barge / vessel loading facility at Coastal Sand Spit, Kasarkod Tonka Village, Honnavar Taluk, Uttara Kannda District. Total land requirement for the proposed facility is 44 Ha.

Total capacity of cargo handling is 4.9 MTPA of which Coal (2.70 MTPA), Iron Ore (1.00 MTPA), General Cargo (1.20 MTPA i.e. Granite - 0.16 MTPA; Fertilizer - 0.2 MTPA; Molasses with Agro products - 0.15 MTPA; Steel Products- 0.40 MTPA and Sugar - 0.29 MTPA. In order to maintain tranquillity in the harbour basin, two break waters are proposed (Southern Break Water: 865 m and northern break water: 820 m). Berth of 440m long and 30m wide with backup area of 44 Hectares, dredging, approach channel: (length of approach channel inner: 1395m & outer 2280m, width of the channel 100m and depth of the channel: (-)10 m), Turning circle (diameter of the turning circle -250m, dredged to a depth of (-) 10 m), Estimated dredging quantity 3.9 million cum, Estimated quantity proposed to be used for reclamation 1 million cum.

The Public Consultation was held on 27.01.2012. HPPL obtained the Environmental & CRZ Clearance through File No. SEIAA: 22: IND:2011 dated September 21, 2012 for Development of Barge/Vessel loading facility to handle 4.9 MTPA of Cargo at Coastal Sand Spit, Kasarkod Tonka village, Honnavar Taluk, Uttar Kannada District. EC & CRZ clearance validity extension for three years was obtained through File No. SEIAA: 22: IND: 2011 dated July 01, 2019 and further EC & CRZ clearance validity extension for further one year was obtained through File No. SEIAA: 22: IND: 2011 dated September 20, 2023.

SEIAA through vide letter no. SEIAA0 03 MISC 2024 dated May 18, 2024 clarified that Construction of four lane road of 2.58km length from Honnavar Port to NH-66 and to improve the NH-66 from Chainage km 195.00 to km 197.00 is integral part of the EC and CRZ clearance granted. Part of the proposed road is passing through the Forest lands and 'in-principle' (Stage-I) clearance for the diversion of 0.76 ha. of forest land in F. Sy. No 233 and 237 of Kasarkod village, Manki Hobli, Honnavar Taluk, Uttara Kannada District (Honnavara Forest Division) for Approach Road from NH 66 to Kasarkod side of Honnavar Port was obtained from Integrated regional office through vide letter F. No 4-KRB1275/2021-BAN/1298 dated January 20, 2022 and user agency charges for the Net Present Value (NPV) of the forest land being diverted under this proposal also paid and recommendation for according the final (Stage-II) approval is also processed by Office of Principal Chief Conservator of Forests (Head of Forest Force), Govt. of Karnataka has been obtained through E-office File No. KFD/HOFF/A52K(GFL)/47/2019-FC E- 78072 dated May 22, 2024.

Consent for Establishment (CFE) was obtained from Karnataka State Pollution Control Board (KSPCB), Bengaluru through vide Order No. KSPCB/SEO (Non-EIA)/Honnavar Port/EIA/2012-13/1381 dated February 06, 2013. CFE extension was obtained through vide Order No. PCB 185/infra 2020/4003 dated October 25, 2023.

Based on the above mentioned Environmental &CRZ clearances and CFE's, the following activities and cargo have been permitted to be handled at the Honnavar Port and details are given in **Table 1-1.**

Table 1-1: Cargo Handling Capacities at HPPL

Company	Cargo	Approved Handling Capacity (MTPA)
Honnavar Ports Private Limited (HPPL)	Coal	2.70
	Iron ore	1.00
	General Cargo • Granite (0.16 MTPA)	1.20

Company	Cargo	Approved Handling Capacity (MTPA)
	• Fertilizer (0.2 MTPA) • Molasses with Agro Products (0.15 MTPA) • Steel Products (0.40 MTPA) • Sugar (0.29 MTPA)	
	Total Handling Capacity at Port (MTPA)	4.9

The above-mentioned EC/CRZ clearance letters and CFE are given in **Appendix A.** The certified compliance report obtained dated May 29, 2024 for the EC&CRZ clearance is given as **Appendix B**.

It is proposed to construct a jetty of 440 x 30 m with two approach trestles of 67.5 x 15 m each and two parallel breakwaters at the estuary of River Sharavthi and Badagani in the Northern and Southern side respectively.

1.3 Details of Project Proponent

The contact details of authorised person of HPPL are as below.

Address for correspondence:
Mr. G. Raghavendra Reddy
Executive Director
Honnavar Ports Private Limited
#103, Lalehzar Apartments, 45/1-2,
Palace Road, Bengaluru – 560 001,
Karnataka, India
Phone No: +91 9886199355, 8088202128
E-Mail: coordinator@honnavarport.com

1.4 Port Location

The proposed site for development of Barge/ Vessel loading facility is located near mouth of Sharavati River in Honnavar Taluk of Uttara Kannada district in Karnataka. It is at a distance of about 90 km from Karwar, the district headquarter and about 400 km from Bengaluru.

Port limits of Honnavar Port as per notification by Public Works, Ports and Inland Water Trasport Department of Government of Karnataka (GoK) through notification no. PWD 142 PSP 2011 dated August 13, 2013 is as follows:

Point A: 14°18' N, 74°25' E	Point B: 14°18' N, 74°22' E
Point C: 14°13' N, 74°24' E	Point D: 14°13' N, 74°26' E

A copy of port limits notification is given as **Appendix C.** Port limits on hydrographic chart is shown in **Figure 1-1.**

Figure 1-1: Port Limits

The location map showing the project site is given as **Figure FD0101**.

The location of the proposed Barge/Vessel loading site in Google Earth Satellite is presented in **Figure 1-2.**

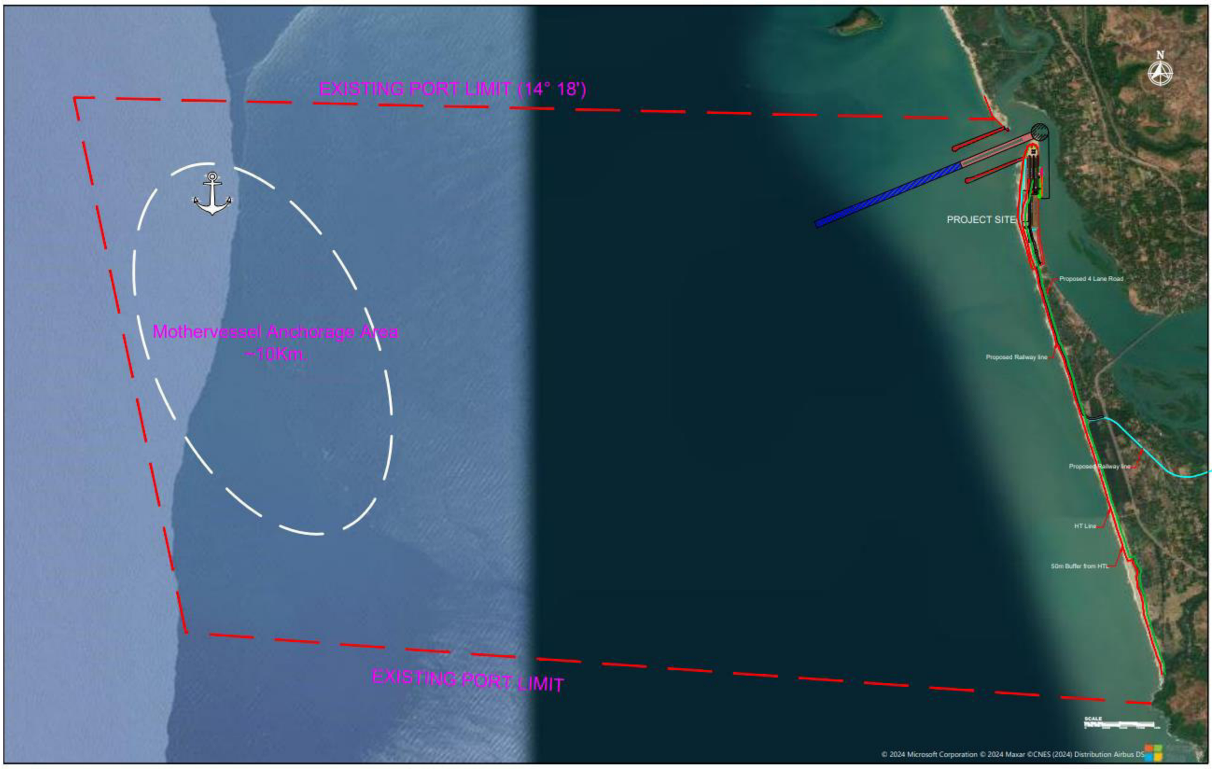


Figure 1-2: Google Earth Imagery of the Project Site

1.4.1 Salient Features of Project Site

The salient features of Project site are given in **Table 1-2.**

Table 1-2: Salient Features of Project Site and its Surroundings

S. No.	Details	Description
1.	Location	Near mouth of Sharavati River in Honnavar Taluk of Uttara Kannada district in Karnataka
2.	Coordinates	Latitude 14°17'15" N Longitude 74°25'32.30" E
3.	Survey No.	305
4.	Land availability	44 Ha
5.	Road Connectivity	NH 66
6.	Rail Connectivity	Honnavar railway station at ~ 2.26 km, Manki RS – 14 km
7.	Airport	Goa International Airport ~135 km; Mangaluru International AirPort ~ 155 km
8.	Seismicity	Proposed project falls under Seismic Zone III
9.	Archeologically Important Places	Nil
10.	National Parks/Wildlife Sanctuaries	Nil
11.	Defence Installations	Nil
12.	Tourist Destinations*	Bule Flag beach is at a distance of ~2.38 km from the Port area and adjacent to proposed road and rail corridor
13.	Forest	No Forest Land is involved for the proposed development. There is a Forest nursery near Kasarkod located at 2.5km towards South. There are minor forests including Basavarajadurg island within the 15 km radius and Reserve Forest located near Hebbankere at a distance of 9 km towards NE
14.	Nearby River/Sea	Sharavathi River
15.	Fish landing Centre	Honnavar (~ 1 km)
16.	R&R	Not Envisaged

*Note: NoC from Tourism Department is given as **Appendix D**.

1.4.2 Connectivity

The proposed Port is located on the west side of National Highway 66 (running between Maharashtra to Tamil Nadu), 2.58km long road connectivity is being proposed from Honnavar Port to NH 66 as part of Bharatmala Pariyojana Phase I programme. The proposed road project will provide a direct link between National Highway and the Honnavar port, reducing travel time and for safe and speedy transportation/evacuation of cargo.

The rail connectivity to the Port site is proposed to be provided with Broad gauge Single line from a new railway station proposed at Hosapattana under section of Konkan Railway broad gauge line, which is 8.5 km from the Port site.

1.5 Project Status/Existing Development

HPPL initiated the construction work after completing the financial closure formalities and after getting the clearances from Honourable courts. Mobilization and material procurement activities were initiated and following activities are fully/partially completed

- Approach Trestle No. 1 (Completed)
- Approach Trestle No.2 (Partially completed 5 out of 17 piles)

- Internal earthen road work for construction materials transportation (Completed)
- Black topping of existing Kachha road for a length of 2.10 Km along the seashore of Kasarkod village (Partially Completed)
- Initial work was carried out till the year 2022. Due to Covid-19 and other issues the construction work was halted.

The facilities developed and yet to be developed at Honnavar Port are shown below.

Approach Trestle 1 (Completed)

Approach Trestle 2 - Sheet Piles Driven and Liner Fabrication

Internal Roads for construction activities

Spuds Of Dredger and Tetrapods At Site

Dredging Hose Pipes & Spuds of Dredger

Exhibit 1-1: Facilities being developed and Mobilization of Construction Material at Project Site

1.5.1 Court Case Details

Various Writ Appeal (WA) / Want of Prosecution or Writ Petition (WP) / Public Interest Litigation (PIL) / Appeals / Applications were filed from the year 2016 to 2022 against the accorded approvals related to GO's issued by the Port Officer, Honnavar, Appeal against the court order, Appeal against ownership of the land, Challenged the Environment Clearance granted on September 21, 2012 and the extension granted on July 01, 2019, on turtle nesting grounds in project area, on the dedicated road corridor to provide road connectivity from the Honnavar Port Project to the National Highway – 66.

All the court cases pertaining to turtle nesting grounds in project area, connectivity corridor and land ownership with Honourable Karnataka State High Court, Dharwad branch, Karnataka; Honourable Court of Deputy Commissioner, Uttara Kannada, Karwar, Karnataka; Honourable Karnataka State High Court, Bengaluru; Honourable Court of the PRL. District & Sessions Judge, Uttara Kannada, Karwar, Karnataka; Honourable the National Green Tribunal, Southern Zone, Chennai; were Dismissed/ Disposed in favour of Govt. of Karnataka and Project Proponent HPPL. Details of court cases are given in **Table 1-3.**

Table 1-3: Court Case Details

S. No.	Case Details				Status
	WA / WP / PIL Nos	Date of Filing	Allegation/s	Date of Disposal/ Dismiss	

S. No.	Case Details				Status
	WA / WP / PIL Nos	Date of Filing	Allegation/s	Date of Disposal/ Dismiss	
1	WP No.100908-934/2016 (GM-RES)	22/01/2016	Requesting for a writ of certiorari to quash the GO dated 22/09/2010 and the notices issued by the Port Officer, Honnavar dated 19/10/2015 & 24/11/2015.	10/02/2016	Hon'ble High Court of Karnataka, **DISMISSED** the WP as premature and directed the Respondents / Authorities to consider the representations of the Petitioners and pass appropriate orders in accordance with law.
2	WA No. 100303/2016 & 101144-101169/2016 (GM –RES) in the Hon'ble High Court of Karnataka, Dharwad Bench	28/03/2016	Appeal against the order of the Learned Single Judge order dated, 10/02/2016 and Requesting for a writ of certiorari to quash the GO dated 22/09/2010 and the notices issued by the Port Officer, Honnavar dated 19/10/2015 and 24/11/2015.	20/09/2016	This W.A. was **DISPOSED** on 20/09/2016 with an observation that the Port Officer, Honnavar and the District Court which is seized of the matter in M. A. Nos. 1 to 27/2016 would dispose of the said matter pending before them independently of and without being influenced by the learned Single Judge's order. Further, if the Government comes to the judicious conclusion that the appellants have the eligibility and entitlement to the grant/lease of land, it may consider their cases in respect of the alternative Government lands subject to their availability.
3	No. RB/LND-II/CR-72/12-13		Called upon for personal hearing with respect to the ownership of the land.	29/11/2016	**DIRECTED THE PETITIONERS TO VACATE AND DELIVER VACANT POSSESSION OF THE SCHEDULE PROPERTY IMMEDIATELY**. On failure to do so, the Port Authorities are directed to evict the encroachers and take vacant possession of the schedule property.
4	Miscellaneous Appeal No. 01/2016 to 27/2016 in the Court of the Principal & Sessions Judge, Uttara Kannada, Karwar.	30/12/2015	Challenged the order passed by the Port Officer, Honnavar on 30/12/2015.	07/01/2019.	The appeals filed by the appellants were **DISMISSED** on 07/01/2019 with regard to the facts and circumstances of the case the parties to bear their own costs.
5	Writ Petition No 4039/2021 (GM-POL) PIL filed by the Hasimeenu Vyaparastara Sangha (R) in the Hon'ble High Court of Karnataka, Bengaluru.	22/02/2021	Challenged the Environment Clearance granted on 21/09/2012 and the extension granted on 01/07/2019, Challenged that the construction of port is a prohibited activity in CRZ I area, that there are private revenue	24/11/2021	The Hon'ble Court of Karnataka **DISPOSED** of the matter taking into consideration the report of NCSCM, Chennai and the report of Deputy Commissioner, Uttara Kannada, Karwar with regard to change in location of the project in favor of M/s. Honnavar Port (P) Ltd and the State Government Authorities/Departments.

S. No.	Case Details				Status
	WA / WP / PIL Nos	Date of Filing	Allegation/s	Date of Disposal/ Dismiss	
			lands on which the project is coming up, that the entire area of 45 hectares on which the project is to come up is a turtle nesting ground, that the location of the project as set out in the environment clearance has undergone a change.		
6	Original Application No 76 of 2022 (SZ) & I.A. Nos. 116, 144 and 146 of 2022 (SZ) filed by Ms. Damayanti Subray Mesta in the Hon'ble National Green Tribunal (NGT), South Zone, Chennai	12/07/2022	Raised substantial questions relating to the Environment arising out of an ongoing construction (4-Lane, 4-Km, 40mwide) dedicated road corridor to provide road connectivity from the Honnavar Port Project to the National Highway – 66.	26/09/2023	**DISPOSED** in favor of the State Government Authorities / Departments and M/s. Honnavar Port (P) Ltd.

Details of the court verdicts are given as **Appendix E**.

Construction work started in Feb 2019 only, after obtaining EC&CRZ in 2012 and the construction work was stopped from the year 2022. Currently no construction activity or dredging work was taking place.

1.6 Need for the Project

Ports are the major gateway for the flow of goods from in and out of the country since about more than 90% of India's trade by volume is conducted via the country's maritime route[1], Presently, the state of Karnataka is responsible for handling ~4.5% of India's total port cargo[2]. Total traffic handled at Indian Ports rose from 885 M TPA in 2010-11 to 1300 M TPA in 2019-20.

Coastal movement of iron ore of 100 to 110 M TPA can be expected by 2030, primarily driven by increase in steel/pellet production in Maharashtra, Karnataka, and Gujarat. Karnataka has a potential of ~0.5 MTPA traffic of fertilizers. Karnataka state, jumping 5 places, stood at the 8th position in ease of doing business ranking conducted by Department of Industrial Policy and Promotion (DIPP) in collaboration with World Bank under Business Reform Action Plan (BRAP) 2017. In 2018-19, Karnataka occupied a share of 5.35 per cent in India's overall exports. During 2013-14 to 2018-19, exports from Karnataka witnessed a positive CAGR of 0.53 per cent to reach US$ 17.34 billion against a negative CAGR of -0.92 per cent in India's global exports.

[1] https://sagarmala.gov.in/project/port-modernization
[2] Infrastructure Development, Ports & Inland Water Transport, Administrative report 2022-23

As per state export basket identification "9" export items emerged as "*Champion Export Sectors*" of the State, carrying an export value worth US$ 10.21 billion with a share of 66 per cent in overall exports from Karnataka being one of the sector as Iron and Steel[3]. The State has a very wide and varied mineral resource. Mineral resources are high-grade iron ore, exotic granites, Bauxite[4] etc. Karnataka specialises in the production of Ruby red, chilly red, cera grey, Kanakpura multicolour, Himalayan blue and Sira grey varieties of granite[5], standing 3rd in total resources after Rajasthan and Odisha. Karnataka alone contributes 72% of magnetite deposits in India[6]. It is a known fact that there is a big gap between the current capacity of ports in India and the huge demand for port services.

Based on the growing demand/export potential in the state, the Government of Karnataka also has estimated that Karnataka coast would need more seaports/barge/vessel loading facility along Coast. Out of the ports of the state, NMPT, the major port currently caters to only ~4.5% of Indian port cargo. Cargos such as granite, fertilizer, molasses, iron ore, coal with other agro products and steel products also has the potential to grow in demand and supply which will increase the traffic. This will increase the traffic across the proposed Barge/ Vessel loading facility.

1.7 Applicable Policy Framework

The proposed development of Port with associated facilities at the Honnavar attracts the provisions of Environmental Impact Assessment (EIA) Notification, 2006 (as amended) and Coastal Regulation Zone (CRZ) Notification, 2019 (as amended). The project categorisation as per EIA Notification is provided in **Table 1-4.**

Table 1-4: Project Components and its EIA Study

Project	Activity as per schedule of EIA Notification	Category
Ports and Harbours	7 (e) Port, Harbour, Break water and Dredging [< 5 million TPA of cargo handling capacity (excluding fishing harbours)] of EIA notification, 2006 (as amended)	Category B

The following rules and regulations are applicable to proposed development is given in **Table 1-5.**

Table 1-5: Applicable Environmental Regulation

Applicable GoI Policies & Regulations	Year	Objective	Reason for Applicability
Environmental (Protection) Act	1986	To protect and improve overall environment.	Environment in general.
Environmental Impact Assessment Notification (as amended)	2006	EIA notification for more effective Environmental clearance process.	Direct
Coastal Regulation Zone Notification (as amended)	2019	To protect the Coastal ecological resources and to prevent coastal pollution.	Direct
Air (prevention and control of pollution) Rules and its amendment	1982	To control air pollution by controlling emissions according to prescribed standards.	Control of Air pollution
Noise Pollution (Regulation and Control) and Amendment Rules	2000	Noise pollution regulation and controls.	Control of Noise pollution
Water (Prevention and Control of Pollution) Rules (as amended)	1975	To control water pollution by controlling emission & Water pollutants as per the prescribed standards.	Control of Water pollution.

[3] Export strategy of Karnataka 2020, Department of Commerce and Industries
[4] Karnataka Export Policy
[5] Indian Minerals yearbook 2014
6 Indian Minerals yearbook Part-III, 2021

Applicable GoI Policies & Regulations	Year	Objective	Reason for Applicability
Solid Waste Management Rules	2016	Management of Solid Waste.	Appropriate handling of Solid Waste.
Hazardous and other Wastes (Management and Transboundary Movement) Rules and Amendment Rules	2016	To store/handle hazardous waste and materials as per the provisions of the manufacturer, storage and import of Hazardous Chemical Rules, Hazardous Wastes (Management and Handling) Rules and Amendments	Appropriate handling of Hazardous and other Waste
E- Waste (Management) Rules	2022	Consumer or bulk consumer of electrical and electronic equipments listed in Schedule I shall ensure that e-waste generated by them is channelized to authorized collection centre (s) or registered dismantler (s) or recycler or is returned back to the pick up or take back services provided by the producers.	Involvement of information technology and telecommunication equipment, electrical and electronics.
Batteries Waste Management Rules	2022	Consumer to ensure that used batteries are not disposed off in any manner other than depositing with the dealer, manufacturer, importer, assembler, registered recycler, reconditioner or at the designated collection centres.	Appropriate handling of used batteries.
Construction and Demolition Waste Management Rules and amendment thereof	2016	Generator shall prima-facie be responsible for collection, segregation of concrete, soil and others and storage of construction and demolition waste generated, as directed or notified by the concerned local authority in consonance with these rules. The generator shall ensure that other waste (such as solid waste) does not get mixed with waste and is stored and disposed separately.	Appropriate handling of Construction and Demolition waste.
Bio-medical Waste Management Rules and amendments thereof	2016	Generator to take all necessary steps to ensure that bio-medical waste is handled without any adverse effect to human health and the environment.	Appropriate handling of Bio-Medical Waste.
The Manufacture, Storage and Import of Hazardous Chemical Rules (as amended)	1989	To prevent major chemical accidents arising from industrial activities; and to Limit the effects of chemical (industrial) accidents.	HPPL port envisages handling, Non-Hazardous chemicals and other Liquid cargos. Appropriate handling and storage of these cargos.
Chemical Accidents (Emergency Planning, Preparedness and Response) Rules	1996		

SEIAA has accorded the Terms of Reference (ToR) for the proposed Development vide File No: SEIAA 02 IND 2024 dated August 12, 2024. A copy of the ToR letter is enclosed as **Appendix F**. The EIA study has been carried out in line with the accorded ToR. Compliance to ToR is enclosed as **Appendix G.**

1.8 EIA/EMP Study Approach and Methodology

The Environmental Impact Assessment (EIA) study has been carried out covering both terrestrial and marine environments for the proposed development to obtain necessary statutory clearances under EIA notification 2006 as amended and CRZ Notification, 2019 (as amended) from SEIAA.

The EIA study has been carried out covering both terrestrial and marine environments for the proposed Development of Barge/vessel loading facility to handle 4.9 MTPA of cargo at Coastal Sand Spit, Kasarkod Tonka Village, Honnavar Taluk, Uttara Kannda District, Karnataka.

1.8.1 Project Influenced Area (PIA)/Study Area

As per the Ports and Harbours EIA guidance manual issued by MoEF&CC, an area within 5 km radius from project boundary for primary data generation and 15 km radius as the general study area for secondary data generation is considered. The study area map is given as **Figure FD0102.**

1.8.2 Study Period

The terrestrial and marine environmental data generated as part of existing port environmental monitoring programme has been considered. The data generated during winter season of 2023 (October 2023 – December 2023) has been used for the study.

1.8.3 EIA Contents

The EIA study has been carried out considering construction as well as operational phases. In each phase, anticipated impacts due to proposed development on terrestrial, marine environment and social components have been addressed. The contents/components covered in the EIA study and presented in the EIA Report are briefly discussed below.

1.8.3.1 Project Description

The details of cargo, information on surveys and investigations, port layout, various existing and proposed facilities, infrastructure facilities, project development plan, development schedule and project cost details are discussed in **Chapter 2**.

HTL/LTL and CRZ Demarcation Survey

The physical demarcation of HTL and LTL was carried out by National Centre for Sustainable Coastal Management (NCSCM), Anna University, Chennai which is an authorised agency by MoEF&CC. Port layout has been superimposed on CRZ map based on approved CZMP as per CRZ Notification, 2019. The project layout was superimposed on the CRZ set back lines and details are discussed in **Chapter 2**.

1.8.3.2 Description of Environment

The terrestrial and marine environmental data are being generated as part of existing port Environmental monitoring programme and the same has been used for the Environmental impact assessment study. In addition, authenticated secondary data was also collected, reviewed and presented. The baseline environmental data was generated within the study area for following attributes.

- Meteorology, Ambient Air Quality, Noise Levels, Water Quality and Soil
- Marine Baseline surveys
- Ecology (Flora and Fauna)
- Land use and Land Cover Mapping

Terrestrial Environment: The Terrestrial Environment Monitoring was carried out by M/s Vision Labs, Hyderabad, Telangana NABL accredited laboratory appointed by HPPL. The terrestrial environmental data was collected within the study area for following attributes.

- Ambient air quality monitoring at the identified monitoring locations in the study area was carried out with twice a week frequency.
- Hourly noise levels were recorded at identified monitoring locations once during the study period.
- Inland water quality (surface and groundwater)
- Soil quality sampling was carried out once during the study period at the identified sampling locations in the study area.

Marine Environment:

CSIR – National Institute of Oceanography (NIO), Panaji, Goa was engaged to survey the marine environmental attributes. Sampling was carried out once during the study period at the identified sampling locations within the project region. The marine environment was monitored in terms of:

- Seawater quality
- Sediment quality
- Marine ecology

Socio-Economic Aspects: Data on population, literacy, occupation, amenities, medical facilities and fisheries data was collected from Primary Census Abstract (Census of India), 2011 and other study reports. The baseline environmental conditions are described in **Chapter 3**.

1.8.3.3 Anticipated Environmental Impacts and Mitigation Measures

The environmental and social attributes likely to be affected by project activities are identified and impacts were assessed. Project activities can be broadly classified into construction and operation phase activities. Operation phase activities include cargo handling/storage, movement of ships/tugs, etc. Most appropriate and accepted methods were used to quantify impacts likely to arise due to development of the project. The impacts have been assessed both quantitatively and qualitatively for various terrestrial and marine environmental components and impact specific mitigation measures are proposed. The mitigation measures proposed to minimise/avoid each of the likely impacts that occur during construction and operation of the proposed project are presented in **Chapter 4**.

1.8.3.4 Analysis of Alternatives

Since, the proposed development is for the development of Barge/vessel loading facility to handle 4.9 MTPA of cargo at Coastal Sand Spit, Kasarkod Tonka Village, Honnavar Taluk, Uttara Kannada District, Karnataka by HPPL for which earlier EC & CRZ clearance through File No. SEIAA: 22: IND:2011 dated September 21, 2012 were obtained and subsequently HPPL obtained validity extension for EC & CRZ Clearances and CFE was obtained from KSPCB through vide Order No. KSPCB/SEO (Non-EIA)/Honnavar Port/EIA/2012-13/1381 dated February 06, 2013 and subsequently HPPL obtained validity extension for the same. HPPL initiated the groundwork after getting reprieve from Honourable Courts and NGT where PILs were filed against the development. Since then HPPL has undertaken initial project work and project activity was stopped in 2022 due to various Covid and other issues. Present development is confined to the existing port boundary, there are no other alternatives in regards with site selection as the development for Honnavar Port has already being undertaken, study of site alternatives has not been carried out same has been discussed in **Chapter 5.**

1.8.3.5 Environmental Monitoring Programme

Environmental Monitoring Programme for implementation during construction and operation phases of project has been formulated to oversee the environmental safeguards, to ascertain the agreement between prediction and reality, and to suggest remedial measures during operation. The Environmental Monitoring Programme suggested is presented in **Chapter 6.**

1.8.3.6 Additional Studies

Risk Analysis (RA) and Disaster Management Plan (DMP): preliminary risk analysis covering the hazard identification has been carried out. Based on which, preventive measures and Disaster Management Plan were prepared outlining various measures to combat accidents and natural disasters. Also measures to guard against fire hazards have been provided in **Chapter 7.**

Social Impact Assessment (SIA): The social impacts associated with development of additional berths during construction and operational phases and an outline of Social Welfare/Social Upliftment Activities under Corporate Social Responsibility (CSR) are detailed in **Chapter 7**.

1.8.3.7 Project Benefits

The benefits due to the proposed development in terms of employment potential and other tangible benefits are discussed in **Chapter 8**.

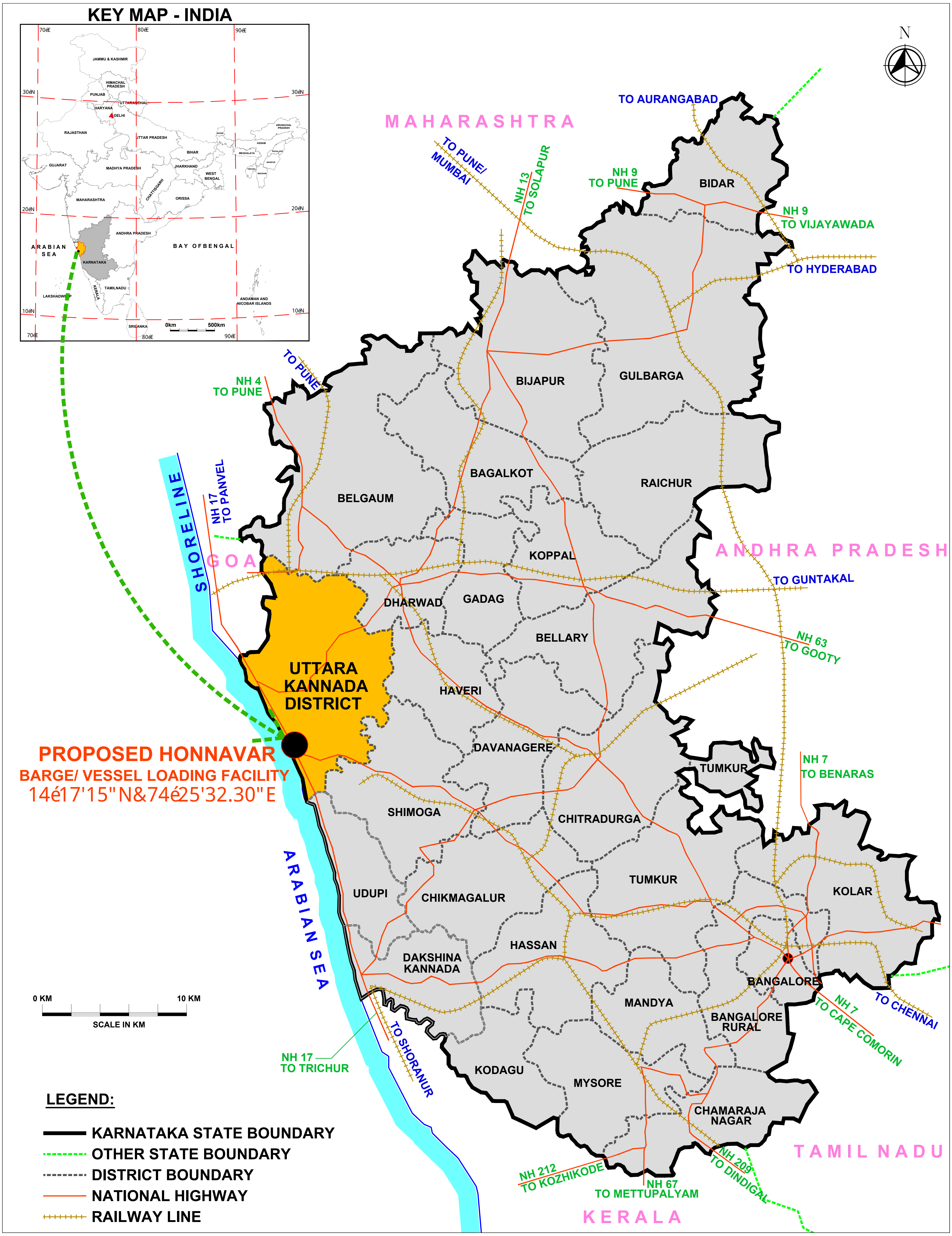
1.8.3.8 Environmental Management Plan (EMP)

An Environmental Management Plan (EMP) has been prepared based on the mitigation measures for the impacts during construction and operation phases and environmental monitoring programme proposed. The mitigation measures have been discussed in **Chapter 5** under the respective sections. The Environmental Monitoring Programme has been discussed in **Chapter 6**. The institutional mechanism responsible for the implementation of the mitigation measures and Greenbelt development and Terrestrial Biodiversity Assessment are presented in **Chapter 10**.

1.9 Structure of EIA Report

The report is structured as per Appendix III of EIA Notification, 2006 as amended:

Chapter 1: Introduction
Chapter 2: Project Description
Chapter 3: Description of Environment
Chapter 4: Anticipated Environmental Impacts and Mitigation Measures
Chapter 5: Analysis of Alternatives
Chapter 6: Environmental Monitoring Programme
Chapter 7: Additional Studies (incl. Public Hearing MoM and Replies)
Chapter 8: Project Benefits
Chapter 9: Environmental Cost Benefit Analysis
Chapter 10: Environment Management Plan (EMP)
Chapter 11: Summary and Conclusion
Chapter 12: Disclosure of Consultants Engaged



PROJECT: ENVIRONMENT AND CRZ CLEARANCE FOR DEVELOPMENT OF BARGE/VESSEL LOADING FACILITY FOR 4.9 MTPA AT HONNAVAR, UTTARA KANNDA

PROJECT NO: C1241301

TITLE: LOCATION MAP

DATE: 27.08.2024

MADE: JMH

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FIGURE NO: FD0101

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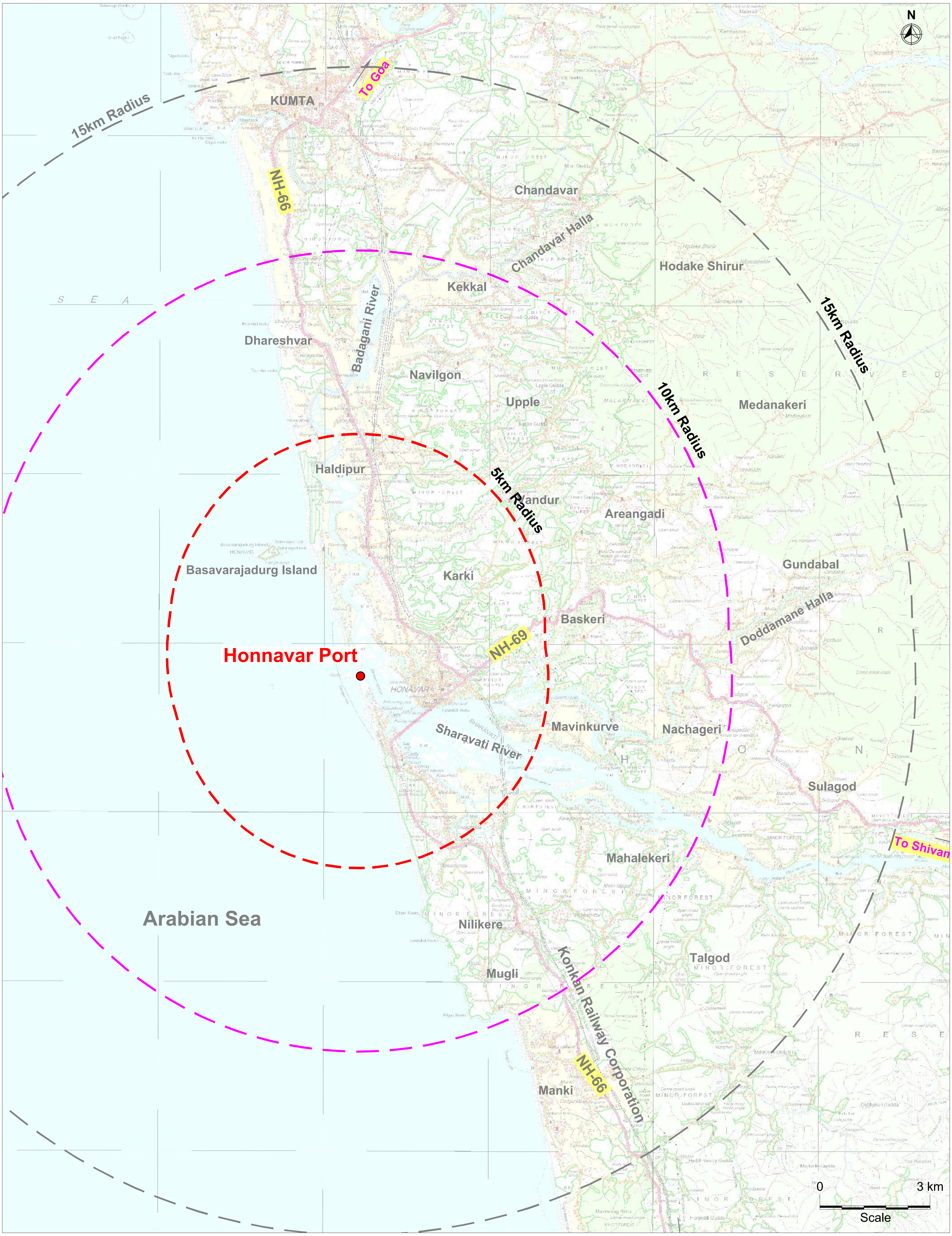

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PROJECT:	ENVIRONMENT AND CRZ CLEARANCE FOR DEVELOPMENT OF BARGE/VESSEL LOADING FACILITY FOR 4.9 MTPA AT HONNAVAR, UTTARA KANNDA
PROJECT NO:	C1241301
TITLE:	STUDY AREA
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Chapter 2
Project Description

Chapter 2 Project Description

2.1 General

In this chapter, Development Plan for Barge/Vessel Loading facility at Honnavar is presented summarising the details of location, land, traffic, potential field survey investigation, layouts, Dredging and Reclamation, cargo handling, utilities and services and estimated cost for the development of the project, environmental protection works, project implementation schedule and the proposed activity with respect to the CRZ compatibility. Port location is discussed in **Section 1.4** of **Chapter 1**.

2.2 Location

The proposed barge/ vessel loading facility site is located near Sharavati River mouth in Honnavar town, Uttar Kannada district of Karnataka State. The location map with project site is given as **Figure FD0101**.

The following are the advantages of identified project site which favours the development of barge/vessel loading facility:

- The location is already declared as a minor port by GoK
- Development proposed inside the river, a stable environment for operation
- Sufficient Land Availability.
- No R&R is envisaged.
- Better Connectivity
- No ASI Listed Monuments
- No Tourist Beaches
- Minimal Impact on river mouth and Minimal disturbance to fishing activities.
- Required Draft (~10 m) availability closer to Shore
- Strategically located in Karnataka Coast, which is halfway between Gujarat and Kerala

Based on the above analysis on environmental and social aspects, Honnavar is found to be the best suitable site for Barge/Vessel Loading Facility development.

2.2.1 Hinterland for Proposed Honnavar Port

The potential cargo zone or industrial zones within 150 km radius from Honnavar port is considered as the primary hinterland. The secondary hinterland extends upto the north, north – eastern and central districts of Karnataka which includes Bidar, Gulburga, Raichur, Vijayapur, Koppal, Bellary, Bagalkot, Gadag, and Belagavi. The region beyond this secondary hinterland is considered as the tertiary hinterland and includes southern districts of Karnataka, part of Telangana, Andra Pradesh, Maharashtra and Madhya Pradesh

The identified primary, secondary and tertiary hinterlands for the proposed port at Honnavar port are as follows

- **Primary Hinterland**- within a radius of 150km from Honnavar port which includes Uttara Kannada, Shivamogga, parts of Dharwad, and Davanagere
- **Secondary Hinterland** – North, North-eastern and central districts of Karnataka which includes Bidar, Gulburga, Raichur, Vijayapur, Koppal, Bellary, Bagalkot, Gadag, and Belagavi.
- **Tertiary Hinterland -** Southern districts of Karnataka, part of Andra Pradesh, Maharashtra and Madhya Pradesh

2.2.1.1 Projected Cargoes for Honnavar Port

Honnavar Port intends to mainly handle dry bulk cargo as there is significant demand for the same from the immediate hinterland it aims to serve. In addition, the client will also develop facilities to handle general cargo.

Based on the hinterland traffic assessment and competitive assessment of adjacent port, the following principal commodity groups have been analysed.

- Imports: Coal, Fertiliser, Edible Oil
- Exports: Iron ore, Sugar, Molasses, Steel Products and Granite

2.3 Land Availability

The land available along both sides of river (Pavinkurve and Kasarkod) Sharavati offers a good potential for developing the barge/ vessel jetty. The land identified for development of Barge / Vessel loading facility is about 44 ha falls in survey number 305 within the port limits issued by Government of Karnataka. HPPL proposing the rail and road connectivity along the coast area within the port limits (within port land of 50m width from hightide line). Four lane road with a length of 2.58km is being proposed under Bharathmala Pariyojana Phase I and land for the road and rail corridor is under the Honnavar port limits and portion of proposed corridor is falling in the forest lands of ~0.76 ha with a length of 220m for the which Stage I clearance and final approval (Stage II) was also proposed by PC office, GoK (**Section 1.2**). Land proposed for port project is without any settlements and under possession of HPPL. Hence, No R&R is envisaged due to the proposed development in the port project area.

The proposed land use plan/land break up details of Honnavar Barge/Vessel loading facility is given in **Table 2-1.**

Table 2-1: Barge / vessel loading facility Land Use Breakup

S. No	Description	Area (Ha)
1.	Coal Stockyard	7.00
2.	Iron Ore Stockyard	1.80
3.	General Cargo Storage (Open)	4.00
4.	General Cargo Storage (Closed)	2.00
5.	Liquid cargo storage	0.10
6.	Roads and Circulation Area	8.15
7.	Operation Building	0.05
8.	Canteen	0.02
9.	Vehicle Parking	0.09
10.	Substation	0.02
11.	Gate House/Security/Weigh Bridge	1.50
12.	Truck Parking	5.40
13.	Fuel Station	0.02
14.	Control Tower	0.01
15.	Green Belt	3.10
	Sub total	33.26
16.	Area available for other Operations and area earmarked for future expansion	6.72
17	Rock armour area (approx)	4.00
	Total	**44.00**

2.4 Barge/Vessel Loading Traffic

2.4.1 Coal

Coal is the one of most important fossil fuel in India. The majority of energy requirement in India are met through coal, largely mined in the eastern and central regions of the country. Coal accounts for approximately 55 percent of the country's energy need. India is the third largest producer of coal in the world and has the fourth largest reserves of coal in the world. The primary demand of coal is from the power sector though steel and cement plants also require coal for their production.

Though, India is the third-largest producer of coal, the demand for coal in India for its power and steel plants is higher than the supply. Therefore, India is a net importer of coal, and its import has been rising over the past 10 years. There is a decline in coal import during 2021-22 largely due to decrease in import by Power Sector which came down from 45 MT in 2020-21 to 27 MT in 2021-22, decline of almost 40%. The decline is steeper if we compare coal imports by power sector in 2021-22 to pre-covid year of 2019-20 when such import was 69 MT. This is despite the fact that total thermal power generation in the country increased to 1115 BU in 2021-22 from 1032 BU in 2020-21, an increase of 83 BU in absolute terms and almost 8 % in percentage terms at a CAGR of 22.86 percent to meet the demand-supply mismatch. The import growth has been primarily driven by increased import of non-coking (thermal) coal, which has grown at 33.3 percent per annum, in response to the growing thermal power plants in India. The main sources for imported coal in India are from Australia, China, Indonesia and South Africa. Export of coal from India has not been significant in the past due to the high domestic demand.

The state of Karnataka is endowed with a number of steel production units and cement plants whose coal requirement is increasing proportionally to their production. JSW steel, Bellary is the largest producer of steel in the hinterland. In addition numbers of steel and power plants are also coming which will further increase the demand for coal in Karnataka. Majority of the power plants and steel production plants import coal from the eastern part of India via coastal movement. Considering all these, it is understood that Honnavar, will attract Thermal coal traffic of 2.7 MTPA annually.

2.4.2 Iron Ore

India is ranked fourth in the world in terms of iron ore reserves, with approximately 6 percent of the total iron ore reserves. Brazil, Russia, China, and Australia are the top four countries. Indian iron ore industry is fragmented with around 270 mines spread across country. India is one among the leading exporters of iron ore in the world and competes with Australia and Brazil. Jharkhand, Orissa, Chhattisgarh, Karnataka, Goa & Maharashtra are key major states with iron ore deposits in India.

Karnataka state is endowed with rich deposits of iron ore with about 9 billion tones or about 41% of India’s total haematite and magnetite resources. Numerous iron ore mines present in Bellary district account for almost 75% of the iron ore exported from the state. The quantity of iron ore mined from Hospet and Bellary had touched 20 MT and 50 MT respectively. About 80% of this iron ore is being exported and the rest is consumed domestically.

Honnavar has a very good prospective in exporting iron ore being located in close proximity to Bellary Hospet belt. Taking into account all the above said factors, the facility being developed in Honnavar is expected to handle around 1.0 MTPA of iron ore annually. However, considering the recent ban on iron ore, HPPL is committed to the national regulations and therefore Iron ore will be handled as and when the handling is legally permitted.

2.4.3 General and Other cargoes

The General cargoes proposed for the barge/vessel loading facility includes steel products, molasses, edible oil, granite, sugar and fertiliser.

2.4.3.1 Steel Products

Karnataka's annual output of iron ore is around 45 MT with around 70-75% of it being exported. Based on this the average annual output of steel from Karnataka is around 27 MT. But due to the ban in the iron ore mining in Bellary by the Supreme Court, the steel industry for which iron ore is the basic raw material got affected. This threatened the production output of the steel. In September 2011, India's Supreme Court allowed state-owned NMDC Ltd to mine 1 MT of iron per month in Karnataka's Bellary district to meet domestic steel maker's needs. This has helped the steel industry to recover to an extent. As per expert's opinions, it is expected that the amount of iron ore supply to the steel industry will be further increased and the ban on the iron ore mining will be partially or fully recovered sooner or later. Keeping in view of the prevailing situation, Honnavar barge/vessel loading facility will handle 0.4 MTPA of steel products.

2.4.3.2 Fertilizer

Chemical fertilizers play a key role in the agricultural productivity growth of India. However, the demand-supply gap of fertilizers in India has increased in recent times, thereby leading to increased dependency on imports. Indian imports, which were about 2 MT in early part of 2000, increased to 10.2 MT in 2008-09. India is the second largest consumer of fertilizers in the world after China, consuming about 26.5 MT in 2009 - 10.

Fertilizer consumption in Karnataka state is increasing while the production is less which necessitates the import of fertilizers. Considering the potential for fertilizer, Honnavar barge/vessel loading facility plans to attract 0.2 MTPA.

2.4.3.3 Granite

Karnataka produces 25% of India's total granite production followed by Jharkhand (24%), Rajasthan (23%), Andhra Pradesh (6%), Madhya Pradesh (5%) and Orissa (5%) which altogether accounts for 88% of the resources. The quarries in Karnataka are located in Chamarajnagar sector, Kollegal sector, Kanakapura sector, Hassan sector, Mandya sector, Mysore sector and Ilkal sector. Considering the potential for granite, Honnavar barge/vessel loading facility plans to export 0.16 MTPA.

2.4.3.4 Sugar

India is the second largest producer of sugar next to Brazil. With a hold of 13.5% of country's sugar production, Karnataka ranks fourth in the country in terms of sugarcane production and third in the country in terms of production of sugar. Increase in the sugar projection was owing to the availability of large quantity of sugarcane in the state. Considering the potential for sugar, Honnavar plans to export 0.29 MTPA.

2.4.3.5 Molasses

Molasses is produced by sugar factories during the sugar manufacturing process. Godavari Sugar Mills located in Bagalkot is the largest producer of molasses in the hinterland. Demand for ethanol in the petroleum sector and potable alcohol industry is the driving forces for high molasses consumption.

Brazil, the world's largest exporter has banned molasses exports in order to produce ethanol to be used as a biofuel; hence India could cater to the international demand for molasses. Growing demand for ethanol which is blended with petroleum will be the major factor that will fuel molasses exports in future.

In order to cater to international demands, sugar factories in the hinterland supply local distilleries as well as export a part of their volumes. Considering the potential for molasses, Honnavar plans to export 0.08 MTPA.

2.4.3.6 Edible Oil

Indian vegetable oil economy is the fourth largest in the world, accounting for about 14.5% of the world's oilseeds area and 6.65% of the production next to U.S.A, China and Brazil. The per capita consumption of edible oil is about 11.5 kg which is very low compared to world average of 20 kgs. With steady growth in population and personal income, Indian per capita consumption of edible oil has been growing steadily. However, oilseeds output and in turn, vegetable oil production have been trailing consumption growth, necessitating imports to meet supply shortfall. Hence India being deficient imports 40% of its consumption requirements, making it the world's third-largest importer of edible oil. The country buys soya oil from Argentina & Brazil and palm oil from Malaysia & Indonesia. Exemption on import duty on edible oils (since 2008) has resulted in a huge rise in imports and has also boosted the per capita consumption of oil in the country.

In Karnataka Edible Oil is imported from Argentina, Indonesia, Brazil, Malaysia, etc through New Mangalore Port. The edible oil imported at the Port is despatched to various destinations like Karwar in Karnataka State and to Ruchi Oil refineries in Mumbai and in some parts of Kerala State. The crude Palm oil imported is processed locally and sent to various destinations in the hinterland. Considering the potential for edible oil, Honnavar barge/vessel loading facility plans to export 0.07 MTPA. The total general cargo handled will be 1.2 MTPA.

2.4.4 Traffic for Honnavar

Based on the hinterland potential analysis, the overall traffic figures for proposed barge/ vessel loading facility are provided in **Table 2-2.**

Table 2-2: Cargo Throughput for Honnavar Barge/Vessel Loading Facility

S. No.	Commodity	Traffic (MTPA)
1.	Coal	2.70
2.	Iron Ore	1.00
	General Cargo	
3.	Granite	0.16
4.	Fertilizer	0.20
5.	Molasses with Agro Products	0.15
6.	Steel Products	0.40
7.	Sugar	0.29
8.	**Total**	**4.90**

Overall Traffic Projection for next 30 years: The overall potential of the cargo for Honnavar port. In the initial year, on an average 5MTPA of traffic can be attracted to Honnavar port and this traffic potential is expected to increase to 21.66 MTPA by the end of next 30 years.

2.5 Field Surveys and Investigations

Comprehensive field surveys and investigations were carried out covering oceanographic measurements, marine geotechnical investigations and topography at the location of project site. Detailed investigations that included seabed surveys (viz. bathymetry), Oceanographic measurements (tide measurements, current meter observations) and seabed sediment sampling were carried so that the results were used for the planning of the proposed facilities at Honnavar Barge/vessel loading facility. These surveys were carried out by M/s. Indomer Coastal Hydraulics (P) Ltd., Chennai and M/s. Fugro Geo-Tech Pvt. Limited.

2.5.1 Bathymetry

Bathymetry of the study area exhibits a gentle bed slope of 1:180 up to 5 m contours beyond which it flattens to 1:350. The 10 m water depth occurs at a distance of approximately 3350 m from the coast.

The bathymetry survey carried out on the river side of the project site illustrates that the river bed is shallow and there are few deeper portions depending on the current. A maximum river depth of 3-4 m is observed, otherwise the whole of the bed seems to be very shallow and few islands in the river course. Mouth/estuary of the river also seems very shallow with maximum water depth of 2-3 m in the river mouth. Large area of shallow depth of 0.7 m is observed on either side of the river mouth which is mainly due to the deposition of the sediments brought by the river.

The bathymetric chart is presented in **Figure 2-1.**

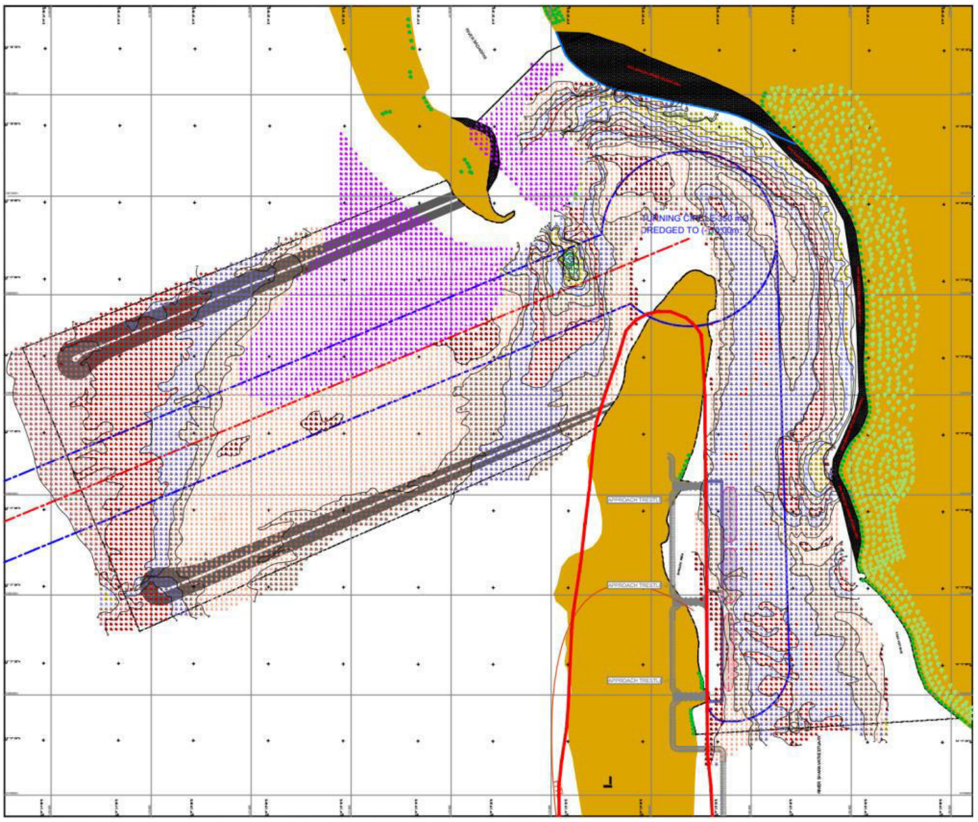


Figure 2-1: Bathymetry of Port Area

The National Hydrographic Office chart showing the depth contours of the Project region is given in **Figure 2-2**.

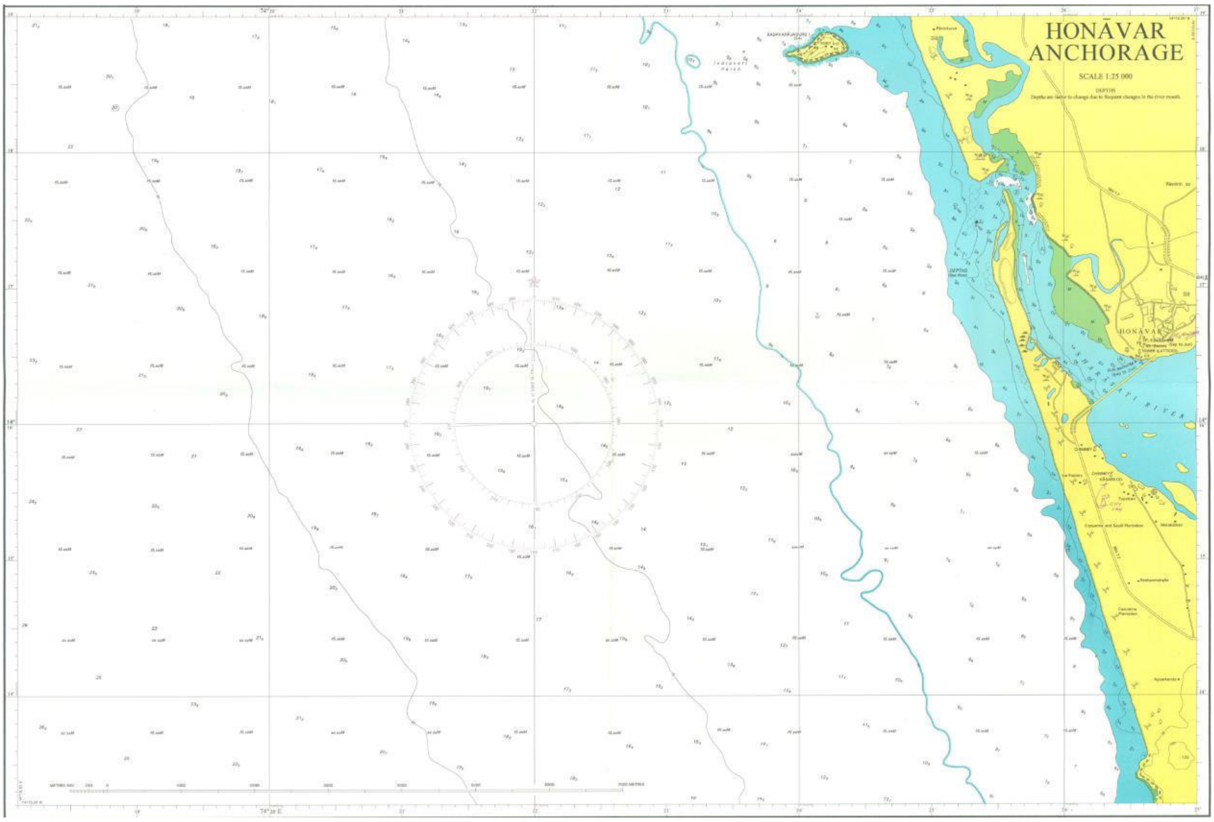


Figure 2-2: NHO Chat

2.5.2 Geotechnical Investigation

Geotechnical investigations were carried out to determine various soils/rock parameters at the proposed project location and 11 marine boreholes were explored to assess the geotechnical parameters.

The soil profile of the four land boreholes reveals that medium dense to dense yellowish brown fine to coarse sand up to 13.5 m, stiff dark grey clay from 13.5 to 16.5 m, dense yellowish brown coarse sand from 16.5 to 18 m, very dense whitish grey gravels with some sand from 18 to 22.5 m, hard reddish clay with few gravels from 22.5 to 28.5 m, highly reinforced greenish weak chloride schist from 28.5 to 31.5 m and moderately weathered greenish weak to moderately weak chloride schist from 31.5 to 35 m.

The soil profile of the eleven marine boreholes reveals that loose to dense yellowish brown fine to coarse sand up to 4.5 m, soft to firm dark grey clay from 4.5 to 6.0 m, loose to dense yellowish grey sandy clayey gravels from 6.0 to 9.0 m, medium dense whitish greyish sand with gravels from 9.0 to 12.0 m, stiff to very stiff whitish grey clay from 12.0 to 19.5 m, hard whitish grey clay with minor silt from 19.5 to 27.0 m, hard greenish clay from 27.0 to 30.15 m and moderately weathered greenish moderately weak to weak chloride schist from 30.15 to 35.0 m. Weathered rock is encountered in all boreholes at varying depths. The observed bedrock is moderately weathered at surface and rapidly grades into sound rock as depth increases.

2.5.3 Oceanic Investigation

The oceanographic conditions such as tide, wave, current, bathymetry etc, and meteorological conditions such as climate, temperature, relative humidity, rain fall, wind, visibility, cyclone etc are discussed below.

2.6 Mathematical Model Studies

2.6.1 Oceanographic Features

Tides

The tides in the project region are predominantly semidiurnal in nature. The various design tide levels with respect to chart datum for Honnavar region as presented in Naval Hydrographic Chart NHC No. 216 are given in **Table 2-3**.

Table 2-3: Design Tide Level

Level	Tide (m)
Mean High Water Spring (MHWS)	(+) 1.8
Mean High Water Neap (MHWN)	(+) 1.5
Mean Sea Level (MSL)	*(+) 1.2*
Mean Low Water Neap (MLWN)	(+) 1.0
Mean Low Water Spring (MLWS)	(+) 0.4

Source: Honnavar (NHC-216)

Additionally, the tide measurements carried out at the project location in April 2011 have been compiled and the variation of measured tides is shown in **Figure 2-3**.

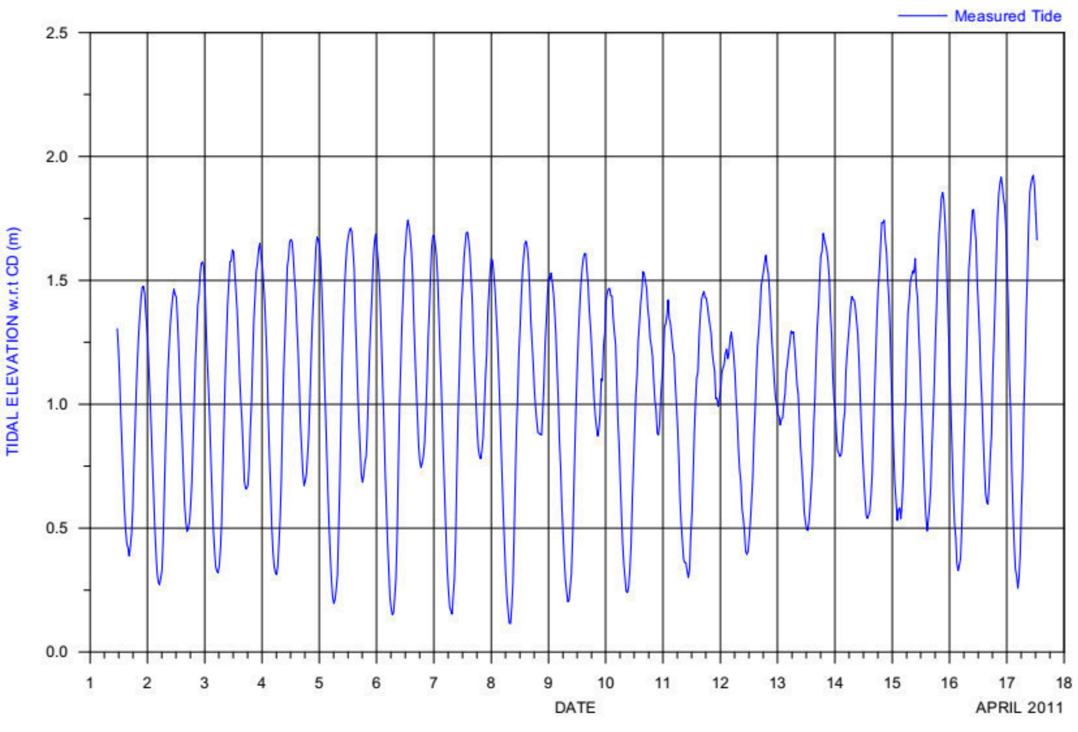


FIG. 4.1. VARIATION OF TIDES AT PROJECT LOCATION

Figure 2-3: Tidal Variations

Currents

Based on the oceanographic study conducted in April 2011 at the project region, the current patterns in the area exhibited significant variation in both speed and direction. The variations of current speed and direction at the proposed project location is shown in **Figure 2-4**. The maximum surface current speeds ranged from 0.34 m/s in the open sea to as high as 1.23 m/s inside the river close to the project location.

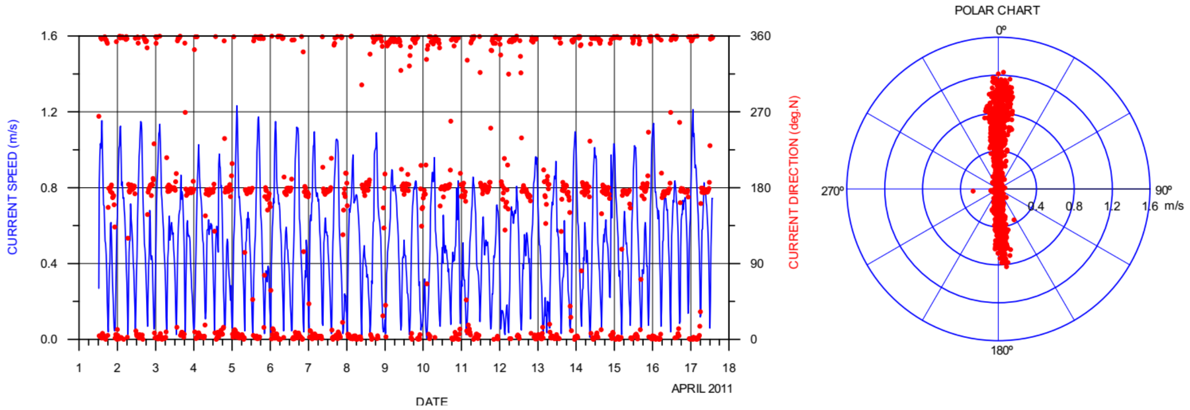
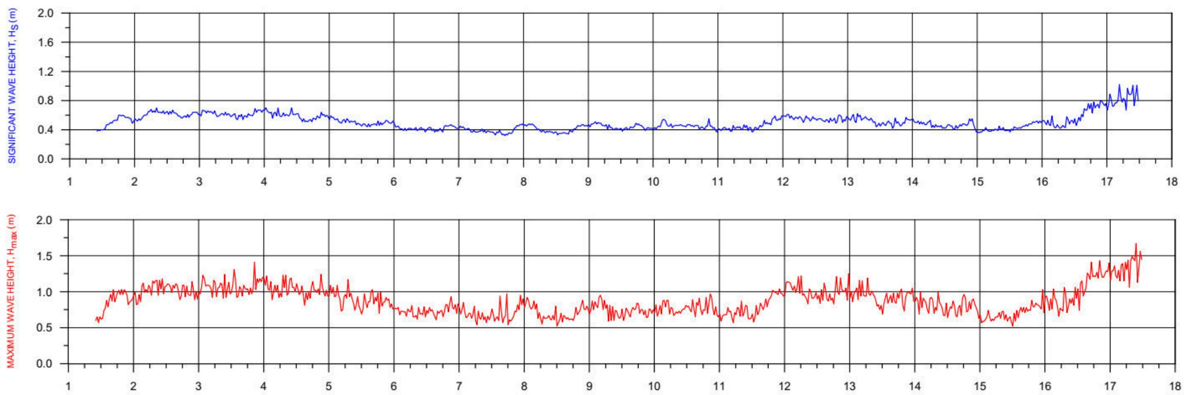


Figure 2-4: Variation Of Current Speed And Direction With Polar Chart

In the open sea, the currents generally flowed southward, influenced by the regional monsoon winds. Within the river areas, the current patterns were more complex and heavily influenced by the tidal phases. During flood tide, the river currents predominantly moved southward, driven by the incoming tide pushing water upstream. Conversely, during ebb tide, the currents reversed direction, flowing northward as the tide receded and water drained back into the sea. This bidirectional flow is typical of estuarine environments, where the interaction between river discharge and tidal forces creates dynamic and variable current patterns.

Waves

In the Honnavar region, wave dynamics play a crucial role in shaping the coastal environment and influencing maritime activities. The study conducted by Indomer in April 2011 provides a detailed understanding of these wave conditions on the open sea adjacent to the proposed project location. The variation of measured wave characteristics at the project location is shown in **Figure 2-5**. During the measurement period, the significant wave height varied between 0.32 m and 1.02 m. The maximum wave height recorded was 1.67 m. The zero-crossing wave periods range from 3 to 10 seconds. The predominant wave direction was around 230º, indicating that waves generally approached the coast from the southwest.



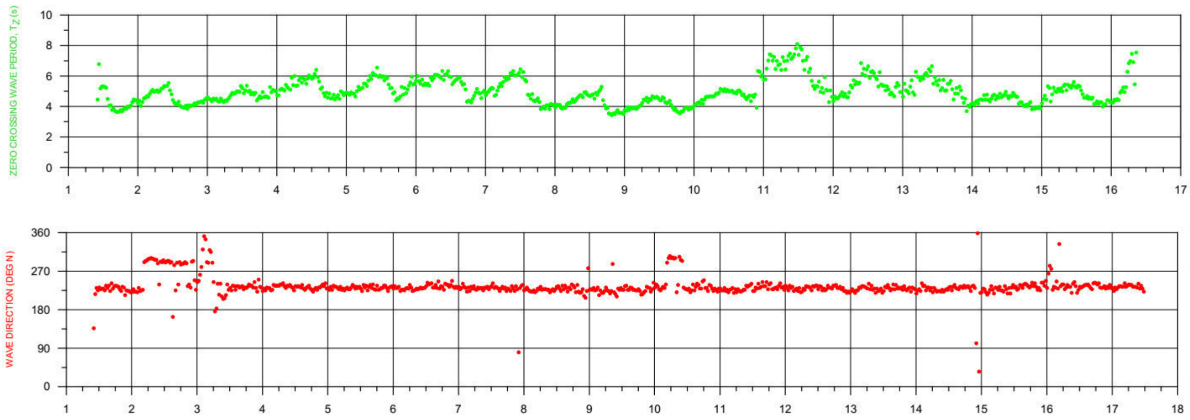
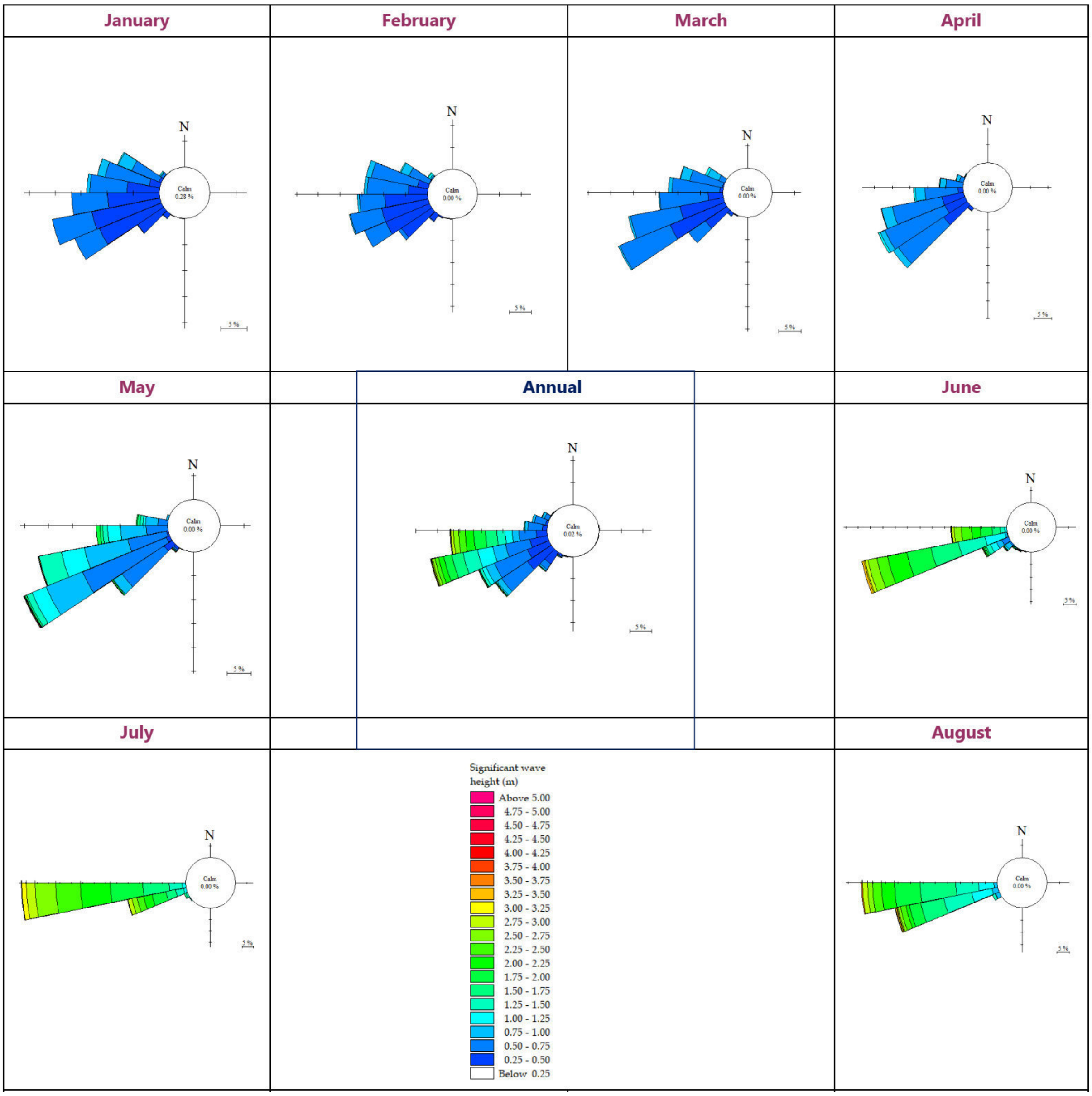


Figure 2-5: Variation of Measured Wave Characteristics

Additionally, to understand annual wave climate, the in-house available wave data pertaining to the project location is compiled. The monthly and annual wave rose at the project location is shown in **Figure 2-6**.



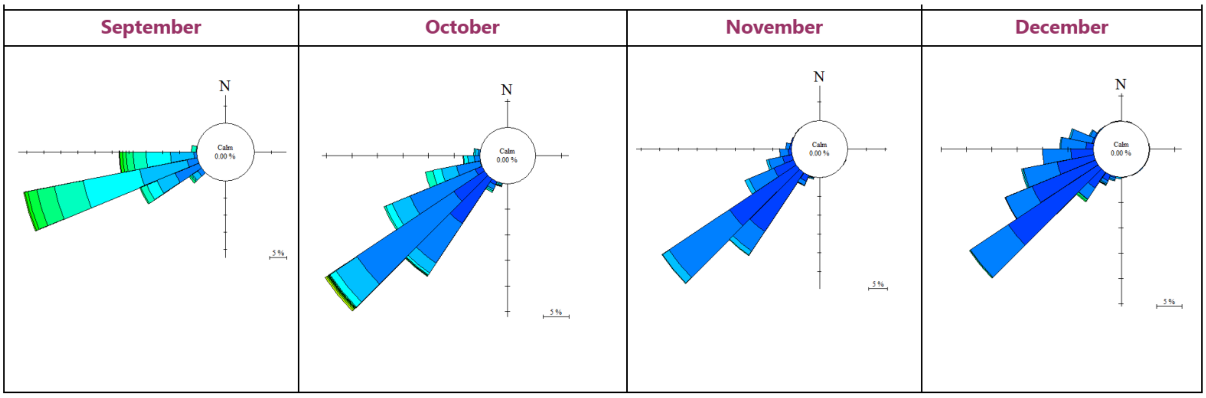


Figure 2-6: Monthly and annual wave roses at Honnavar

Based on the compiled wave statistics, the monthly predominant wave characteristics are given below.

- January: Wind speed predominantly varied 2 – 6 m/s and the wind predominantly arrived from 292.5° – 360°.
- February: Wind speed predominantly varied 2 – 6 m/s and the wind predominantly arrived from 292.5° – 360°.
- March: Wind speed predominantly varied 2 – 6 m/s and the wind predominantly arrived from 270° – 360°.
- April: Wind speed predominantly varied 2 – 6 m/s and the wind predominantly arrived from 247.5° – 337.5°.
- May: Wind speed predominantly varied 2 – 6 m/s and the wind predominantly arrived from 270° – 337.5°.
- June: Wind speed predominantly varied 2 – 8 m/s and the wind predominantly arrived from 225° – 292.5°.
- July: Wind speed predominantly varied 2 – 8 m/s and the wind predominantly arrived from 247.5° – 292.5°.
- August: Wind speed predominantly varied 2 – 8 m/s and the wind predominantly arrived from 247.5° – 292.5°.
- September: Wind speed predominantly varied 2 – 6 m/s and the wind predominantly arrived from 247.5° – 315°.
- October: Wind speed predominantly varied 2 – 6 m/s and the wind predominantly arrived from 270° – 337.5°.
- November: Wind speed predominantly varied 2 – 6 m/s and the wind predominantly arrived from 45° – 90°.
- December: Wind speed predominantly varied 2 – 6 m/s and the wind predominantly arrived from 45° – 90°.

From the compilation of wind parameters, it is observed that wind speed is high during monsoon months i.e., from June to August. During the rest of the months in the year, the wind speed is relatively low.

Bathymetry

The bathymetric chart of the project region based on the bathymetry survey carried out in 2011**.** The bathymetry chart depicts that the depth contours are generally uniform and parallel to the coastline. The seabed in the project region displays a steep slope of 1:150 up to a depth of 5 meters from the shoreline, beyond which the slope becomes gentler at 1:650 from 6 to 10 meters depth. The variation in water depth with distance from the shoreline shows a gradual increase in depth from 2 meters at approximately 520 meters from the shore to 10 meters at about 3630 meters offshore. The variation of water depth with respect to distance from the shoreline is given in **Table 2-4**.

Table 2-4: Variation of water depths with distance

Water depth (m)	Approximate distance from shoreline (m)
Wave breaking zone	
2	520
3	560
4	600
5	720
6	1000
7	1320
8	1940
9	2640
10	3630

In contrast, the riverine part of the Sharavathi estuary exhibits more variability in depth contours. Near the river mouth, particularly in the SE part, the depth contours are more regular and parallel to the embankment, with depths ranging from 2 to 7 m. However, the NW part of the river shows irregular depth contours, reflecting a more complex riverbed morphology, likely influenced by sediment transport and erosion. Near the river mouth and embankment, the depths vary between 4 and 8 meters, indicating dynamic interactions between riverine and marine processes.

Model domain

The tide and wind induced flow field over the study area was simulated using MIKE 21-HD module. The vertically integrated shallow water equations governing large scale flow fields and the alternate direction implicit method are used in MIKE 21 HD module for the solution.

Simulation of flow field with existing condition: The model domain in the study area covers an area of approximately 21 km x 13 km. The grid spacing is 20 m in both X and Y directions. A rectilinear grid system was used for the simulation of flow field in the study region. The grid system comprised of totally 6,82,500 computational points. The model domain used for the simulation are shown in **Figure 2-7**.

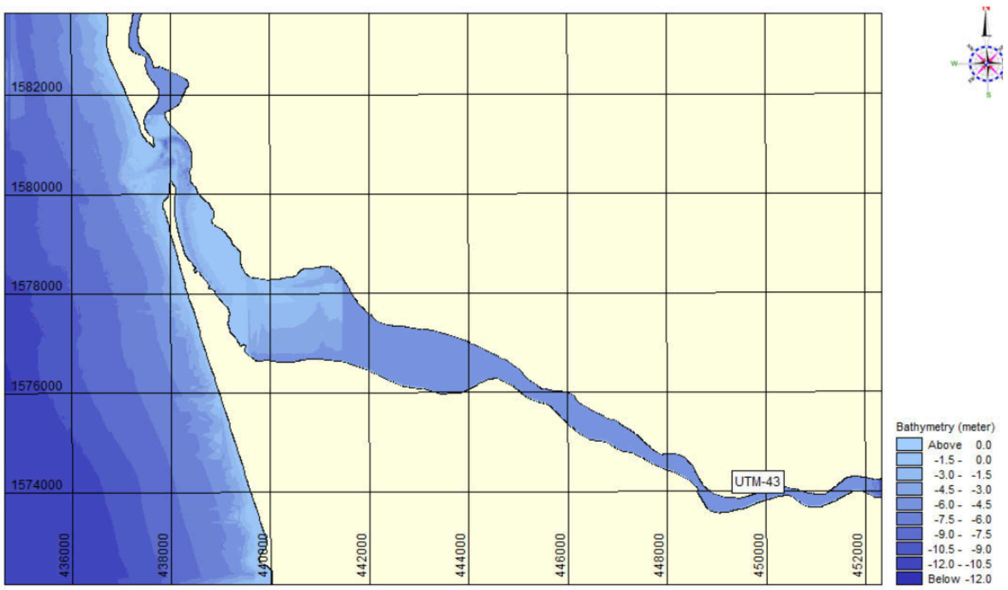


Figure 2-7: Model Domain- Without Breakwater

Simulation of flow field with proposed developments: The computational model was modified by incorporating the proposed developments. The channel as well as harbor area is dredged up to -10.0m depth. A northern breakwater of 820m length and southern breakwater of 865m length having a clear gap of 360m in between them was incorporated in the model. The model domain in the study area covers an area of approximately 28 km x 15 km. The grid spacing is 20 m in both X and Y directions. A rectilinear grid system was used for the simulation of flow field in the study region. The grid system comprised of totally 10,50,000 computational points. The model domain used for the simulation are shown in **Figure 2-8**.

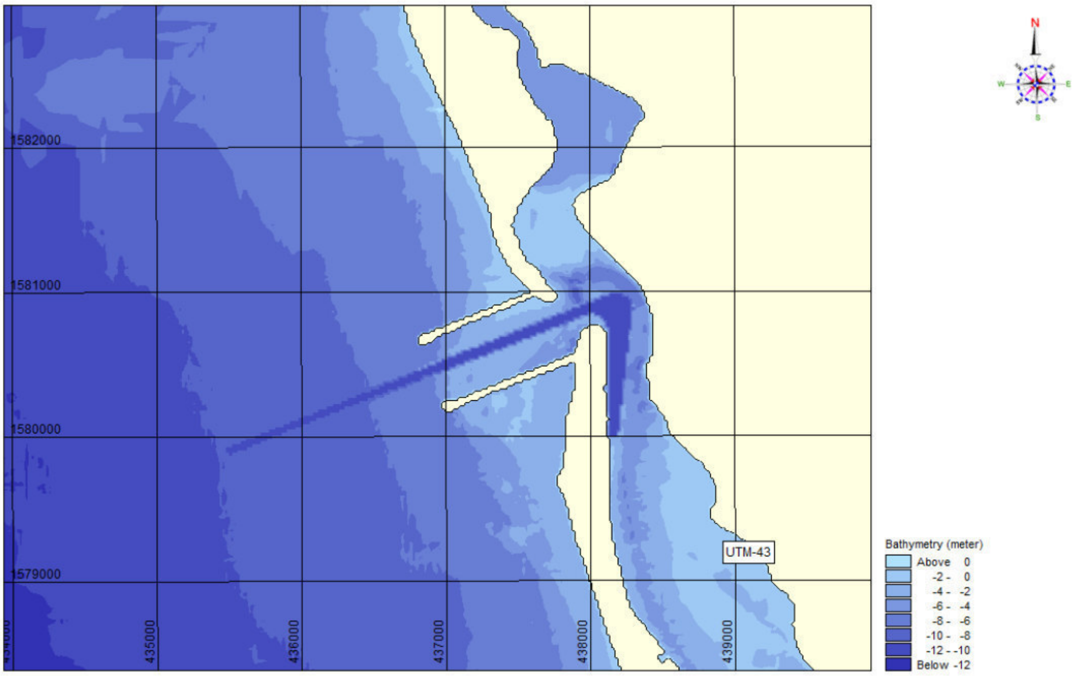


Figure 2-8: Model Domain- With Breakwater

Data Requirements:

The data for the MIKE 21 HD module is described below:

- Bathymetry
- Initial Conditions: Water surface levels and Flux densities in x and y directions
- Boundary Conditions: Water levels
- Other Driving Forces: Wind speed and direction

Depth schematization

For the schematization of depths in the flow model, the water depths were extracted from: i) DHI - MIKE 21 – *C Map* data base, ii) Indian Naval Hydrographic Charts corresponding to this region, and iii) available measured bathymetry data.

Depth schematization or estimation of water depths at model grid points has always been one of the most important and yet crucial part of any coastal modelling problem. The availability of MIKE C-MAP worldwide electronic chart database has significantly reduced the time and effort required for this task. This database and the program to extract the bathymetric data over the selected area with as much detail as possible have been developed jointly by DHI and C-MAP, Norway. C-MAP database is extracted from large and small scale Admiralty Sea charts, where a larger scale chart covers large areas with limited detail and small scale maps cover smaller areas in greater detail. The larger scale maps offer complete coverage, and the small-scale maps are available only in regions where ships and boats navigate, which require detailed maps for safe navigation. From this database it is also possible to get information on tidal elevation at important tidal stations.

2.6.2 Wind-wave Model and Nearshore Wave Transformation and Wave Tranquillity

The wave transformation model has been run for deep-water waves approaching from six directions (S, SSW, SW, WSW, W and WNW). However, due to the typical orientation of the coastline and the nearshore bathymetric pattern, the waves undergo refraction and approach the coast predominantly with a westward component (WSW, W and WNW). To examine the effect of the proposed breakwaters and other structures on the waves and other parameters in the study area, models were run for the existing conditions without breakwaters (case-I) and for the future conditions incorporating the proposed breakwaters (case-II).

For case-I (without breakwaters), during monsoon season, when the deep-water wave directions are S, SSW, and SW the wave heights along the coast are between 1.0 to 1.5 m up to a distance of about 1 km offshore. For WSW waves, wave heights greater than 1.75 m are noticed in the region. However, in the neighbourhood of the inlet channel (river mouth), on the seaward side the wave heights are less than 1.0 m and this is due to wave divergence in the region. On the riverside of the entrance channel good, tranquillity conditions with wave heights less than 0.5 m are noticed.

For case-II (with breakwaters), the wave conditions along the coast outside the port area are almost same as in case I. But near the mouth adjoining the breakwaters somewhat rough conditions with wave heights ranging from 1 to 1.5 m are noticed. This could be due to the diffraction and reflection of the waves by the breakwaters.

The wave transmission factor is important for the study of wave tranquillity. Higher transmission factor indicates low tranquillity and vice versa. During the non-monsoon season when W and WNW waves prevail, the transmission coefficients are quite low (0.15) and the tranquillity conditions are quite good. During monsoon months when WSW and SW waves prevail the transmission coefficients are significantly higher (>0.3) near the entrance channel; but the values rapidly decrease on the riverside of the channel.

For case-II, with breakwaters, the transmission coefficients are generally less than 0.15 indicating good tranquillity conditions for non-monsoon months. But during monsoon months when S and SSW waves prevail, the inlet channel adjoining the breakwaters show higher transmission coefficients (>0.75) and the tranquillity conditions are not so good.

However, the tranquillity conditions on the riverside of the channel are quite good during all seasons. The model studies show that the tranquillity conditions have improved on the riverside where barge/ vessel loading facilities are located, when the breakwaters are incorporated in the model.

2.6.3 Hydrodynamic Model Studies

The changes in the current patterns near the inlet and inside the river up to the point of the proposed barge/ vessel loading facilities were studied by using hydrodynamic models. The model results show that the ebb currents are strong during wet season when the river discharge is very high. The current strengths increase further during spring tide periods compared to neap tide.

For case-I (without breakwaters), during wet season with peak river discharge (300 m^3/s) strong currents of about 1.0 to 1.2 m/s are observed inside the channel as well as on the seaward side of the channel. Inside the river also up to 5 km upstream, the ebb currents are strong (0.4 to 0.6 m/s). During flood period, also the currents continue to be in the ebb direction and no reversal is found. However, there is slight reversal outside the channel to the south. The currents in the river also show no reversal with tide; they continue to be in the ebb direction even during flood period. This is due to the overwhelming effect of the river discharge, which totally controls the circulation. Similar variations of currents are observed during neap tides also.

For case-I during wet season, the impoundment of water within the river and the inlet area is observed. During ebb period, the water levels in the river are at about 0.6 to 0.75 m while on the seaside the water levels are around 0.3 to 0.45 m. However, during the flood period the water levels in the river and in the sea remain almost same at around 0.9 m. During dry season the magnitude of currents has generally decreased to about 0.2 m/s and a clear reversal in tidal currents is noticed.

For case-II (With Breakwater) in the wet season strong currents directed seaward are observed near the inlet during ebb period. The ebb current strength in the river is found to be stronger compared to case-I. With the inclusion of breakwaters, the effective cross sectional area at the entrance has decreased resulting in the increase of current strength. The water levels during the flood period remain almost same as case-I and so it may be inferred that the construction of breakwaters will have negligible effect on the water level changes in the Barge / vessel loading facility.

The increase in current strengths prevents any increase in water levels and no flooding is expected. Since, the currents show higher values only during ebb period, the riverine sediments could be carried offshore by such currents and sedimentation problem within the proposed facility is expected to be lesser. For case-II during dry season reversal of currents in the river are observed from ebb to flood periods. The water levels also do not show any variations compared to case-I.

2.6.4 Cohesive/Mud Transport (MT) Model

Cohesive or mud transport studies are essential for coastal regions where river or tidal inlets are present. The Flow model (HD and MT) has been simulated for different wave directions obtained from wave radiation stresses output from NSW fine-resolution model simulations. The model setup is divided into two parts one with low discharge conditions (dry monsoon) and the other with high discharge conditions (wet monsoon). For dry monsoon season, the Sharavathi river discharge is very less (50 m^3/s) and for the wet monsoon season, it varies from 200-500 m^3/s during peak discharge periods.

For case-I (without breakwaters) in the wet season, on the 5th day of the model run higher Suspended Sediment Concentration (SSC) values are noticed both inside the river and near the inlet entrance, which gradually decreased and by 10th day became negligible except on the southern end of the river. By 15th day the SSC is completely flushed out and higher SSC values are noticed only far away on the seaside of the channel. For dry season the SSC values continue to be less throughout the model run up to 15 days. The model run for bed level changes shows negligible bed level changes up to 5th day throughout the entire area; but by 10th day slight deposition is noticed on the right bank of the river to the north of the channel entrance and by 15th day the deposition seems to have increased further. For dry season however the bed level changes are negligible for the entire area.

For case-II (with breakwaters) during wet season slightly higher values of SSC are noticed inside the region of breakwaters and also inside the river. But by 10th day the SSC is flushed out and by 15th day the entire area is free of any SSC. During dry season the SSC is negligible throughout the study area. The bed level changes during wet season indicate the sedimentation is negligible up to 10th day; but by 15th day slight deposition appears on the right bank of the river facing the channel inlet. But this siltation is not severe and it shall be concluded that the construction of breakwaters will not have any significant effect on siltation in the proposed project area.

2.6.5 Non-Cohesive Sediment Transport

The littoral sand transport studies conducted through MIKE 21 (ST) model gave information on sand transport rates along the coastal stretch and near the tidal inlet.

For case-I (without breakwater) the rates of sediment transport for deep water waves from S and SSW are much less (<200 m^3/yr/m) along the entire coastal stretch. However slightly higher values (about 400) are noticed on the seaward side of the entrance where shoals are present. The bed level changes indicate deposition at the mouth and to the south of the inlet. For SW and SSW waves during monsoon season high values of sand transport (>2000) are noticed along the entire coastal stretch due to high and steep waves during this season. The bed level changes indicate significant deposition (0.005 m/day) both to the south and north of the entrance channel. During non-monsoon season, when W and WNW waves prevail the sediment transport as well as the bed level changes are not significant.

For case-II (with breakwaters) during monsoon season when SW and WSW waves prevail the sediment transport is significant (>2000) to the north as well as to the south of breakwater. Bed level changes indicate deposition to the northern and southern coastline in general; but there is also erosion just to the north of northern breakwater, some deposition is observed inside the breakwaters zone just at the mouth of the entrance channel, which must be cleared periodically in maintenance dredging.

Model studies indicate an annual deposition of about 10,300 m^3/yr in the dredged channel. Again, during non-monsoon months there is no significant deposition. On the whole the sand transport model studies indicate depositional trend near the mouth of the channel as well as to the north of the channel for case-I. But for case-II, the depositional trend in the channel has somewhat decreased due to breakwaters while some erosional trend is noticed towards the northern shores.

The predominant direction of alongshore sediment transport is towards north due to S, SSW and SW waves and the net transport of sediment is around 0.6×10^6 m^3 directed towards north.

2.6.6 Tranquillity Studies at Honnavar

Tranquillity model studies for the Honnavar port area have been conducted using MIKE 21 wave model for the existing conditions (case-I) as well as for future conditions with the proposed breakwaters (case-II).

The wave transmission factor is important for the study of wave tranquillity. Higher transmission factor indicates low tranquillity and vice versa. During the non-monsoon season when W and WNW waves prevail, the transmission coefficients are quite low (0.15) and the tranquillity conditions are quite good. During monsoon months when WSW and SW waves prevail the transmission coefficients are significantly higher (>0.3) near the entrance channel; but the values rapidly decrease on the riverside of the channel.

For case II, with breakwaters, the transmission coefficients are generally less than 0.15 indicating good tranquillity conditions for non-monsoon months. But during monsoon months when S and SSW waves prevail, the inlet channel adjoining the breakwaters show higher transmission coefficients (>0.75) and the tranquillity conditions are not so good. The effective working days are considered as 260 days considering the weather downtime including monsoon and public holidays. The proposed dredge depth at the Approach Channel (Inner/ Outer), Turning Circle and Berthing area will be (-) 10.0 m CD.

However, the tranquillity conditions on the riverside of the channel are quite good during all seasons. The model studies show that the tranquillity conditions have improved on the riverside where barge loading facilities are located, when the breakwaters are incorporated in the model.

2.6.7 Shoreline Changes Study

The coastline evolution with the breakwaters and other interventions can be well modelled with state of art LITPACK model in the MIKE 21 software. The model has been simulated for two cases: (1) with breakwaters and without shore protection on the northern side of inlet and (2) with breakwaters and with sea wall on the northern side of inlet.

Case (I):

It is observed that severe erosion may occur towards the northern side of the north-breakwater with shoreline recession of around 20-30 m for 10 years (2-3 m/yr). Whereas, on the southern side, deposition occurs with a shoreline advancement of 50-60 m.

Case (II):

When a shore protection strategy like sea wall is constructed on the northern side of the barge/ Vessel loading facility, it is observed that the coast is almost stable and no net change in shoreline is observed. Whereas, on the southern side, slight deposition occurs with a shoreline advancement of 30-40 m.

2.6.8 Dredge Disposal Study

Mathematical model study has been carried out to assess the fate of dredged spoil during dredging and dumping and its impact on the project area and near-shore regions. The dredging quantity during the proposed development is estimated to be 3.9 million m^3. Around 1.0 million cum of dredging quantity will be used for reclaiming purpose and the remaining quantity will be disposed in sea. MIKE 21 hydrodynamic model (with mud transport) has been used to simulate the suspended sediment concentration (SSC) and bed level changes when the dredged material is discharged in to the sea.

As the sediment transport and littoral drift studies revealed that the net transport along this coast is towards north, an appropriate disposal site towards north of the northern breakwater were chosen such that the disposed material does not come back towards the port entrance and at the same time it could be helpful in nourishing the eroding beaches in the area. After examining several locations along the northern coast, the most suitable site for dredge disposal is recommended at a distance of about 2 km to the north of port entrance channel located at latitude 14.308^{0}N and longitude 74.415^{0}E. It is observed that during wet season, the suspended sediment concentration (SSC) is relatively high for a few days after dredge disposal but later it spreads along the coast towards north without any impact to the port entrance area and the nearby environment. However, during dry season with WNW waves, the discharged sediment (SSC) spreads along the coast towards south, but it does not extend up to the entrance channel. It is evident from the rate of bed level changes that during wet season, there is very little increase in bed level in the nearshore regions at the disposal site. During dry season, the supplied sediment is carried towards south supplying sediment to the northern part of the north breakwater. This positive feedback from the natural nearshore current system is quite helpful for nourishing the northern beaches.

During periods of strong near shore currents (during peak wet season), it is suggested to dispose the sediment offshore at greater depths (>30 m). Based on the studies it is concluded that the dredge disposal at the recommended site will not cause any natural imbalance to the nearby shoreline and will not affect the coastal eco-system in any way. The details of the dredge spoil study such as Deposition pattern, Average suspended sediment concentration at dumping areas are discussed **in Section 4.4.2.1 of Chapter 4**.

2.7 Honnavar Barge/Vessel Loading Facility Development Plan

The following attributes have been considered during the planning of barge/vessel loading facility layouts:

Bathymetry
Type of seabed at the proposed site
Wind and current condition at the site as well as in its vicinity
Wave incidence
Required tranquillity in harbour areas
Littoral drift and sediment transport at the project site
Traffic volume
Availability of backup land for the terminal
Expansion in stages
Environmental and Social aspects

Based on the data collected on planning parameters and analysis of alternative layouts, development plan layout has been prepared for the proposed facilities at Honnavar. The barge/ vessel loading facilities is proposed near the mouth of Sharavati River. The facilities will be located at the northern end of the Kasarkod Sand spit. The berth is proposed parallel to the coastline (along the left bank of Sharawati river near the mouth). The berth is oriented in North south direction. The facilities proposed are as follows:

- Breakwater
- Turning circle, Approach channel
- Berthing area
- Stockyard

2.7.1 Barge/Vessel Loading Facility Layout

The salient features of barge/ vessel loading facility Layout are presented in **Table 2-5.**

Table 2-5: Salient Features of Barge/ Vessel Loading Facility

S. No	Parameter	Description
1.	Land Area	44 Ha (108 acres)
2.	Cargo handling capacity	**<u>Handling Capacity: 4.9 MTPA</u>** • Coal - 2.7 MTPA • Iron Ore – 1.0 MTPA • General cargo – 1.2 MTPA • Granite – 0.16 MTPA • Fertilizer – 0.2 MTPA • Molasses with Agro Products – 0.15 MTPA • Steel Products – 0.4 MTPA

S. No	Parameter	Description
		• Sugar – 0.29 MTPA
3.	Cargo Storage	• Iron Ore – 1.8 Ha • Coal – 7.0 Ha • General Cargo storage (Open) – 4.0 Ha • General Cargo storage (Closed) – 2.0 Ha
4.	Cargo handling equipment	Barge/Vessel loader, mobile harbor cranes, pay loaders
5.	Berthing facilities	Berth of length 440 m and width 30 m
6.	Length of Northern Breakwater	820 m
7.	Length of Southern Breakwater	865 m
8.	Navigation Facilities	Approach Channel (Inner/ Outer): Length: 1395/2280 m; Width: 100/100 m; Depth:(-) 10/10 m Turning Circle: Diameter: 250 m; depth: (-)10.0 m
9.	Dredging and Reclamation	• Capital dredge material: 3.9 MCM • Reclamation: 1 MCM of dredged material will be used • Remaining dredge material will be disposed at the identified disposal location, recommended through mathematical modelling studies at a distance of about 2.0 km to the north of port entrance channel. During periods of strong near shore currents (during peak wet season), it is suggested to dispose the sediment offshore at greater depths (>30 m).
10.	Navigational Aids	• Channel marker buoys; Fairway marker Buoy; Breakwater marker lights; Berth Corner Lights
11.	Connectivity	• Proposed Rail Corridor Connecting project site to Manki Railway station of about 8.5 km • New railway station in between Hosapattana between existing Honnavar RS and Manki RS is being proposed • Road Corridor connecting project site to NH 66 is proposed under Bharatmala Pariyojana.

A layout showing the planned barge/vessel loading facility is given as **Figures FD0201.**

2.7.2 Present status of onshore and offshore facilities

The proposed development comprises of the facilities like Berth & Approach trestle, and other onshore and offshore infrastructure and utilities. Two approach trestles at northern and southern side were proposed.

Mobilization and material procurement activities were initiated and following activities are fully/partially completed

- Approach Trestle on the southern side of 67.5m length and 15m width is completed. (Completed)
- For the approach trestle on the northern side concreting of 5 pilers out of 17 have been completed
- Internal earthen road work for construction materials transportation (Completed)
- Black topping of existing Kachha road for a length of 2.10 Km along the seashore of Kasarkod village (Partially Completed)

- Casting of tetrapod's (Partially completed)

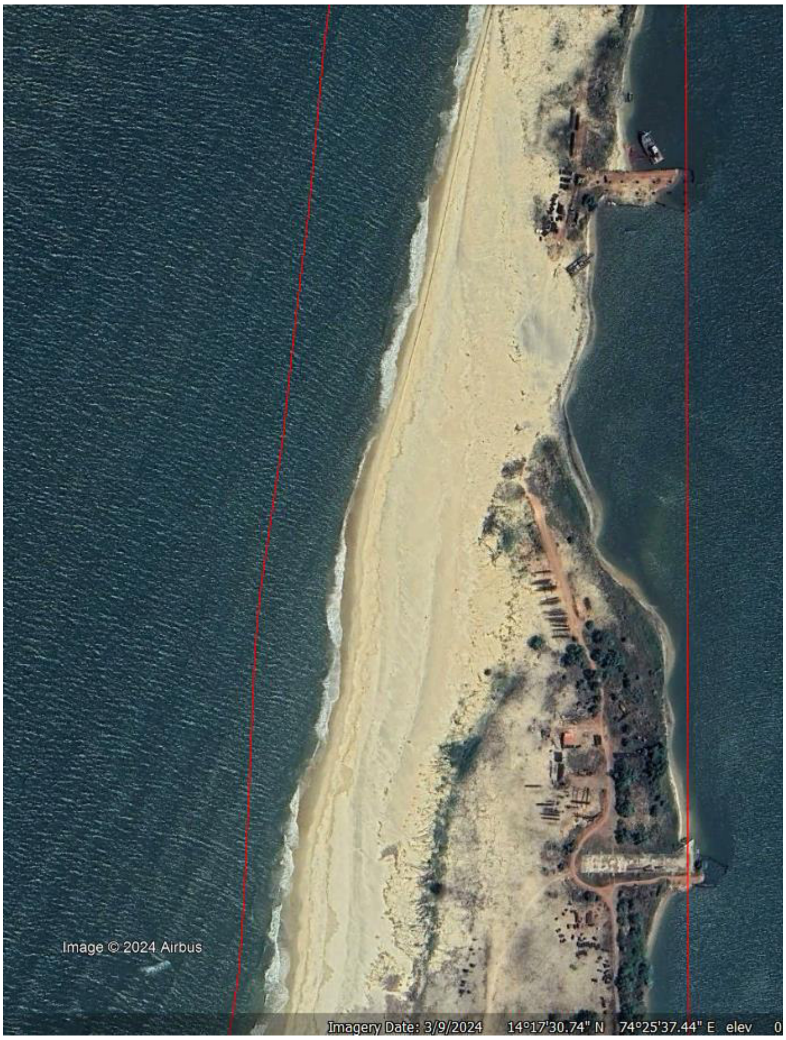


Figure 2-9: Construction activities at Port site

2.7.3 Cargo Handling Capacity

The cargo planned to be handled at Barge/ Vessel Loading Facility is provided in **Table 2-6.**

Table 2-6: Cargo Handling Capacity

S. No.	Commodity	Traffic (MTPA)
1.	Coal	2.70
2.	Iron Ore	1.00
	General Cargo	
3.	Granite	0.16
4.	Fertilizer	0.20
5.	Molasses with Agro Products	0.15
6.	Steel Products	0.40
7.	Sugar	0.29
8.	**Total**	**4.90**

2.7.4 Design General Cargo Mother Vessel for Honnavar

Considering the future scenario, vessel up to 40,000 – 1,00,000 DWT can also visit Honnavar Port. The Mother vessels calling at Honnavar port will predominantly be Panamax and Handymax vessels but may include some Capesize vessels also in future.

Anchorage occupancy (Lighterage)

Honnavar anchorage is at a distance of 5-9km from the shore, the no: of ships likely to visit the port having the depth of -20 to -30 MSL will not impose constraint on the operation of the port as the anchorage occupancy is 73%.

2.7.5 Design Vessel size and Dimension

The design vessel size considered for planning of facilities at Barge/vessel area is given in the **Table 2-7.**

Table 2-7: Design Barge/Vessel Size and Dimension

Type of Vessel/Barge	Design Vessel Size (T)	LOA (m)	Beam(m)	Draft (m)
Vessel	10,000-20,000 DWT	156	21	8.8
Barges	10,000	110	26	6.7

2.7.6 Berthing Facilities

The requirements for berths are worked out taking into consideration of throughput, parcel size, cargo handling rates, vessel size/parcel size, operational downtime, effective working hours per day and number of barges. Proposed barge/ vessel loading facility involves the development of Two (2) berths to handle various types of cargo.

- Two berths will accommodate 2 vessels or 4 barges of 10000-20,000 DWT Size
- Each berth with length 220 m will be provided with a width of 30 m.
- The dredged depth at the berthing area will be (-) 10.0 m CD.

2.7.7 Operation Downtime and Effective Working Hours

The effective working days are considered as 260 days considering the weather downtime including monsoon and public holidays. The cargo handling and barge servicing will be carried out 16 hours a day in two shifts. The productive cargo handling hours on an average in a day when a barge is at berth has been taken as 15 hours to account for shift changes and for any unplanned stoppages.

2.7.8 Breakwaters

To protect the approach channel from siltation and to maintain tranquillity in the harbour basin, two (2) parallel breakwaters are proposed with 500m c/c spacing are aligned in southern direction for Honnavar barge/vessel loading facility. The southern breakwater of length 865 m starts from shore and extends upto (-) 5 m contour. The top level of breakwater is maintained at (+) 6 m CD at head portion and tapered to (+) 4.3 m towards HTL. The northern breakwater of length 820 m and the top level of breakwater is maintained at (+) 6 m CD head portion and tapered to (+) 4.3 m towards HTL. Siltation pattern near the mouth of the harbour will be observed for 1 to 2 years and will be extended to (-6) m contour if required.

Quantity of quarry stones required is about 4.5 Million Tonnes, which will be transported by road from neighbouring districts of Udipi which is about 90 km from the site.

2.7.9 Approach Channel and Turning Circle

The channel alignment is oriented considering the following aspects:

To avoid cross winds and currents on the barges.
In a straight line as far as possible.

To reach the deep-water contours in shortest possible distance (this is to optimise the quantity of dredging).

The dimensions of the navigation channel to barge loading terminal are dependent on vessel size, the behaviour of vessel when sailing through the channel, maritime environmental conditions (winds, currents and waves) and channel bottom conditions. Channel design primarily involves the determination of the safe channel width and depth for the dimensions of design vessel. The estimated width and depth of the channel is presented in the **Table 2-8.**

Table 2-8: Width & Depth of Channel for Honnavar Barge/ Vessel Loading Facility

Description	Width in meters	Depth in meters	Length in meters
Outer Channel	100	10	1395
Inner Channel	100	10	2280

The diameter and depth of turning circle for safe manoeuvring of design vessel for the proposed barge loading facility is presented in **Table 2-9.**

Table 2-9: Diameter & Depth of Turning Circle for Honnavar Barge / Vessel Loading Facility

Description	Diameter in meters	Depth in meters
Turning Circle	250	(-) 10.0

2.7.10 Dredging and Disposal

2.7.10.1 Capital Dredging and Disposal

For a safe manoeuvring of the vessels through navigational channel, harbour basin and berths, dredging depths is required. The capital dredging quantity for development is estimated at 3.9 MCM. It is observed from the geotechnical investigations that the sea-bed soil profile varies from medium sand to clay, a major portion of which can be used for reclamation.

The entire landside facilities (viz., stockyard, operation buildings, etc.) will be developed in an area of 44 Ha. The entire area selected for the port back-up area is a low-lying land which will require reclamation upto (+) 4.30 m CD. It is proposed to use the 1.0 MCM of material (dredge spoil) for reclaiming the backup area and remaining material will be dumped at the identified disposal location, recommended through mathematical modelling studies at a distance of about 2.0 km to the north of port entrance channel. During periods of strong near shore currents (during peak wet season), it is suggested to dispose the sediment offshore at greater depths (>30 m).The dumping location or the disposal area is selected on the basis of the following parameters:

- Less adverse effect on the environment particularly on marine life
- Seabed levels (within the disposal area) should not get reduced, affecting thereby the depth requirements for safe navigation at all times.
- The material should not flow back to the channel and the dumping area should be along the direction of the most prevailing littoral current
- The lead distance should be the minimum possible to save on cost of disposal
- Least / minimum disturbance to the natural hydraulic regime/equilibrium

2.7.10.2 Maintenance Dredging and Disposal

The total maintenance dredging quantity is estimated to be around 10,300 m^3/year. The material collected will be dumped in the identified disposal ground. The details are discussed in **Chapter 4.**

2.7.11 Cargo Handling

The major commodities to be handled at Honnavar barge/vessel loading facility are iron ore, coal and other general cargo. The barge-shore cargo handling rate is generally selected on cost optimisation analysis, which takes into consideration reasonable barge time at berth, parcel size, the derived berth occupancy factor, relative cost of installing equipment of different rated capacity and barge time costs.

2.7.12 Cargo Handling Rate

The major commodities to be handled at Honnavar Port are iron ore, coal and general cargo. The barge-shore cargo handling rate is generally selected on cost optimisation analysis, which takes into consideration reasonable barge time at berth, parcel size, the derived berth occupancy factor, relative cost of installing equipment of different rated capacity and barge time costs. The cargo handling rate considered for planning purposes at both the barge berth location and mid sea is given in **Table 2-10.**

Table 2-10: Average Cargo Handling Rates

Cargo	Ship to Barge/ Barge to Berth	Equipment	Average Handling Rate (TPH)	No: of Equipment
Dry Bulk				
Coal - Import	Ship to Barge	Ship's own Gear	600	2
	Barge to Berth	Mobile Harbour crane	600	2
Iron Ore - Export	Barge to Berth	Loaders	720	2
	Ship to Barge	Ship's own Gear	600	2
General Cargo				
Sugar – Export	Barge to Berth	Mobile Harbour crane	480	2
	Barge to Ship	Ship's own Gear	300	2
Edible Oil and Molasses – Export	Barge to Berth	Pipe	840	2
	Barge to Ship	Ship's own Gear	600	2
Steel Products – Export	Barge to Berth	Mobile Harbour crane	480	2
	Barge to Ship	Ship's own Gear	300	2
Granite – Export	Barge to Berth	Mobile Harbour crane	480	2
	Barge to Ship	Ship's own Gear	480	2
Fertiliser – Import	Ship to Barge	Ship's own Gear	480	2
	Barge to Berth	Mobile Harbour crane	480	2

2.7.12.1 Cargo Handling Equipment

Selection of the equipment essentially depends on the through put. The iron ore will be transferred to barges from berth through barge loaders. The barge to shore transfer of coal will be using grab type mobile harbour crane. The type, capacity and number of equipments required for unloading and loading coal and iron ore are presented in **Table 2-11.**

Table 2-11: Summary of Cargo Handling Equipment

S. No.	Type	Cargo to be handled	Capacity	No. of equipment
At Mid sea				
1.	Barge unloader	Iron ore export	1200 TPH rated capacity	2
		Granite and Molasses export	960 TPH rated capacity	1
		Sugar and Steel export	600 TPH rated capacity	2
2.	Barge Loader	Coal import	1200 TPH rated capacity	1
		Fertiliser import	960 TPH rated capacity	1
At Berth				
3.	Mobile Harbour Crane	Coal import	1200 TPH	1
		Granite	960 TPH	1
		Molasses (Pipeline)	600 TPH	1
		Fertilizer	960 TPH	1
		Steel and sugar	960 TPH	1
4.	Loader	Iron ore export	1440 TPH	1
	Payloaders	Iron ore/coal		8

However, the proposed Barge/ vessel loading facility at Honnavar is planned to handle 2.7 MTPA of Coal and 1 MPTA of Iron ore. Such a small quantity of bulk cargo it is not feasible to adopt the mechanised handling and closed storage system. Therefore, an open storage system with compacted mud flooring is planned for the proposed facility to handle/store Coal and iron ore.

2.7.12.2 Cargo Transfer System

The iron ore will be brought from Bellary-Hospet region through trucks which will directly dump on the feeder of the barge loaders which will be transferred to barges. The additional iron ore will be stocked in the stockyard. Whenever the ore from the stockyard is to be loaded to barges, trucks can be used to transfer the iron ore to the berth and Molasses shall be transferred through pipelines.

The coal brought by the barges will be unloaded by mobile harbour crane. The conveying of coal from the platform to the stockyard will be done by trucks. Other cargo will also be handled in a similar way. The general cargoes will be stored in the space allotted for their storage.

2.7.13 Cargo Storage Area

The size of the storage areas have been worked out based on the criteria like the annual throughputs, design barge sizes, stowage factor, angle of repose, maximum and average stacking height, aisle space, reserve capacity factor, peaking factor, etc. Suitable space has been allocated in the backup areas in the form of open and covered storage facilities. The storage area requirements for various cargos are given in **Table 2-12.**

Table 2-12: Cargo Storage Area Requirements

S. No.	Cargo	Storage Area (in hectares)
1	Coal	7.00
2	Iron Ore	1.80
3	Other General Cargo (Closed, Open)	6.00
	Total	**14.80**

2.7.14 Shore Protection Works

The stockyard which will be developed by reclaiming the portion of the sand spit on the Kasarkod side. Since the area is directly exposed to sea, the interface of sea & land shall be protected by appropriate protection works.

As all port facilities are planned inside the river, area near the river mouth need to be protected from erosion. It is proposed to provide shore protection work on both sides of the river mouth and seaside of the storage area.

It is proposed to use geo-textile and rock boulders for protection of shore. The length of protection worked out is 3330 m. A typical cross-section of the protection work is presented in **Table 2-6.**

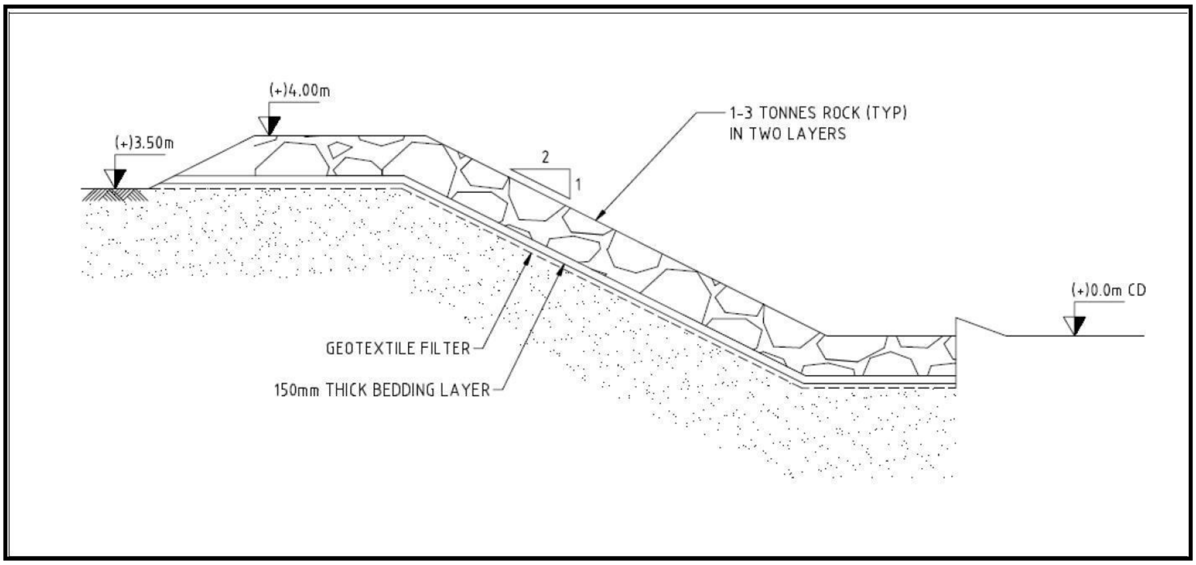


Figure 2-10: Typical Cross-section of Shore protection works

2.7.15 Fendering and Mooring Systems

Fenders are provided to absorb the berthing energy, which arise from the berthing of barge to avoid damage either to the structure or the vessel. Adequate numbers of fenders at adequate spacing has to be provided to avoid excessive load on the structure. Selection of fender will depend on the following parameters:

Vessel size
Berthing velocity
Absorption capacity of fender
Reaction force and deflection of fender
Disposition of fender

2.7.16 Navigational Aids

The proposed development involves creating an approach channel, turning circle and manoeuvring area. Approach channels must be delineated by appropriate navigational aids. Navigational aids proposed for Honnavar barge/ vessel loading facility are Channel Marking Buoys, Star board size (2 Nos.), Port-hand side buoys (4 Nos.), Fairway marker Buoy, Breakwater marker lights and Berth Corner Lights.

2.7.17 Port Crafts

To handle the proposed vessel sizes in the short-term development, two tugs of about 20 T bollard pull capacity with fire-fighting arrangements are proposed. Also, the tug would have pollution control equipment on board. It is also proposed to provide the one pilot launch for the Honnavar barge/vessel loading facility.

2.7.18 Existing Hinterland Connections and Road/Rail Network

Good road and rail connectivity is an essential requirement for the efficient functioning of any barge/ vessel loading facility. As far as Honnavar barge/ vessel loading facility is concerned, the main commodities proposed to be handled are iron ore and coal. The iron ore handled at Honnavar is expected to come mainly from Hospet-Bellary belt of Karnataka state. At present, 30% of the iron ore exported from this belt is taken to the respective port by means of road and the rest 70% via rail. Similarly, the coal being imported at Honnavar is taken to the respective destinations, mostly power plants, through road and rail.

2.7.19 Proposed Dedicated Rail/Road Corridor

Proposed road/rail connectivity to the barge/vessel loading facility is discussed below and shown in **Figure 2-11.**

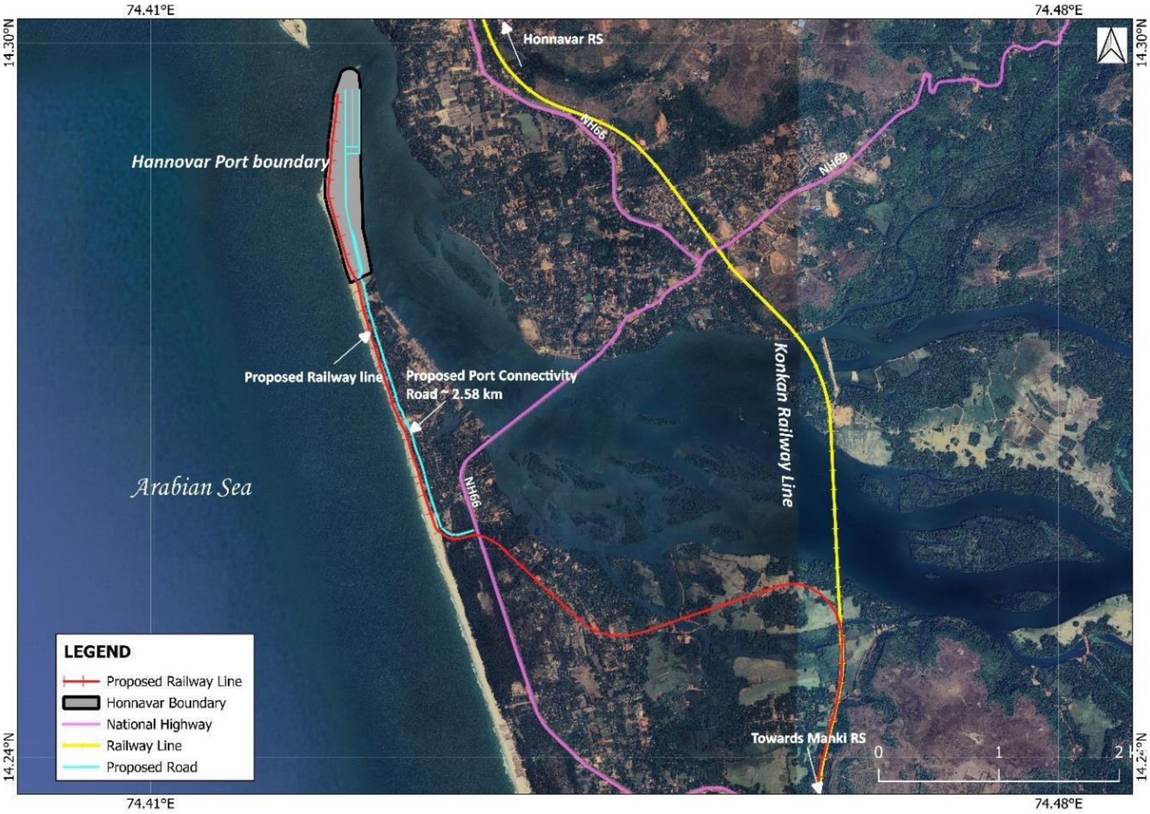


Figure 2-11: Proposed Road/Rail Connectivity to the Barge/ vessel loading facility

2.7.19.1 Road Connectivity

The site has good road connectivity. NH 66 passes through Honnavar towards East of project site at a distance of about 1 km. Connectivity Road from km 0.00 (Kasarkod side of Honnavar port) to Km 2.580 (towards NH 66) connecting Honnavar Port with NH - 66 at Km 195.986 and to improve NH – 66 from Km 195.00 to Km 197.00 as part of Bharatmala Pariyojana Phase I programme has been proposed. The proposed road will consists of 3 under passes and 1 box culvert as part of the development. Detail design shall be carried out during the implementation state.

Presently the site can be approached from a single lane black topped road that runs in continuation to NH 66 and then lies parallel to shoreline. The site can also be accessed from a Kachha road that was formed by the Minor Irrigation/Port department for construction of coastal protection works along the seashore of Kasarkod village. The road details are given in **Table 2-13.**

Table 2-13: Engineering features of the proposed road stretch

S. No.	Parameter	Existing	Proposed
1	Right of Way (RoW)	-	30.8m
2	Design Speed	-	100 km/hr
3	Major Bridges	-	0
4	Minor Bridges	-	0
5	Viaduct	-	0
6	No. of Railway Crossings	-	0
7	Railway Over Bridge (ROB)	-	0
8	Railway Under Bridge (RUB)	-	0
9	No. of Culverts	-	1
10	Pedestrian/Cattle Underpasses	-	2
11	Vehicular Underpasses/LVUPs	-	0
12	Fly Overs	-	0
13	Foot Over Bridges	-	0
14	Bus Bays/Bus shelter	-	4
15	Truck Lay Byes	0	
16	Rest Areas	-	-
17	Toll Plazas	-	0
18	Bypasses/Realignments	-	0

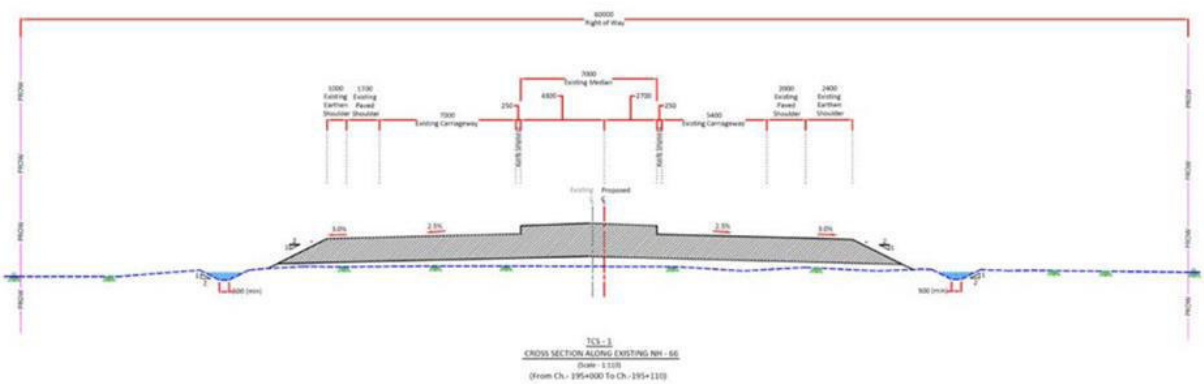
Table 2-14: Details of Existing ROW along NH-66

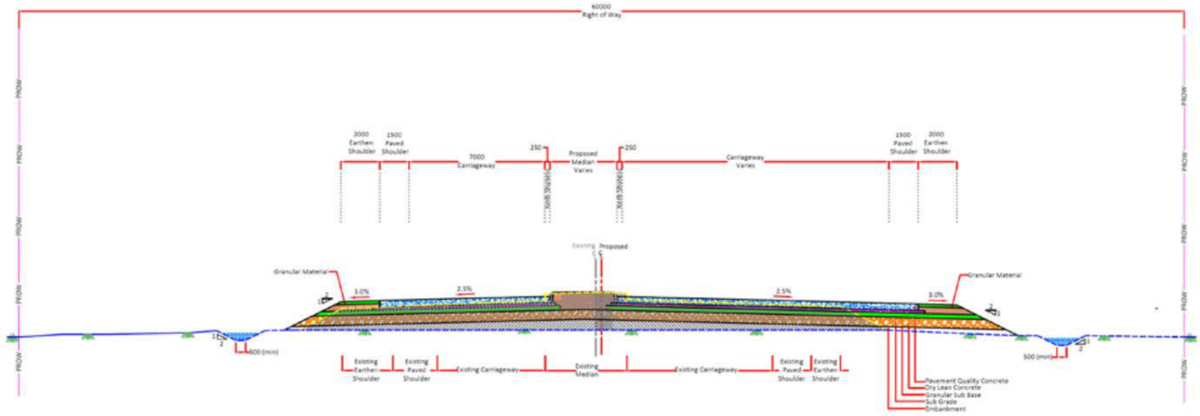
Sl. No.	Existing Chainage (km)		Existing ROW (In meters)
	From	To	
1	195+000	195+530	60
2	195+530	195+610	45
3	195+610	195+700	52
4	195+700	195+880	55
5	195+880	197+000	52.5

Table 2-15: Details of Proposed ROW connecting Honnavar Port to NH-66

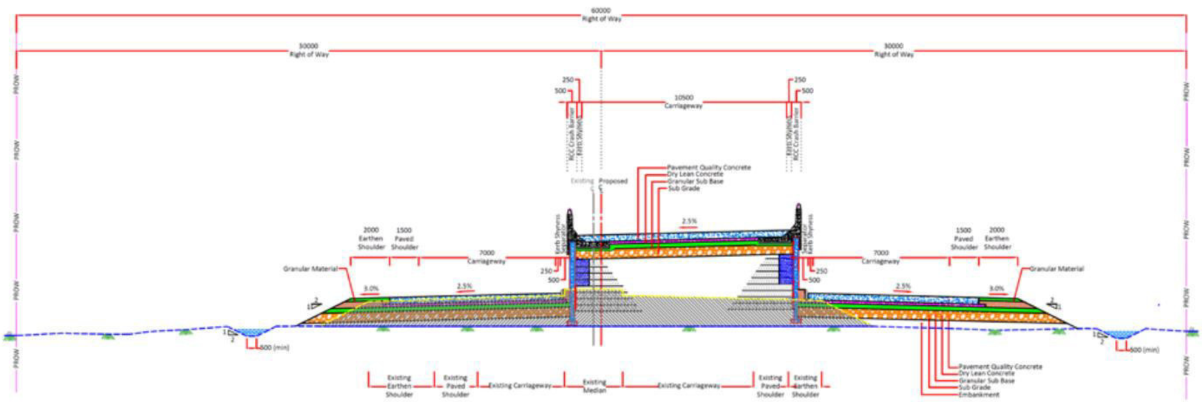
Sl. No.	Existing Chainage (km)		Existing ROW (In meters)
	From	To	
1	0.00	0.400	20.6
2	0.400	2.100	30.8
3	2.100	2.580	20.6

The project highway shall be constructed with 4 lane configurations. Typical cross sections are shown below.

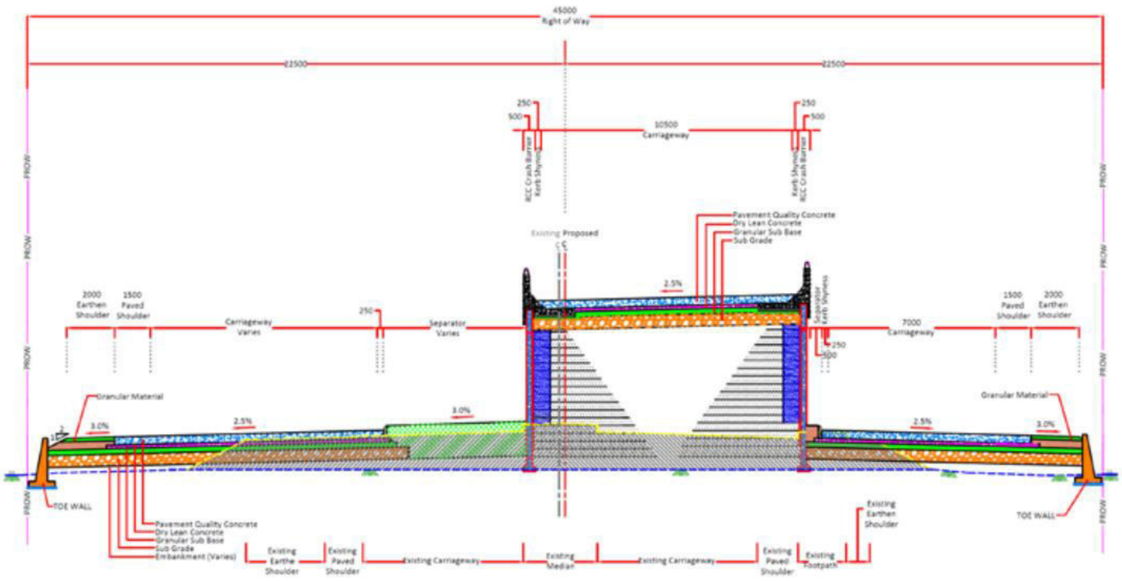




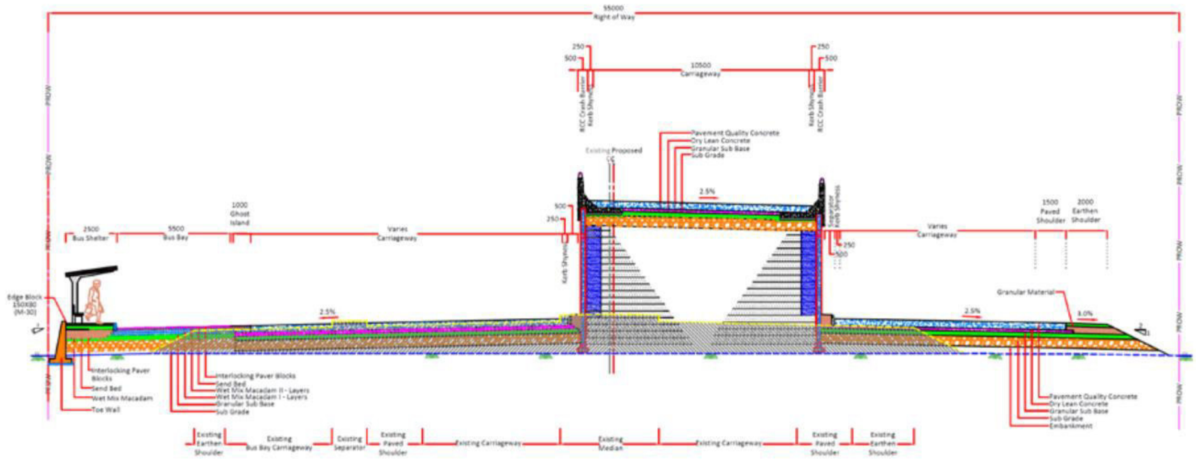
TCS - 2
(Scale - 1:110)
(From Ch.- 195+110 To Ch.-195+200)



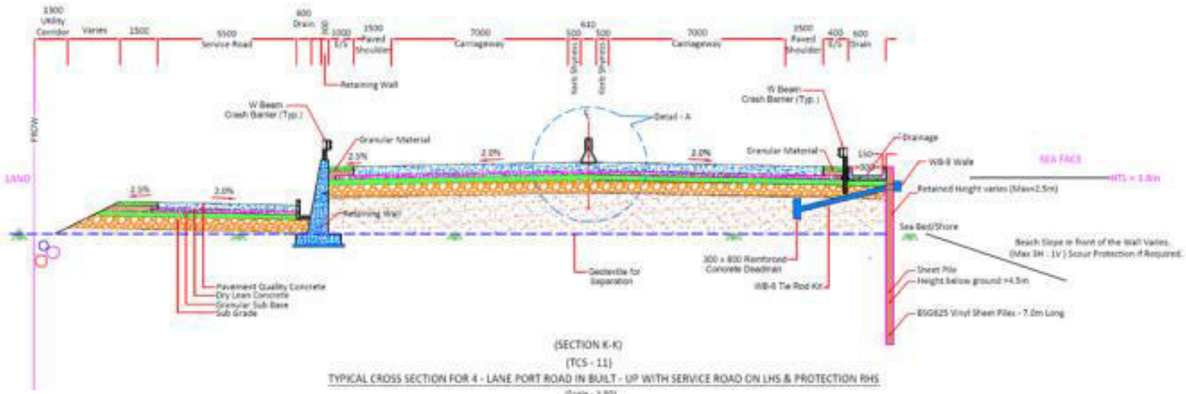
TCS - 3
(Scale - 1:110)
(From Ch.- 195+200 To Ch.-195+325)



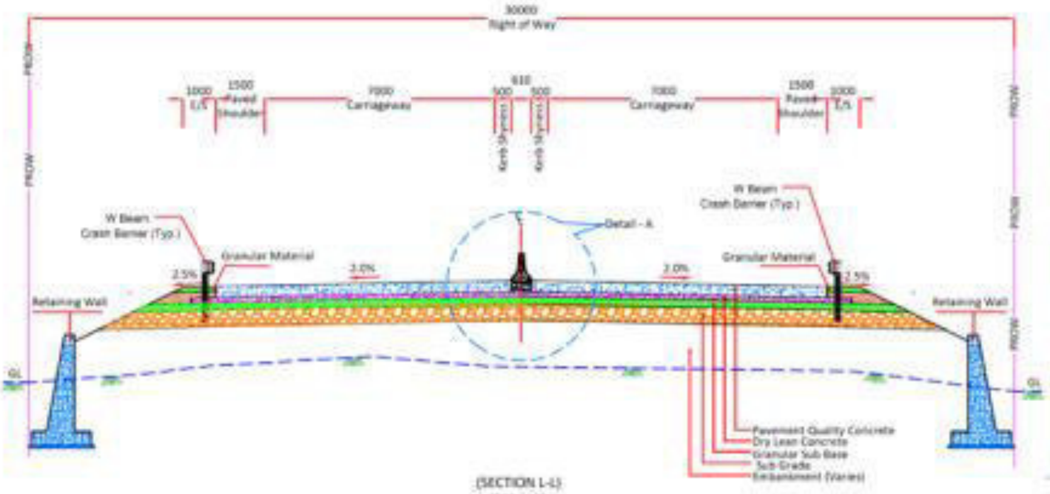
TCS - 4
(Scale - 1:110)
(From Ch.- 195+325 To Ch.-195+600)



TCS - 5
(Scale - 1:110)
(From Ch.- 195+600 To Ch.-195+835)



(SECTION K-K)
(TCS - 11)
TYPICAL CROSS SECTION FOR 4 - LANE PORT ROAD IN BUILT - UP WITH SERVICE ROAD ON LHS & PROTECTION RHS
(Scale - 1:80)
(From Ch.- 0+400 To Ch.-2+100)



(SECTION L-L)
(TCS - 12)
TYPICAL CROSS SECTION FOR 4 - LANE PORT APPROACH OF LVUP WITH RCC RETAINING WALL
(Scale - 1:80)
(From Ch.- 2+100 To Ch.- 2+490)
* ROW from - Ch.- 2+278 To Ch.- 2+580 is 35m

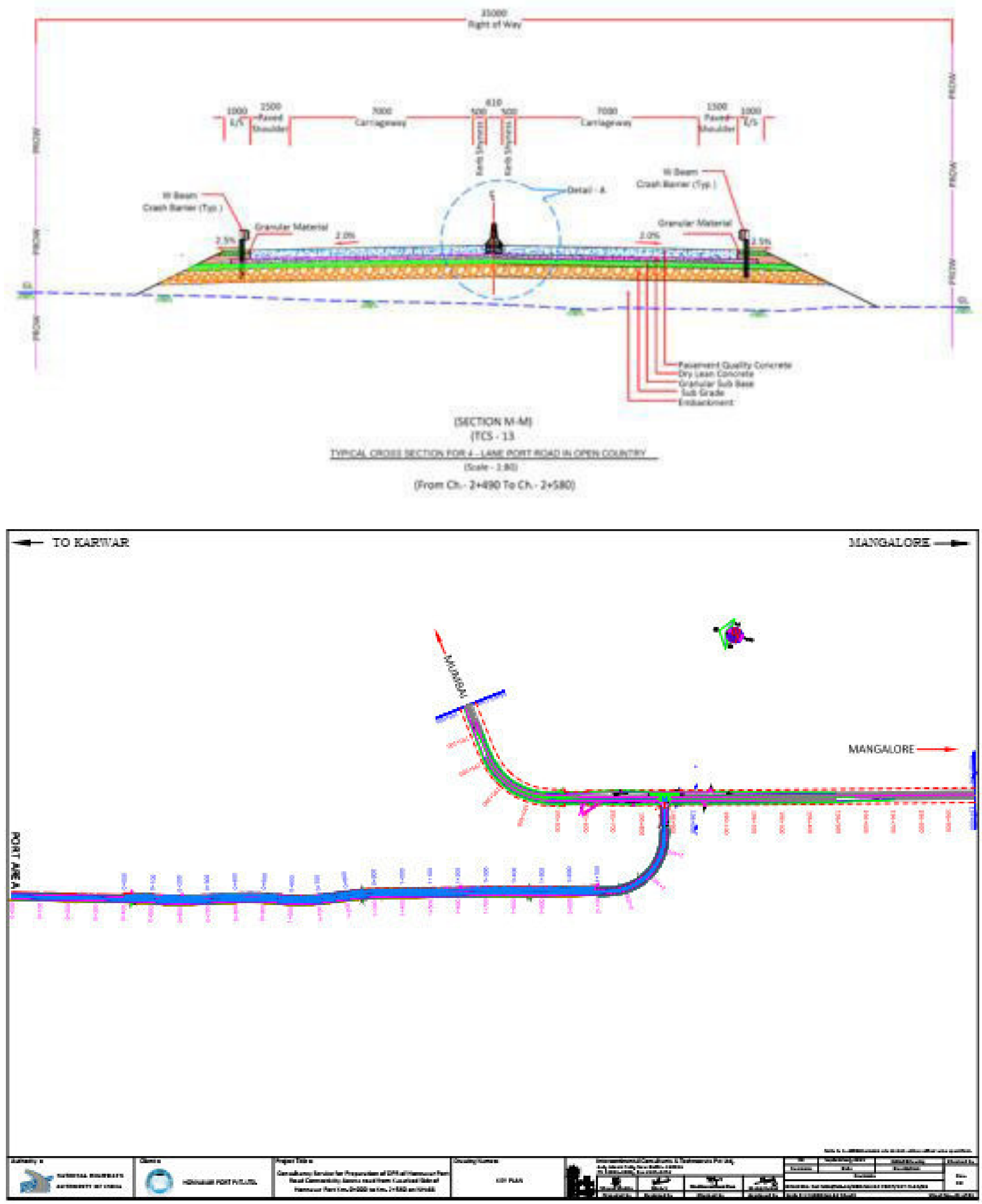


Figure 2-12: Typical cross sections and chainage of Proposed Road

2.7.19.2 Rail Connectivity

The site can be easily accessed through Konkan railway (Connecting Kerala with Mumbai). The barge/vessel loading facility proposed at Honnavar is at a distance of 5.0 km from Honnavar railway station and 14 km from Manki railway station.

The Konkan Railway Corporation Ltd. (KRCL) has prepared a feasibility study Report in October 2018. The rail connectivity to the Port site is proposed to be provided with Broad gauge Single line from a new railway station proposed at Hosannapattana under section of Konkan Railway broad gauge line, which is 8.5 km long.

At Honnavar port following cargo is planned to be handled through rail. The number of rakes required to be handled in the proposed siding has been assessed broadly as 2 rake per day for the proposed cargo handling capacity.

During operation phase project rakes will be handled using semi-mechanized operation hydraulic excavators. Provisions shall be given to convert rail handling facility using completely mechanized operation in future. Keeping in mind the above requirements proposed layout will have following facilities:

Two Loading/Unloading lines in port area with CSR 750 Meters.

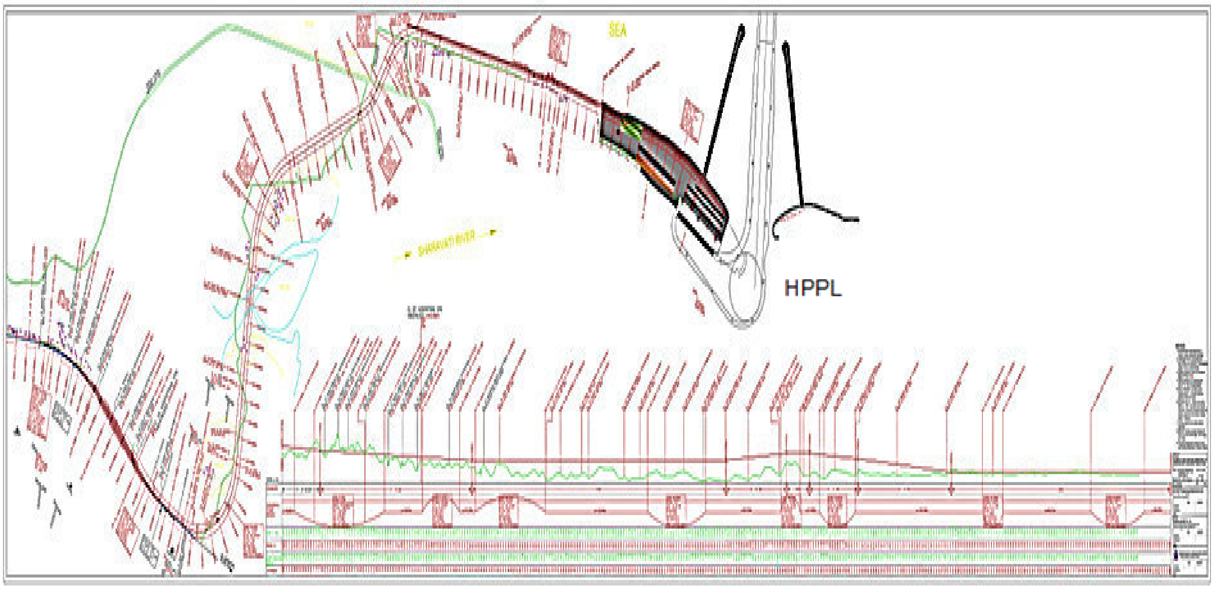
- One Engine escape line.
- One brake Van siding (BV) of CSR 70 Meters.
- One Digital Motion Weigh Bridge.
- One office close to Weigh Bridge for Port officials as well as for Railway officials.

Proposed Facilities at Hosapattana Station

For the level of traffic projected and for the number of rakes to be dealt at the proposed terminal the following layout and track standards are proposed keeping in mind the standards of construction of Indian Railways for the BG system for the track and allied structures:

- Loop 1 of 750 m CSR on East side with Platform (650*10 m)
- Future UP Main line
- Loop 2 on West side to serve rail connectivity to port with Platform (650*10 m)
- Station Building with Relay Rooms, battery rooms etc.
- Isolations, dead ends wherever required

Proposed rail alignment is shown in **Figure 2-13**.



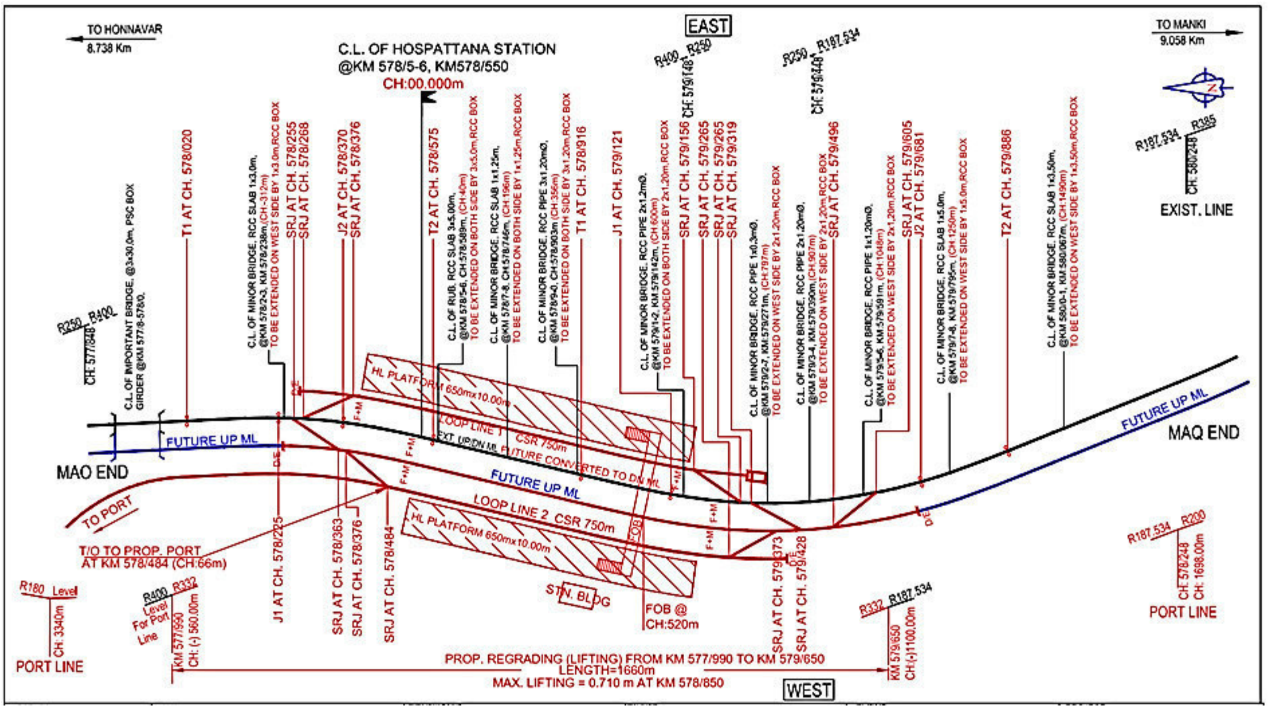


Figure 2-13: Proposed Rail Alignment

2.7.19.3 Airport & Seaport – Harbour

The nearest Airports are at Mangalore and Goa which is about 150 km and 220 km respectively and the nearest seaport is at Karwar which is about 90 km from the project site.

2.8 Green Areas and Greenbelt Development

An area of about ~3.10 Ha is proposed to be developed as greenbelt. Greenbelt will be developed at stockyards, administration building and along the road areas. The tree species to be used for the green belt development will be in line with the local ecology (indigenous species). Greenbelt layout is given as **Figure FD0202.**

2.9 Utilities and Services

2.9.1 Water Supply

Water is required at the Honnavar barge/vessel loading facility for the following activities:

- Supply to barges
- Supply to facility staff
- Miscellaneous purposes
- Dust Suppression and firefighting purposes
- Green Belt Development

Water requirement during the construction is expected to be around 15m^3/day. Water demand during operational phase of barge/ vessel loading facility is estimated as 7m^3/day.

The break-up of the demand for each of the activity is presented in **Table 2-16.**

Table 2-16: Break-up of Water Requirement

S. No.	Activity	Water Requirement (m^3/day)
1.	Supply to barges	3
2.	Supply to barge loading facility staff and users	2

S. No.	Activity	Water Requirement (m^3/day)
3.	Miscellaneous	2
	Total	**7**

The water requirement will be met from Karnataka Rural water supply and sanitation agency which includes supply to Barge/vessels, staff and users. In addition to that water required for dust suppression system and fire fighting will be sourced from Sharavati River.

2.9.2 Power Supply

The power supply is required for the following barge/vessel loading facility operations

- Lighting of the berth and storage yard
- Fire Fighting Equipment
- Operation Building
- Substation Lighting
- Miscellaneous

Power requirement during construction phase is expected to be around 1 MVA. The power demand is estimated at 1 MVA during operation. Construction phase power requirement will be met from DG sets and operation phase power will be drawn from Substation located at Honnavar (~2 km).

2.9.3 Buildings

Various buildings envisaged in the proposed barrage/vessel loading facility are as follows:

- Administrative buildings including the administrative office and officer's amenities, operational buildings / offices and the office space for major facility users.
- Maintenance buildings comprising a workshop, functional workstations and fire station.
- Substations to provide distribution of power.
- Navigational control centre, plant operational buildings, customs and security buildings, traffic offices, medical centre and amenity buildings / conveniences.

2.9.4 Firefighting Facilities

Firefighting system will be provided to both control and extinguish fires. It is proposed to install Fire Hydrant System, which will be designed to give adequate fire protection for the facility based on Indian Standards or equivalent and will conform to provisions of Tariff Advisory Committee's Fire Protection Manual. Fire hydrant system is provided for the following areas in the barge/ vessel loading facility:

- Berth areas
- Coal Stockpile area
- Main substation
- Control room
- Fuel depot area
- Generator powerhouse
- Main administration office
- Workshop Areas
- Operation building

The fire hydrant system is designed to ensure that adequate quantity of water is available at all times, at all areas of the facility where a potential fire hazard exists. The hydrant service shall consist of two or more interconnected ring mains to cover the facility, each with its individual pump, located in a common pump house. Adequate arrangement with jockey pumps, pressure switches, etc., shall be provided to maintain the required pressure in the hydrant system.

Commonly used fire-fighting agents are water, foam, carbon dioxide and powder. In most of the cases when water is used as the fire-fighting agent, the intake mains should be below water at any point of time and protected from damages. A fire station will be provided for attending to all calls which will house required mobile fire tenders. One fire tender will be provided with snorkel attachment.

2.9.5 Pollution Control Aspects

2.9.5.1 Dust Suppression System

Dust suppression equipment will be provided for efficient control of dust pollution on environment during storage and handling of coking Coal and Iron ore at berth and stockyard. An efficient dust suppression system will contain dust particles before it is airborne.

A common system consisting of suitable pump, storage tank, nozzles have been proposed for efficient dust control system. Dust control is envisaged at following locations:

- Barge/ vessel loading /unloading area
- Stockyards

Water sprinkling system at high pressure with swivelling type nozzles will be installed to cover entire stockpile. Nozzles will be installed on pipes at different levels from ground. Nozzles will be installed along stockpile at regular intervals to cover stockpile height and width.

2.9.5.2 Wastewater Management

The wastewater and sewage generated during construction at site and at labour camp will be collected in holding tank and periodically transferred to nearby Treatment Plant. During operation, the sewerage system will be provided to collect the sewage from Barge/ vessel loading facility administration building, canteen and operation buildings and it will be collected in septic tank followed by soak pits. The cargo storage area will be provided with an extensive drainage and treatment system so that the contaminated water from the stockyard area does not flow directly into the natural water bodies or into the groundwater system. Drainage pits will be provided in the workshop areas, which will be connected to an oily wastewater tank. Oily wastewater if any will be collected and will be treated (if required) to meet the discharge standards.

Sewage Treatment Plant

Sewage generation of ~2.3KLD is envisaged and STP of Advanced SMART SBR sewage treatment Technology shall be proposed designed to treat sewage water with influent characteristics BOD – 400mg/l and COD – 800mg/l. STP shall be designed to treat effluent cum sewage generated having the following characteristics.

Influent Sewage Parameters

- BOD 400 mg/l
- COD 800 mg/l
- SS 300 mg/l
- Oil and Grease 10 mg/l

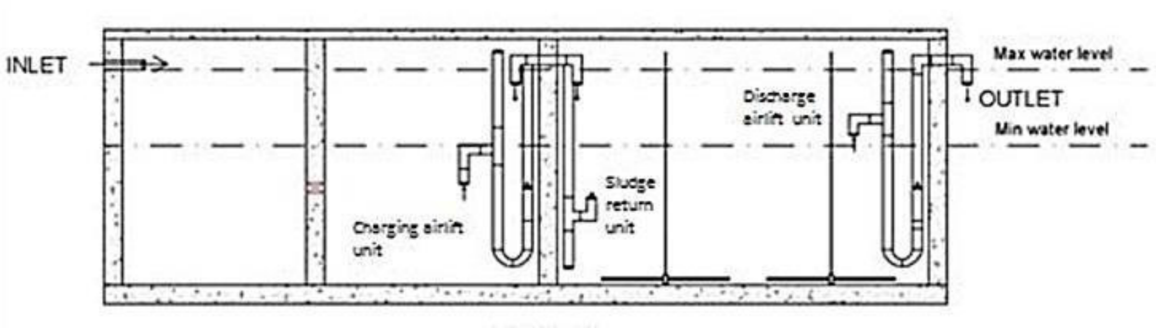
Expected Treated Sewage Characteristics

- PH - 6.5 – 8.5
- BOD < 10 mg/l
- COD l < 50 mg/l
- TSS l < 10 mg/l
- Turbidity l > 2mg/l

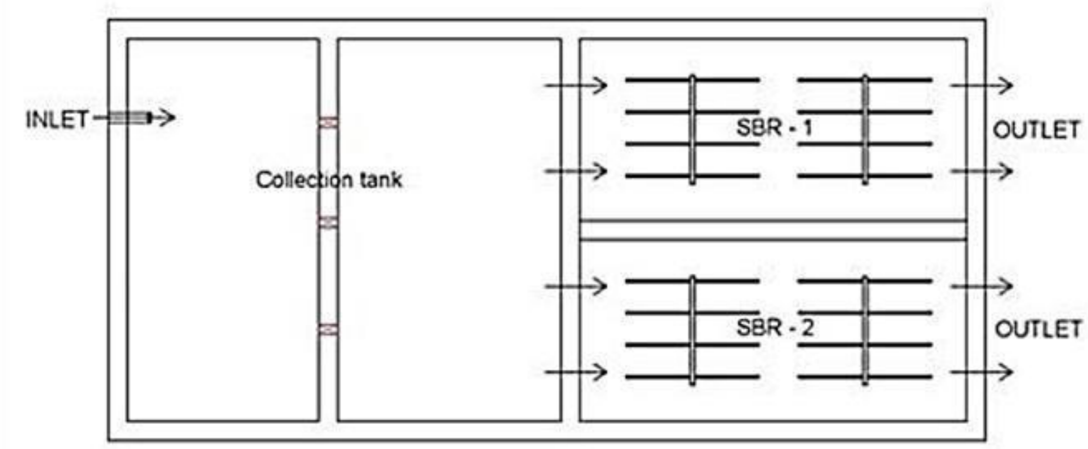
The sewage treatment plant comprises of the tanks in civil works with each of the following tank having its role in treatment,

- Raw water inlet/Collection tank/ Sludge storage tank
- SBR tank
- Treated water tank (optional)
- Tertiary treated water tank (Optional)

The tanks required for the EcoSBR plants are constructed on-site as per design in concrete with a rectangular shape. The below diagram illustrates a small EcoSBR series collection tanks and SBR reactor.



SECTION



PLAN

Treated wastewater from STP shall be used for dust suppression and Greenbelt development.

Leachate Collection and Treatment: To prevent water and soil pollution the water used for dust suppression in the stockyards will get absorbed to the extent of the property of the material. No runoff is expected during normal operations since the use of specialised (atomised) sprinklers. Excess water if any, will be collected through drainage.

During rainy season the rainwater over vast stockyard area will also to be collected. For this purpose, the stockyard ground level will be provided with a slope in each of each stockyard from the centre to the sides. For collecting water draining out of the stockyards RCC toe drains will be constructed along the length of each row and interconnected to finally lead it to a settlement pond. Settling ponds will be constructed out of concrete.

Lime will be added in the settling pond to neutralise the heavy metal, if any in the runoff from the stockyard. The settled materials will be retrieved and sent back to respective cargo stockyard. The supernatant water will be reused for dust suppression. The schematic of RCC Drain system and settling pond is given in **Figure 2-14**.

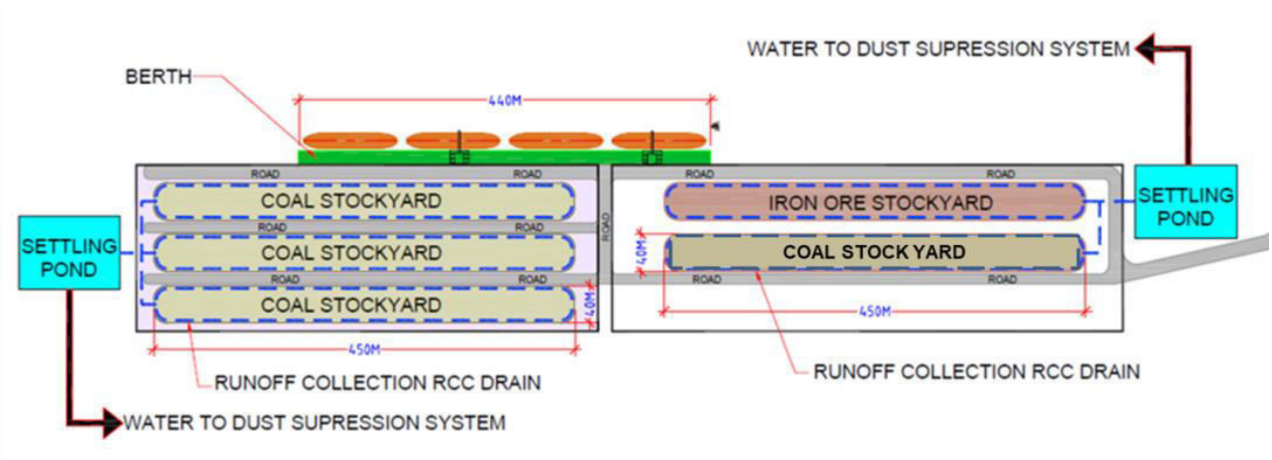


Figure 2-14: Typical RCC Drain along the Stockyard and Settling Pond

2.9.5.3 Rainwater harvesting System

Rainwater collected from roof of buildings will be channelized through rainwater down comers and routed to garland drain around the buildings. These garland drains are connected to the plant storm water drainage network system all around the proposed barge/ vessel loading facility area. Recharge wells will be located at strategic locations within the site and will be interconnected to the storm water drain network system.

2.9.5.4 Solid Waste Management System

Solid waste from the utilities such as canteen shall be segregated as biodegradable and non-biodegradable waste and collected separately by providing bins at respective places. The collected biodegradable waste shall be subjected to composting and the compost will be used as manure for the development of green belt within the facility. The non-biodegradable waste like plastic shall be disposed off to approved vendors of KSPCB/CPCB in a scientific manner.

2.10 Coastal Zone Regulation Compatibility

National Centre for Sustainable Coastal Management (NCSCM), Chennai has carried out demarcation of High Tide Line (HTL), Low Tide Line (LTL) and Coastal Regulation Zone (CRZ) classification of the project site. Based on the survey, CRZ set back lines were demarcated and the project layout was superimposed on CRZ map.

The Port facilities fall in CRZ-IB, CRZ III NDZ, CRZ-IV A and CRZ-IV B as per the approved CZMP 2019 and as per the NCSCM. The proposed activities are permissible as per CRZ Notification 2019, amended till date, as it requires waterfront and foreshore facilities as given in **Table 2-17.**

Table 2-17: CRZ Compatibility

S. No	Proposed Development	CRZ area Classification	Permissibility	Applicable Clause
1.	Fuel Station, Entry gate, Internal Road, canteen, operation building, vehicle parking, substation	CRZ-III NDZ	Permissible	2.3.3
2.	Cargo storage	CRZ-IB, CRZ-III NDZ, CRZ-IVB	Permissible	5.1.2 (ii), 5.1.2 (vi), 5.1.2 (xiv), 5.3 (i), 2.3.3, 5.4(vi), 5.4 (xii)
3.	Approach berth	CRZ-IB, CRZ-III NDZ, CRZ-IV B	Permissible	5.1.2 (ii), 5.1.2 (xiv), 5.3 (i), 2.3.3, 5.4(iii), 5.4 (xii)
4.	Breakwaters	CRZ-IB, CRZ-III NDZ, CRZ-IV A	Permissible	5.1.2 (i)(a), 5.1.2 (ii), 5.3 (i), 2.3.3, 5.4(iii)
5.	Approach Channel	CRZ-IV A	Permissible	5.4 (iii), 5.4 (xi)
6.	Shore protection	CRZ-IB, CRZ-III NDZ	Permissible	5.1.2 (ii), 5.3 (i), 2.3.3
7.	External Port Connectivity (Road)	CRZ-IA, CRZ-III NDZ, CRZ-III 200m to 500m HTL	Permissible	5.1.2 (i)(c), 2.3.3, 5.3 (i),

The port layout on approved CZMP is shown below**.** HTL/LTL/CRZ demarcation map and prepared by NCSCM is attached as **Attachment 1.**

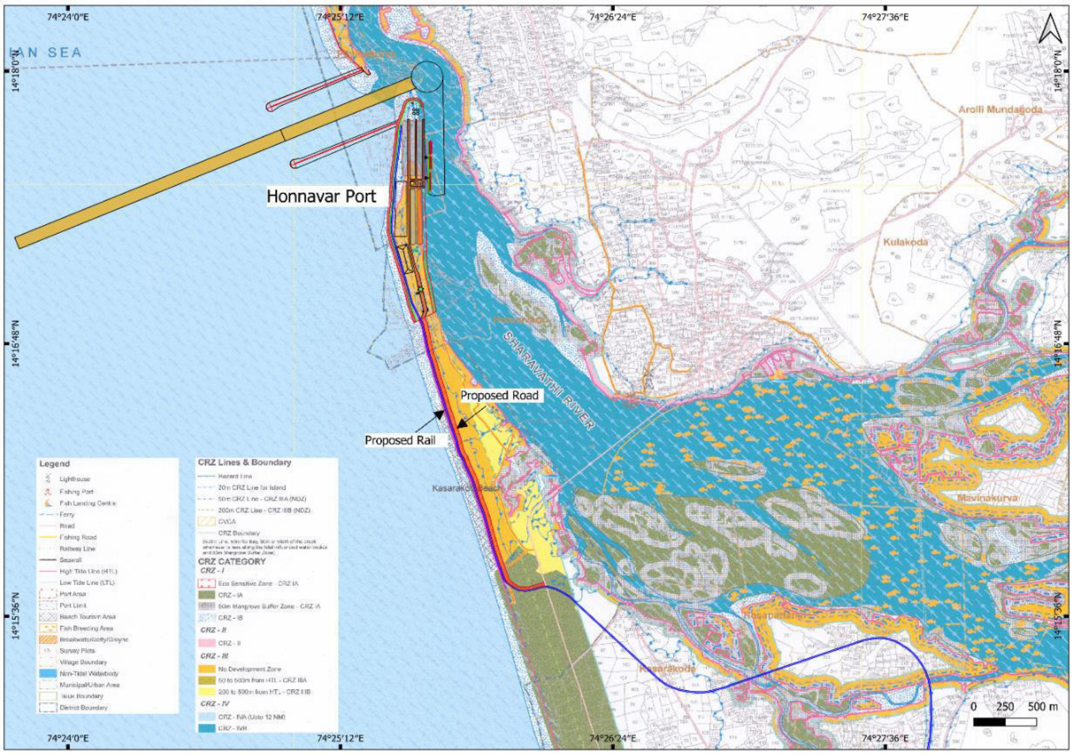


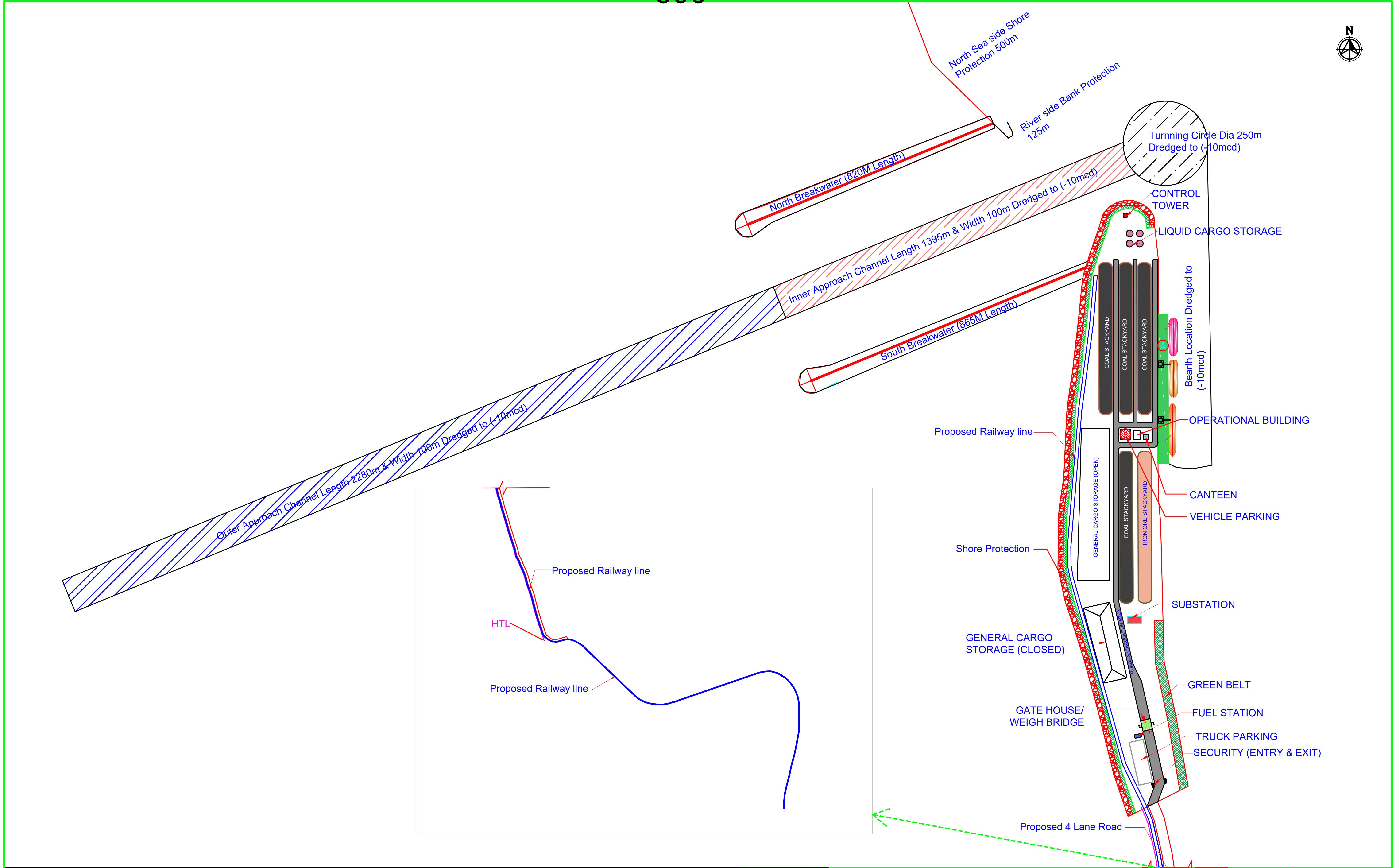
Figure 2-15: Port layout on Approved CZMP

2.11 Project Cost

The capital cost estimate for development proposed barge / vessel loading facility is estimated at **607.03 Crores**.

2.12 Project Implementation Schedule

It is aimed at to achieve commissioning of the Barge/ vessel loading facility within a period of 36 months from construction start / Financial Closure.



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TITLE: LAYOUT OF PROPOSED FACILITY	DATE: 27.08.2024
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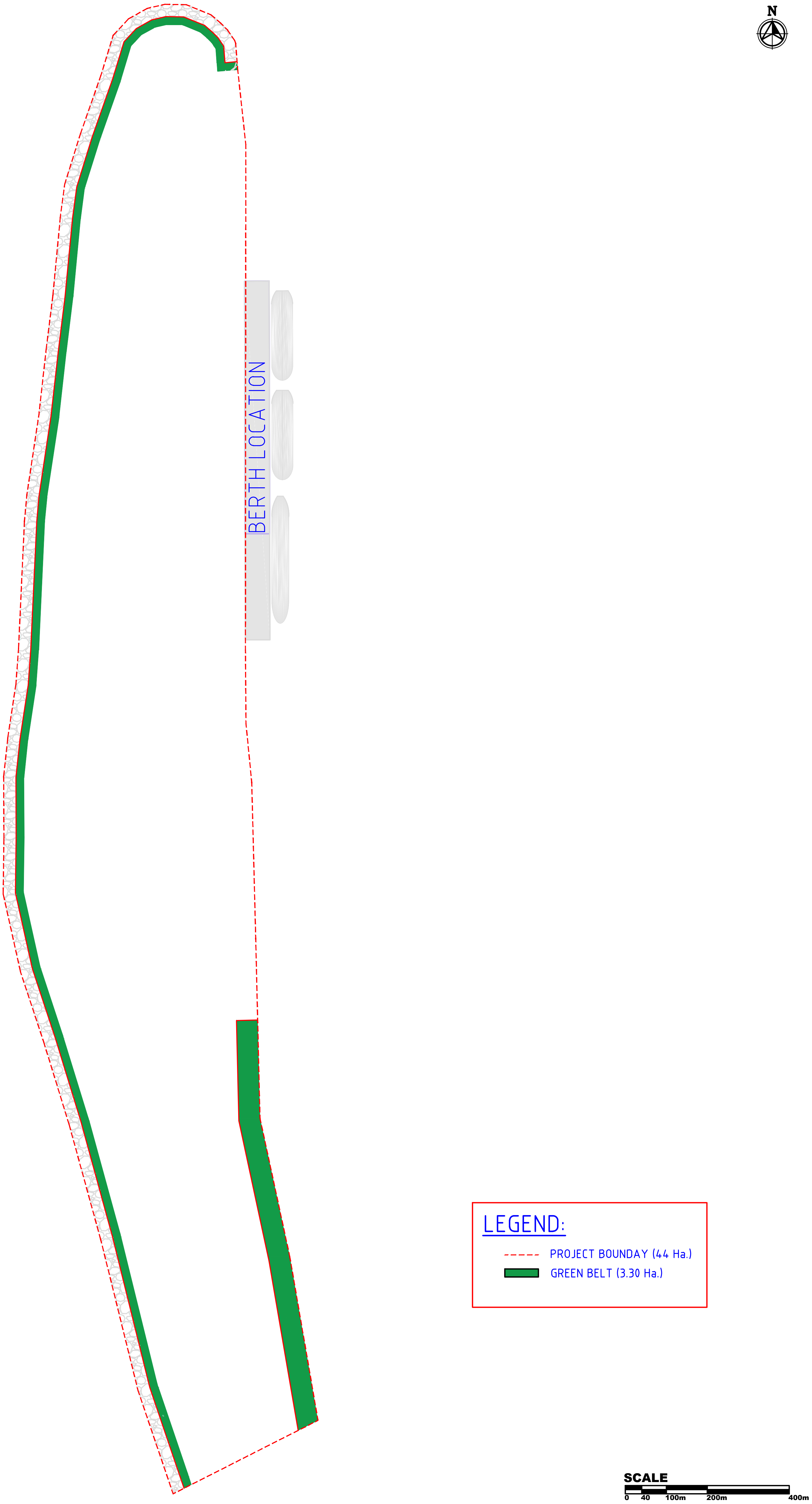

PROJECT: ENVIRONMENT AND CRZ CLEARANCE FOR DEVELOPMENT OF BARGE/VESSEL LOADING FACILITY FOR 4.9 MTPA AT HONNAVAR, UTTARA KANNDA	PROJECT NO: C1241301	
TITLE: PROPOSED GREEN BELT DEVELOPMENT PLAN	DATE: 27.08.2024	
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Chapter 3
Description of Environment

Chapter 3 Description of Environment

3.0 General

The baseline/existing environmental conditions in the study area/Project Influence Area (PIA) are established based on field surveys, investigations and review of data collected from various secondary sources. The baseline environmental conditions form a benchmark to evaluate the potential impacts of the proposed port development.

Proposed development falls in the Project Influenced Area (PIA) district of Uttara Kannada. Discussion of the salient features of PIA district and existing baseline conditions are discussed in this chapter of the EIA Report.

3.1 Study Area and Study Period

Project Influence Area/Study Area: As described in **Chapter 1**, an area within 15 km radius, with the barge/vessel loading facility site as boundary has been earmarked for the study as the PIA/study area. The core area is the project site. The study area is of 5 km radius for primary data generation.

Description of Project Influence Area: The proposed Honnavar Barge/vessel loading facility is located near the mouth of Sharavati River in Kasarkod Tonka Village, Uttara Kannada District, Karnataka.

Study Period: The terrestrial baseline environmental data was generated for one season (12 Weeks) i.e., Winter Season (October to December 2023) and marine baseline data was carried out during pre-monsoon (April 2024).

3.1.1 Environmentally/Ecologically Sensitive Areas

The environmental sensitive areas covering an aerial distance of 15 km radius from the boundary of the Port is given in **Table 3-1** and **Figure 3-1.**

Table 3-1: Environmentally Sensitive Areas within 15 km from centre of the Port

S. No.	Areas	Name/Identity	Aerial distance (within 15 km)
1.	Areas protected under international conventions, national or local legislation for their ecological, landscape, cultural or other related value	Mangroves in Sharavati river	~0.3 km, E
		Mangrove in Sharavati River	~0.41 km, E
		Mangroves near Pavin kurve	~0.92 km, N
		Eco Blue Flag Beach near Kasarkod	~2.3km
		RF near Pavinkurve	~2.3km N
		RF near Kasarkod	~2 km, S
		RF near Hebbankere	~8 km, NE
		RF near Talamakki	~14.4km, S
		Mixed Forest (MF) Basavarajadurg Island	~2,76 km, NW
		MF near Karki	~1.36 km, E
		MF near Shikkar	~2.88 km, NE
		MF near Nagare	~4.94 km, E
		MF near Beroli	~6.27 km, E
		MF near Mavinkurve	~7.1 km, SE
		MF near Apsarakonda	~5.21 km, SE
		MF near Holegadde	~7.86 km, N
		MF near Hosapattana	~5.24 km, SE
		MF near Navilgon	~7.72 km, N
		MF near Chandavar	~10.3 km, NE

S. No.	Areas	Name/Identity	Aerial distance (within 15 km)
		MF near Jalavalli	~10.5 km, SE
		MF near Kumta	~12.2 km, N
2.	Areas which are important or sensitive for ecological reasons - Wetlands, watercourses or other water bodies, coastal zone, biospheres, mountains, forests	Sharavati River	Adjacent
		Badgani River	~ 0.98 km, N
		Akshumi Thirth (Waterbody)	~2.25 km, E
		Mangroves in Sharavati river	~0.3 km, E
		Mangrove in Sharavati River	~0.41 km, E
		Mangroves near Pavin kurve	~0.92 km, N
		Eco Blue Flag Beach near Kasarkod	~2.3km
		RF near Pavinkurve	~2.3km N
		RF near Kasarkod	~2 km, S
		RF near Hebbankere	~8 km, NE
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		MF near Mavinkurve	~7.1 km, SE
		MF near Apsarakonda	~5.21 km, SE
		MF near Holegadde	~7.86 km, N
		MF near Hosapattana	~5.24 km, SE
		MF near Navilgon	~7.72 km, N
		MF near Chandavar	~10.3 km, NE
		MF near Jalavalli	~10.5 km, SE
		MF near Kumta	~12.2 km, N
3.	Areas used by protected, important or sensitive species of flora or fauna for breeding, nesting, foraging, resting, over wintering, migration	Mangroves in Sharavati river	~0.3 km, E
		Mangrove in Sharavati River	~0.41 km ,E
		Mangroves near Pavin kurve	~0.92 km, N
4.	Inland, coastal, marine or underground waters	Arabian sea	Adjoining West.
		Sharavati River	Proposed Project is near River mouth of Sharavati.
		Badgani river	~0.9 km, N
		Akshumi Thrith	~2.52 km, E
5.	State, National boundaries	No	-
6.	Routes or facilities used by the public for access to recreation or other tourist/pilgrim areas	NH 17/NH66	~0.98 km, E
		NH 69	~2.7 km, E
		Konkan railway line connecting Kerala and Maharashtra	~2.2 km, NE
7.	Defence Installations	Nil	Nil
8.	Densely populated or built-up area	Honnavar	~1.5 km, E
		Karki	~1.5 km, NE
		Apsarkonda	~5.5 km, S
		Manki	~12.5 km, S
		Kumta	~14.3 km, N
9.	Areas occupied by sensitive man-made land uses (hospitals, schools, places of worship, community facilities)	Hospitals near Honnavar	~ 1.5 km, E
		Schools near Honnavar	
10.	Areas containing important, high quality or scarce resources, (ground water resources, surface resources, forestry, agriculture, fisheries, tourism, minerals)	Eco Blue Flag Beach	~ 2.3 km, S
		Laterite Quarries	~2 km, NE
11.	Areas already subjected to pollution or environmental damage. *(those where*	Nil	Nil

S. No.	Areas	Name/Identity	Aerial distance (within 15 km)
	existing legal environmental standards are exceeded)		
12.	Areas susceptible to natural hazard which could cause the project to present environmental problems, (*earthquakes, subsidence, landslides, erosion or extreme or adverse climatic conditions*)	The project falls in Seismic Zone III (Moderate damage zone risk).	-

Figure 3-1: Environmental Sensitive Areas in the Study Area

3.2 Physical Conditions

A major part of the district is covered by hilly areas belonging to Sahyadri hill ranges, except for the narrow coastal strip on western side and plain table land areas on eastern most parts of the district occupying parts of Mundgod and Halyal taluks. The land mass of the district is situated between the elevations of 0 to 800 m above msl. The highest peak in the district is Darshangudda located 915 m. amsl near the border to Goa state. The district is having coastline of 140 kms. Main surface water resources are harnessed for generating electricity by Kalinadi hydroelectric project and Kadra hydroelectric project. There are no major or medium irrigation projects in the district[7].

3.2.1 Climate

The Uttara Kannada district experiences tropical monsoon climate. Generally, the weather is hot and humid on the coastal areas throughout the year. The district falls under the Hilly agro climatic zone except for western parts of Karwar, Ankola, Kumta, Honnavar and Bhatkal taluks which fall under coastal agro climatical zone.

The temperatures start rising from January to peak in May, around 30 degrees is common. The highest day time temperatures rise some time up to 38°C. Thereafter it declines during the monsoons. As can be expected, the humidity is lowest during the dry season and highest during the monsoons. The winds are predominantly south westerly during the summer monsoon and north easterly during the winter monsoon.[8]

The year may broadly be classified into four seasons. The dry season is from January to February with clear and bright weather. It is followed by hot weather from March to May. During this season thunderstorms are common in the month of May. The monsoon season is from June to September. This season yields around 75% (Halyal taluk) to 90% (Karwar taluk) of the annual rainfall. The period from October to December may be termed as the post monsoon season.

3.2.2 Rainfall

Honnavar receives significant rainfall throughout the year due to its proximity to the Arabian Sea and the Western Ghats. The annual average rainfall in Honnavar is around 3,000 mm. The majority of rainfall occurs during the monsoon seasons, with June, July, and August being the wettest months. This abundant rainfall supports agriculture and contributes to the town's scenic landscapes.[9]

3.2.3 Cyclones/Storms

Cyclone is a vast violent whirl or vortex in the atmosphere following formation of an intense low-pressure area. The district falls within the cyclone area of storms originating in the Arabian Sea and those that enter across the Indian Peninsula from the Bay of Bengal. However, historically it is seen that cyclones are not as severe as and as frequent as in the Bay of Bengal along the eastern coast of India. On July 8, 2022 heavy rainfall caused severe flooding in Gundbal, Bhaskeri, Badagani, and Mankuli Nagamastikeri villages. The overflowing rivers and streams have inundated these villages and caused widespread damage.

3.2.4 Floods

From Western Ghats five medium and 13 small rivers join the sea in the district. Of these, two rivers, Kali and Sharavati have dams constructed for hydroelectric purpose. When the

[7] District Environmental Plan for Uttara Kannada district, Karnataka State, 2022
[8] Ground Water Information Booklet Uttara Kannada
[9] Honnavar.com

reservoirs reach the maximum storage level, large quantity of water is released into the rivers thus causing floods inundating into the villages resulting in large scale loss of life, livestock and property. If heavy rainfall continues smaller rivers also cause flooding and damage.

3.2.5 Drought

Drought is a normal, recurrent feature of climate and characterized in terms of its spatial extension, intensity and duration. Conditions of drought appear when rainfall is deficient in relation to the statistical multi-year average for a region, over an extended period of a season or a year, or even more. Drought is a temporary aberration unlike aridity, which is a permanent feature of climate. Uttara Kannada district have faced many drought conditions earlier due to deficit rainfall and overexploitation of ground water resource.

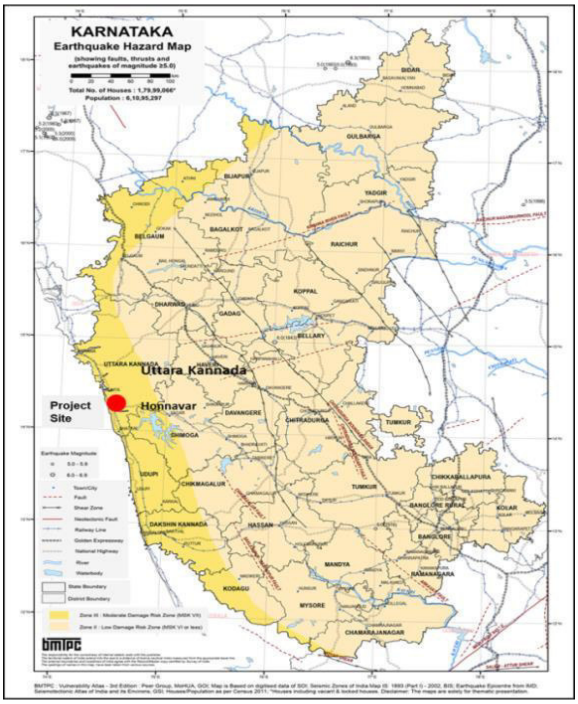
3.2.6 Seismicity and Earthquake[10]

The seismic scenario of Karnataka is being monitored by Karnataka State Natural Disaster Monitoring Centre (KSNDMC). KSNDMC has set up a VSAT Enabled and Solar Powered Permanent Seismic Monitoring Stations Network in the State of Karnataka during 2009-2010 at 14 locations.

Earthquakes are result of tectonic displacement of plates. The entire Uttara Kannada falls under the Zone II of the earthquake classification as per Indian Standards, which is relatively safe. Historically there has been no incident of earthquake during last one hundred years. There are no major/regional seismically active faults, thrusts or trenches are present in the project area.

However, there are moves to upgrade the region to Zone III in view of changing geological patterns, as the possibility of an earthquake in the district cannot be totally ruled out.

Seismic Map of the PIA district is given as **Figure 3-2**.



Source: BMTPC

Figure 3-2: Seismic Map of PIA Uttara Kannada District

[10] Earthquake Action Plan-2022

3.2.7 Forest Fire

Uttara Kannada has dense forests all over the district. Historically there has been no incidence of forest fires in the district.

3.2.8 Tsunami

Though the impact of recent tsunami on the Uttara Kannada coast is minimum; as per the interpretation of the Scientists, a tsunami in the West Coast is not ruled out.

3.3 Land Environment

3.3.1 Topography and Regional Setting

Uttara Kannada (PIA district) (formerly North Kanara) is located between 13º55' to 15º32' N latitude and 74º05' to 75º 05' E longitude. Its geographic area is 10,291 km². The district has boundaries with Goa and Belgaum towards the north, Dharwar, Haveri and Shimoga towards the east and Udupi towards the south. The Arabian Sea borders it on the west creating a long continuous, though narrow coastline, of 120 km.

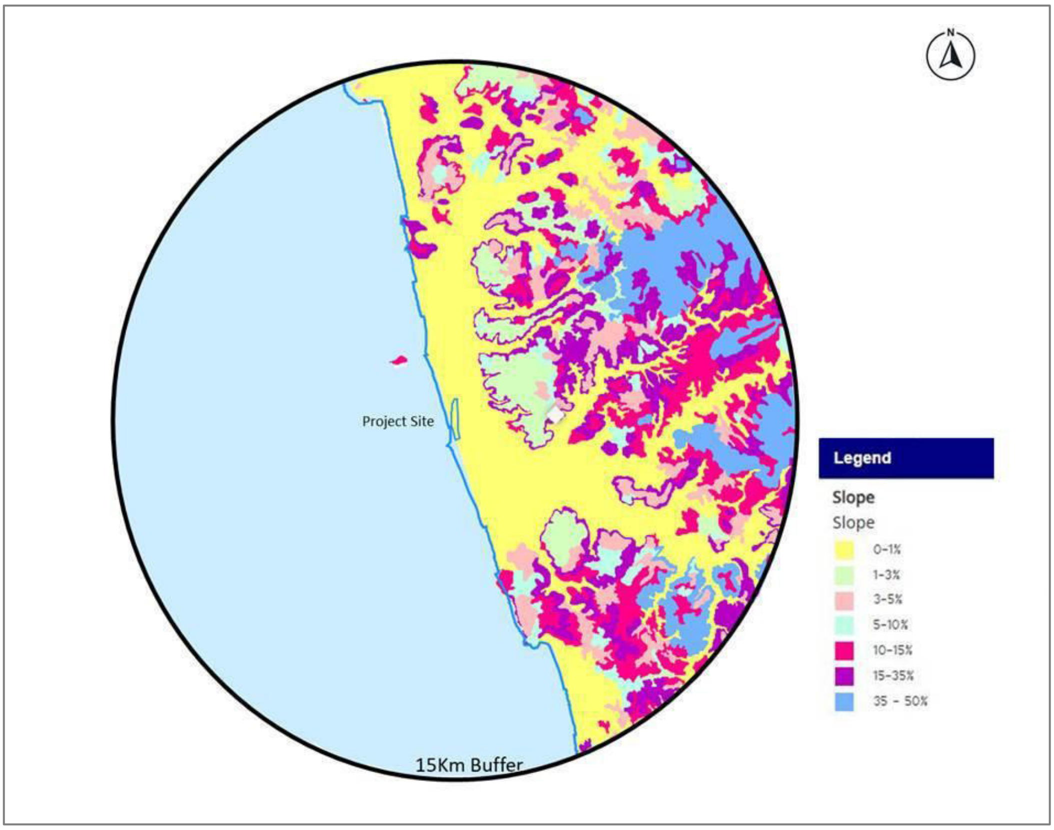
Topographically the district may be divided into 3 distinct zones, viz., the narrow coast, the abruptly rising hills, and the flatter, elevated eastern zone that merges with the Deccan Plateau. The coastal zone is the most thickly populated with a multitude of coconut clad villages. The hill chains of the Western Ghats, which run in the north-south direction, parallel to the coast, form the backbone of the district. These hills, unlike the rest of the Western Ghats, seldom exceed 600 m. These are precipitous towards their western aspect. At several points in the district, the hills run right into the sea, interrupting the continuity of the sea beaches, and providing ample rocky inter-tidal and subtidal habitats with their unique flora and fauna.

Five major rivers viz., Kalinadi, Gangavali, Aghanashini, Sharavati and Venkatapura have their sources in the Sahyadris and flow west through the district into the Arabian Sea. Some of the magnificent waterfalls in the district such as the Jog, the Lushington (Unchalli) and Magod are associated with the rivers Sharavati, Aghanashini and Gangavali respectively. Also, where these rivers meet the sea, there are some of the finest estuaries of the west coast.

The district is divided into 11 taluks. The district capital is at Karwar, the northernmost coastal taluk. The Deputy Commissioner is the administrative head of the district. The Chief Executive Officer of the Zilla Panchayat has also his office at Karwar. The Zilla Panchayat consists of the elected representatives of the people. The district has four Assistant Commissioners- at Karwar, Kumta, Bhatkal and Sirsi. The Tahasildar is the administrative head of the taluk. The villages are grouped under Village Panchayats, run by elected representatives.

3.3.1.1 Slope scenario of Study area

The slope in the project site and surrounding areas are nearly 0-1 % and the slopes show increasing trend in the East starting from 1-3%. Maximum slopes can be observed in the Eastern and Southeastern region due to the presence of hilly terrains as shown in the **Figure 3-3.**



Source: (KSGIS) Karnataka State GIS

Figure 3-3: Slope map of study area.

3.3.1.2 Contour of Study Area

The elevation within the project site is almost 0m and highest elevation in the study area is 620m as given in **Figure 3-4.**

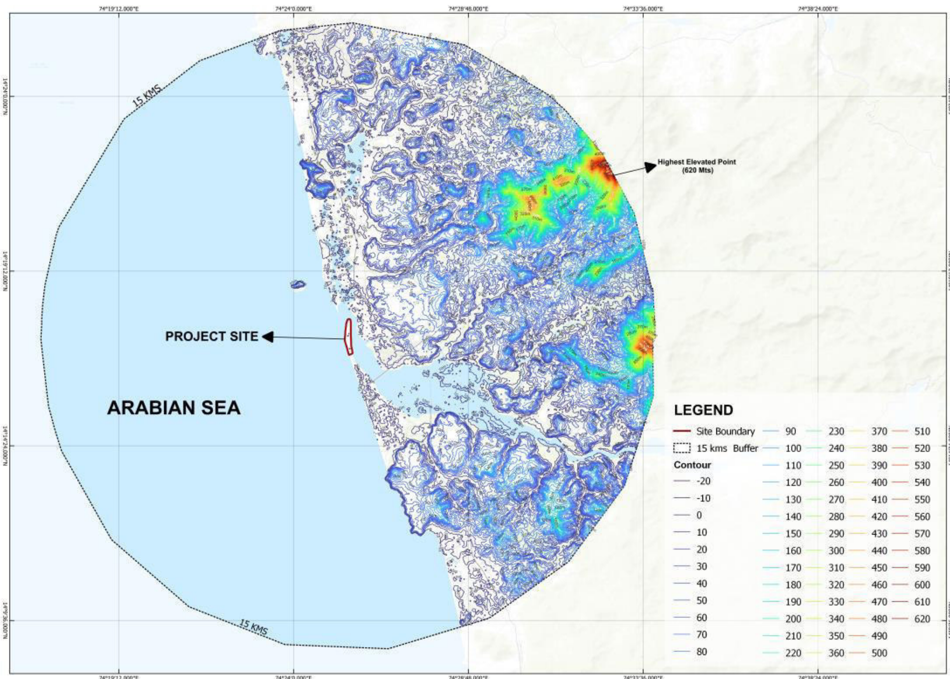


Figure 3-4: Contour of Study Area

3.3.2 Natural Resources of PIA District

The total area of the district is 10.27 lakh hectares out of which over 80% i.e. 8.28 lakh is forest land and about 10% i.e. 1.12 lakh hectare is being used for agriculture and horticulture. Out of this, only 11,094 hectares more than one crop and in 1,11,981 hectares only one crop is obtained.

The chief crops of the district are rice and areca nut, along with a great diversity of other crops. Tree crops include coconut, sugarcane, cocoa, cashew, mango, banana, pineapple, garcinia, jack fruit, and sapota; vegetables include onion, radish, cucumber, cauliflower, sweet potato, eggplant (brinjal), and amaranth; spices pepper, cardamom, ginger and nutmeg. Millet and cotton are grown in the drier portion of the district east of the Western Ghats.

Paddy is the main monsoon crop. Wherever possible, river water is stored with small bunds or tanks to get second crop, generally watermelon, groundnut and other horticultural crops are cultivated in the winter. Most of the dry land is unused during winter and summer months.

3.3.3 Geology

The district consists of rock formation of Archaean complex, the oldest rock of the earth crust. Rocks of the Archaean era occur over the whole of the district. They have not been submerged under the great lava flows known as the Deccan Traps, which have overspread most of the central India forming the great plateau with steep precipices. The district is characterized by a system of ridges and a plateau on the west descending rapidly to a narrow strip of low land covered by alluvium, which with the abundant annual rainfall supports cultivation. The low land appears to be the creation of later period than the upghat region. It emerged from the sea during the glacial and inter glacial period due to the changes in the sea level.

The Archaean formations are divisible into an older group of sediments and igulous viatrusives, all very highly metamorphosed, which are classified as the Dharwar system and a younger group of plutonic intrusive termed the peninsular geisses. A capping of laterite, which is locally the source of iron and magnesium ores, frequently overlies both the Dharwar and the peninsular gneisses. In the western part of the district, nearly parallel to the coastline, there is a range of hills with several peaks over 700m high descending westwards gradually in broken country to the coast. This consists of varied assemblage of granite and schists. These ridges separate the Sahyadris, consisting of Dharwar schist in the south. Eastwards in the interior, the district is almost entirely hilly and consists of both the Dharwar and the Peninsular gneisses, the latter frequently occupying the low grounds. In this district the Dharwars are typically represented by chlorite-schists as opposed to the areas in the southern Karnataka where hornblende rocks predominate.

The chloritic types are considered to be younger than the hornblend types. Other rock formations belonging to this system are quartzite, magnetic-quartzite, limestone-quartzite, senicite-quartz-schist, phyllite fine-grained grey limestone, dolomite, epidiorite and other basic igneous rocks. The Dharwar rocks generally out crop as narrow lenses and shingers, elongated nearly NS enclosed in the intrusive peninsular gneisses, which have invaded them after their folding. Most of the Dharwar are highly pilcated. Their folding is clearly seen in the limestone, which is thought to be the youngest in the Dharwar sequences.

The Archaean granites and gneisses with their sparse bounds of Dharwars are capped by laterite at many places in the district. They are typical tropical rocks resulting from the alteration under tropical condition of the basement rocks. They are found capping flat topped ridges and bluffs all along the coast of a hundred feet in thickness and occasionally show local enrichment of iron and manganese ore.

The Geological map of PIA district is given in **Figure 3-5.**

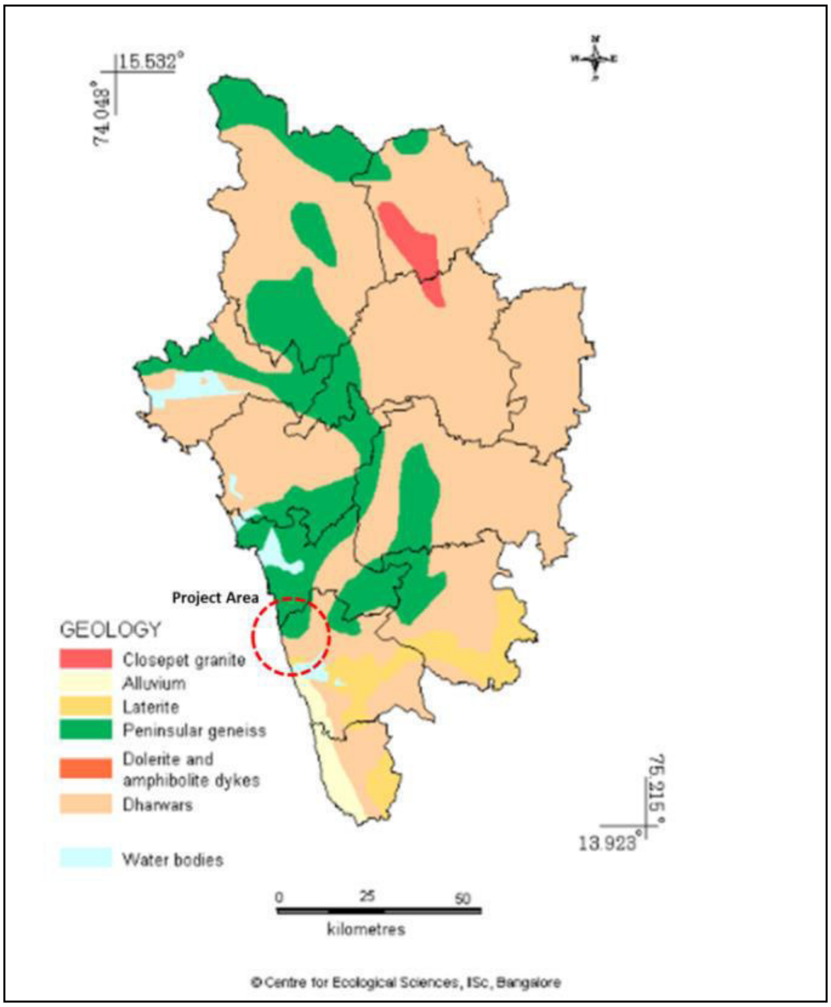


Figure 3-5: Geology Map of PIA district

3.3.4 Geomorphology

A major part of the taluk is covered by hilly areas belonging to Sahyadri hill ranges. Geomorphologically, the taluk is classified as denudational uplands with about 20- 25% of the district falling in this category. The taluk shows various landforms like hills and plateaus, piedmont zone, plains, reservoir, reservoir islands, river/stream and tanks, etc. After hilly area the next important geomorphological unit is piedmont zone. Coastal plain is common in the western side. In plain land, the slope runs from east to west and also towards centre. The general topographic elevation ranges from 0 to 495m amsl from west to east of the taluk. Sharavati river and Badagani river confluence at Honnavar Port area where both debouche into Arabian sea. The Basavaraj Durga Island is an isolated island 1.3 km off to Pavinkurva beach.

The project site falls in coastal origin-younger coastal plain surrounded by water bodies/Arabian Sea whereas the study area is influenced by denundational origin-Pediplain complex, Structural origin-Highly dissected hills and valleys, denundational origin-low dissected hills and valleys. Fluvial Origin-Active flood plain is at inland water area of Sharavati River away from project site.

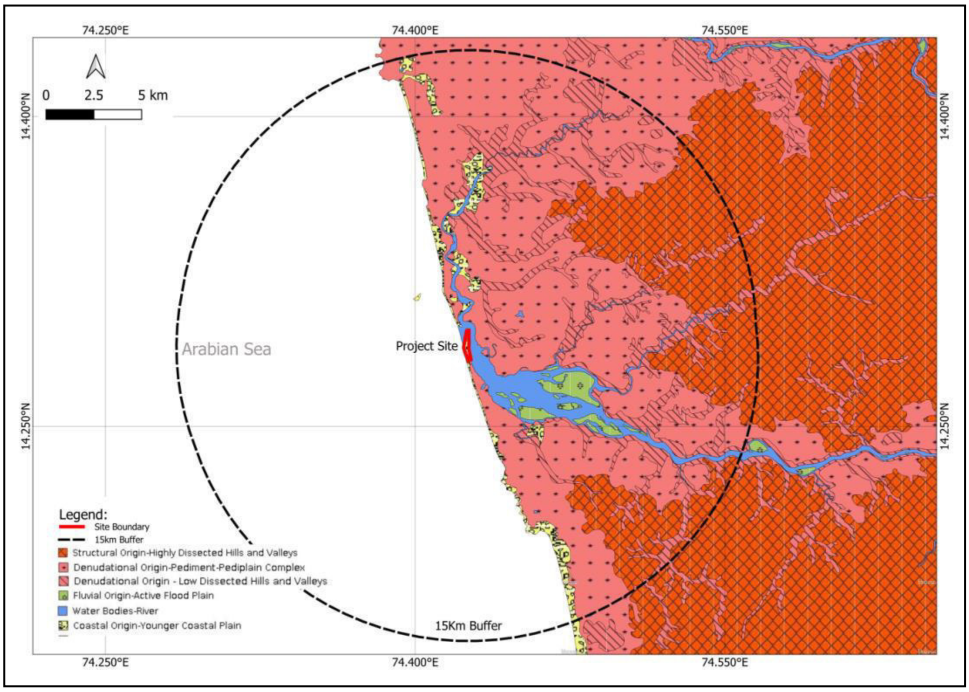


Figure 3-6: Geomorphology map for the study area

3.3.5 Drainage

The important rivers in the district are Sharavathi, Kali, Aghanashini, and Gangavali. The Sharavathi and its tributaries flow through study area and all these rivers flowing in westerly direction to Join Arabian Sea. All the rivers in the district together with their tributaries exhibit dendritic drainage pattern. The taluk is drained by 1st to 4th order streams which flow towards central and central to west. The drainage system is well developed in the taluk by Sharavati and Badagani river basins. Study area falls in two watersheds namely B14NET12 and B14VAS38. The general drainage pattern is dendritic to sub-dendritic in nature.

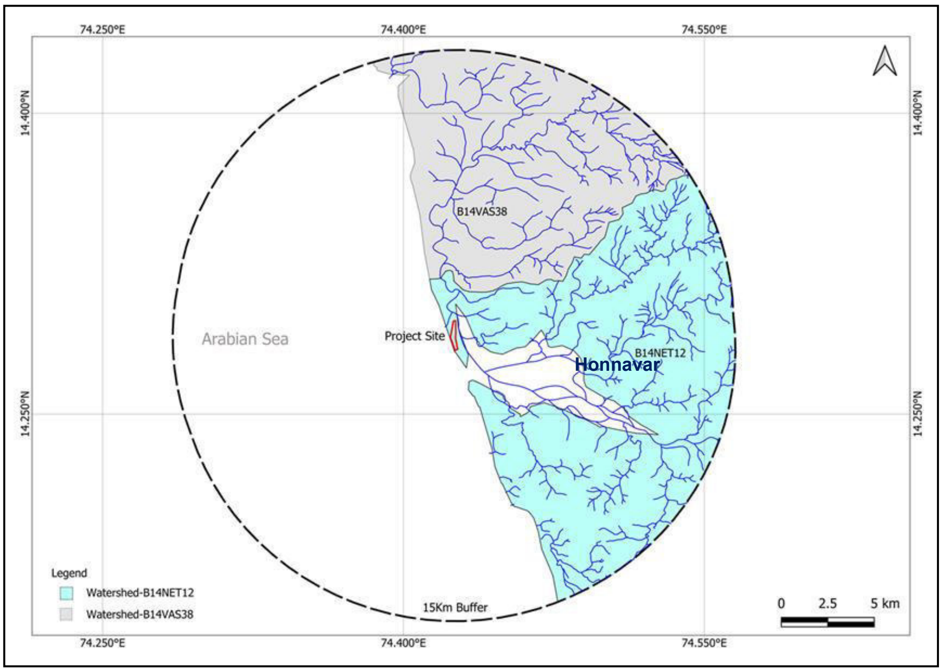


Figure 3-7: Drainage map of study area

3.3.6 Wetland Profile

Uttar Kannada indicates the presence of 1016 wetlands including 570 wetlands smaller than 2.25 ha. Total wetland area is estimated to be 42190 ha. Even though there is diversity of wetland types observed in the district, Reservoirs/Barages (18911 ha) accounted for about 45 per cent followed by River/Stream (14458 ha), Tanks/Ponds (1294 ha), Intertidal mudflats (1471 ha), Mangroves (384 ha) and Creeks (60 ha)[11].

The Study area comprises of River/stream majorly, Intertidal mudflats in the estuary area. Mangroves in the buffer area at a distance of 0.3km. Sharavathi river Waterlogged areas in the East and North, Drains in the buffer areas. Salt marshes and Aqua ponds in the North, also few tanks/ponds. The nearest Ramsar wetland site in the district is "Aghnashini Estuary"[12] which is ~17.1 km N to the project site and falls outside the study area.

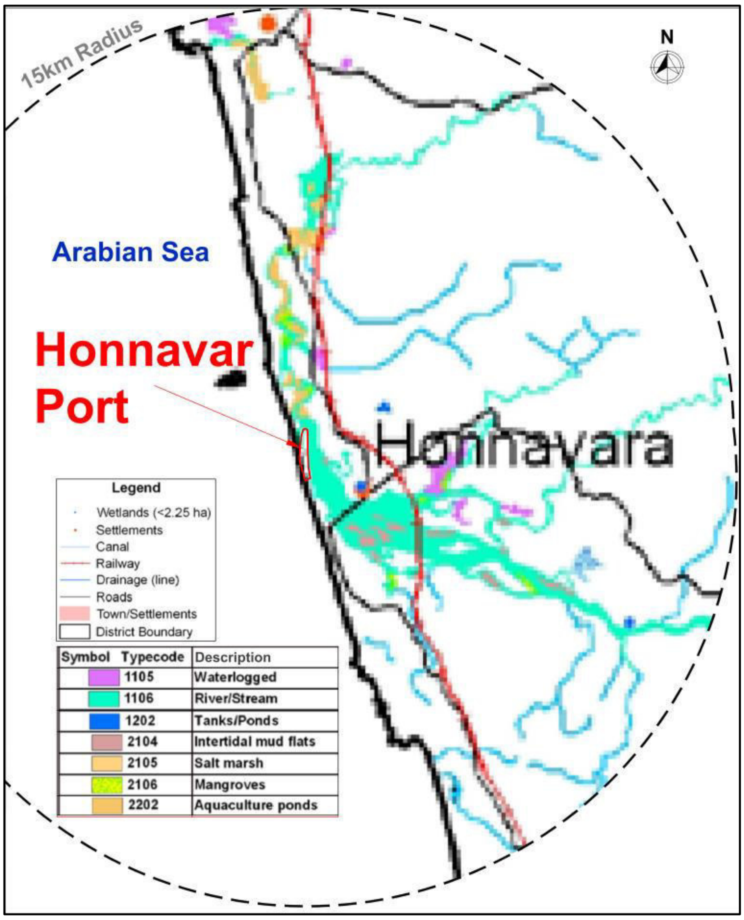


Figure 3-8: Wetland Profile of study area

3.3.7 Land Use/Land Cover

3.3.7.1 Land

Availability of required land for the Barge/ vessel loading activity: The proposed site of 108 acres (~44Ha) of land is completely coastal sand. The rail and road corridor is proposed to be developed to connect port with Konkan Railway network and NH 66 respectively.

The major land use/land cover around the project site is Mangrove Patches in Sharavati riverbank, Reserve Forest, Sand dune, Sandy beach, thickly populated residential areas,

[11] National Wetland Atlas for Karnataka 2010
[12] https://rsis.ramsar.org/RISapp/files/RISrep/IN2534RIS_2401_en.pdf

Hamlets, beach tourism recreational areas, Historical old fishing port with associated activities and its related infrastructures etc., associated with mixed vegetation with residential areas, road and rail networks. The seaside has wide beach with medium to fine grained sand.

3.3.7.2 Land Use pattern in Study Area

A land use land cover map for the project area is presented in **Figure 3-9**. The classification of the area within 10 km distance from the project site is given in **Table 3-2.**

Table 3-2: Land use pattern in the Study Area

S. No	Land use		Sq.Km	Area (%)
	Description	Details		
1	Built up	Settlements	4.396	1.4
2	Water bodies	Tank/River/Arabian Sea	183.062	58.3
3	Forest	Scrub forest/ Forest Blank/ Mangroves	48.042	15.3
4	Crop land	Crop land	22.294	7.1
		Plantation	5.024	1.6
5	Waste lands	Land with scrub	29.83	9.5
		Land without scrub	4.082	1.3
		Coastal land	8.164	2.6
		Creek	4.082	1.3
		Waterlogged area	5.024	1.6
Total			**314**	**100**

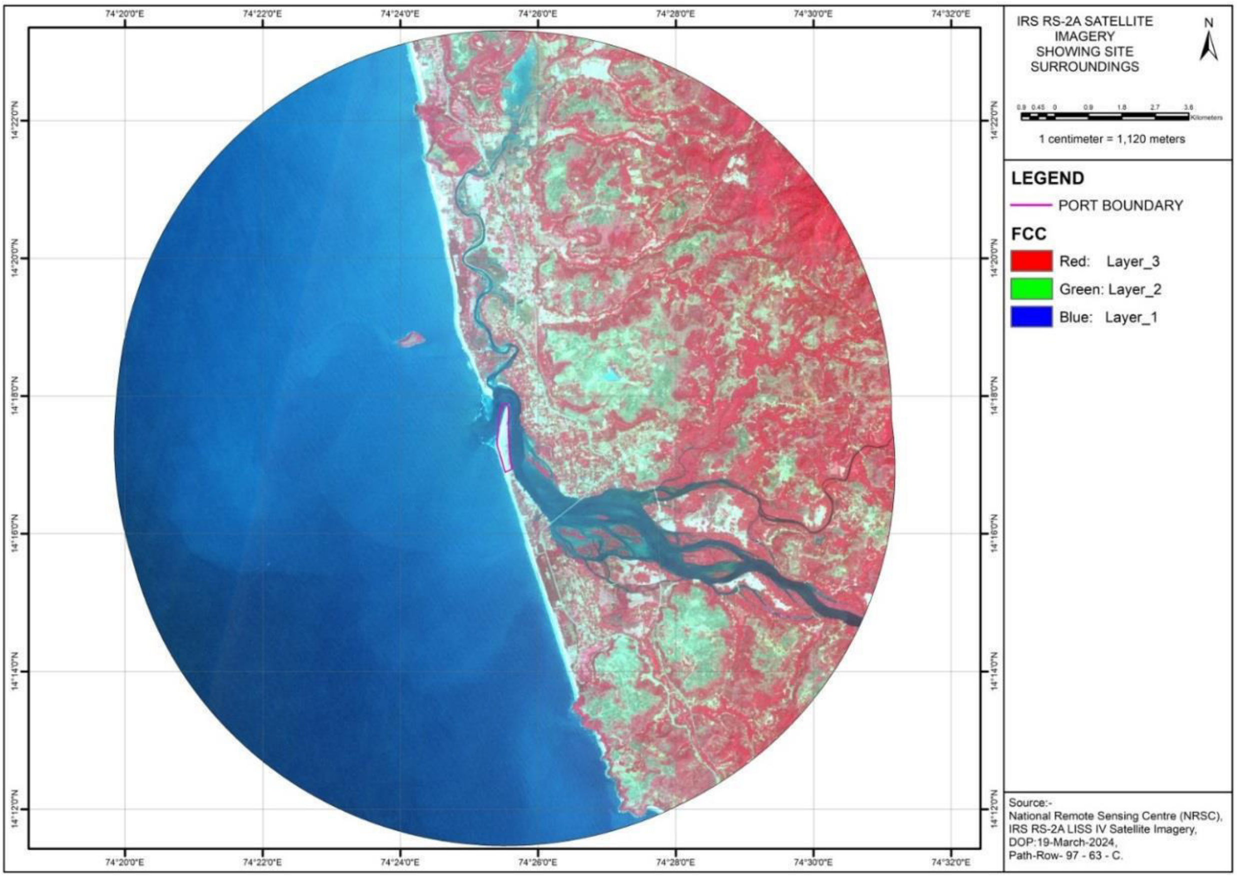
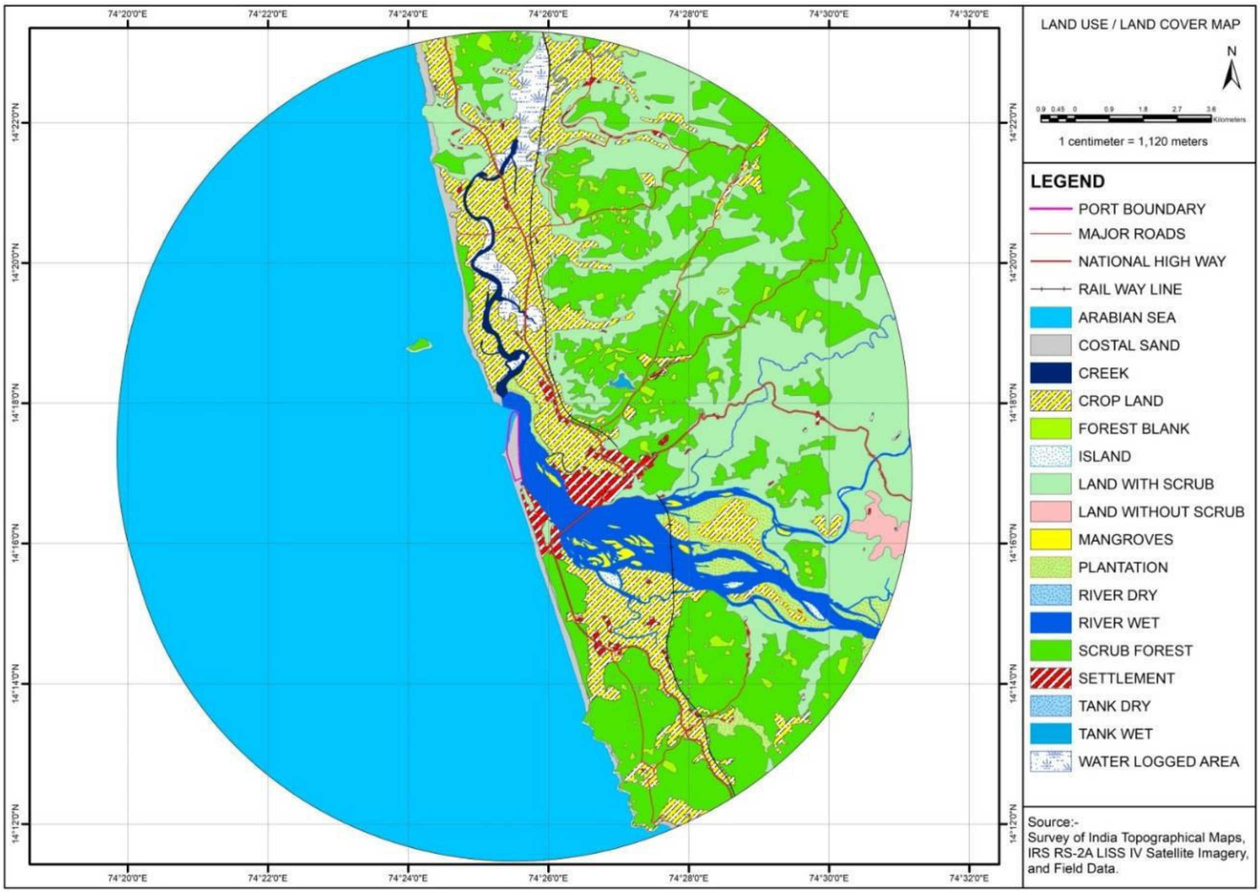


Figure 3-9: Satellite Imagery of the Study area



(Source: NRSC, IRS RS-2A LISS IV Satellite Imagery and Field Data)

Figure 3-10: Land Use/Land Cover map of the Study Area

3.3.8 Soil Environment

3.3.8.1 Soil Classification[13]

Along the coast on the western most part of the district the coastal alluvial soil is occurring. The most rugged hilly parts of the district are covered by hilly type soil and surrounded by the areas covered by lateritic soil. On eastern parts, the lateritic soils change to red loamy soils. Some area on eastern most parts of Mundgod taluk are covered by semi-black cotton soils.

The Soil Map of PIA district is given in **Figure 3-11.**

[13] CGWB Ground Water Information Booklet (2012), Uttara Kannada District, Karnataka

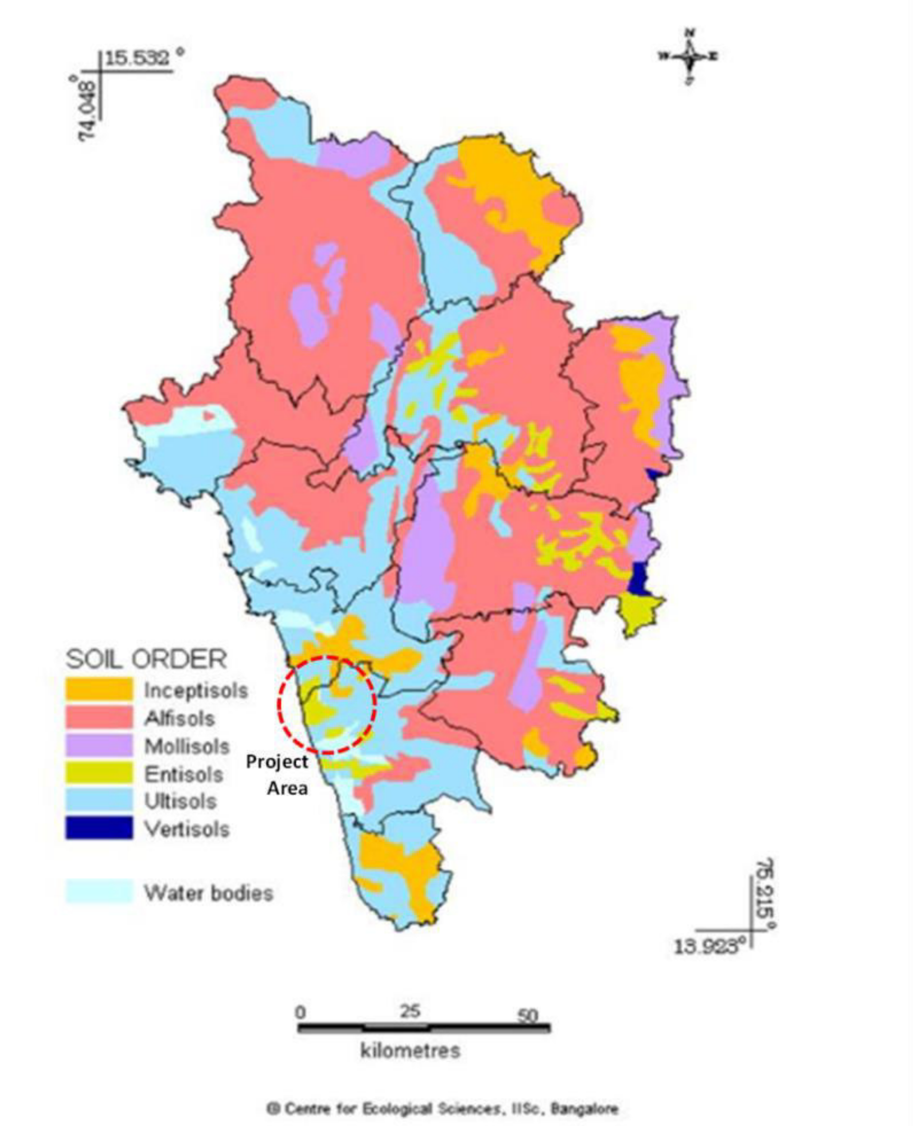


Figure 3-11: Detailed Soil Map of the PIA district

3.4 Water Environment

3.4.1 Surface Water[14]

Uttara Kannada is the land of rivers. There are five important rivers flowing in the district from the high range of mountains to the Arabian Sea. The Kali River rises in Joida Taluk, the Gangavali rises in Dharwad District flows through Ankola Taluk. The Aghanashini rises near Sirsi, Sharavati which forms the famous Jog Falls flows through Honnavar. The other important rivers of the district are the Venktapur and the Varada. Except Varada River which flows eastwards all other rivers flow from East to West, cutting the Western ghats into deep Valleys, thus rendering themselves unfit for irrigation, but at the same time fit for generating hydroelectricity. The depth[15] of these river's ranges from 9′ to 10′ and the riverbank height is about 12′ to 15′. All these rivers flowing in westerly direction to Join Arabian Sea. All the rivers in the district together with their tributaries exhibit dendritic drainage pattern.

[14] ISSN NO : 1869-9391, VOLUME 9, ISSUE 5, 2022- Natural Resources Scenario Of Uttara Kannada District And Its Conservation For Sustainable Environment
[15] https://uttarakannada.nic.in/en/about-district-2/

3.4.2 Ground Water Scenario

Uttara Kannada district consists of rock formations of Achaean complex[16] characterised by a system of ridges and a plateau on the west. Laterites occur overlying the schist and granites, and alluvial along the rivers and lagoons of the coast. Main aquifers in the district are the weaker, weathered and fractured zones of metavolcanics, metasedimentaries, granites and gneisses, laterites, along with the alluvial patches found along the major stream courses. Since the hard rocks in the area do not possess the primary porosity, the secondary structures like joints, fissures and faults present in these formation act as a porous media. It is generally constitute a 3% of volume of formation to facilitate to house the ground water. The ground water under atmospheric influence is the phreatic zone, which generally occurs within the depth range of 3.00 to 30.00 mbgl. The fracture zones occur at various depth zones within the depth of 185.00mbgl are expected to be saturated with ground water. It is found that the water bearing characteristics of schistose rocks are more or less similar to that of gneisses and granites. But the weathered zones of schist's may not yield as granites and gneisses, because of their compact and fine-grained nature. Alluvium occurs along the riverbanks in few to 14.00 metros thickness, holds the bank storage, and occurs as narrow strip along the sea coast and the creeks occurs up to a depth of 50m. Ground water in the above aquifer material generally occurs under unconfined to semi-confined and confined conditions, in the shallower zones under phreatic condition and under semi confined and confined condition in the deeper zones. The ground Water is being exploited from within the depth range of 3.00 to 31.00mbgl through dug wells and 30.00 to 200.00mbgl through dug cum-bore wells and Bore wells. The hydrogeological map depicting all Hydrogeological details of the area is presented as **Figure 3-14**. The hilly tracks have thin weathered covers and the valley portions have thicker weathered zones.

Honnavar area consists of unconfined aquifer and as per dynamic ground water assessment of Honnavar block the total ground water recharge is 2.11 TMC, total natural discharges is 0.22 TMC and total annual extractable groundwater is 1.99 TMC[17]. Stage of ground water extraction is 38.16%. Ground water category assessment blocks of Honnavar and Kumta falls in "Safe category".

3.4.2.1 Aquifer

The study area falls in the laterite and coastal alluvium unconfined aquifers,

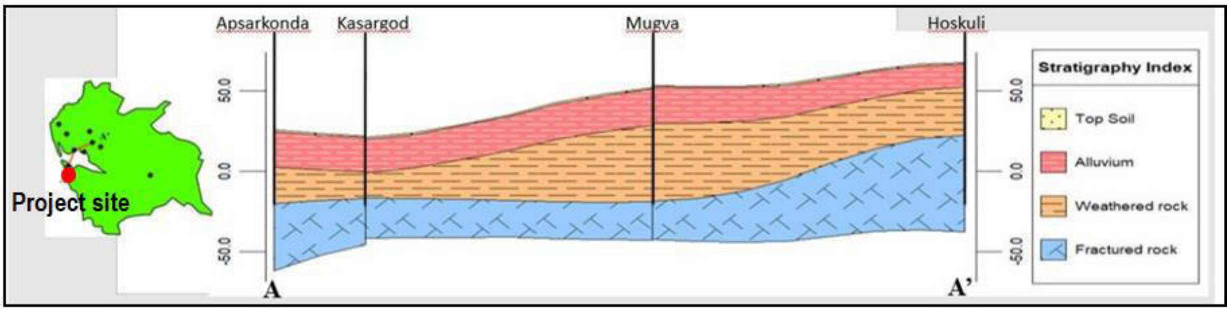
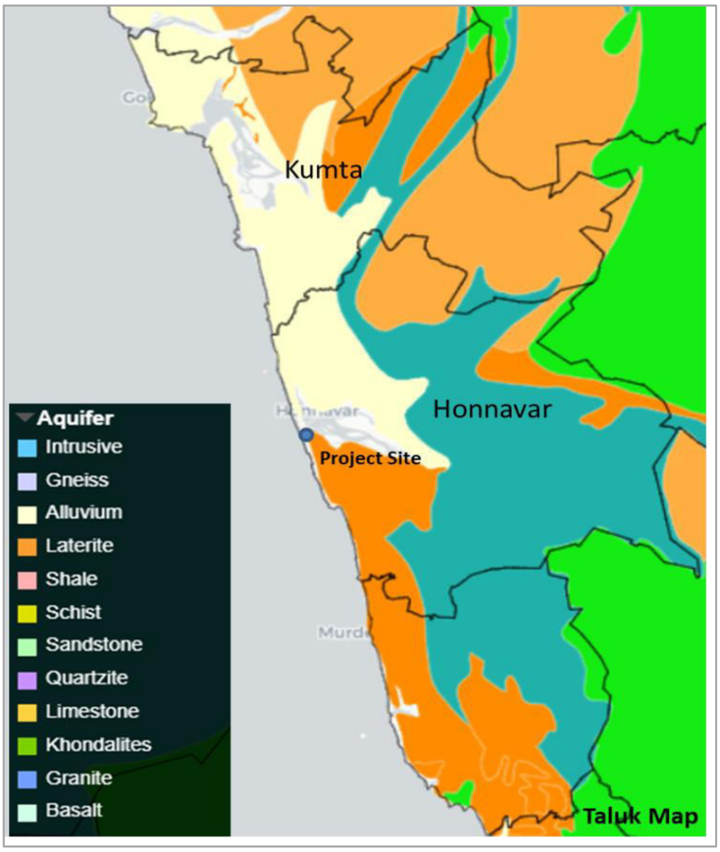


Figure 3-12: 2D Aquifer deposition near Project site.

[16] District Irrigation Plan, Uttara Kannada
[17] Dynamic Ground water resources of Karnataka 2024



Source: https://ingres.iith.ac.in/

Figure 3-13: Aquifer Map of study area blocks

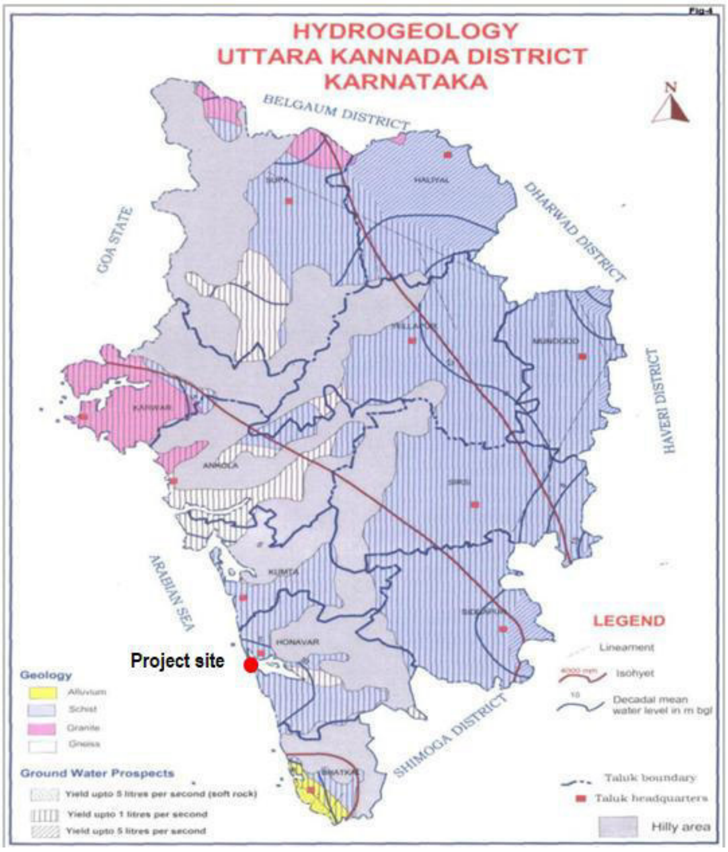


Figure 3-14: Hydrogeological map of Uttara Kannada

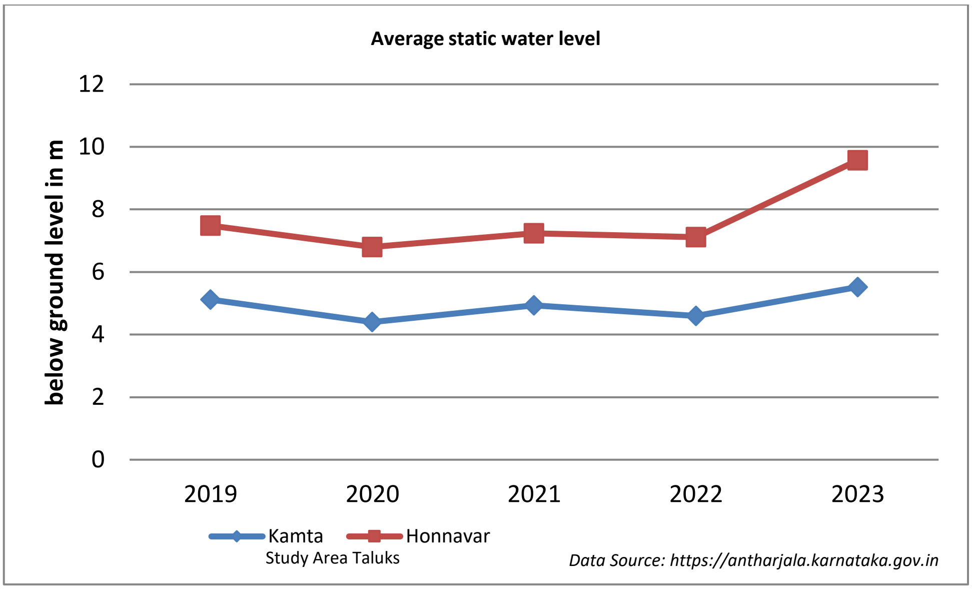


Figure 3-15: Groundwater level of Study Area taluk/s

3.5 Air Environment

3.5.1 Meteorological Data from Nearest Meteorological Station

The nearest Indian Meteorological Department (IMD) station located to project site is Honnavar. The Climatological data for Honnavar (12°6’ N and 74°12’ E), published by the IMD, based on daily observations at 08:30 and 17:30 hour IST for a 30-year period, is presented in the following sections on the meteorological conditions of the region. The monthly variations of the relevant meteorological parameters are reproduced in **Table 3-3**.

Table 3-3: Climatological Summary – Honnavar Region (1991-2020)

Month	Temp (°C)		Rainfall (mm)		Relative Humidity (%)		Station Level Pressure (hPa)		Mean Wind Speed (km/h)	Predominant Wind Directions (From)	
	Daily Max.	Daily Min.	Total	No. of days	08:30	17:30	08:30	17:30		08:30	17:30
Jan	33.0	20.1	0.4	0.1	68	56	1011.0	1007.5	4.8	E,SE,NE	W,SW,E
Feb	32.7	20.3	0.0	0.0	75	60	1010.4	1007.0	4.9	E,SE,NE	W,SW,NW
Mar	32.7	22.8	3.5	0.1	81	67	1009.4	1005.8	4.9	E,SE,NE	W,SW,NW
Apr	33.3	25.0	16.0	1.2	79	68	1008.0	1004.6	5.5	E,SE,W	W,SW,NW
May	33.2	25.8	114.1	5.2	80	71	1006.7	1003.8	5.4	E,W,SE	W,SW,NW
Jun	30.0	24.3	995.7	22.7	91	85	1005.0	1003.1	6.3	W,E,SW	W,SW,S
Jul	28.6	23.8	1161.0	28.6	94	89	1005.1	1003.4	6.0	W,SW,E	W,SW,NW
Aug	28.7	23.7	814.9	26.0	94	88	1006.6	1004.6	4.7	W,SW,E	W,SW,NW
Sep	29.7	23.6	366.2	15.6	92	82	1007.6	1004.9	4.4	E,SW,W	W,SW,N
Oct	31.6	23.5	216.1	8.6	86	77	1008.2	1005.1	4.3	E,SE,W	W,SW,S
Nov	33.5	22.8	37.1	2.0	72	62	1009.3	1005.8	4.8	E,NE,SE	W,E,SW
Dec	33.6	21.6	7.5	0.4	63	54	1010.5	1006.9	5.5	E,NE,SE	W,E,SW

As per the above Climatological table the observations drawn for the study area are given below:

- Daily maximum temperature of 33.6°C and daily minimum temperature of 20.1°C were recorded in the months of December and January respectively
- Maximum and minimum relative humidity of 94% in the months of July & August and 63% in the month of December was recorded at 08:30 hours
- Maximum relative humidity of 89% in the month of July and minimum of 54% was recorded in the month of December at 17:30 hours
- Maximum and minimum mean monthly rainfall of 1161.0 mm and 0.0 mm were recorded in the months of July and February, respectively
- Total annual mean rainfall recorded is 3732.4 mm spread over 110.4 total rainfall days.
- Maximum and minimum mean wind speed is 6.3 kmph (1.75 m/s) and 4.3 kmph (1.19 m/s).

3.6 Baseline Monitoring Results

The Monitoring locations were selected based on the following:

- Topography/Terrain
- Meteorological conditions
- More sites in downwind side/ impact zone
- Residential and sensitive areas within the study area
- Representatives of regional background air quality/pollution levels and
- Representation of likely impacted areas

3.6.1 Ambient Air Quality Monitoring Stations

To evaluate the baseline air quality of the study area, *Six (06)* monitoring locations have been identified. A combined map showing the Air monitoring locations are given as **Figure FD0301** and the details of the locations are given in **Table 3-4**.

Table 3-4: Ambient Air Quality Monitoring Locations

S. No.	Location Name	Distance	Azimuth Direction	Environmental Setting
1	Honnavar Near Port Office	1.8 km	SE	Residential Area
2	Kasarkod Village Near Sub Station	4.2 km	SE	Residential Area
3	Karki Village, Havyka Sabha Bhavan	0.9 km	E	Residential Area
4	Ramtirth Village, Near RTO Office	3.0 km	E	Residential Area
5	Kulkod Village, Near Govt School	4.3 km	E	Residential Area
6	Hosad Village, Near Primary School	7.0 km	SE	Residential Area

3.6.1.1 Ambient Air Quality Monitoring Techniques and Frequency

Ambient air quality was monitored twice a week for complete one season. PM_{10}, $PM_{2.5}$, SO_2, NO_2 were monitored on 24 hourly basis and CO, HC were monitored on eight hourly basis. Sampling was carried out as per Central Pollution Control Board (CPCB) monitoring guidelines at each location for all twelve parameters.

3.6.1.2 Results

The variations of PM_{10}, $PM_{2.5}$, SO_2 and NO_2 are graphically presented in the **Figure 3-16 to Figure 3-19** and remaining parameters such as CO, NH_3, C_6H_6, Pb, BaP, As, Ni are within limits. The detailed results are given in **Appendix H**.

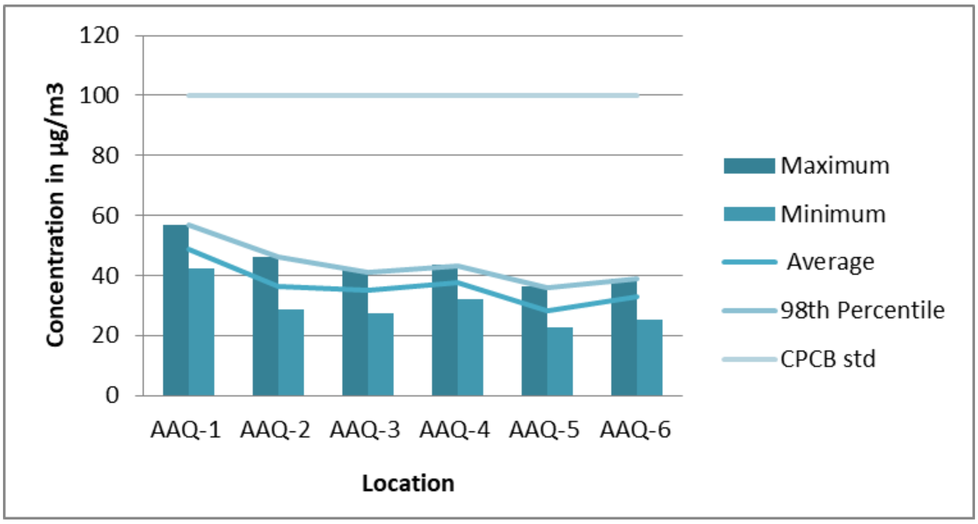


Figure 3-16: Ambient PM_{10} Levels

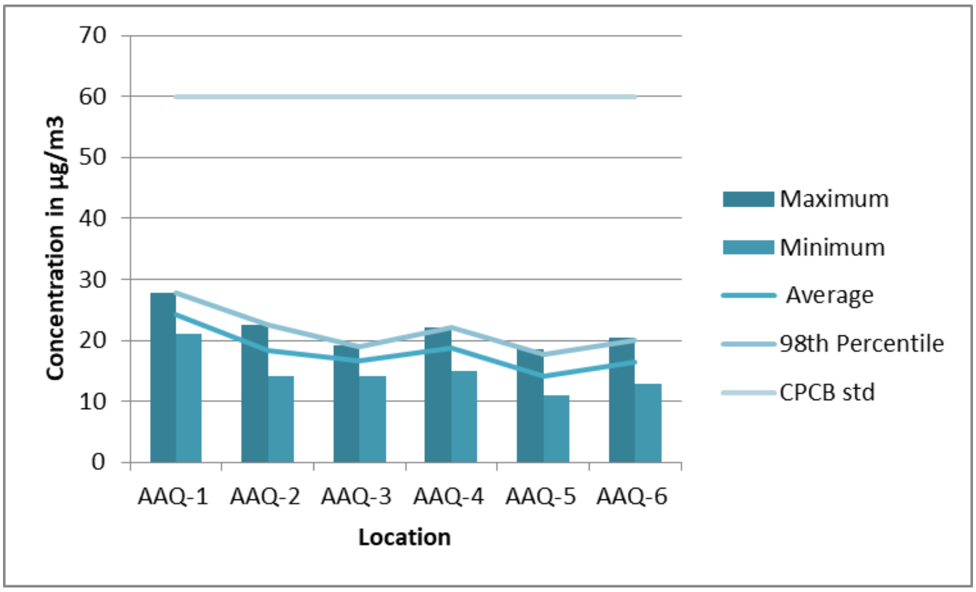


Figure 3-17: Ambient $PM_{2.5}$ Levels

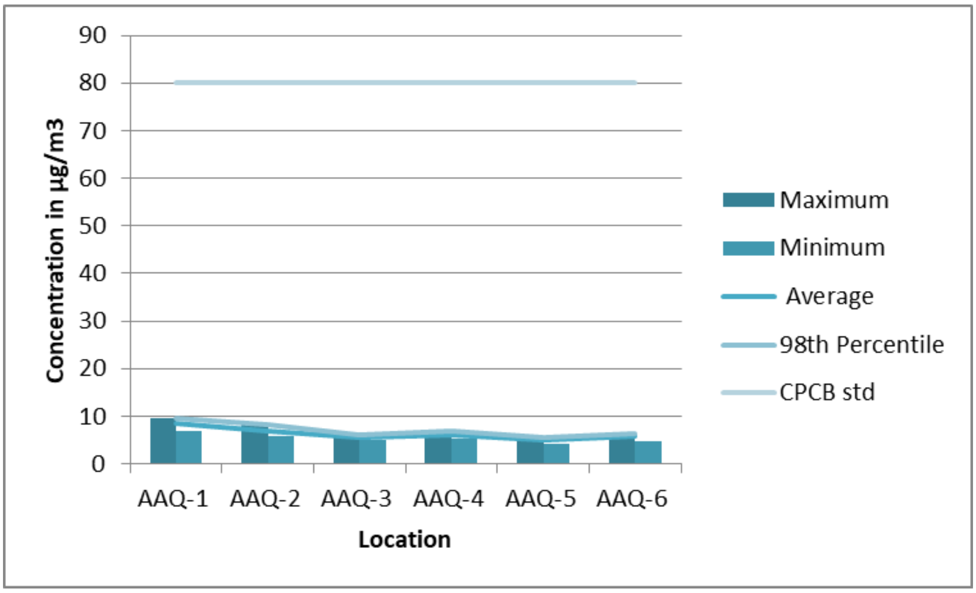


Figure 3-18: Ambient SO_2 Levels

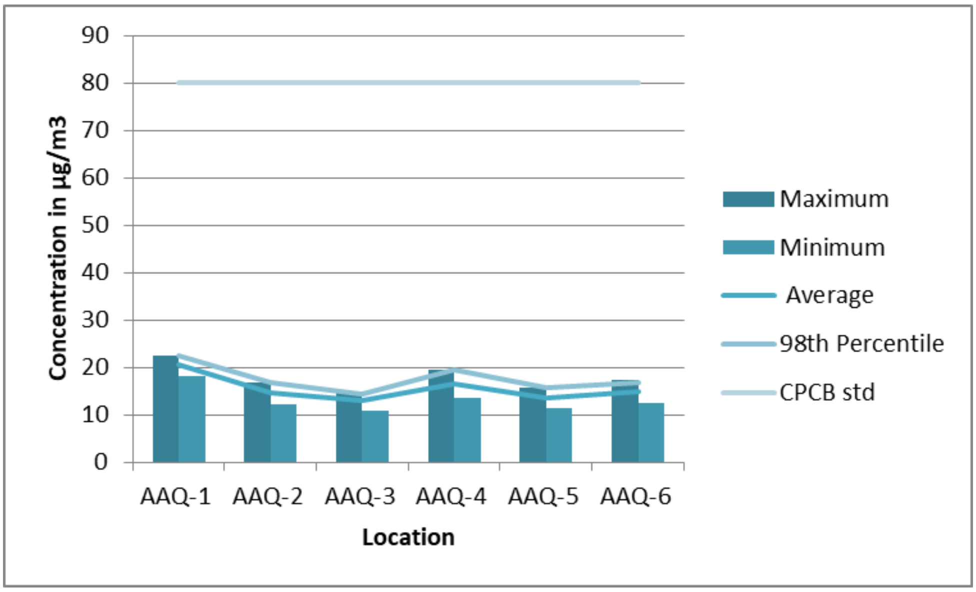


Figure 3-19 Ambient NO_2 Levels

3.6.1.3 Observations and Interpretation

Maximum concentrations of Sulphur Dioxide (SO_2), Nitrogen Dioxide (NO_2), Particulate Matter ($PM_{2.5}$), Particulate Matter (PM_{10}), Carbon Monoxide (CO), Ozone (O_3), Ammonia (NH_3), Lead (Pb), Benzene (C_6H_6), Benzo (a) Pyrene (BaP) – Particulate phase only, Arsenic (As), Nickel (Ni), are well within the National Ambient Air Quality Standards for Residential areas at all monitoring locations during the study period.

- PM_{10} ranged between 22.7 µg/m^3 and 56.9 µg/m^3. NAAQ stipulated standard for PM_{10} for 24 hr. average is 100 µg/m^3.
- $PM_{2.5}$ ranged between 11 µg/m^3 and 27.8 µg/m^3. NAAQ stipulated standard for $PM_{2.5}$ for 24 hr. average is 60 µg/m^3.
- SO_2 ranged between 4.3 µg/m^3 and 9.6 µg/m^3. NAAQ stipulated standard for SO_2 for 24 hr. average is 80 µg/m^3.
- NO_2 ranged between 10.8µg/m^3 and 22.6 µg/m^3. NAAQ stipulated standard for NO_2 for 24 hr. average is 80 µg/m^3.
- O_3, CO, NH_3, Pb, C_6H_6, BaP, As, and Ni were observed below CPCB limits in all the locations.

3.6.1.4 Secondary Data Analysis

To understand the surrounding environment in a comprehensive manner, ambient air quality secondary data comparison is assessed from the baseline data of "EIA/EMP for Proposed Four Laning of Honnavar Port connectivity road from km 0.00 (Kasarkod side of Honnavar port) to Km 2.580 (towards NH – 66) connecting Honnavar Port with NH - 66 at Km 195.986 and to improve NH – 66 from Km 195.00 to Km 197.00" which was collected during post-monsoon season 2022.

Station code	Location	Max/Min	$PM_{2.5}$ µg/m^3	PM_{10} µg/m^3	SO_2 µg/m^3	NO_2 µg/m^3	CO µg/m^3
A1	Project Site	Minimum	36	64.1	10.2	19.9	0.01
		Maximum	47	73.5	17.5	27	0.16
A2	Honnavar Village	Minimum	36.6	64.4	12.1	19.1	0.03
		Maximum	44.2	73.2	16.7	27.7	0.13
A3	Shanthi Nagar	Minimum	28.5	67.4	11.3	24.7	0.01
		Maximum	39.6	74.5	16.9	33.9	0.17

Station code	Location	Max/Min	$PM_{2.5}$ µg/m³	PM_{10} µg/m³	SO_2 µg/m³	NO_2 µg/m³	CO µg/m³
A4	Khariveri village	Minimum	32.5	62.1	12.2	24.7	0.01
		Maximum	43.5	72	17.2	29.8	0.15
A5	Kaladanape village	Minimum	32.4	64.6	11.3	22.2	0.02
		Maximum	42.6	72	16.2	27	0.15
A6	Hosapattana Village	Minimum	31	62	10	21.6	0.01
		Maximum	40.5	73.3	15.7	29.3	0.12
A8	Nachageri village	Minimum	30.2	63.3	11.6	20.5	0.01
		Maximum	41.2	72.7	16.3	29.9	0.12
A9	Haldipur village	Minimum	32.2	63.7	11.4	17	0.01
		Maximum	40.2	73.4	15.1	21.9	0.16

3.6.2 Ambient Noise Levels

Ambient noise levels have been established by monitoring noise levels at six (06) locations in the study area during study period using precision noise level meter. The noise monitoring locations in the study area were selected after giving due consideration to the various land use categories. Noise levels were recorded on an hourly basis for one complete day at each location using pre- calibrated noise levels. A combined map showing the Noise monitoring locations is given as **Figure FD0301** and the details of the sampling locations are given in **Table 3-5**. Detailed noise monitoring data is given in **Appendix H**.

Table 3-5: Baseline Noise Monitoring Locations

S. No.	Location Name	Distance	Azimuth Direction	Environmental Setting
1	Honnavar Near Port Office	1.8 km	SE	Residential Area
2	Kasarkod Village Near Sub Station	4.2 km	SE	Residential Area
3	Karki Village, Havyka Sabha Bhavan	0.9 km	E	Residential Area
4	Ramtirth Village, Near RTO Office	3.0 km	E	Residential Area
5	Kulkod Village, Near Govt School	4.3 km	E	Residential Area
6	Hosad Village, Near Primary School	7.0 km	SE	Residential Area

3.6.3 Results and Discussion

Based on the recorded hourly noise levels at each monitoring location, the day equivalent (Ld) and night equivalent (Ln) were calculated,

- L_d: Average noise levels between 46.6 to 58.5 dB(A) 6:00 hours to 22.00 hours.
- L_n: Average noise levels between 36.5 to 46.5 dB(A) 22:00 hours to 6.00 hours.

The Day-Night (L_{dn}) equivalent noise levels were calculated using the US Environmental Protection Agency formula:

$$L_{dn} = 10 \text{ Log } [0.0416 \{16 (10L_d/10) + 8 (10L_n+10/10)\}]$$

The comparison of day equivalent noise levels (Ld) and night equivalent noise levels (Ln) with the respective CPCB stipulated noise standards for various land use categories are shown in the **Figure 3-20.** The summary of the results are given in **Table 3-6.**

Table 3-6: Ambient Noise Monitoring Results Summary

S. No	Location	Environmental Setting	L_d	CPCB Standard Ld	L_n	CPCB Standard Ln
NQ1	Honnavar, Near Sharavathi Circle	Residential Area	58.5	55	46.5	45
NQ2	Kasarkod, Near Primary school	Residential Area	48.6	55	38.6	45

S. No	Location	Environmental Setting	L_d	CPCB Standard Ld	L_n	CPCB Standard Ln
NQ3	Karki, Near Primary School	Residential Area	49.8	55	40.7	45
NQ4	Ramtirth, Near RTO Office	Residential Area	50.8	55	41.4	45
NQ5	Kulkod, Near Church	Residential Area	47.5	55	37.6	45
NQ6	Hosad, Near Bus Stop	Residential Area	43.8	55	36.5	45

3.6.4 Observations

It is observed that day and night-time equivalent noise levels at all locations are within NAAQS standards for Industrial, residential and silent zones.

- Day equivalent noise levels (Ld) ranged between 43.8 to 58.5 dB(A)
- Night equivalent noise levels (Ln) ranged between 36.5 to 46.5 dB(A)
- Noise levels are slightly high in the project site due to the traffic and construction activities.

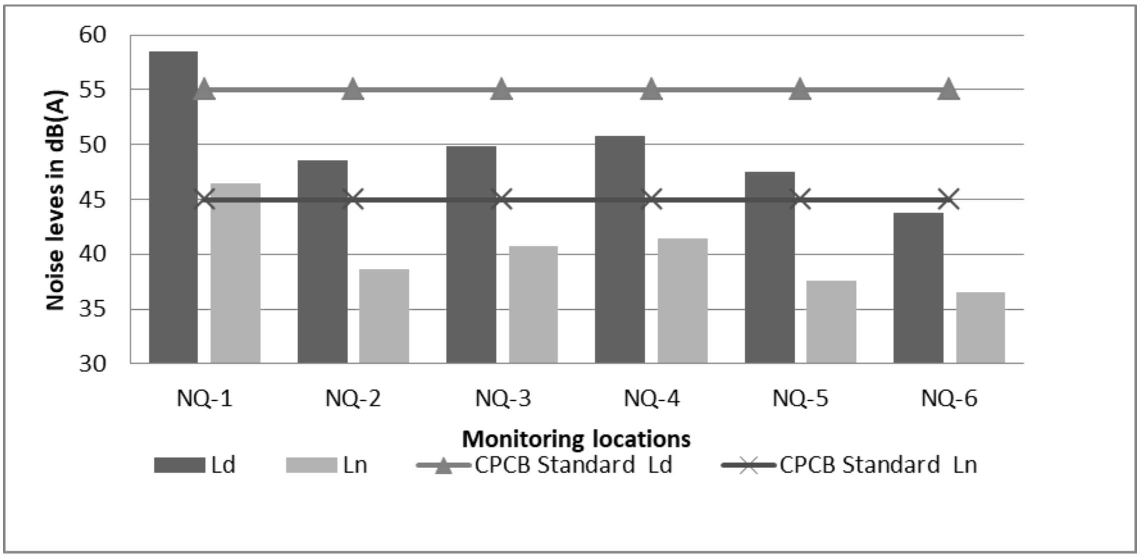


Figure 3-20: Noise Monitoring Results

3.6.4.1 Secondary Data Analysis

To understand the surrounding environment in a comprehensive manner, noise quality secondary data comparison is assessed from the baseline data of “EIA/EMP for Proposed Four Laning of Honnavar Port connectivity road from km 0.00 (Kasarkod side of Honnavar port) to Km 2.580 (towards NH – 66) connecting Honnavar Port with NH - 66 at Km 195.986 and to improve NH – 66 from Km 195.00 to Km 197.00” which was collected during post-monsoon season 2022.

- Ambient Noise levels during the day ranged between 44.1 to 54.7 dB(A)

Noise monitoring results reveal ambient noise levels are well within the limits as per CPCB standards.

3.6.5 Inland Surface and Ground Water Quality

The baseline status of water quality has been assessed through the identification of water resources and appropriate sampling locations for surface and groundwater in the study area. The water samples were collected once during the study period and were analysed for physical, chemical and bacteriological parameters. Standard methods prescribed for sampling and analysis were adopted. Sampling protocol was based on the hydrogeological conditions of the region and also based on the competitive usage of the respective water source from which the sample has been collected.

3.6.6 Ground Water Quality

Total Six (03) ground water monitoring locations were identified for assessment in different villages around the project site based on the usage of ground water by the settlements/ villages in the study area. The groundwater results are compared with the desirable and permissible water quality standards as per IS: 10500 (2012) (as amended) for drinking water. Groundwater quality monitoring locations are given in **Table 3-7.** A combined map showing the Groundwater quality monitoring locations is given as **Figure FD0301**.

Table 3-7: Groundwater Monitoring Locations

S. No.	Location Name	Co-Ordinates	
		Latitude	Longitude
1	Honnavar, Near Coastal Police Station	14°16'37"N	74°26'25" E
2	Kasarkod, Near Ganesh Mandir	14°14'58"N	74°26'51" E
3	Karki, Near Bus Stop	14°17'46"N	74°26'12" E

3.6.6.1 Results and Discussion

The detailed results are given in **Appendix H** and summary of the results are given below.

- Temperature ranged between 25.6 to 26.4°C.
- pH ranged between 6.86 to 7.3.
- Salinity ranged between 0.02 to 0.07 ppt.
- Electrical Conductivity (EC) ranged between 66 to 286 μs/cm
- BOD ranged less than 02 mg/l at all locations
- COD ranged less than 04 mg/l at all locations
- DO ranged less than 01 mg/l at all locations
- Residual free chlorine varied less than 0.02 mg/l at all locations.
- Total dissolved solids ranged between 43 mg/l to 186 mg/l
- Total alkalinity (as $CaCO_3$) varied between 10 mg/l to 60 mg/l
- Total hardness (as $CaCO_3$) ranged between 10 mg/l to 80 mg/l
- Calcium ranged between 02 mg/l to 20 mg/l.
- Chlorides (as Cl^-) ranged between 10 mg/l to 40 mg/l
- Fluorides as (F^-) ranged less than 0.1 to 0.5 mg/l at all locations.
- Sulphates as (SO_4) ranged between 6.6 to 20.8 mg/l.
- Nitrates value ranged between 1.2 to 5 mg/l.
- Manganese (Mn), Zinc as (Zn), Cadmium (Cd), Arsenic (As), Mercury (Hg), Total Chromium (Cr), Phenol Compounds, Cyanide (CN) found to be below 0.001 mg/l at all the locations.
- Coliforms not detected at any of the locations. Faecal Coliforms were below 2 MPN/ml in all the water samples.

It is observed that all ground water sample collected within the study area are well within the permissible limits of drinking water standards IS 10500:2012 (as amended).

3.6.6.2 Secondary Data Analysis

To understand the surrounding environment in a comprehensive manner, surface water quality secondary data comparison is assessed from the baseline data of “EIA/EMP for Proposed Four Laning of Honnavar Port connectivity road from km 0.00 (Kasarkod side of

Honnavar port) to Km 2.580 (towards NH – 66) connecting Honnavar Port with NH - 66 at Km 195.986 and to improve NH – 66 from Km 195.00 to Km 197.00" which was collected during post-monsoon season 2022.

Test Parameters	Unit	max	min
Colour Hazen Units	Hazen	<5	--
Odour	---	Agreeable	Agreeable
Conductivity	µs/c	1467	893
pH Value	---	7.38	6.89
Turbidity	NTU	<1	-
Total Dissolved Solids	mg/L	935	572
Chloride as Cl	mg/L	220	110
Total Hardness as $CaCO_3$	mg/L	520	290
Calcium as Ca	mg/L	124.2	76.1
Magnesium as Mg	mg/L	51	24.3
Sulphate as SO_4	mg/L	34.8	11.6
Fluoride as F	mg/L	0.7	0.3
Total Alkalinity as $CaCO_3$	mg/L	360	140
Total Alkalinity as $CaCO_3$	mg/L	360	140
Nitrate as NO_3	mg/L	6.1	4.2
Iron as Fe	mg/L	<0.1	-
Total Coliform, MPN/100ml	mg/L	Not Detected	Not Detected
E. Coli, MPN/100ml	mg/L	Not Detected	Not Detected

3.6.7 Surface Water Quality

Three (03) surface water monitoring locations were identified for assessment in different villages around the project site based on the usage of surface water by the settlements/ villages in the study area.

Water sample analysis with respect to physico-chemical, nutrient demand and bacteriological parameters having relevance to public health and aesthetic significance are selected to assess the water quality status with special attention. Standard methods prescribed for surface sampling and analysis were adopted.

Descriptions of sampling locations are given in **FD0301** and **Table 3-8**.

Table 3-8: Surface Water Monitoring Locations

S. No.	Code	Location Name	Co-Ordinates	
			Latitude	Longitude
1	SW-1	Sharavati River Near Honavar	14°16'34"N	74°26'24" E
2	SW-2	Badgane River Near Pavinkurve	14°15'53"N	74°29'15" E
3	SW-3	Sharavati River Near Hosad	14°20'25"N	74°25'10" E

3.6.7.1 Results and Discussion

The detailed results are given in **Appendix H** and summary of the results are given below.

- Temperature ranged between25 to 26.1°C.
- pH ranged between 6.88 to 6.75 indicating the surface waters are neutral to slightly acidic in nature
- Electrical Conductivity (EC) ranged between 80 to 128 µs/cm
- Total Dissolved Solids (TDS) ranged between 52 to 84 mg/l
- Total Solids (TDS) ranged between 52 to 84 mg/l
- Turbidity ranged between 13.5 to 22.8 mg/l

- Total Hardness (as $CaCO_3$) ranged between 20 to 30 mg/l
- Total Alkalinity (as $CaCO_3$) ranged between 10 to 30 mg/l
- Calcium ranged between 4 to 8 mg/l
- Magnesium ranged 2.4 mg/l at all locations.
- Chlorides ranged between 10 to 15 mg/l
- Sulphates ranged between 8.5 to 14.3 mg/l
- Nitrates ranged between 2.5 to 3.7 mg/l
- BOD ranged between 5 to 6 mg/l
- COD ranged between 20 to 30 mg/l
- Dissolved Oxygen (DO) ranged between 4 to 4.8 mg/l
- Mercury (Hg), Zinc (Zn) Lead (Pb) Arsenic (As), Cadmium (Cd) is <0.01 mg/l at all locations
- Total Coliforms recorded were 130 to 210 MPN/100 ml
- Faecal Coliforms recorded were 20 to 30 MPN/100 ml

As per CPCB classification, the samples fall under classification C (Drinking water source after conventional treatment and disinfection)

3.6.7.2 Secondary Data Analysis

To understand the surrounding environment in a comprehensive manner, surface water quality secondary data comparison is assessed from the baseline data of “EIA/EMP for Proposed Four Laning of Honnavar Port connectivity road from km 0.00 (Kasarkod side of Honnavar port) to Km 2.580 (towards NH – 66) connecting Honnavar Port with NH - 66 at Km 195.986 and to improve NH – 66 from Km 195.00 to Km 197.00” which was collected during post-monsoon season 2022.

Test Parameters	Unit	SW1	SW2
Colour	Hazen	25	30
Odour	…	Disagreeable	Disagreeable
Conductivity, µs/cm	…	921	2840
pH Value	…	7.86	7.71
Turbidity	NTU	21.4	22.4
Total Dissolved Solids	mg/L	597	1980
Chloride as Cl	mg/L	120	500
Total Hardness as $CaCO_3$	mg/L	210	580
Calcium as Ca,	mg/L	56.1	160
Magnesium as Mg	mg/L	17	84
Sulphate as SO_4	mg/L	15.9	351.4
Fluoride as F	mg/L	0.3	1.1
Total Alkalinity as $CaCO_3$	mg/L	220	290
Nitrate as NO_3	mg/L	4.1	12.1
Iron as Fe	mg/L	<0.1	0.3
Dissolved Oxygen	mg/L	3.4	4.2
Total Coli form,	MPN/100ml	12	60
E. Coli, MPN/100ml	MPN/100ml	<1	<1

3.6.8 Soil Quality Monitoring

Soil plays a vital role in EIA study because disturbance in the soil will leads to deterioration of other components of environment such as air, water quality and health. It is essential to determine the potential of soil in the area and identify the current impacts of urbanization on soil quality and also predict impacts due to the proposed construction. Accordingly, a study of assessment of baseline soil quality carried out.

The Baseline monitoring for soil quality has been conducted during the study period at 5 locations. The soil collection was carried out once during the study period based on which the Physio-Chemical were analysed. The soil quality monitoring locations are given in **FD0301** and in the **Table 3-9**

Table 3-9: Soil Quality Monitoring Locations

S. No.	Code	Location Name	Co-Ordinates	
			Latitude	Longitude
1	S-1	Project Site	14°16'55"N	74°25'34" E
2	S-2	Honnavar, Near fish Market	14°16'36"N	74°26'25" E
3	S-3	Kasarkod, Near Ganesh Temple	14°14'50"N	74°26'53" E
4	S-4	Karki, Near sharadha Hospital	14°17'58"N	74°26'03" E
5	S-5	Apsarakonda, Near Beach	14°14'17"N	74°26'34" E

3.6.8.1 Results and Discussion

The detailed results are given in **Appendix H** and the summary of the results are given below:

- Sand -40-60% and Silt – 16-28%, Clay 22-35% at monitored locations
- pH of soil ranged between 6.5 and 7.12 showing slightly acidic to slightly alkaline nature
- Electrical Conductivity varied between 126 μs/cm and 176 μs/cm.
- Water holding capacity varied between 2.3 inch/foot and 5.8 inch/foot
- Infiltration rate varied between 15.2 mm/hr and 20.5 mm/hr
- Bulk density varied between 1.5 gm/cc and 2.62 gm/cc
- Permeability varied between 3.2 and 4.2 cm/hr
- Porosity varied between 0.36 % and 0.52%
- Organic Matter varied between 0.64 % and 1.1 %
- Organic Carbon varied between 0.36 % and 0.64 %
- Zinc (Zn) varied between 0.32 mg/kg and 0.92 mg/kg
- Copper (Cu) varied between 0.08 mg/kg and 0.16 mg/kg
- Iron as Fe varied between 0.48 mg/kg and 0.64 mg/kg
- Sodium Absorption Ratio SAR ranged between 1.05 and 1.46 meq/kg
- Available Nitrogen varied between 398 mg/kg and 454mg/kg
- Available Phosphorus as P varied between 126 mg/kg and 185 mg/kg
- Available Potassium as K varied between 75 mg/kg and 91 mg/kg
- Nickel as Ni, Manganese as Mn, Chromium as Cr ranged below 1mg/kg

3.6.8.2 Secondary data analysis

To understand the surrounding environment in a comprehensive manner, soil quality-secondary data comparison is assessed from the baseline data of "EIA/EMP for Proposed Four Laning of Honnavar Port connectivity road from km 0.00 (Kasarkod side of Honnavar port) to Km 2.580 (towards NH – 66) connecting Honnavar Port with NH - 66 at Km 195.986 and to improve NH – 66 from Km 195.00 to Km 197.00" which was collected during post-monsoon season 2022.

Test Parameters	units	Max	Min
Coarse Sand	%	17	10.5

Test Parameters	units	Max	Min
Fine San	%	25.8	22.5
Silt	%	28.9	24.5
Clay	%	36.6	32.7
Cation Exchange capacity	Mg/kg	29.5	24.3
pH (1 : 2.5)	-	7.58	7.12
Electrical Conductivity (1 : 2.5)	µs/cm	186	119
Organic Matter	%	1.56	1.2
Nitrogen as N	Kg/ha	91.4	75.9
Phosphorous as P	Kg/ha	37.4	30.3
Potassiumas K	Kg/ha	35.2	28.6
Calcium as Ca	mg/kg	29.6	25.4
Chloride as Cl	mg/kg	89	72.9
Moisture Content	%	10.8	8.4
Magnesium as Mg	mg/kg	17.2	12.8
Sulphates as SO4	mg/100g	14.7	12.1
Zinc as Zn	mg/kg	5.5	3.8

3.7 Marine Environment

The Marine sampling locations were carried out at 14 locations including estuarine area of Sharavati River. The MSL map is given as **FD0302**.

S. No	Location Code	Latitude	Longitude	Depth (m)
1	MSL-1	14°16.890'N	74°25.917'E	2.3
2	MSL-2	14°17.571'N	74°25.649'E	2.5
3	MSL-3	14°18.008'N	74°25.500'E	2.0
4	MSL-4	14°18.595'N	74°24.668'E	5.5
5	MSL-5	14°18.079'N	74°24.929'E	4.5
6	MSL-6	14°17.409'N	74°25.027'E	5.0
7	MSL-7	14°16.748'N	74°25.312'E	5.5
8	MSL-8	14°16.954'N	74°24.605'E	8.0
9	MSL-9	14°16.348'N	74°23.751'E	11.5
10	MSL-10	14°15.447'N	74°22.397'E	16.5
11	MSL-11	14°16.564'N	74°20.142'E	20.0
12	MSL-12	14°18.652'N	74°21.830'E	13.5
13	MSL-13	14°18.193'N	74°23.359'E	10.0
14	MSL-14	14°17.842'N	74°24.4016'E	8.2

3.7.1 Sea/Harbour Water Quality

3.7.1.1 Physico-Chemical Parameters

Temperature: The water temperature was recorded from 30.16°C to 31.88°C. The lowest water temperature was found in MSL-11 and the highest temperature was found MSL-1
Salinity: The salinity varied from 4.52 PSU to 35.39 PSU. The lowest salinity was found in MSL-1 and the highest salinity was found in MSL-4
T**urbidity:** The turbidity ranged from 0.84 NTU to 8.97 NTU (average: 2.23±1.55 NTU). The lowest turbidity was observed in MSL-11 and the highest turbidity was observedin MSL-5
Dissolved Oxygen: The dissolved oxygen varied from 4.43 to 8.34 mg/l (average: 6.98±0.98 mg/l). The lowest DO was found in MSL-11 (bottom) and the highest DO was found in MSL14

Biochemical oxygen demand: The BOD varied from 1.08 mg/l to 2.86 mg/l (average: 1.66±0.60 mg/l). The highest BOD was found in MSL-14. In two stations (MSL-10 and MSL-12)

The Results of Physico-chemical parameters of marine water is shown in the **Figure 3-21** to **Figure 3-22**.

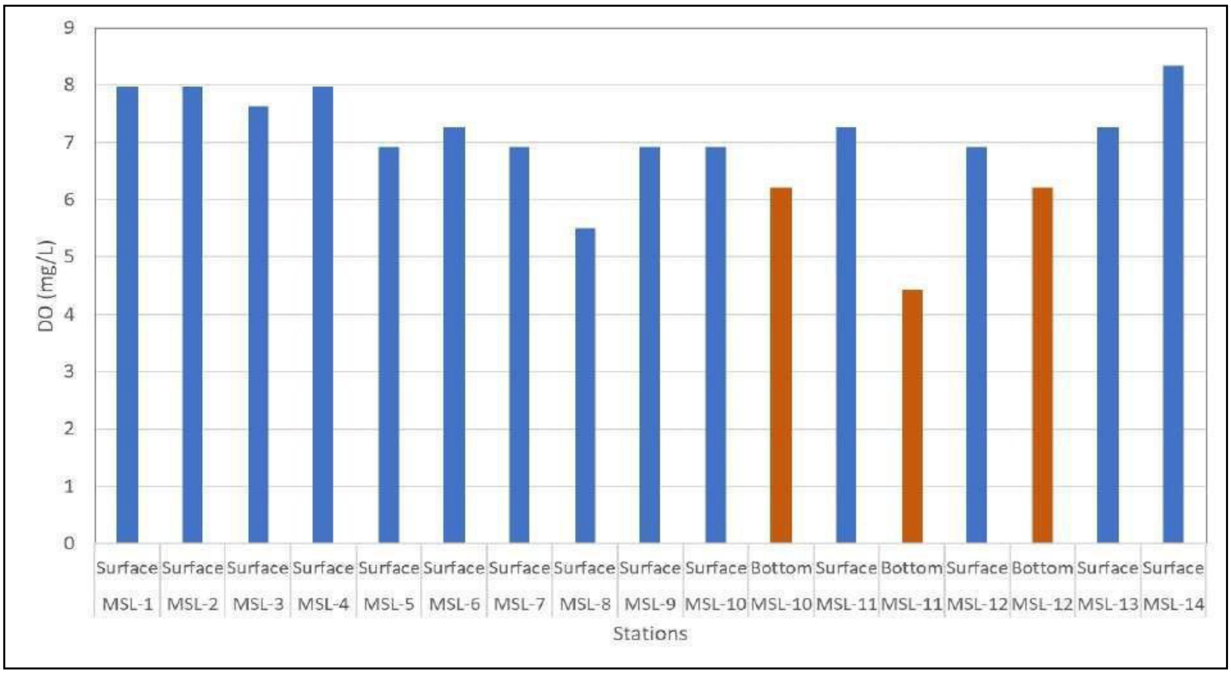


Figure 3-21: DO in the water samples of study locations

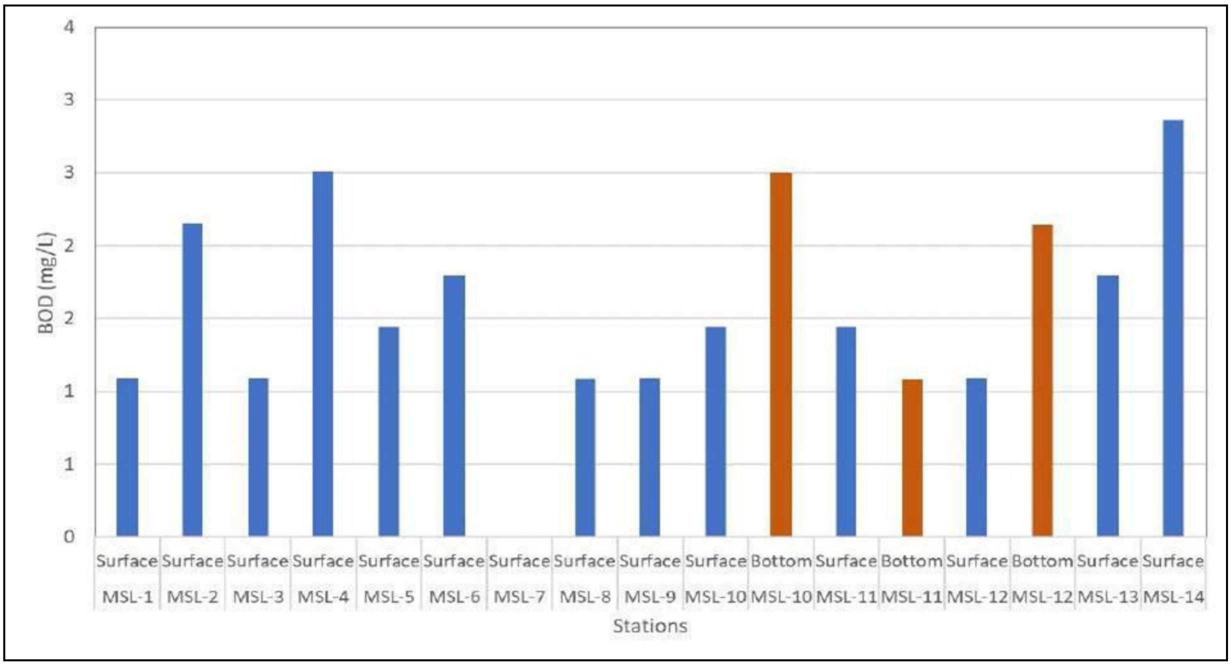


Figure 3-22: BOD in the water samples of study locations

3.7.1.2 Nutrients

Nitrate: Concentration of Nitrate ranged between 0 to 0.32 µmol/l, minimum was recorded in the MSL-7 and maximum was recorded in MSL-10

Nitrite: Concentration of Nitrite ranged between 0.01 to 0.06 µmol/l, minimum was recorded in the MSL-11 and maximum was recorded at MSL-9 & MSL-1

Total Phosphate: Concentration of total phosphate ranged between 0.14 to 0.45 µmol/l, where the minimum level was recorded in MSL-3 & MSL-2 and maximum was recorded in MSL-14.

Silicate: Concentration of Silicates ranged between 17.96 to 111.72 µmol/, minimum level was recorded in MSL-12 and maximum was recorded in MSL-1.

Ammonia: Concentration of Ammonia ranged between 0.71 to 2.07 µmol/l minimum level was recorded in MSL-3 and maximum was recorded in MSL-1.

The Results of Nutrients in marine water are shown from **Figure 3-23** to **Figure 3-27.**

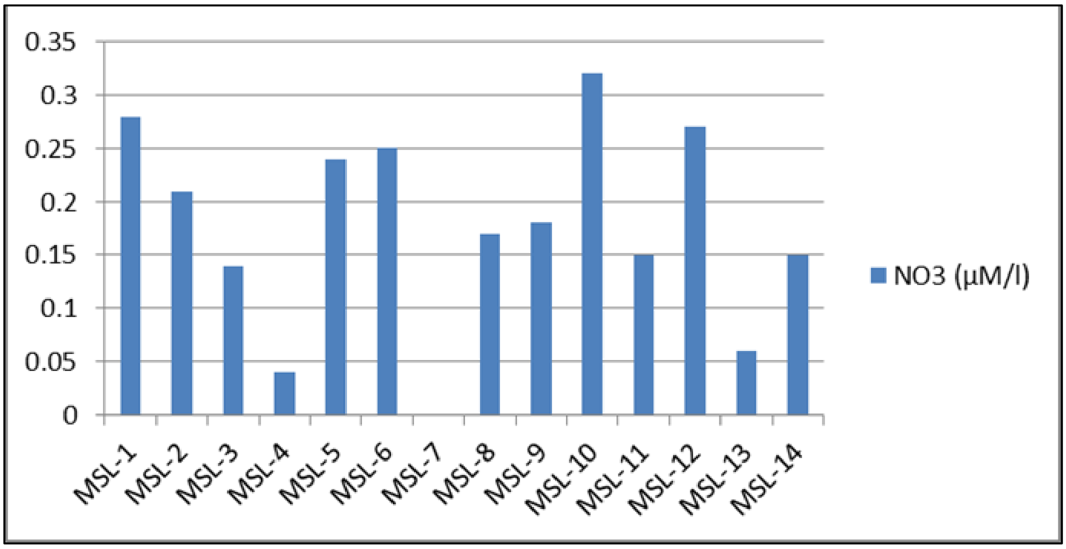


Figure 3-23: Nitrates in the study locations

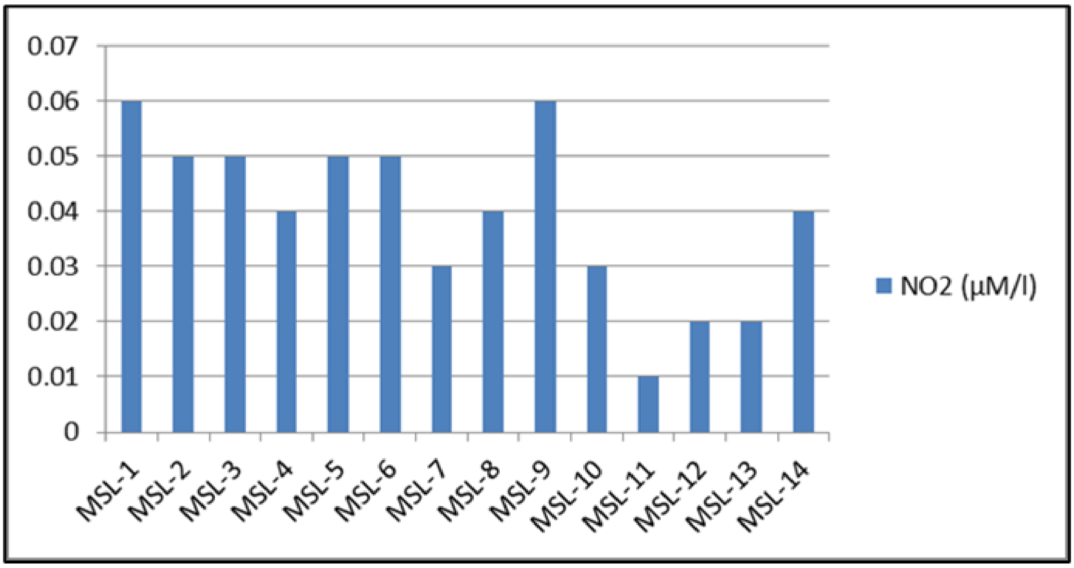


Figure 3-24: Nitrites in the water samples of study locations

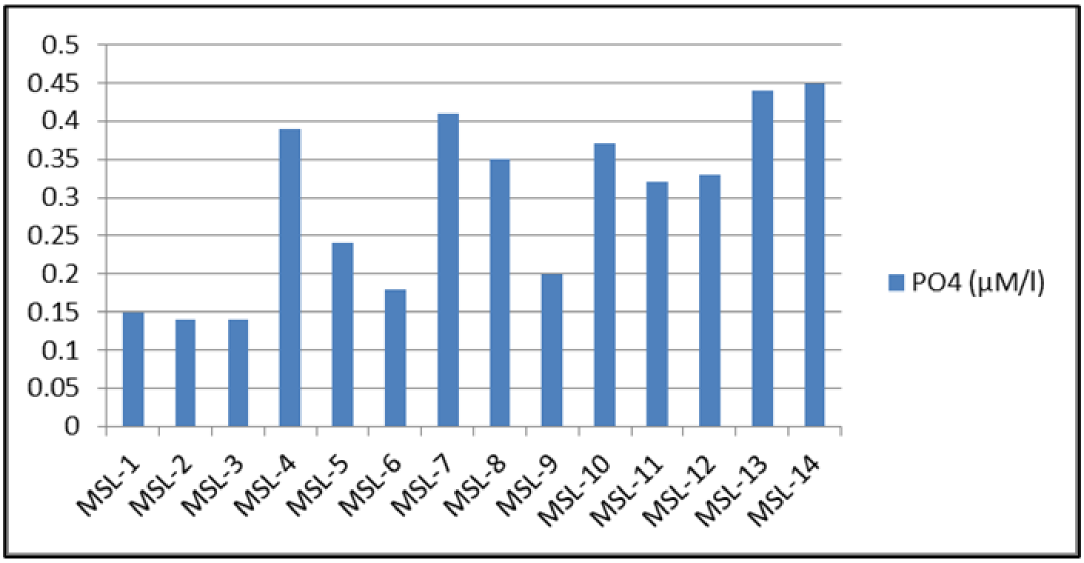


Figure 3-25: Total Phosphate in the study locations

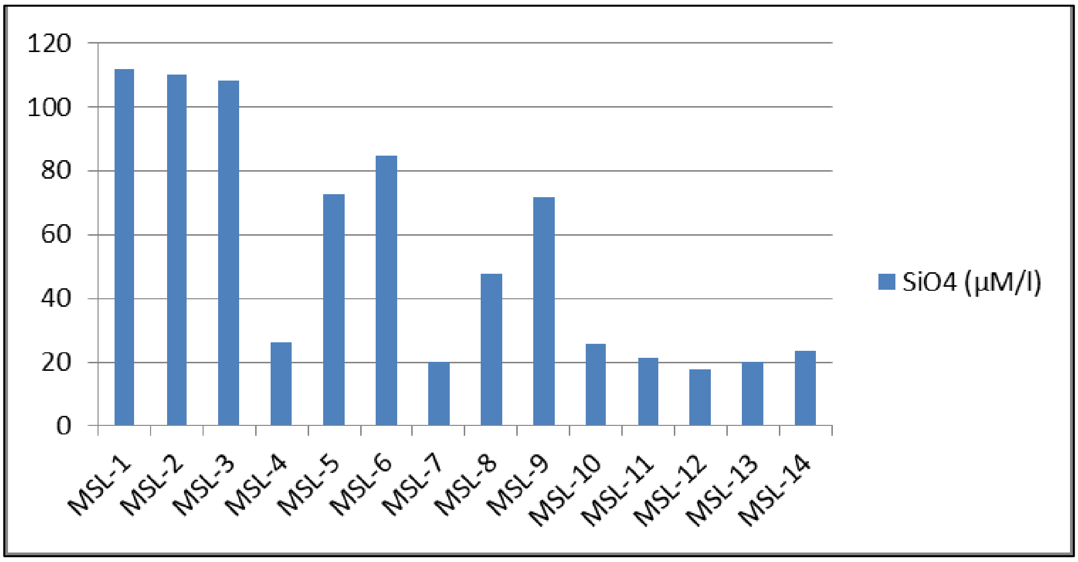


Figure 3-26: Silicates in the water samples of study locations

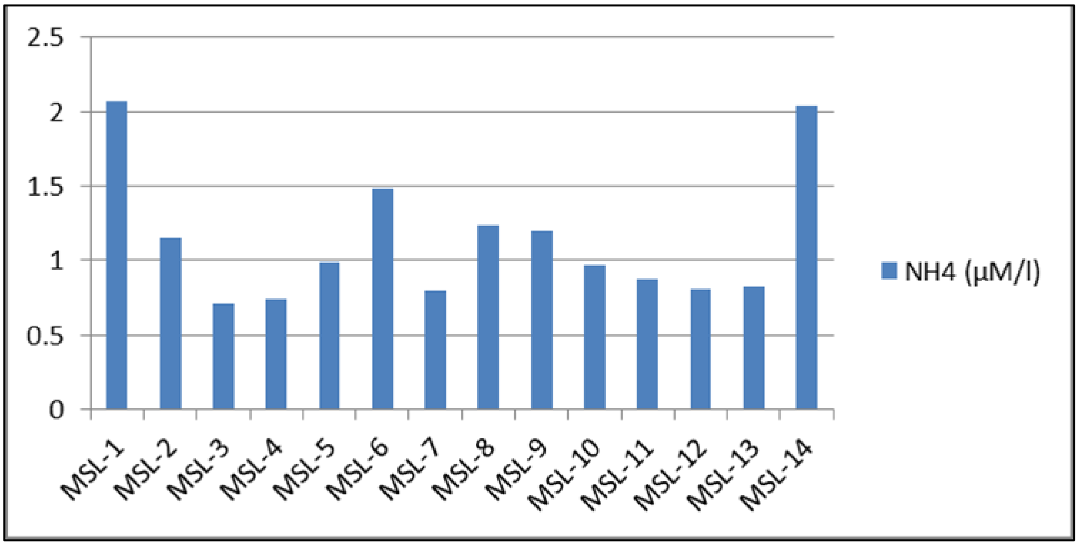


Figure 3-27: Ammonical Nitrogen in the study locations

3.7.2 Marine Sediment

The marine environment of the project region has been studied for the evaluation of baseline information and the existing marine environmental conditions around the site were established through collection and analysis of water and sediment samples in the project region.

The potential impacts due to the construction and operation of the proposed project components will be felt on the marine environment. Therefore, existing marine environmental conditions were monitored to establish the baseline status. This will remain as benchmark data for monitoring environmental impacts due to various project activities. The locations in the marine monitoring network were selected such that the existing baseline conditions in the area likely to be affected by the effect of potential environmental impacts of the project activities.

The detailed results are given in **Appendix H** and summarised results are given below.

3.7.2.1 Physico-chemical parameters

Sediment texture analysis indicates that sand, silty sand and sandy silt and clay were observed in the study area. The sand fraction ranged from 0.02 to 97.44%, silt fraction ranged from 2.16% to 99.32 and clay fraction ranged from 0.08 to 1.69% as shown below.

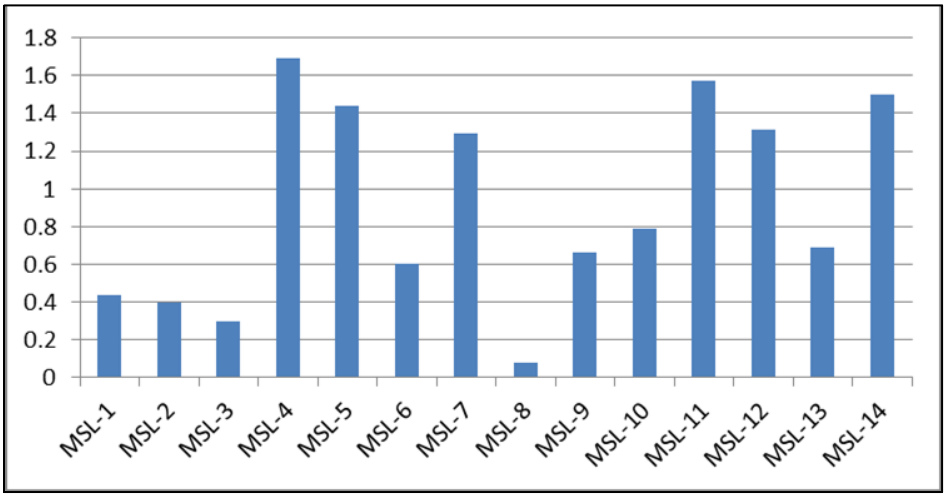


Figure 3-28: Clay concentration % in marine sediment

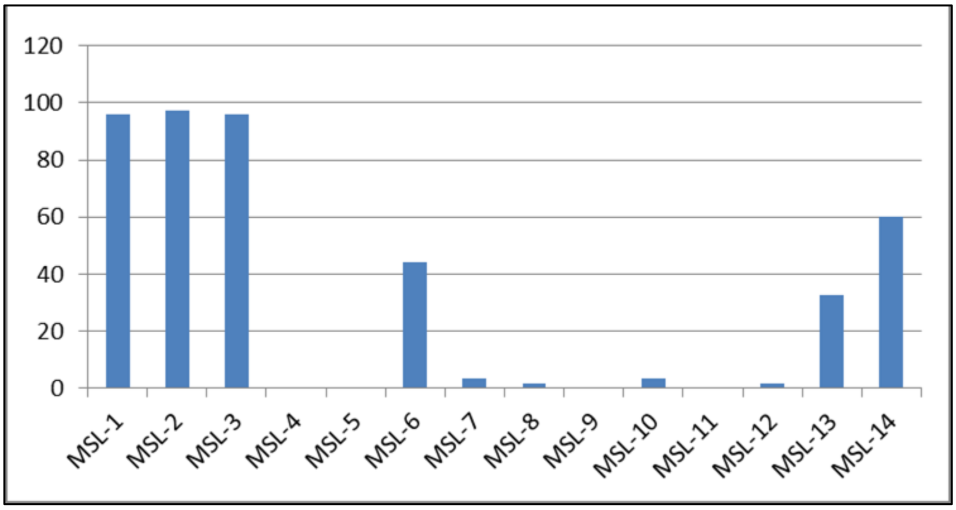


Figure 3-29: Sand concentration % in marine sediment

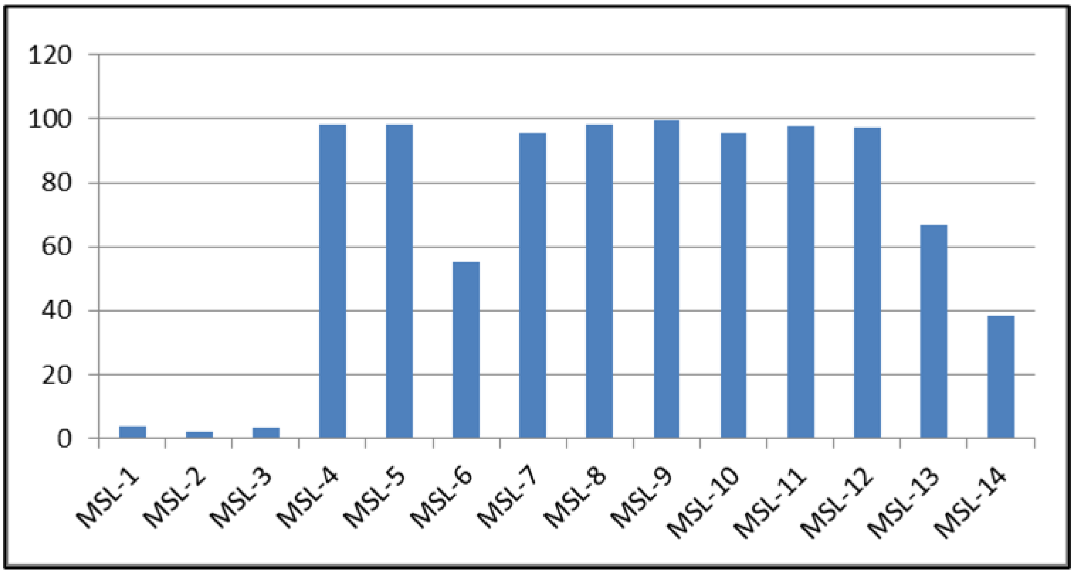


Figure 3-30: Silt concentration % in marine sediment

3.7.2.2 Trace Metals

Aluminium: Concentration of Al ranged 7.27 to 14.43 %, min at MSL-3 and Max at MSL-8 respectively.
Calcium: Concentration of Ca ranged 0.36 to 2.26 %, min at MSL-2 and Max at MSL-8 respectively.
Iron: Concentration of Fe ranged 0.6 to 6.35 %, min at MSL-2 and Max at MSL-8 respectively.
Magnesium: Concentration of Mg ranged 0.03 to 2.38 %, min at MSL-3 and Max at MSL-8 respectively.
The Results of Nutrients in marine sediment is shown from **Figure 3-31** to **Figure 3-34**

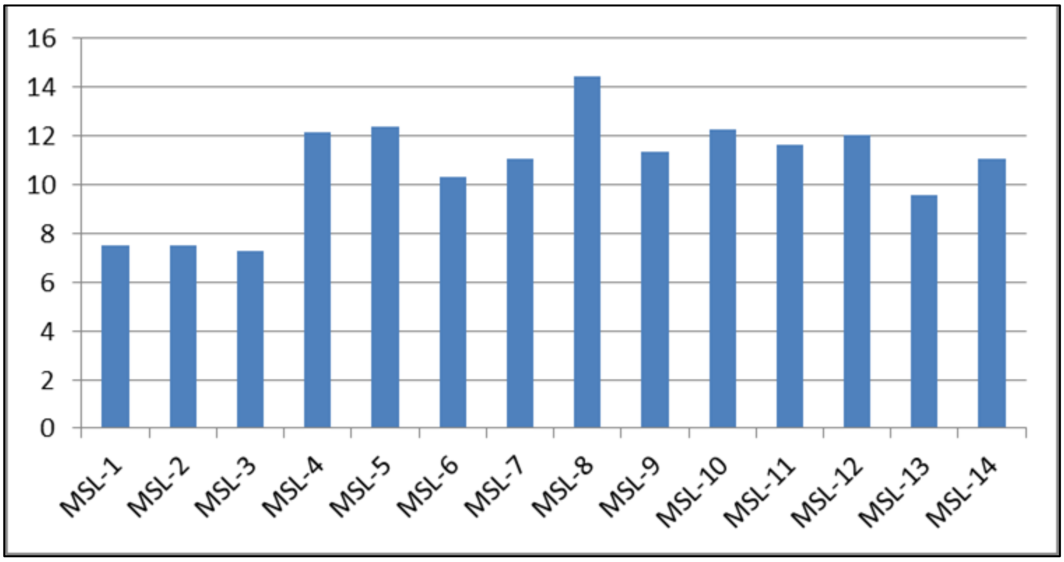


Figure 3-31: Aluminium % in the sediment samples of study locations

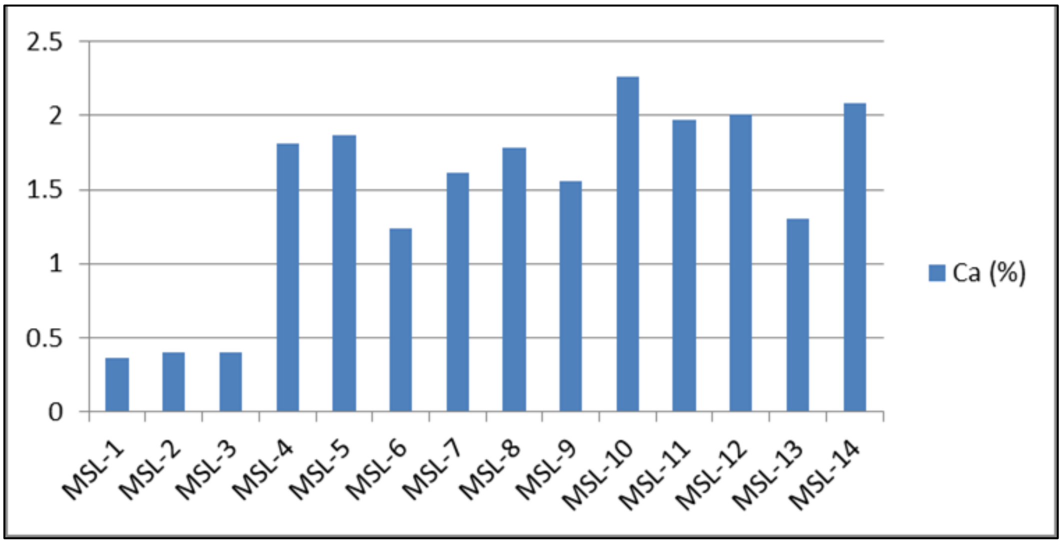


Figure 3-32: Calcium % in the sediment samples of study locations

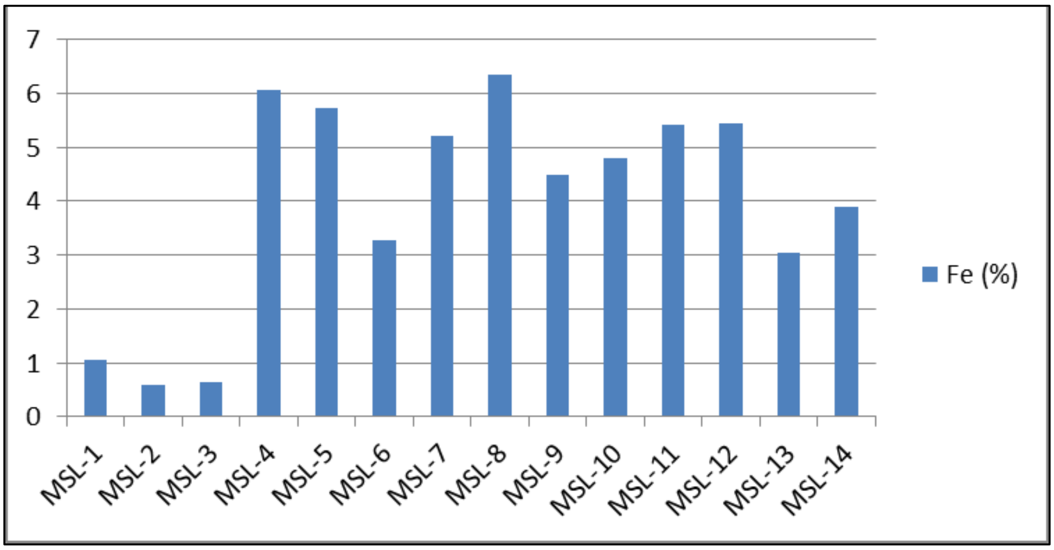


Figure 3-33: Fe % in sediment samples in the study locations

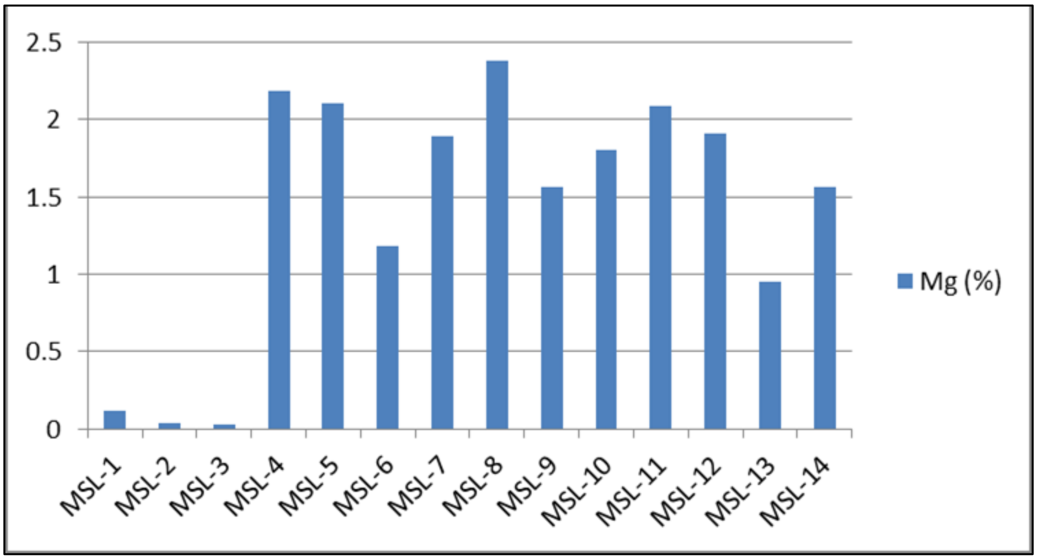


Figure 3-34: Magnesium % in the sediment samples of study locations

3.7.2.3 Heavy Metals

Mercury: Concentration of Hg ranged upto 0.05 µg/g at MSL-11.
Chromium: Concentration of Cr ranged 14.55 to 217.65 µg/g, min at MSL-2 and Max at MSL-8 respectively.
Zinc: Concentration of Zn ranged 21.8 to 115.9 µg/g, min at MSL-2 and Max at MSL-5 respectively.
Nickel: Concentration of Ni ranged 18.33 to 98.2 µg/g, min at MSL-2 and Max at MSL-8 respectively.
Copper: Concentration of Cu ranged 9.45 to 53.37 µg/g, min at MSL-2 and Max at MSL-8 respectively.
Cobalt: Concentration of Co ranged 0.78 to 22.38 µg/g, min at MSL-3 and Max at MSL-4 respectively
Lead: Concentration of Pb ranged 3.14 to 19.75 µg/g, min at MSL-2 and Max at MSL-8 respectively.
Arsenic: Concentration of As ranged 4.18 to 29.52 µg/g, min at MSL-2 and Max at MSL-4 respectively.
Cadmium: Concentration of As ranged 4.18 to 29.52 µg/g, min at MSL-2 and Max at MSL-4 respectively.
Manganese: Concentration of As ranged 4.18 to 29.52 µg/g, min at MSL-2 and Max at MSL-4 respectively.

The Results of Heavy Metals in marine sediment is shown from **Figure 3-35** to **Figure 3-42.**

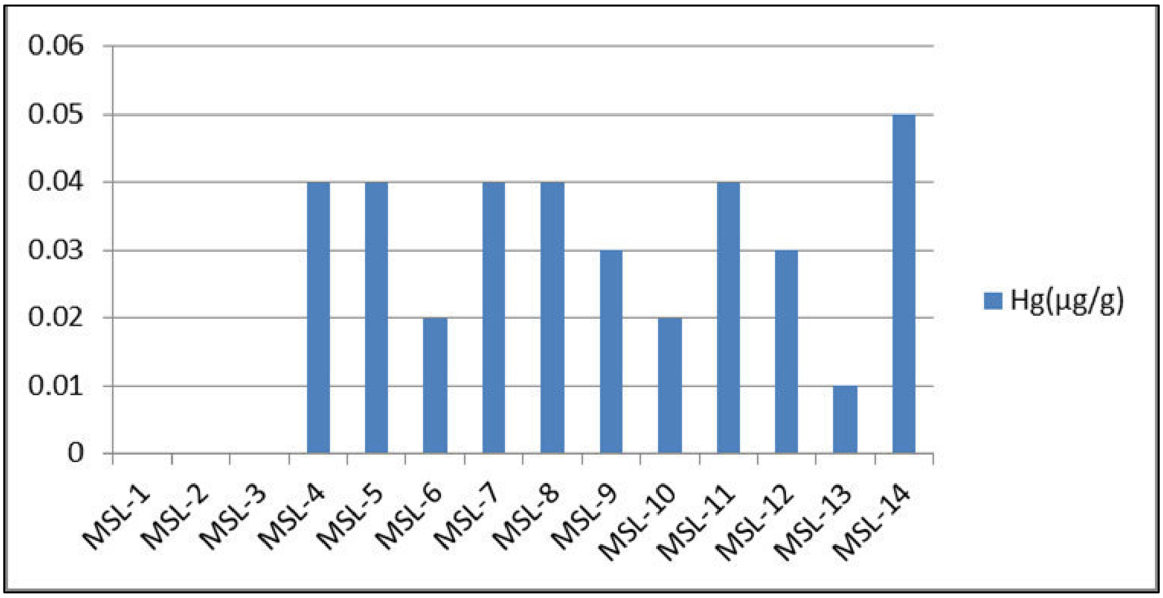


Figure 3-35: Mercury concentration in the Marine sediment

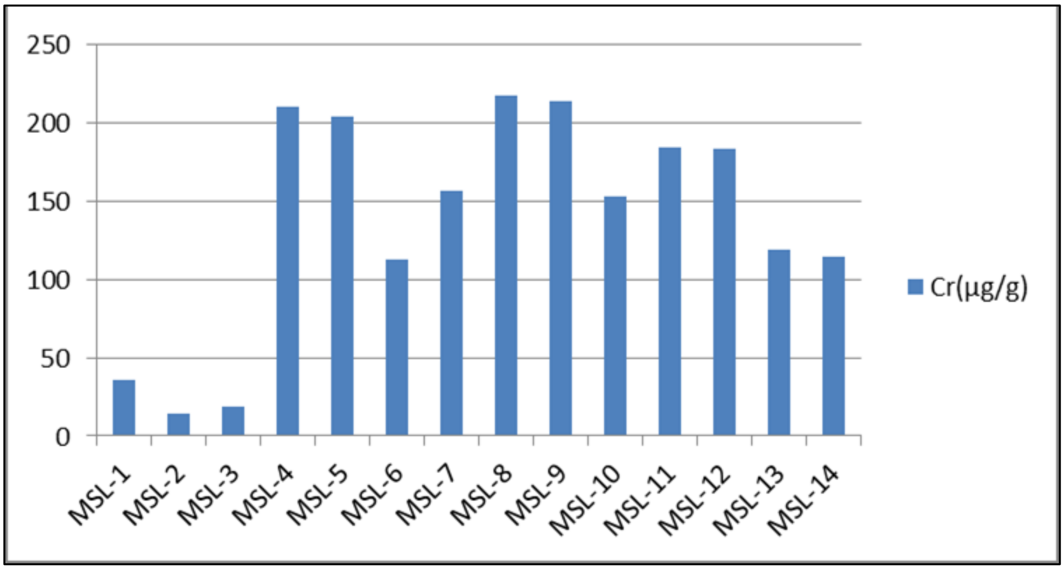


Figure 3-36: Chromium concentration in the Marine sediment

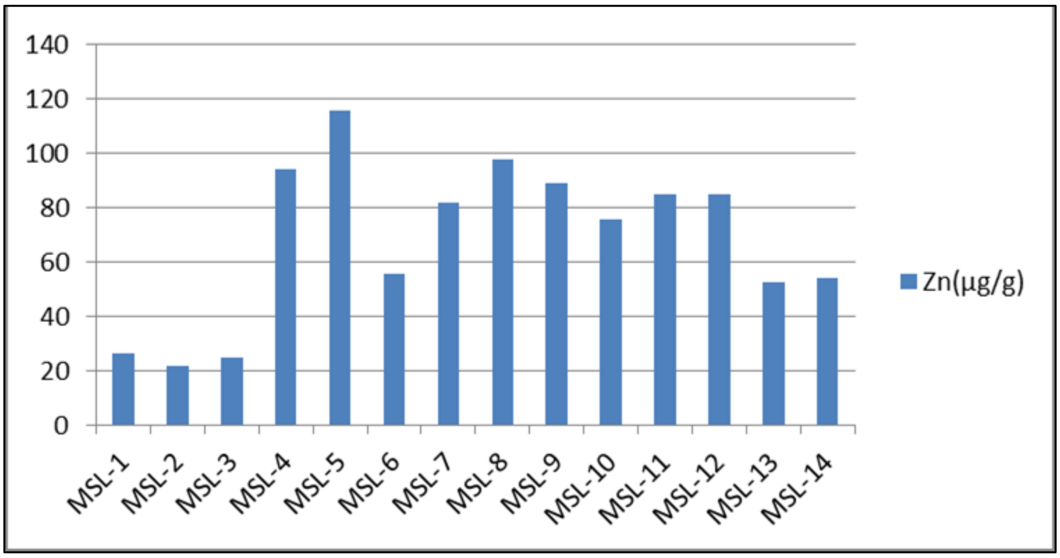


Figure 3-37: Zinc concentration in the Marine sediment

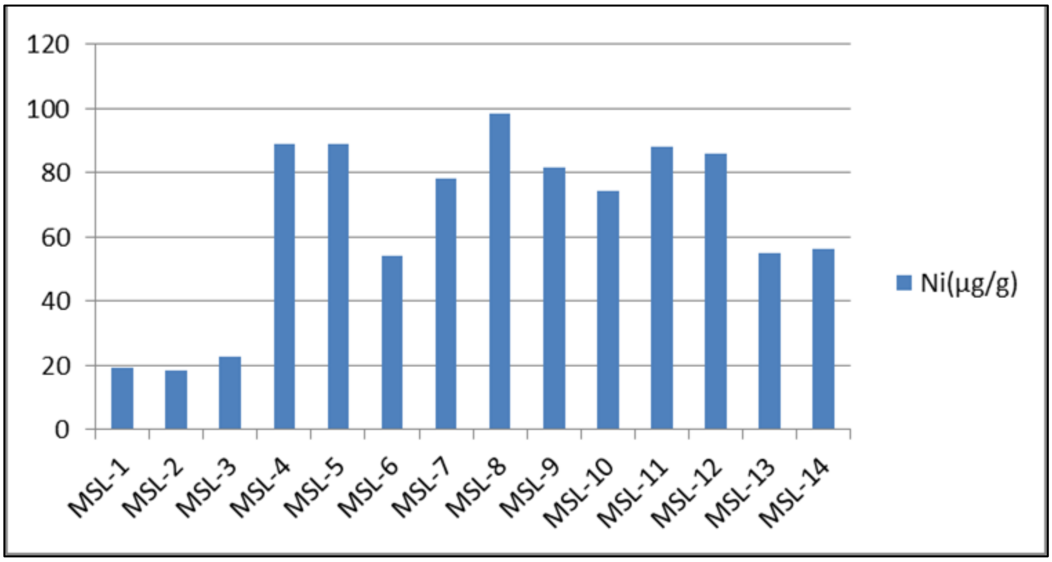


Figure 3-38: Nickel concentration in the Marine sediment

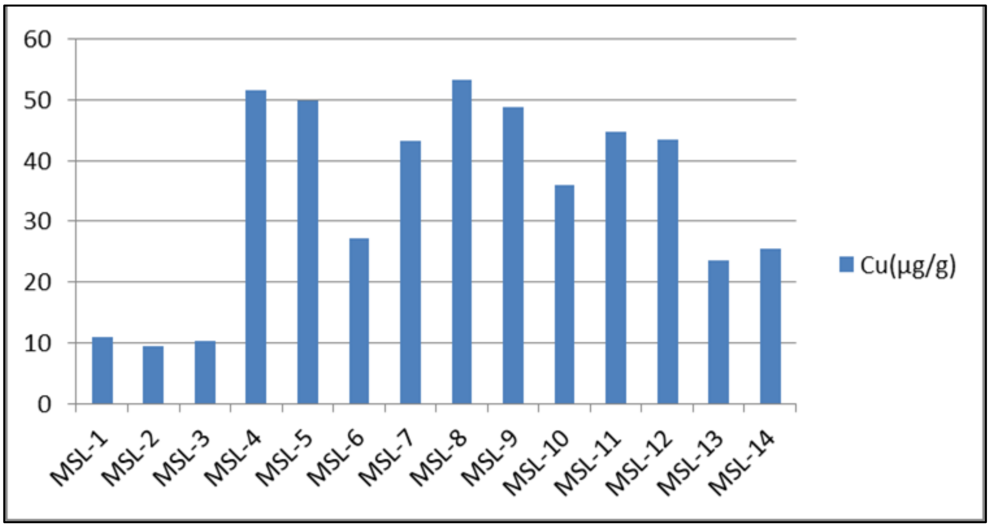


Figure 3-39: Copper concentration in the Marine sediment

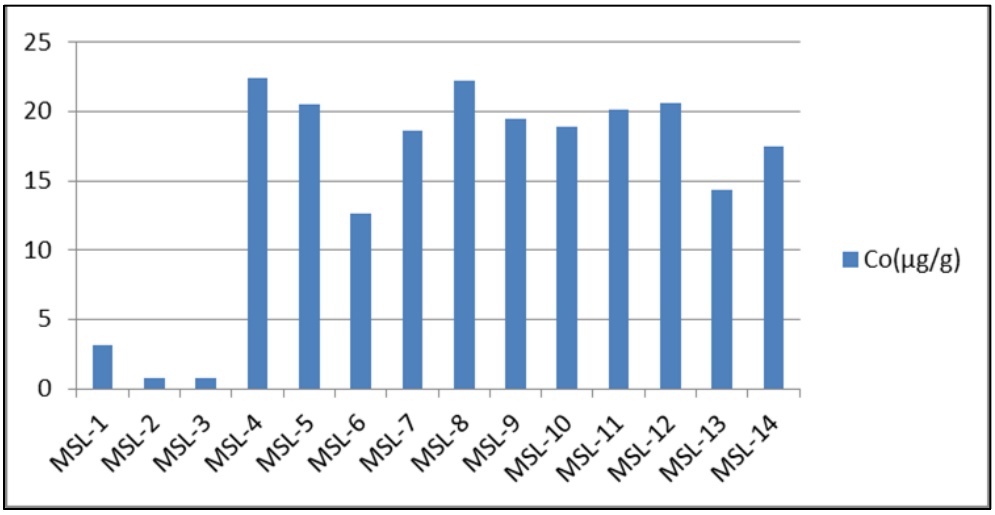


Figure 3-40: Cobalt concentration in the Marine sediment

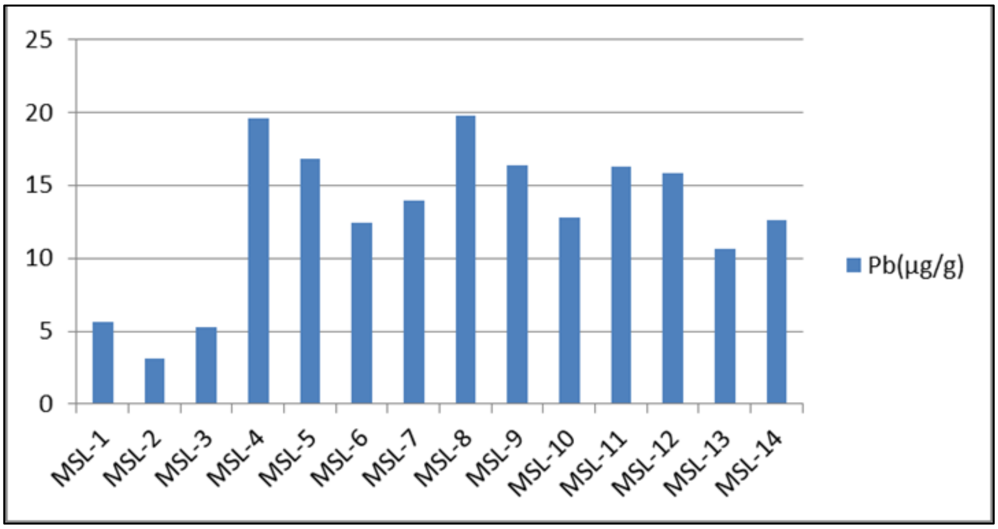


Figure 3-41: Lead concentration in the Marine sediment

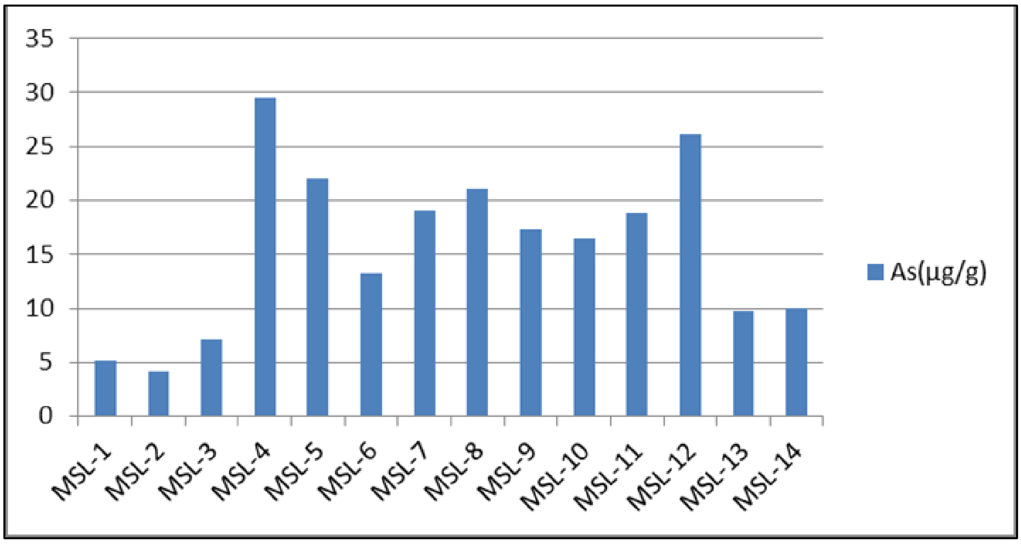


Figure 3-42: Arsenic concentration in the Marine sediment

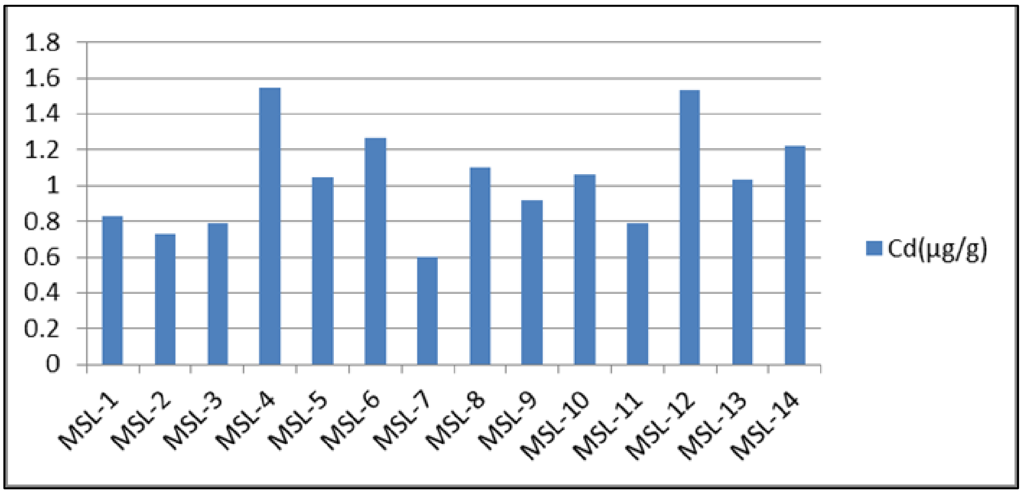


Figure 3-43: Cadmium concentration in the Marine sediment

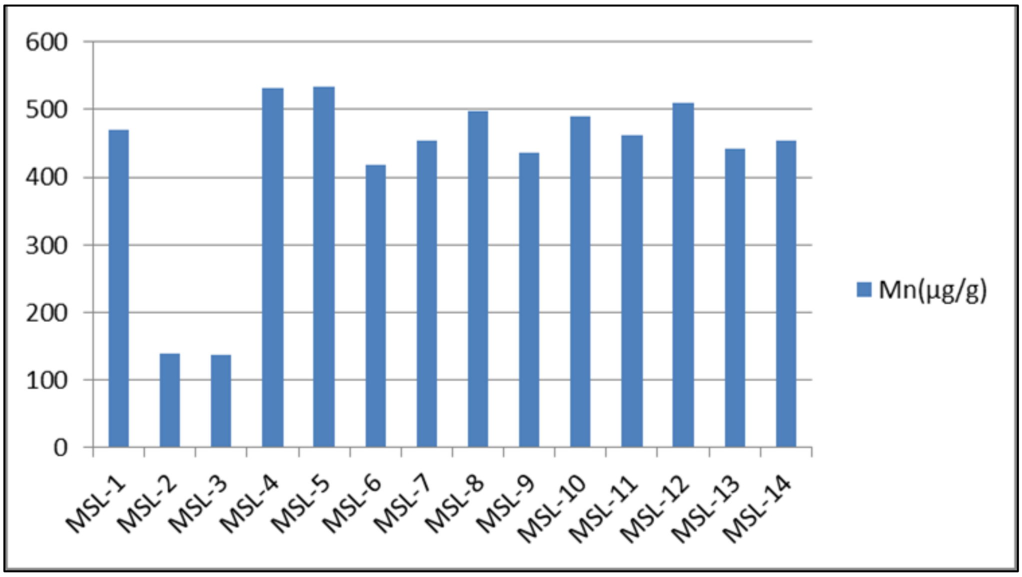


Figure 3-44: Manganese concentration in the Marine sediment

3.7.3 Marine Biology

3.7.3.1 Bacterial population

3.7.3.1.1 Total viable count of Bacteria

Total viable count of bacteria varied between 3 x 10^3 CFU $100mL^{-1}$ at MSL-13 and MSL-14 and 4 x 10^4 CFU $100mL^{-1}$ at MSL-5 as shown in following table.

Table 3-10: Total viable count of bacteria

Locations	Source	Total viable Count (CFU $100mL^{-1}$)
MSL-1	Surface Water	2 x 10^4
MSL-2	Surface Water	3 x 10^4
MSL-3	Surface Water	3.9 x 10^4
MSL-4	Surface Water	2 x 10^4
MSL-5	Surface Water	4 x 10^4
MSL-6	Surface Water	1.2 x 10^4
MSL-7	Surface Water	2 x 10^4
MSL-8	Surface Water	1.9 x 10^4
MSL-9	Surface Water	7 x 10^3
MSL-10	Surface Water	1.9 x 10^4
MSL-10	Bottom Water	5 x 10^3
MSL-11	Surface Water	1.3 x 10^4
MSL-11	Bottom Water	7 x 10^3
MSL-12	Surface Water	2.5 x 10^4
MSL-12	Bottom Water	6 x 10^3
MSL-13	Surface Water	3 x 10^3
MSL-14	Surface Water	3 x 10^3

3.7.3.1.2 Total E. coli and Other Coliforms Count

Total E. coli count of bacteria varied between 1 x 10^1 CFU $100mL^{-1}$ at MSL-3 and MSL-9 and 2 x 10^1 CFU $100mL^{-1}$ at MSL-6 and MSL-8 as shown in following table. No E. coli growth was observed in other marine sampling locations.

Other coliforms count varied between 3 x 10^1 CFU $100mL^{-1}$ at MSL-9 and 8.2 x 10^2 CFU $100mL^{-1}$ at MSL-3. No coliforms growth was detected in marine sampling locations MSL-4, MSL-10, MSL-12, MSL-13 and MSL-14. At MSL-11, other coliforms were observed in surface water sample which were absent in bottom water.

Table 3-11: Total *E. coli* and Other Coliforms Count

Locations	Source	Total Count (CFU $100mL^{-1}$)	
		E. coli	Other Coliforms
MSL-1	Surface Water	Nil	1.4 x 10^2
MSL-2	Surface Water	Nil	3.7 x 10^2
MSL-3	Surface Water	1 x 10^1	8.2 x 10^2
MSL-4	Surface Water	Nil	Nil
MSL-5	Surface Water	Nil	2.6 x 10^2
MSL-6	Surface Water	2 x 10^1	2.6 x 10^2
MSL-7	Surface Water	Nil	1 x 10^2
MSL-8	Surface Water	2 x 10^1	4.3 x 10^2
MSL-9	Surface Water	1 x 10^1	3 x 10^1
MSL-10	Surface Water	Nil	Nil
MSL-10	Bottom Water	Nil	Nil
MSL-11	Surface Water	Nil	4 x 10^1
MSL-11	Bottom Water	Nil	Nil
MSL-12	Surface Water	Nil	Nil

Locations	Source	Total Count (CFU 100mL^{-1})	
		E. coli	Other Coliforms
MSL-12	Bottom Water	Nil	Nil
MSL-13	Surface Water	Nil	Nil
MSL-14	Surface Water	Nil	Nil

3.7.3.1.3 Total Faecal Coliforms Count

Total faecal coliforms count varied between 1 x 10^1 CFU 100mL^{-1} at MSL-9 and 7 x 10^1 CFU 100mL^{-1} at MSL-6 as shown in following table. Faecal coliforms growth was observed only at five marine sampling locations viz. MSL-2, MSL-3, MSL-6, MSL-8 and MSL-9

Table 3-12: Total Faecal Coliforms Count

Locations	Source	Total Faecal Coliforms Count (CFU 100mL^{-1})
MSL-1	Surface Water	Nil
MSL-2	Surface Water	4 x 10^1
MSL-3	Surface Water	3 x 10^1
MSL-4	Surface Water	Nil
MSL-5	Surface Water	Nil
MSL-6	Surface Water	7 x 10^1
MSL-7	Surface Water	Nil
MSL-8	Surface Water	5 x 10^1
MSL-9	Surface Water	1 x 10^1
MSL-10	Surface Water	Nil
MSL-10	Bottom Water	Nil
MSL-11	Surface Water	Nil
MSL-11	Bottom Water	Nil
MSL-12	Surface Water	Nil
MSL-12	Bottom Water	Nil
MSL-13	Surface Water	Nil
MSL-14	Surface Water	Nil

3.7.3.1.4 Total Vibrio Count

Total Vibrio count varied between 1x10^1 CFU 100mL^{-1} at MSL-12 and 5.2x10^3 CFU100 mL^{-1} at MSL-7 as shown below.

Table 3-13: Total *Vibrio* Count in water samples

Locations	Source	Total Vibrio Count (CFU 100mL^{-1})
MSL-1	Surface Water	6 x 10^1
MSL-2	Surface Water	1.6 x 10^2
MSL-3	Surface Water	1.18 x 10^3
MSL-4	Surface Water	5 x 10^1
MSL-5	Surface Water	9 x 10^2
MSL-6	Surface Water	5.9 x 10^2
MSL-7	Surface Water	5.2 x 10^3
MSL-8	Surface Water	8.4 x 10^2
MSL-9	Surface Water	2 x 10^1
MSL-10	Surface Water	4 x 10^1
MSL-10	Bottom Water	1.27 x 10^3
MSL-11	Surface Water	4.5 x 10^2
MSL-11	Bottom Water	6.2 x 10^2
MSL-12	Surface Water	1 x 10^1
MSL-12	Bottom Water	1.7 x 10^2
MSL-13	Surface Water	1.2 x 10^2
MSL-14	Surface Water	1.78 x 10^3

3.7.3.1.5 Total Pseudomonas Count

Pseudomonas growth was observed only at six marine sampling locations viz. MSL-1, MSL-5, MSL-8 (1 x 10^1 CFU 100mL-1), MSL-2 (3 x 10^1 CFU 100mL^{-1}), MSL-3 and MSL-6 (4 x 10^1 CFU 100mL^{-1}) as shown

Table 3-14: Total Pseudomonas Count in marine water samples

Locations	Source	Total *Pseudomonas* Count (CFU 100mL^{-1})
MSL-1	Surface Water	1 x 10^1
MSL-2	Surface Water	3 x 10^1
MSL-3	Surface Water	4 x 10^1
MSL-4	Surface Water	Nil
MSL-5	Surface Water	1 x 10^1
MSL-6	Surface Water	4 x 10^1
MSL-7	Surface Water	Nil
MSL-8	Surface Water	1 x 10^1
MSL-9	Surface Water	Nil
MSL-10	Surface Water	Nil
MSL-10	Bottom Water	Nil
MSL-11	Surface Water	Nil
MSL-11	Bottom Water	Nil
MSL-12	Surface Water	Nil
MSL-12	Bottom Water	Nil
MSL-13	Surface Water	Nil
MSL-14	Surface Water	Nil

3.7.3.1.6 Total Salmonella & Shigella Count

Salmonella growth was observed only at six marine sampling locations viz. MSL-2, MSL-5, MSL-6, MSL-8 (1 x 10^1 CFU 100mL^{-1}), MSL-7 (2 x 10^1 CFU 100mL^{-1}) and MSL-3 (9 x 10^1 CFU 100mL^{-1}) as shown in following table.

Total *Shigella* count varied between 1 x 10^1 CFU 100mL^{-1} at MSL-5, MSL-10 and MSL-12 and 1.36 x 10^3 CFU 100mL^{-1} at MSL-8 as shown in following table. No *Shigella* growth was observed at MSL-4, MSL-9 and MSL-13. At the same time, at MSL-10, MSL-11 and MSL-12 growth of *Shigella* was observed only in bottom water sample.

Table 3-15: Total Salmonella and Shigella Count in water samples

Locations	Source	Total Count (CFU 100mL^{-1})	
		Salmonella	*Shigella*
MSL-1	Surface Water	Nil	1.9 x 10^2
MSL-2	Surface Water	1 x 10^1	2.3 x 10^2
MSL-3	Surface Water	9 x 10^1	8.3 x 10^2
MSL-4	Surface Water	Nil	Nil
MSL-5	Surface Water	1 x 10^1	1 x 10^1
MSL-6	Surface Water	1 x 10^1	1.8 x 10^2
MSL-7	Surface Water	2 x 10^1	1.35 x 10^3
MSL-8	Surface Water	1x 10^1	1.36 x 10^3
MSL-9	Surface Water	Nil	Nil
MSL-10	Surface Water	Nil	Nil
MSL-10	Bottom Water	Nil	1 x 10^1
MSL-11	Surface Water	Nil	Nil
MSL-11	Bottom Water	Nil	5.4 x 10^2
MSL-12	Surface Water	Nil	Nil
MSL-12	Bottom Water	Nil	1x 10^1
MSL-13	Surface Water	Nil	Nil
MSL-14	Surface Water	Nil	5x 10^1

3.7.3.2 Phytoplankton community structure and biomass

As total 34 genera of phytoplankton were observed in the water samples collected from the estuarine and coastal region of Honnavar in April 2024. The abundance was varied between 375 - 35100 cells/litre. The number species found in each sample had a range of 3-18. The Shannon diversity was ranged between 0.8-1.6. Out of 17 samples, 7 had high evenness (uniform abundance among species) and 10 samples had less evenness (dominance of few species). The biomass (chlorophyll-a) was ranged between 0.19 and 2.33 µg/L. Out of 34 genera observed, 15 were dominated by abundance (>5% contributed). Only 7 genera (Coscinodiscus spp., Pleurosigma spp., Ornithocercus spp., Trichodesmium spp., Leptocylindrus spp., Staurastrum spp., Skeletonema spp.) had >20% of cell abundance.

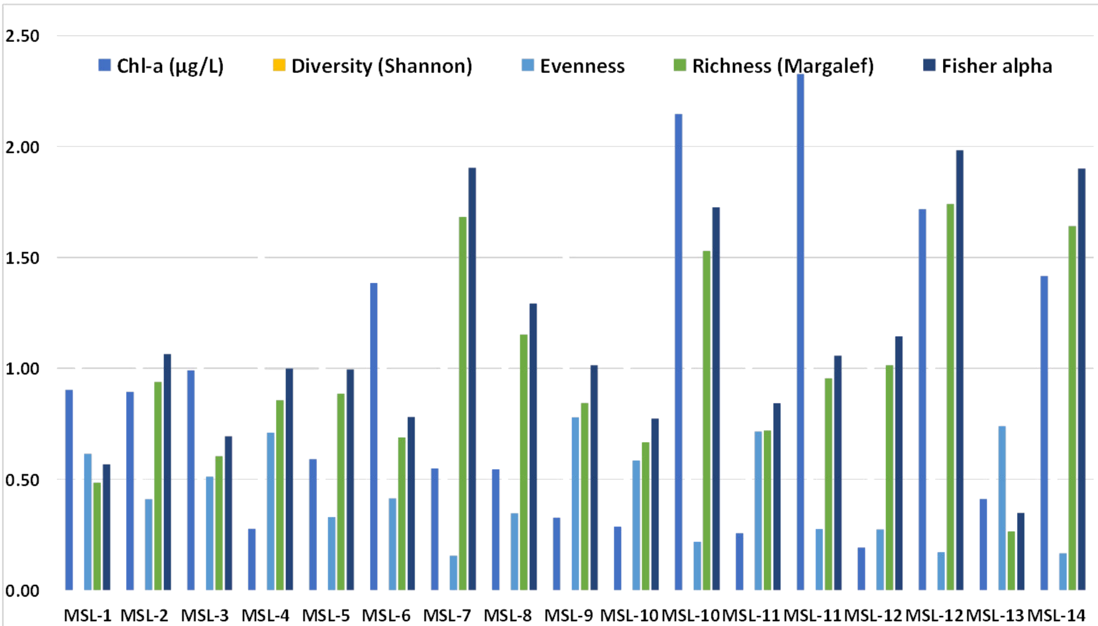


Figure 3-45: The graph shows the phytoplankton biomass (Chl-a) and different diversity indices at each location around Honnavar estuary and coastal region.

Note: The repeated labels in x-axis indicate the bottom water sample of same location

Table 3-16: The percentage contribution of dominant phytoplankton species (cell abundance > 5%) observed at different locations around Honnavar estuary and coastal region

% of phytoplankton	MSL-1	MSL-2	MSL-3	MSL-4	MSL-5	MSL-6	MSL-7	MSL-8	MSL-9	MSL-10	MSL-10	MSL-11	MSL-11	MSL-12	MSL-12	MSL-13	MSL-14
Coscinodiscus spp.	54.5	53	60.8	45.5	67.9	68.6	79.0	57.6	33.3	55.6	63.1	50.0	63.4	13.1	74.2	45.3	23.0
Pleurosigma spp.	-	-	6.3	-	-	-	-	-	6.7	-	8.1	15.4	24.8	-	-	-	-
Ornithocercus spp.	-	-	-	9.1	-	-	-	-	6.7	25.0	19.3	11.5	-	-	10.1	52.0	-
Rhizosolenia spp.	-	-	-	-	-	-	-	6.6	-	-	-	-	-	-	-	-	-
Nitzschia spp.	-	-	7.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Prorocentrum spp.	-	-	-	9.1	-	-	-	-	6.7	5.6	-	7.7	-	-	-	-	-
Chaetoceros spp.	-	-	-	-	-	-	-	-	-	-	-	11.5	-	-	-	-	-
Thalassiosira spp.	-	-	-	-	-	-	-	5.5	-	-	-	-	-	-	-	-	-
Protoperidinium spp.	-	-	-	-	-	-	-	-	-	5.6	-	-	-	-	-	-	-
Oscillatoria spp.	-	-	-	-	-	-	-	16.2	-	-	-	-	-	73.8	-	-	69.9
Leptocylindrus spp.	11.7	-	22.8	18.2	16.7	9.6	-	-	-	-	-	-	-	-	-	-	-
Staurastrum spp.	28.6	9.0	-	-	7.7	12.8	-	-	33.3	5.6	-	-	-	-	-	-	-
Skeletonema spp.	-	28.0	-	-	-	-	-	7.9	-	-	-	-	-	-	-	-	-
Pseudonitzschia spp.	-	-	-	-	-	-	-	-	13.3	-	-	-	-	-	-	-	-
Eucampia spp.	-	-	-	9.1	-	-	-	-	-	-	-	-	-	-	-	-	-

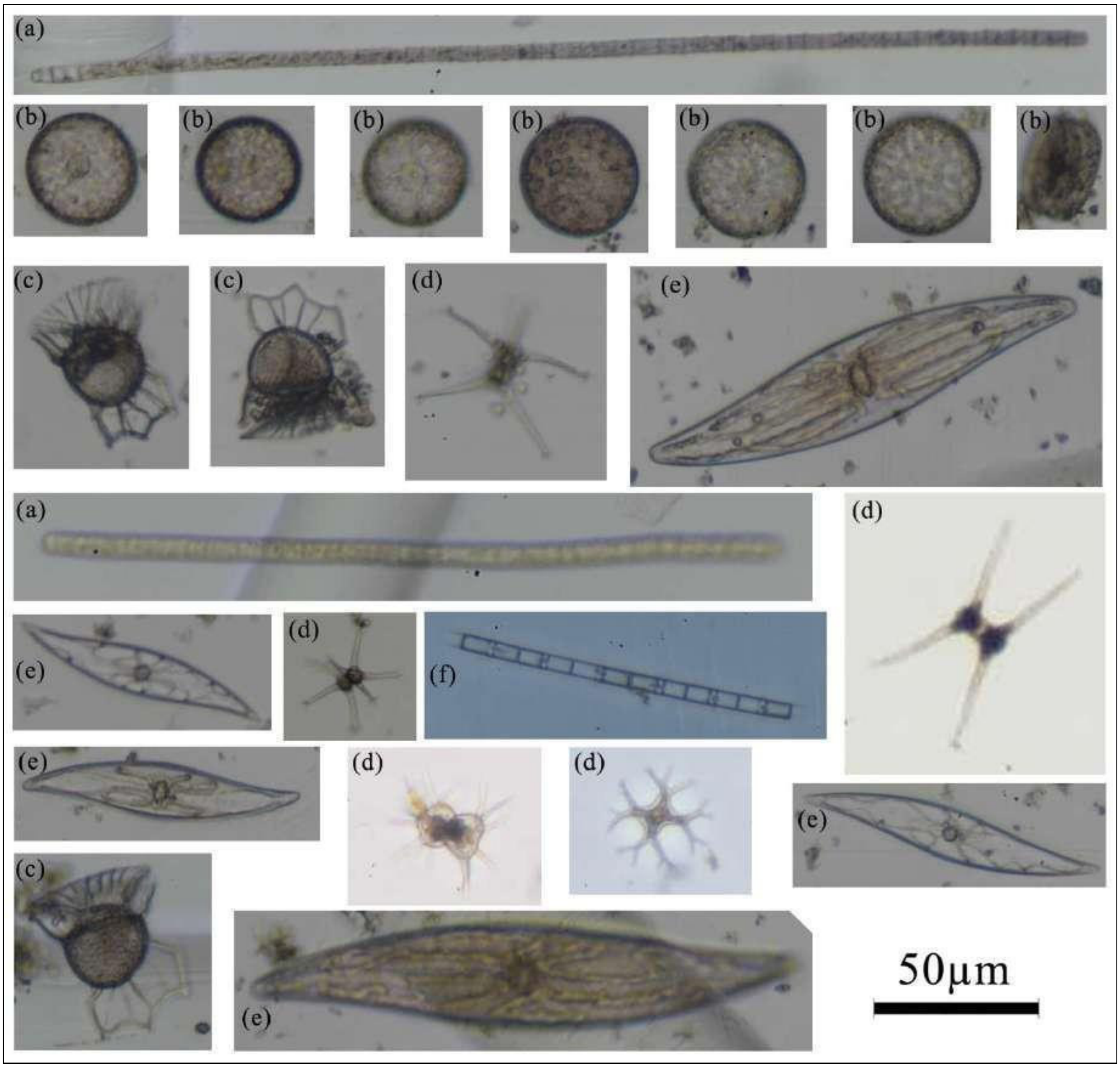


Exhibit 3-1: The microscopic images of dominant phytoplankton observed at Honnavar estuarine and coastal waters

Where (a) *Trichodesmium* spp. (b) *Coscinodiscus* sp. (c) *Ornithocercus* sp. (d) *Staurastrum* spp. (e) *Pleurosigma* spp. (f) *Leptocylindrus* sp.

3.7.3.3 Zooplankton

The zooplankton abundance varied from 852 Nos./m^3 to 15537 Nos./m^3 (average: 7237±4032 Nos./m^3). The lowest abundance was found in MSL-1 and the highest was observed in MSL-12. The zooplankton biomass varied from 0.06 ml/m3 to 0.98 ml/m3 (average: 0.58±0.29 ml/m^3). The lowest biomass was found in MSL-1 and the highest was observed in MSL-12. The dominant zooplankton groups observed were copepods, appendicularia, chaetognatha, gastropods. In stations MSL-10 and MSL-14, high number of echinoderm larvae was observed compared to other stations. The highest number of taxa was observed in MSL-8 (19 taxa) and MSL-12 (20 taxa). The number of taxa was lower in estuarine region compared to coastal regions.

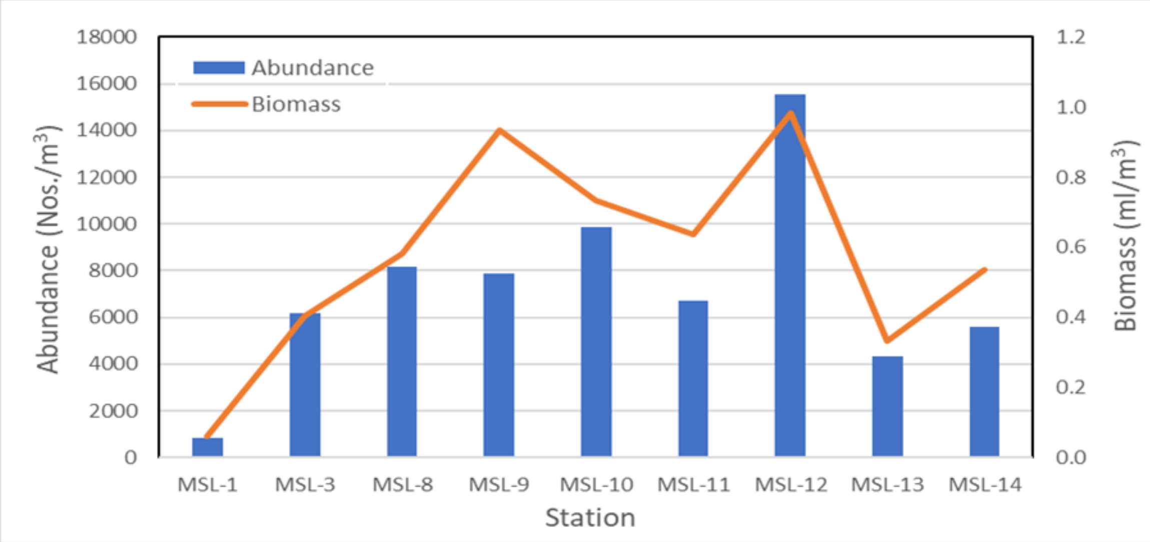


Figure 3-46: Zooplankton abundance and biomass in estuarine and coastal areas of Honnavar during April 2024

3.7.3.4 Benthos

Benthic fauna is a crucial component of the marine ecosystem with multiple ecological roles. They are broadly divided into three distinct groups based on their size namely macrobenthos (>500 µm), meiobenthos (500 – 63 µm) and microbenthos (< 63 µm). Due to their size range and various feeding habits they contribute to different levels in the marine food chain. Additionally, their limited mobility, and diverse species with different tolerances to stress and environmental perturbation make them important biomarkers in assessing the health of the marine ecosystem at spatial and temporal scales.

Macro benthos

During the present survey of coastal regions of Honnavar, a total of 30 taxa of benthic fauna were recorded belonging to a wide range of taxonomic groups viz., Polychaeta, Amphipoda, Cumacea, Bivalvia, Gastropoda, Ophiuroidea, and Chaetognatha. Polychaeta, with 19 taxa (63%), was the most dominant group, followed by Crustacea 5 taxa (16.6%) and Gastropoda, 4 taxa (13%).

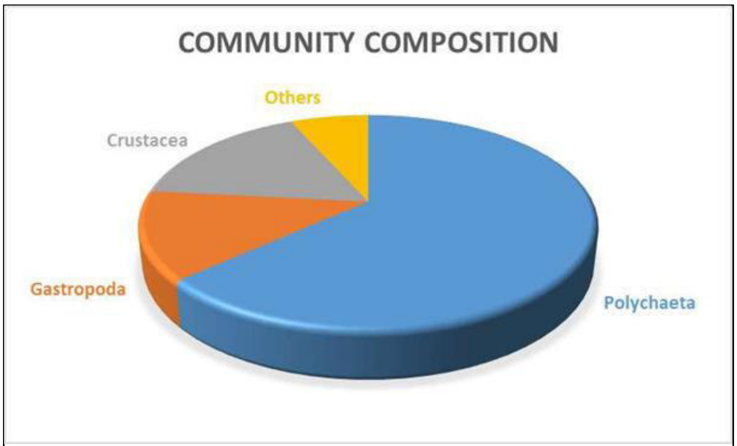


Figure 3-47: Taxonomic composition (%) of Macrobenthos in Honnavar coastal region

The abundance of macro benthic fauna varied between 119 ind.m^{-2} to 928 ind.m^{-2}. The lowest abundance was found in MSL-2 and the highest was observed in MSL-7.

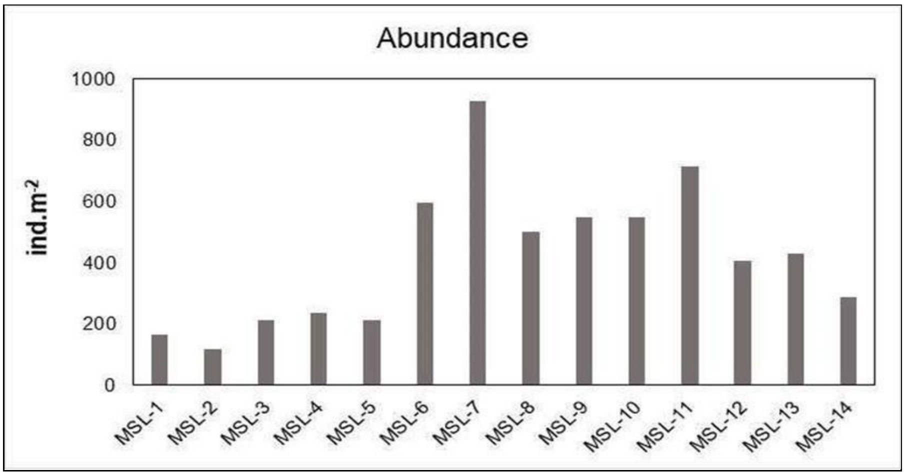


Figure 3-48: Abundance of benthic fauna in the coastal region of Honnavar

Each station represented a variable abundance of particular fauna and few taxa were specific to one or two particular stations. For the assessment of diversity, three diversity indices viz., Margalef's index (d), Pielou's evenness (J') and Shannon-Wiener index (H') were calculated. All the indices revealed MSL-6 as the most diverse station concerning benthic fauna whereas MSL-8 was the least diverse.

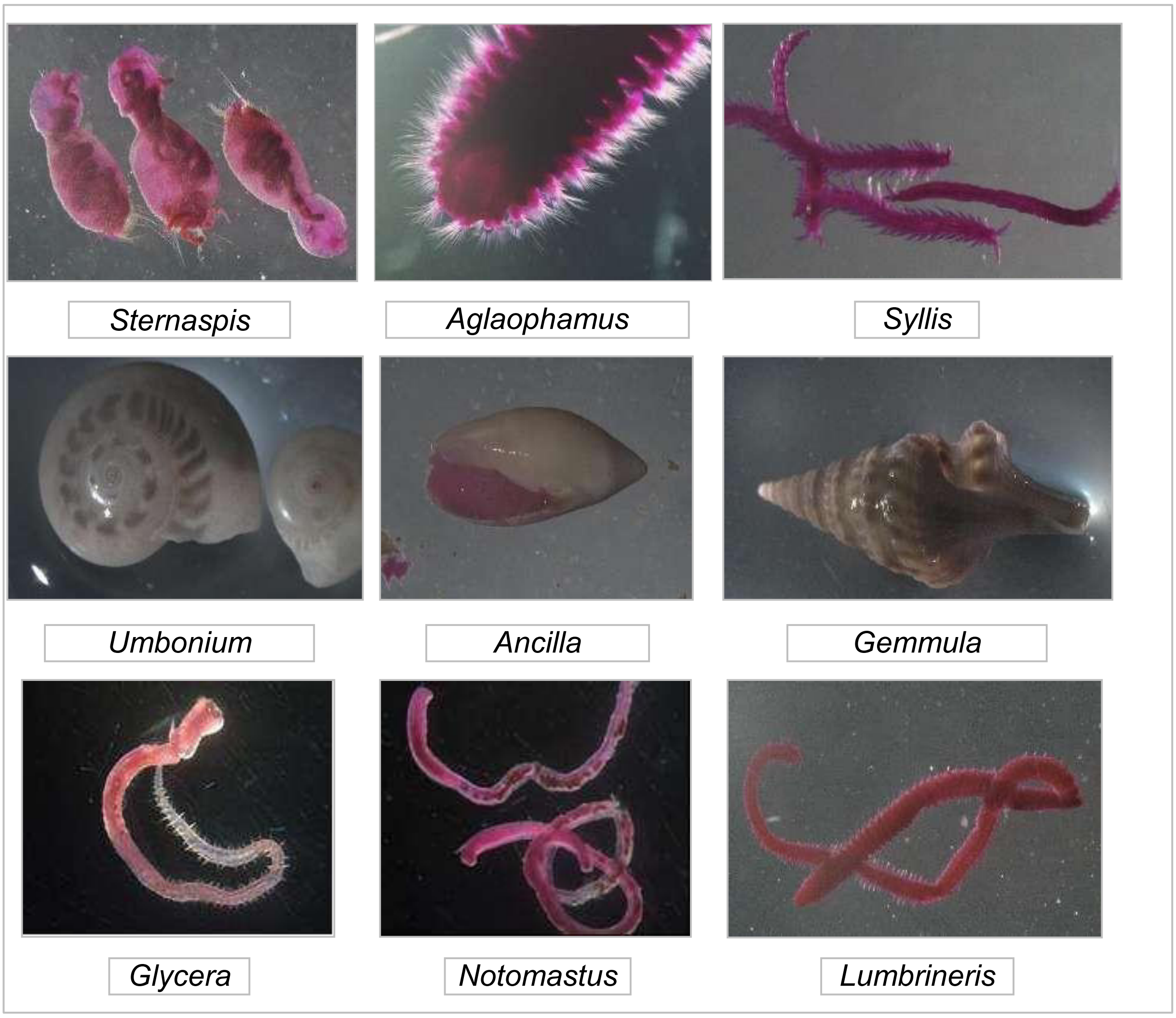


Exhibit 3-2: Some selected macrobenthic species from coastal regions of Honnavar

Meibenthos

Meiobenthos are considered as an important link between macro and microbenthos in the sediments. It indirectly improves the rate of carbon mineralization in sediments by encouraging microbial activity through predation, and/or directly through feeding of detritus material contributed by larger deposit-feeding invertebrates. Meiobenthic community are also known in helping stabilization of the sediment through their mucus secretion and thus act as a potential microbioturbators. They increase productivity of shallow waters by enhancing recirculation of nutrients, augment energy flow, and mineralization of organic matter.

During the present survey of coastal regions of Honnavar, meiobenthos recorded belonged to a wide range of taxonomic groups viz., Nematoda, Oligochaeta, Copepoda, Amphipoda, Cumacea, and Polychaeta. Nematoda, was the most dominant group, followed by Oligochaeta.

The abundance of meiobenthic fauna varied between 1 ind/10 cm^2 to 151 ind/10 cm^2, with the highest and lowest abundance found in MSL-10 and MSL-1 respectively. There was no meiobenthic fauna in 4 stations, namely – MSL-2, MSL-3, MSL-4 and MSL-14. Percentage composition of meiofaunal group from study site is presented below.

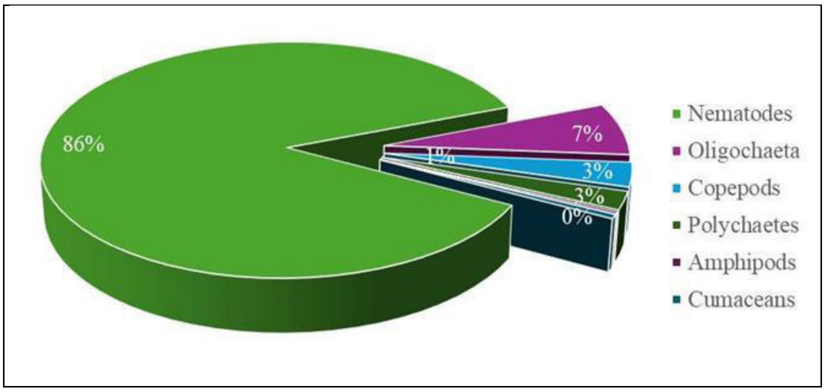


Figure 3-49: Percentage composition of meiofauna at Honnavar coastal region

Nematoda was found dominant and was the major organism in meiofaunal composition at all the stations. Oligochaeta was the next dominant group followed by Copepods and Polychaetes. Amphipoda and Cumaceans contributed less than 2 percentages to meiofaunal composition.

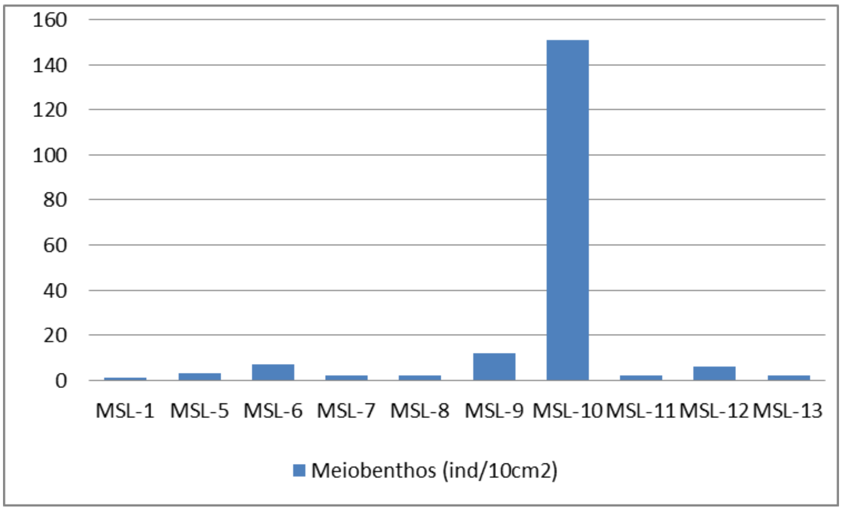


Figure 3-50: Abundance of meiofauna at each sampling location

3.7.4 Marine Flora Fauna

3.7.4.1 Marine Turtle Nesting areas

Man Made turtle breeding / hatchery sites are present near the project area. Report on Water Quality and Biological Parameters Related to Rapid Marine Environmental Impact Assessment Studies in connection with Port development at Honnavar carried out by NIO is enclosed as **Appendix I.**

3.7.4.2 Marine Flora

In the sand dune area ten species were recorded belonging to ten different families **Table 3-17**. Spinifex littoreus and Ipomoea pes-caprae was found to be the common species occurring in both core and project influence area.

Table 3-17: List of sand dune flora species recorded during survey

Family	Species
Aizoaceae	*Sesuvium portulacastrum*
Asteraceae	*Launaea sarmentosa*
Casuarinaceae	*Casuarina equisetifolia*
Convolvulaceae	*Ipomoea pes-caprae*
Fabaceae	*Crotalaria pallida*
Myrtaceae	*Syzygium* sp.
Pandanaceae	*Pandanus sp.*
Poaceae	*Spinifex littoreus*
Rubiaceae	*Oldenlandia* sp.
Verbenaceae	*Lantana camara*

Exhibit 3-3: Observed Sand dune floral species

Where: **a.** *Ipomoea pes-caprae* **b.** *Spinifex littoreus* **c.** *Launaea sarmentosa* **d.** *Sesuvium portulacastrum* **e.** *Lantana camara* **f.** *Syzygium* sp. **g.** *Pandanus* sp. **h.***Crotalaria pallida*

Table 3-18: Location of sand dune flora observed at the proposed core site

Station	Latitude	Longitude	Species observed	
			Family	Species
Station-1	14° 17.800'N	74° 25.523'E	*Poaceae* Convolvulaceae Aizoaceae Asteraceae Casuarinaceae	*Spinifex littoreus* *Ipomoea pes-caprae* *Sesuvium portulacastrum* *Launaea sarmentosa* *Casuarina equisetifolia*
Station-2	14° 17.722'N	74° 25.520'E		
Station-3	14° 17.492'N	74° 25.486'E		
Station-4	14° 17.322'N	74° 25.435'E		
Station-5	14° 16.992'N	74° 25.531'E		
Station-6	14° 16.946'N	74° 25.543'E		

The present survey also revealed the presence of three salt marsh species represented by *Sesuvium portulacastrum, Porteresia coarctata* and *Scirpus littoralis.*

Exhibit 3-4: Species observed in salt marshes

3.7.4.3 Mangroves

Mangrove primary survey revealed presence of a total ten mangrove species belonging to five families. The dominant mangrove species were *Sonneratia alba*, and *Kandelia candel* followed by *Sonneratia caseolaris*, *Acrostichum aureum*, *Avicennia officinalis*, *Acanthus ilicifolius*, *Aegiceras corniculatum, Rhizophora mucronata,* and *Excoecaria agallocha*. Species such as *Bruguiera gymnorhiza* have only been found in one plot. Three common mangrove associateswere found in majority of the mangrove plots.

Table 3-19: List of mangroves and the associate flora recorded during field survey

Family	Species
Acanthaceae	*Avicennia officinalis* (Linnaeus, 1753) *Acanthus ilicifolius* (Linnaeus, 1753)
Euphorbiaceae	*Excoecaria agallocha* (Linnaeus, 1759) Lythraceae *Sonneratia alba* Sm.
Lythraceae	*Sonneratia caseolaris* (Linnaeus)
Primulaceae	*Sonneratia caseolaris* (Linnaeus) *Aegiceras corniculatum (L.) Blanco*
Pteridaceae	*Acrostichum aureum L.*
Rhizophoraceae	*Rhizophora mucronata* (Lam) *Kandelia candel* (L.) *Bruguiera gymnorhiza* (L.) Lam.
Mangrove associated flora	
Family	**Species**
Apocynaceae	*Cerbera manghas*
Fabaceae	*Derris trifoliata*
Lamiaceae	*Volkameria inermis*

Exhibit 3-5: Mangrove species recorded during the survey

The overall tree density ranged between 1140/ha to 4400/ha at mangrove patch located opposite to core area of proposed site. In project influence area, tree density value varied 2300/ha to 6500/ha. In terms of basal area, minimum (5.8 m^2/ha) and maximum (110.3 m^2/ha) was recorded. The mean girth and height minimum and maximum value recorded as 15.4cm and 4.7m and 43.3cm and 6.5m, respectively. Regeneration potential of mangrove ranged between 1000/ha and 4800/ha and was due to huge plantation of *Kandelia candel* by the forestdepartment. The complexity index of mangroves recorded varied 0.01 to 0.67.

3.7.4.4 Seagrass

In coastal areas of Karnataka, huge seagrass beds are not reported, however there are report of two species of seagrass *Ruppia maritima* and *Halophila beccarii* occurring along Swarnasita, Chakra, Haladi, Kollur, and Venkatapur estuary.

In Honnavar, there is no earlier reports or scientific publication mentioning the occurrence of seagrass. However, during our survey, we found presence of huge seagrass bed of *Halophila* sp. occurring adjacent to the mangrove forest patch situated in the sharavathi estuary. The seagrass bed is located 3.4 km away towards the south direction of the proposed core project site area. The approximate area of seagrass was found to be around five to seven hectares, however more detailed season sampling is required to confirm the exact area and the presenceof any other seagrass species.

Seagrass are listed as Ecologically Sensitive areas as per CRZ notification, 2019 and classified as CRZ1A and protected under the Environment (Protection) Act 1986.

3.7.4.5 Avifauna in mangrove area

During our mangrove survey, we have recorded avifauna found foraging from the saltmarsh and mangrove areas. A total eleven species were recorded, out of which Oriental white ibis wascategorized as near threatened (NT) according IUCN Red List of Threatened Species.

Table 3-20: Avifauna in mangrove area

Common name	Species
Little cormorant	*Microcarbo niger*
Little egret	*Egretta garzetta*
Grey heron	*Ardea cinerea*
Brahminy kite	*Haliastur indus*
Grey-headed swamphen	*Porphyrio poliocephalus*
Median egret	*Ardea intermedia*
Oriental white ibis	*Threskiornis melanocephalus*
Indian pond heron	*Ardeola grayii*
Red-wattled lapwing	*Vanellus indicus*
Sanderling	*Calidris alba*
Marsh sandpiper	*Tringa stagnatilis*

The avifauna documented was based on a rapid field survey in the month of April, 2024. Hence, the data should not be treated as a comprehensive or conclusive account of the avifauna found in mangrove area of Honnavar/Sharavati estuary. Avifauna species spotted during the survey is shown in **Exhibit 3-6**.

a. Little cormorant **b.** Little egret **c.** Grey Heron **d.** Brahminykite
e. grey-headed swamphen **f.** Median egret

a. Sanderling **b**. Oriental white ibis **c**. Indian pond heron
d. Red- wattled lapwing **e**. Marsh sandpiper

Exhibit 3-6: Avifauna species in mangrove area

3.8 Terrestrial Flora and Fauna

Biodiversity encompasses a variety of existing life forms, the ecological roles they perform and the genetic diversity they contain (FAO, 1989).

The Honavar is situated on the northern bank of the river Sharavathi to the north of Bhatkal and to the south of Karwar. The river Sharavathi is navigable up to Gersoppa in the up Ghat. The present Honavar is also called Ponnavaru or Honnavaruin ancient times which literally means golden village. This place might have derived its name from the plant name Honnavar, which is called Tangadi (Gaz.Kar.VII.Kan:925) in Kannada[18].

3.8.1 General Description of Study Area

For better understanding of the habitat setup and identification of influences/impacts, the study was carried in both core zone and buffer zone.

Core Zone (Project area) study: Quantification has been done for the trees, shrubs, herbs, grasses and terrestrial & arboreal fauna in the core area. Status of natural vegetation, soil type, and associated services were also recorded. Maximum effort has been taken to assess the damage to be caused by the activity (if any) in the core zone and suggest appropriate implementable conservation action plan (if any). Project area mainly dominated by *Cocos nucifera, Casuarina equisetifolia* and *Acacia auriculiformis.*

[18] Working Plan for the Forests of Honnavar Division (2022-2023)

Buffer zone/PIA (Study area) study:

The following habitats are investigated in the study area:

- Vegetation type (Agriculture, Plantation types, Avenue plantations, Mangroves and Reserve Forests)
- Terrain type (Plain & Undulating)
- Aquatic Habitat (lentic and lotic)

The forests in the study area represent a wide range of diversity in composition and quality due to edaphic, biotic and climatic factors. The UttaraKannada District is primarily an agriculture District with very limited presence of Industry. The district is known for its Dhan (paddy), Pan (Betel) and Meen (Fish). The vegetation ranges from jungle and coastal area comprising species like *Acacia auriculiformis, Acacia nilotica, Alstonia scholaris, Anacardium occindentale, Areca catechu, Azadirachta indica, Butea monosperma, Cassia fistula, Casuarina equisetifolia, Ceiba pentandra, Cocos nucifera, Cordia dichotoma, Excoecaria agallocha, Ficus benghalensis, Ficus racemosa, Ficus religiosa, Limonia acidissima, Mangifera indica, Manilkara zapota, Melia azedarach, Pandanus fascicularis, Peltophorum pterocarpum, Phoenix sylvestris, Phyllanthus emblica, Pongamia pinnata, Psidium guajava, Syzygium cumini, Tamarindus indica, Terminalia arjuna, Terminalia catappa, Thespesia populnea, Avicennia marina, Avicennia officinalis, Bruguiera gymnorrhiza, Ceriops decandra, Rhizophora mucronate and Sonneratia alba*.

The following forest types (as per H. G. Champion and S. K. Seth's classification) occur in the study area includes

- 1AC4 (Evergreen Forest)
- 2AC2 (Semi-evergreen Forest)
- 3BC1 (Teak bearing Moist Deciduous Forests)
- 3BC2 (Moist Mixed Deciduous Forests)
- 2/E4 (Lateritic semi-evergreen Forests)
- 5/E5 (Lateritic Thorn Forests)
- 3BC2S1 (Secondary Moist Deciduous forests)

The study area was divided in two major parts namely the Core area and Buffer area.

Core Zone study: The area within the project boundary is the core zone area; almost entire region was thoroughly investigated. Quantification has been done for the trees, shrubs, herbs, grasses and terrestrial and arboreal fauna in the core area. Maximum effort has been taken to assess the damage to be caused by the activity in the core zone and suggest conservation action plan accordingly if any.

Buffer zone Study: The area within the 15 km from the core zone area or from the project site boundary is considered as buffer zone area/Study area. The following habitats are investigated in the study area.

- Vegetation type (RFs, Agriculture and Villages)
- Terrain type (Plain, Undulating)
- Road network (Avenue plantation)
- Aquatic Habitat (Lentic, lotic and Marine)

3.8.2 Methodology for Ecological Survey

The primary data was collected by visual observations as well as by discussion with villagers. The field investigation and satellite imagery data shows that the study area is a mixture of

Agricultural, Coconut-Casuarina plantation, barren/wasteland and waterbodies. Tropical dry thorny forests vegetation is observed within the study area.

Methodology for study of Flora & Fauna consisted of detailing taxonomic accounts based on visual observation, direct visual enumeration of plant species was carried out to generate data on flora. With regard to fauna, circumstantial evidence based on footprints, feathers, skin, hair, hooves etc. and the habitat features, reports from locals especially the local residents. These observations were supplemented by published literature and data including the reports, records and working plans of the forest department.

The ecological studies were carried out in Summer season and also considered secondary date conducted covering the post monsoon season and Winter season (2023-2024).

Flora: Phyto-sociological aspects of the study were carried out by perambulating and sampling through quadrat sampling method. Sample plots were selected in such a way to get maximum representation of different types of vegetation and plots were laid out in different parts of the areas. Accordingly, quadrats of 20 m x 20 m for the trees, 5 m x 5 m for shrubs and 1 m x 1 m for herbs. The plants were identified using state floras and also by using updated check list from www.theplantlist.org.

Fauna: Surveys were conducted by using transect method of 500 to 1000 m in all major habitats and recorded the species through direct and indirect evidence. Species were identified using standard field guides like mammals by Vivek Menon (2003), Reptiles by Whitaker and Captain (2004), Amphibians by Daniel (2005), Birds by Grimmet *et.al* (1998) and Butterflies by Isaac Kehimkar (2008). Scheduling of species is made as per the Indian Wildlife Protection act (1972) and IUCN to check the Rare Endangered Endemic and Threatened (REET) species. For fauna no quantitative assessment is made as it can be done through a detailed species specific and seasonal survey. Migratory paths for the birds and mammals were discussed with locals and forest department. Habitats used by for foraging, nesting, breeding and other ecological parameters were ascertained.

The authenticity of field observations are confirmed through discussions with local people and based on secondary data collected from different Government offices like Karnataka Forest Department (Wildlife wing), NGO’s and Fisheries Department etc.

3.8.3 Status of Flora

3.8.3.1 Core Area

The core area is port site located on coastal sand pit and mostly plain and other proposed development area (road & rail and ancillary sites) are plain and undulating with commercial plantations. Trees such as *Acacia auriculiformis, Anacardium occindentale, Cocos nucifera, Cerbera odollam, Casuarina equisetifolia, Pandanus fascicularis, Pongamia pinnata* are observed. There are no Reserve Forests (RF) or Biosphere Reserves or National Parks or Wildlife Sanctuaries or other Protected Areas within a radius in core area. Due to sandy conditions the core area is sparsely occupied with vegetation.

The plant resources in core area consist of 17 species belonging to 12 families. The floral forms include Trees with 7 sp. followed by 3 Shrubs sp., 5 Herbs & Grass sp. and 2 sp. climbers. Detailed checklist is presented in **Appendix H**.

3.8.3.2 Phytosociological studies in Core Zone

Among trees species *Acacia auriculiformis* (13.25), *Cocos nucifera* (12.67), *Casuarina equisetifolia (12.37), Pongamia pinnata (9.34), Anacardium occindentale, Cerbera odollam &*

Pandanus fascicularis (12.50), *Cereus triangularis* (9.78) and *Launaea sarmentosa* (9.60) are the dominating in the core area. Details of other species are presented in **Appendix H**.

3.8.3.3 Species Diversity Index in Core area

There are two important indices to denote the diversity such as Shannon Wiener Index (H') and Simpson diversity Index. The trees in core area showed Shannon Wiener Index (H') value as 1.82 and Simpson Index values as 0.181. The shrubs in core area showed Shannon Wiener Index (H') value as 0.868 and Simpson Index values as 0.5. The herbs in core area showed Shannon Wiener Index (H') value as 1.47 and Simpson Index values as 0.26. Majority portion of the site is barren and remaining areas is under plantations hence the species diversity values interpret very less diversity in plant composition and major area is devoid of any vegetation except the herbaceous flora.

3.8.3.4 Buffer Area

The buffer area, i.e., 15 km radial distance around the project site, comprises mostly of agricultural crops, and commercial plantations and few reserve forest blocks. Forest type ranges between Dense scrub and Fairly Dense scrub. The different soils in the study area are
Saline and Saline Alkali Soils, Coastal Alluvial Soil, Coastal Sandy Soils. Predominate soils encountered in the study area are Sandy Clay soils which are confined to the coastal village areas.

The plant resources of the buffer area account about 224 plants species belonging to 46 families. The predominant life forms includes Trees (93 sp.), Shrubs (50 sp.), Herbs (42 sp.), Grass (27 sp.) and Climbers (12 sp.). Detailed checklist of flora represented in both core and buffer are enclosed as **Appendix H**.

Phytosociological studies in Buffer Zone

Among trees species *Cocos nucifera (82.25), Areca catechu (62.59), Acacia auriculiformis (42.47), Terminalia catappa (35.74), Syzygium cumini (32.41), Anacardium occindentale (31.36), Casuarina equisetifolia (30.49), Ficus religiosa (30.36), Mangifera indica (29.92), Cassia fistula (28.56), Pandanus fascicularis (28.42), Avicennia marina (27.59), Azadirachta indica (25.93), Melia azedarach (25.81), Excoecaria agallocha (25.70), Thespesia populnea (25.31), Acacia nilotica (24.65), Terminalia arjuna (24.43), Ceriops decandra (22.71), Cordia dichotoma (22.06), Ficus racemosa (21.94), Psidium guajava (21.94), Tamarindus indica (21.71), Alstonia scholaris (21.28), Limonia acidissima (21.05) and Peltophorum pterocarpum* (21.05) are dominating. Among herbaceous species, Lantana camara (53.57), Ricinus communis (47.67), Vitex negundo (31.18), Justicia adhatoda (26.95), Ixora coccinea (23.51), Ziziphus mauritiana (22.29), Canthium parviflorum (18.77), Clerodendrum inerme (18.77), Calotropis gigantea (18.49), Duranta repens (18.49), Atalantia wightii (18.24), Sesuvium portulacastrum (18.24), Ardisia solanacea (18.06) and Launaea sarmentosa (18.06) are dominating. Details of other species are presented in **Appendix H**.

Species Diversity Index in Buffer area

The trees in Buffer area showed Shannon Wiener Index (H') value as 3.40 and Simpson diversity Index values as 0.045. The shrubs in Buffer area showed Shannon Wiener Index (H') value as 2.66 and Simpson Index values as 0.08. The herbs in Buffer area showed Shannon Wiener Index (H') value as 2.83 and Simpson Index values as 0.06. The species diversity in the buffer area interprets moderate diversity in plant composition due to the occurrence of agricultural farmlands, commercial plantations and coastal belt plantation.

Habitat features of the core and buffer areas presented below.











3.8.4 Status of Fauna

3.8.4.1 Core Area

A total of 5 bird species were recorded in the study period representing Common Myna, Pond Heron, Cattle Egret, House Crow, Little Egret are the common species which are encountered during the survey period. Details of other species are presented in **Appendix H**.

3.8.4.2 Buffer Area

During the study period, there is no direct evidence of major wild animal species observed. Through indirect evidences and also by interacting with the local fishermen community pug marks of jackal and wild boar were observed near the sea coast.

By direct and indirect evidences, a total of 80 species were recorded in the study area which include Mammals 5 sp., Birds 26 sp., Herpetofauna 19 sp., Invertebrates 25 sp. Details of other species are presented in **Appendix H**.

Mammals: Common species includes Common Indian Field Mouse, Striped Squirrel, Indian palm squirrel or three-striped palm squirrel, Indian Hare and Indochinese rhesus macaque.

Birds: Common bird species of the area include Common Myna, Pond Heron, Cattle Egret, House Crow, Little Egret, Shikra, Jungle Myna, Common Iora, Small Blue Kingfisher, White Breasted Waterhen, House Swift, Grey Heron, Purple Heron, Rock Pigeon, Indian Roller, Indian Couckoo, Black Drongo, Koel, White Breasted Kingfisher, Brahminy Kite, Tailor Bird, House Sparrow, Spotted Dove, Common Sandpiper, Common Babbler, Jungle Babbler.

Herpetofauna: Common species includes Ferguson's Toad, Common Indian Toad, Common skittering Frog, Bamboo tree frog, Indian pond frog, Malabar Gliding frog, The Vine Snake, Indian Gamma Cat Snake, Forest Lizard, Common Garden Lizard, Coastal Day Gecko, Common rat snake, Bronze backed Tree Snake, Southern House Gecko, Hump nosed Pit Viper, Gunther's Supple Skink, Indian Cobra, Rat Snake, Russels viper.

Invertebrates: Common species Hedge blue, Caper White or pioneer, Plain Puffin, Common castor, Common pierrot, Common gull, Black rajah, Plain tiger, Common tiger, Common Indian Crow, Small grass yellow, Grass Jewel, Common jay, Danaid egg fly, Yellow pancy, Blue pansy, Common sailor, Common Rose, Common mime, Common Mormon, Common leopard, Rounded pierrot, Blue tiger, Common Four ring and Tiny grass blue.

Among the fauna in study area the Species richness was high in birds (87 sp.) followed by Herpetofauna (33 sp.), Mammals (26 sp.). Invertebrates (50 sp.), This clearly indicates the moderate representation of species composition with low levels of energy transfer, predation, composition and niche availability.

3.9 Fisheries

Karnataka state emerged as a maritime State in 1956 with the reorganization of the states. The fisheries sector plays an important role in the socio-economic development of State in view of its contribution to the food basket, nutritional security, foreign exchange earnings, employment generation and income. Traditionally, Karnataka coast is known as "Mackerel Coast" and the pelagic fishery wealth of Karnataka coast, mainly comprising mackerel and oil sardine. An estimated 6.04 lakh tones of marine fish were landed in Karnataka in 2023, a 13% decrease from record landing in 2022. Honnavar is a historical estuarine port town in the Uttara Kannada district of Karnataka with huge population of fishers. Major species of fishes landing in Uttara Kannada district are listed in following **Table 3-21**.

The Sharavathi, a westward flowing river joins the Arabian sea at Honnavar, forming an ever shifting river mouth in the region. Several diversified methods of traditional fishing are used in this estuary almost throughout the year. These include gill nets, cast nets, hook & line, pole & line, drag nets, scoop nets, light fishing, scare line, crab fishing with traps and clam fishing by hand-picking at low tide or by dragging bagnets of wire meshes. In addition, many areas in Honnavar have been used by fishers for generations for drying fishes and park their boat equipment that employs more than 15,000 people. **Table 3-22** represent fisheries data in Sharavati River as per personal discussion with Dr. Sreekanth G B, Senior Scientist, Fisheries Resource Management, ICAR - Central Coastal Agricultural Research Institute, Goa.

Table 3-21: List of major species of fishes landing in Uttara Kannada district

Species	
Mackerel	Crabs-Charybdis spp.
Oil sardine	Croakers
Anchovies	Horse Mackerel
Big jawed jumper	Little Tuna (kawa kawa)
Bull's eye	Metapenaeus spp.
Setipinn	Parapenaeopsis spp.
Soles	Silverbelliesa,
Tuna and	Squids
Penaeid-Penaeus spp.	Wolf herring
Other clupeids	Other sardines

Table 3-22: List of major species of fishes in Sharavati River

Species	Percentage	Species	Percentage
Nematalosa nasus	1.952	*Paraplagusia bilineata*	0.130
Lates calcarifer	0.211	*Sphyraena jello*	0.472
Ambassis ambassis	5.481	*Hemiramphus far*	0.195
Apogon hyalosoma	0.358	*Strongylura strongylura*	0.130
Etroplus suratensis	2.147	*Sphyraena barracuda*	0.098
Glossogobius giuris	1.854	*Hyporhamphus limbatus*	0.098
Scatophagus argus	1.692	*Escualosa thoracata*	3.188
Barbodes carnaticus	0.976	*Sardinella longiceps*	2.668
Dawkinsia filamentosa	0.553	*Sardinella gibbosa*	1.431
Gerres filamentosus	2.814	*Sardinella fimbriata*	1.252
Sillago sihama	2.863	*Terapon jarbua*	3.953
Mugil cephalus	22.300	*Terapon theraps*	2.977
Moolgarda cunnesius	15.631	*Terapon puta*	2.375
Liza parsia	6.913	*Pelates quadrilineatus*	0.520
Monodactylus argenteus	0.618	*Siganus vermiculatus*	0.260
Eleutheronema tetradactylum	0.228	*Siganus argenteus*	0.114
Lutjanus johnii	0.146	*Atule mate*	0.358
Lutjanus argentimaculatus	0.146	*Caranx ignobilis*	0.179
Lutjanus rivulatus	0.098	*Opisthopterus tardoore*	0.163
Lutjanus russelli	0.033	*Carangoides chrysophrys*	0.130
Thryssa mystax	1.854	*Arius arius*	0.081
Stolephorus commersonii	1.008	*Carangoides praeustus*	0.033
Thryssa malabarica	1.008	*Chrysochir aureus*	0.033
Stolephorus indicus	0.748	*Formio niger*	0.081
Lactarius lactarius	2.505	*Drepane punctata*	0.130
Leiognathus splendens	2.049	*Himantura bleekeri*	0.016
Secutor insidiator	1.008	*Platax orbicularis*	0.016
Cynoglossus arel	0.520	*Scomberomorus commerson*	0.049
Cynoglossus macrostomus	0.488	*Colletteichthys dussumieri*	0.049
Secutor ruconius	0.423	*Grammoplites scaber*	0.033
Pseudorhombus javanicus	0.130	*Platycephalus indicus*	0.033

3.10 Socio-Economic Profile of Project Influence Area

3.11 Socio-Economic Profile (Geography and Demography) of the Study Area

The socio-economic profile of the project influence area was established through compilation of secondary data and 2011 census data for assessing the Study area profile. The project influence area falls under Uttara Kannada District with Honnavar, Kumta Sub districts of Karnataka. The brief socio-economic data is described in this section.

3.11.1 Demographic Profile of Balasore District

3.11.1.1 Census Summary of Uttara Kannada District (Karnataka)

- Uttara Kannada with a total population of 1,437,169 holds the 20th position in terms of total population in the State.
- There are 1289 villages, 11 Statutory Towns and 7 Census Towns in the district Uttara Kannada district accounts for 2.4 percent of the total population of the State.
- With the decadal growth rate of 6.2 percent, it ranks 22nd in the State in terms of decadal growth rate.
- The district with a Sex ratio of 979 holds 18th rank in the State.
- The district with a Sex ratio of 955 among the child population in the age-group 0-6 holds the rank of 12th in the State.

- The proportion of child population, (0-6 age-group) is 10.5 percent in the district and ranks 19th in the State
- The district has a literacy rate of 84.1 percent and is placed at 4th rank in the State.
- The male literacy rate in the district is 89.6 percent and the female literacy rate is 78.4 percent.
- The male – female literacy gap in the district is 11.2 percentage points, which is less than the male – female literacy gap registered by the State (14.39 percentage points).
- The Scheduled Caste population contributes 8.1 percent to the total population of the district and the Scheduled Tribe population contributes 2.4 percent.
- The district has registered a work participation of 42.3 percent and stands at 28th rank in the State.
- The work participation rates for Male and Female population are 59.3 and 25.0 respectively in the district.
- Among the total workers in the district 81.9 percent are Main workers and 18.1 percent are Marginal workers
- Major work force of 61.0 percent is engaged in other workers category and the district holds 5th rank in the State.
- Agricultural sector constitute 37.4 percent of the total workers i.e., Cultivators (18.3 percent) and Agricultural Labourers (19.1 percent) and 1.6 percent of the total workers are engaged in Household Industry.
- About 57.7 percent of the total population in the district is Nonworkers.
- Uttara Kannada district with area figure of 10277 Sq.Km stands at 5th Position in the State in terms of area.
- The population density for this district is 140 and it is the third least dense district in the State.
- There are 1289 villages, 11 Statutory Towns and 7 Census Towns in the district

3.11.2 Villages falling in the Study Area

In the study area of 15 km radius 48 census villages are falling which includes hamlets and settlement villages. The villages falling in the study area is given in the **Table 3-23.**

Table 3-23: Villages and Settlements falling in the study area as per SOI toposheet

S. No	0-1 km	S. No	5-10km	S. No	10-15km
1	Kasarkod	9	Kundguni	28	Kumta
2	Karki	10	Math	29	Manaki
	1-5 km	11	Holegadde	30	Handigona
3	Honavar Urban	12	Harnir	31	Valgalli
4	Vandoor	13	Kekkar	32	Kujalli
5	Mandalakurve	14	Kadle	33	Chandavar
6	Padukuli	15	Haldipur	34	Kadnir
7	Hosapatna	16	Nilkod	35	Hodke Shiroor
8	Pavinakurve	17	Salkod	36	Manki
		18	Gunavante	37	Gudemakki
		19	Mavinkurva	38	Dabbod
		20	Nagre	39	Melin-Mannige
		21	Hadinbal	40	Beranki
		22	Gundabala	41	Kodani
		23	Apsarkonda	42	Balemet
		24	Hosakuli	43	Adukal
		25	Madageri	44	Janna Kadkal
		26	Navilgone	45	Heravali
		27	Horbhag	46	Jalwalli
				47	Tumbolli

S. No	0-1 km	S. No	5-10km	S. No	10-15km
				48	Talgod
					Total-48

3.11.3 Villages summary of the Study Area

The total of 48 census villages falls in the study area. The Census summary of the total villages is summarized as follows

Table 3-24: Summary of all the villages in the study area.

Names	Total of all the 48 villages in the study area
No.of Households	35565
Total Population	156513
Male	78317
Female	78196
Sex ratio	998
SC	9187
ST	335
Total Literacy	122232 (78.1%)
Male	64630 (41.3%)
Female	57602 (36.8%)
Total Worker	62742
Total Main Worker	53370
Total Non-Workers	93771

3.11.4 Secondary Census Data of the Project Study Area

Socio-economic assessment of the study area villages was carried out by interpreting Census of India data along with various other statistical sources of Karnataka government. The study covers around 48 villages of 15 km radius from the proposed project site. The details of the assessment are provided below

3.11.4.1 Census Population

In the study area, the population is 156513 of which males are 50 % and females are 50 %. The sex ratio of the study area is 998 Females over 1000 Males.

Table 3-25: Households and Population of Study Area

Boundary (in Km)	No. of HH	Total Pop.	Male	%	Female	%	Sex Ratio
0 to 1km	3347	14816	7384	49.8	7432	50.2	1007
1 to 5 KmR	5527	24055	12046	50.1	12009	49.9	997
5 to 10 KmR	9115	39180	19509	49.8	19671	50.2	1008
10 to 15 KmR	17576	78462	39378	50.2	39084	49.8	993
Total	**35565**	**156513**	**78317**	50.0	**78196**	50.0	998

3.11.4.2 Population of Below 6-year children

The category wise assessment of population - Child (aged 0-6) was carried out. In the study area, the total Child population is 14389 which is around 9.2 % of total population in study area. The child sex ratio of the study area is 950 females over 1000 males.

Table 3-26: Population of <6 Years Children

Boundary (in Km)	No. of HH	Total Pop.	< 6 yrs Pop	%	< 6 yrs Male	%	< 6 yrs Female	%	Ratio
0 to 1km	3347	14816	1565	10.6	801	5.4	764	5.2	954
1 to 5 KmR	5527	24055	2179	9.1	1132	4.7	1047	4.4	925
5 to 10 KmR	9115	39180	3354	8.6	1696	4.3	1658	4.2	978
10 to 15 KmR	17576	78462	7291	9.3	3751	4.8	3540	4.5	944
Total	**35565**	**156513**	**14389**	9.2	**7380**	4.7	**7009**	4.5	950

3.11.4.3 Population of scheduled caste

The Scheduled Caste population of the study area is 9187 which constitute to be 5.9 % of total population in study area. The sex ratio of the SC population is 1016 females over 1000 males. **Table 3-27** shows population along with gender and sex ratios in the relative aspects of distance from the project site.

Table 3-27: Population of Scheduled Caste

Boundary (in Km)	No. of HH	Total Pop.	SC Pop.	Total SC%	SC Male	%	SC Female	%	Ratio
0 to 1km	3347	14816	920	6.2	480	3.2	440	3.0	917
1 to 5 KmR	5527	24055	586	2.4	292	1.2	294	1.2	1007
5 to 10 KmR	9115	39180	2821	7.2	1427	3.6	1394	3.6	977
10 to 15 KmR	17576	78462	4860	6.2	2359	3.0	2501	3.2	1060
Total	**35565**	**156513**	**9187**	5.9	**4558**	2.9	**4629**	3.0	1016

3.11.4.4 Population of Scheduled Tribes

The Scheduled Tribe population is 335 which aggregate to 0.92 % of total population in study area. The sex ratio of the ST population is 1081 females over 1000 males. **Table 3-28** shows population along with gender and sex ratios in relative aspects of distance from the project site.

Table 3-28: Population of Scheduled Tribes

Boundary (in Km)	No. of HH	Total Pop.	ST Pop.	Total ST%	ST Male	%	ST Female	%	Sex Ratio
0 to 1km	3347	14816	32	0.22	17	0.11	15	0.10	882
1 to 5 KmR	5527	24055	54	0.22	28	0.12	26	0.11	929
5 to 10 KmR	9115	39180	126	0.32	54	0.14	72	0.18	1333
10 to 15 KmR	17576	78462	123	0.16	62	0.08	61	0.08	984
Total	**35565**	**156513**	**335**	**0.92**	**161**	0.10	**174**	0.11	1081

3.11.4.5 Literacy & Illiteracy Population of Study Area

The literate population in the study area is 122232 which constitute to be 78.1 % of the total population of the study area given in **Table 3-29.** The total percentage of male literate population accounts to 41.3 % and total female percentage of literate population is 38.8 %. The overall literacy of the study area is 78.1 % which is greater than 50%. The education of the people around the study area of the proposed project needs some more to be improved.

Table 3-29: Population of Literate in the Study Area

Boundary (in Km)	No. of HH	Total Pop.	Total Literacy	%	Male Lit.	%	Female Lit.	%	Ratio
0 to 1km	3347	14816	11024	74.4	5877	39.7	5147	34.7	876
1 to 5 KmR	5527	24055	19980	83.1	10384	43.2	9596	39.9	924
5 to 10 KmR	9115	39180	29629	75.6	15780	40.3	13849	35.3	878
10 to 15 KmR	17576	78462	61599	78.5	32589	41.5	29010	37.0	890
Total	**17989**	**156513**	**122232**	78.1	**64630**	41.3	**57602**	36.8	891

The illiterate population in the study area is 34281 which constitute to be 21.9 % of the total population of the study area given in **Table 3-30.** the total percentage of male Illiterate population accounts to 8.74% and total female percentage of illiterate population is 13.15%. This indicates that female population progress is at a slow pace and can be ascertained that higher education prospects are very low. The illiteracy among females is above 50%.

Table 3-30: Population of Illiterate in the Study Area

Boundary (in Km)	No. of HH	Total Pop.	Total Ill	%	Male Ill	%	Female Ill	%	Ratio
0 to 1km	3347	14816	3792	25.6	1507	10.2	2285	15.4	1516
1 to 5 KmR	5527	24055	4075	16.9	1662	6.9	2413	10.0	1452
5 to 10 KmR	9115	39180	9551	24.4	3729	9.5	5822	14.9	1561

Boundary (in Km)	No. of HH	Total Pop.	Total Ill	%	Male Ill	%	Female Ill	%	Ratio
10 to 15 KmR	17576	78462	16863	21.5	6789	8.7	10074	12.8	1484
Total	**35565**	**156513**	**34281**	**21.9**	**13687**	**8.74**	**20594**	**13.15**	1505

3.11.4.6 Working & Non-Working Population

The working population in the project area are 62742 out of which males are constituted to 40.1% and females account to 59.9% which is detailed in **Table 3-31**.

The non-working population of the project is 93771 of which males constitute to be 33.2% and females account to be 66.8%. The overall non-working population is 59.9% of study area which implies that there is requirement of encouragement and skill development programs within the 15kmR.

The female working population needs to be increased as well as uplifted with some measures such as encouraging them for higher studies and skill training. These steps will help in making them financially independent, increase the decision-making participation at households and community level. These measures will help in increasing the working population among females and become an equivalent earning member of the family.

Boundary (in Km)	No. of HH	Total Pop.	Total Worker	%	Total Non-Workers	%	Ratio
0 to 1km	3347	14816	5640	38.1	9176	61.9	1627
1 to 5 KmR	5527	24055	8953	37.2	15102	62.8	1687
5 to 10 KmR	9115	39180	17348	44.3	21832	55.7	1258
10 to 15 KmR	17576	78462	30801	39.3	47661	60.7	1547
Total	**35565**	**156513**	**62742**	40.1	93771	59.9	1495

Table 3-31: Working & Non-Working Population Profile

The **Table 3-31** represents the working and non-working profile of the study area. The working profile is maximum in the 5-10 km and slightly less in the 1-5 km. While the working population is nearly 40.1 % which means that the dependency members are little higher than the other places. The non-working population is 59.9% which includes children, unemployed, old aged people, physically or mentally challenged persons. The working population has been further categorized into male and female which is represented under following

Table 3-32: Working & Non-Working (Male and Female) Population Profile

Boundary (in Km)	Male Worker	%	Female Worker	%	Ratio	Male Non-Workers	%	Female Non-Workers	%	Ratio
0 to 1km	4276	75.8	1364	24.2	319.0	3108	33.9	6068	66.1	1952
1 to 5 KmR	7049	78.7	1904	21.3	270.1	4997	33.1	10105	66.9	2022
5 to 10 KmR	12447	71.7	4901	28.3	393.7	7062	32.3	14770	67.7	2091
10 to 15 KmR	23370	75.9	7431	24.1	318.0	16008	33.6	31653	66.4	1977
Total	**47142**	75.1	**15600**	24.9	330.9	**31175**	33.2	**62596**	66.8	2008

3.11.4.7 Main & Marginal Workforce

The total working population has been categorised into two types as:

- Main Working Population - in which a person works for more than 6 months.
- Marginal Working Population - in which a person works for less than 6 months.

Main-Working population in the study area are 53370 which accounts to be 85.1% and Marginal-Working population in the study area is 9372 which accounts to 14.9% The details relative to distance are presented in following tables

Table 3-33: Main & Marginal Working Population Profile

Boundary (in Km)	Total Main Workers	%	Total Mar. Workers	%
0 to 1km	4955	87.9	685	12.1
1 to 5 KmR	8113	90.6	840	9.4
5 to 10 KmR	14399	83.0	2949	17.0
10 to 15 KmR	25903	84.1	4898	15.9
Total	**53370**	85.1	**9372**	14.9

Table 3-34: Main & Marginal (Male & Female) Working Population Profile

Boundary (in Km)	Total Main Workers	%	Total Mar. Workers	%
0 to 1km	4955	87.9	685	12.1
1 to 5 KmR	8113	90.6	840	9.4
5 to 10 KmR	14399	83.0	2949	17.0
10 to 15 KmR	25903	84.1	4898	15.9
Total	**53370**	85.1	**9372**	14.9

The male work force is segregated into main work population and marginal work population with respect to total work force male. As represented in **Table 3-34** main and marginal male & female work force. It is a positive sign that the work occupancy is more as main work force.

3.11.4.8 Infrastructure facilities

Educational & Social facilities

Arts, Commerce and Science Degree Colleges, Private School for Disabled, Engineering Colleges, Polytechnics, Vocational Training School/ITI, Management Institutes, Medicine Colleges are available at nearest places in the study area.

Health & Sanitation facilities

- The most common diseases that usually occur in the study area are fever, malaria, skin diseases, joint pains, back pains, diarrhea, typhoid etc. Government of Karnataka has provided primary healthcare and family welfare centers where primary first aid & government dispensary are provided.
- Almost all the places are having Primary Health Centre (PHC), Primary Health Sub-centre (PHS) and Family Welfare Centre (FWC).
- Non-Govt. Private Medical practitioners and Medical Store are also available in nearest places like Honnavar.
- The Emergency services are essential, the nearest firestation i.e. Honnavar fire station provides 24 hour service for fire and other accidental problems.
- Ambulance services (108 emergency vans) and own vehicle like fire tankers are available in and around Honnavar.

Availability of Banking & Post facilities

Banking and postal facilities are available in areas. Honnavar has good numbers of Nationalized, Corporate and Co-Operative banks like, State Bank of India, Canera Bank and private bank are like Bank of Baroda, Axis Bank Ltd. etc.

Post Office is available in Honnavar. Industries also have International courier (Blue dart, DTDC and the Professional Couriers), postal facility for transferring the documents, samples etc.

Availability of communication & Transportation facilities

Communication and transportation facilities are available in study area. Honnavar has Telephone Exchange (BSNL) with all kind of facilities i.e. Landline, STD, ISD, Fax, Mobile and Broadband. Many households in the study area have landline connections but majority of them using Cell phones.

Well-connected transportation facilities are available in rural areas found study period. All areas have well developed pucca roads. Govt. & Private Bus, Auto rickshaws and Private vehicles are commonly used for travelling purpose by local people. The nearest human habitation is Honnavar, which is at a distance of 0.46 km from the proposed construction site. Railway Station is available at Honnavar which is approximately 4.05 kms from the applied area.

Availability of Drinking Water & Electricity Power Supply facilities:

Gram Panchayat Bore well and Tube well, Tank Water, Well & Overhead Tank has provided water supplied to households for drinking, cooking and washing purpose and agricultural purposes. During the study period found that Major local people having own bore well for agriculture purpose.

3.11.5 Secondary Data Analysis – Fishery Village Census

The details of the fishing community/households and fish landing centre, marine fishing village census, population details, activity details, education details, occupation details, craft owned details and Fishing craft details are given in the **Table 3-44.** Fisheries censuses are sourced from CMFRI Fishery census handbook 2016 for Karnataka State.

Table 3-35: Fishermen Household Details

Fishing Villages	Fishermen Families	Traditional Fishermen Families	BPL families	Fisherfolk population
Alvedande	113	113	88	510
Dareshwar	81	81	81	385
Devgiri	87	87	80	415
Karki	222	220	219	984
Kadatoka	7	7	7	24
Salkode	10	10	10	35
Mugwa	100	100	98	474
Mavinakurve	133	133	132	543
Manki	726	725	719	3,496
Kharva	15	3	11	78
Kelaginoor	90	85	88	340
Jalavalli	72	29	67	345
Idagungi	103	73	94	455
Honnavara	376	356	357	1,690
Handinbalu	16	11	16	100
Chandavara	17	17	17	79
Haladipura	241	241	224	1,233

Table 3-36: Housing –Scale & Amenities (No. of Houses)

Fishing Villages	Tot House holds	Pucca	Kutcha	Rooms less than 3	Without toilet	Electrified	Potable water sources				
							Tap water	Well	Hand pump	Bore well	Others
Alvedande	113	112	1	8	88	113	113	0	0	0	0
Dareshwar	81	79	2	3	57	81	28	52	1	0	0
Devgiri	87	85	2	22	63	86	0	36	0	51	0
Karki	222	186	36	63	104	214	6	173	1	36	6
Kadatoka	7	6	1	4	3	6	1	5	0	1	0
Salkode	10	9	1	6	0	10	5	5	0	0	0
Mugwa	100	84	16	35	48	97	36	61	0	2	1

Fishing Villages	Tot House holds	Pucca	Kutcha	Rooms less than 3	Without toilet	Electrified	Potable water sources				
							Tap water	Well	Hand pump	Bore well	Others
Mavinakurve	133	127	6	98	0	133	92	41	0	0	0
Manki	726	702	24	178	409	702	109	387	0	74	156
Kharva	15	4	11	8	6	15	5	10	0	0	0
Kelaginoor	90	88	2	86	54	83	0	70	0	15	5
Jalavalli	72	56	16	48	23	72	0	65	0	0	7
Idagungi	103	43	60	85	54	95	0	103	0	0	0
Honnavara	376	366	10	114	297	375	153	163	1	54	5
Handinbalu	16	11	5	8	2	16	10	6	0	0	0
Chandavara	17	10	7	8	7	17	0	17	0	0	0
Haladipura	241	227	14	75	157	238	0	95	0	145	1

Table 3-37: Fishermen population Details

Fishing Villages	Male			Female			Totals	Average family size
	Adult	Children		Adult	Children			
		up to 5 yr.	above 5yr		up to 5Yr	Above 5yr		
Alvedande	200	24	56	172	20	38	510	5
Dareshwar	157	7	33	145	21	22	385	5
Devgiri	153	21	35	158	16	32	415	5
Karki	411	29	55	385	22	82	984	4
Kadatoka	7	1	0	9	1	6	24	3
Salkode	411	29	55	385	22	82	984	4
Mugwa	184	8	41	192	13	36	474	5
Mavinakurve	222	25	57	184	14	41	543	4
Manki	411	29	55	385	22	82	984	4
Kharva	24	3	11	28	3	9	78	5
Kelaginoor	164	5	19	116	12	24	340	4
Jalavalli	144	11	30	116	12	32	345	5
Idagungi	179	22	32	167	27	28	455	4
Honnavara	667	38	167	623	41	154	1,690	4
Handinbalu	35	9	16	27	7	6	100	6
Chandavara	25	1	9	24	6	14	79	5
Haladipura	468	65	110	451	57	82	1,233	5

Table 3-38: Fishermen Educational Profile

Fishing Villages	primary		Higher Secondary		Above Higher Secondary		Graduation and Above	
	Male	Female	Male	Female	Male	Female	Male	Female
Alvedande	74	35	52	32	25	20	11	26
Dareshwar	75	36	31	21	14	11	3	3
Devgiri	99	84	41	34	20	17	18	15
Karki	468	65	110	451	57	82	1,233	5
Kadatoka	1	7	2	4	2	0	0	0
Salkode	8	7	5	1	0	3	0	0
Mugwa	63	66	58	53	29	21	9	7
Mavinakurve	48	41	46	31	19	9	4	1
Manki	525	507	752	610	65	55	22	12
Kharva	5	6	14	13	7	0	1	1
Kelaginoor	73	64	46	32	21	11	9	8
Jalavalli	26	10	11	14	8	7	3	2
Idagungi	115	96	57	29	18	9	10	9

Fishing Villages	primary		Higher Secondary		Above Higher Secondary		Graduation and Above	
	Male	Female	Male	Female	Male	Female	Male	Female
Honnavara	269	206	222	161	90	81	34	37
Handinbalu	15	13	4	3	2	2	1	1
Chandavara	6	15	14	10	4	0	0	0
Haladipura	304	252	136	78	40	29	41	27

Table 3-39: Fishermen Activity Profile

Fishing Villages	Actual Fishing		Fish Seed Collection				Total
	Full Time	Part Time	Full Time		Part Time		
			Male	Female	Male	Female	
Alvedande	74	35	52	32	25	20	11
Dareshwar	104	0	0	0	0	0	104
Devgiri	17	0	0	0	0	0	17
Karki	137	1	4	2	0	0	144
Kadatoka	1	2	0	0	0	0	3
Salkode	0	9	0	0	0	0	9
Mugwa	63	66	58	53	29	21	9
Mavinakurve	148	9	0	0	0	1	158
Manki	977	6	0	0	0	0	983
Kharva	1	3	1	0	0	0	5
Kelaginoor	90	88	2	86	54	83	0
Jalavalli	17	55	7	1	19	0	99
Idagungi	31	35	0	0	0	0	66
Honnavara	269	206	222	161	90	81	34
Handinbalu	15	13	4	3	2	2	1
Chandavara	25	1	9	24	6	14	79
Haladipura	71	0	0	0	0	0	71

Table 3-40: Fishermen Occupation Profile

Fishing Villages	Active Fishermen	No. of members involved in fishing allied activities						Other than fishing	Total occupied
		Marketing of fish	Making/ Repairing net	Curing/ processing	Peeling	Labourer	Others		
Alvedande	145	3	0	0	0	0	0	0	148
Dareshwar	104	0	0	0	0	0	0	0	104
Devgiri	17	24	0	0	0	86	0	11	138
Karki	144	80	1	0	0	178	4	75	482
Kadatoka	3	2	0	0	0	2	0	0	7
Salkode	9	2	0	0	0	4	0	16	31
Mugwa	62	29	0	1	2	64	14	43	215
Mavinakurve	158	71	1	0	0	0	0	8	238
Manki	983	267	2	0	19	0	0	71	1,342
Kharva	5	18	0	0	0	11	0	9	43
Kelaginoor	0	19	14	2	16	99	2	30	182
Jalavalli	99	4	0	0	0	3	0	43	149
Idagungi	66	19	36	0	0	72	0	42	235
Honnavara	237	102	0	0	11	276	30	37	693

Fishing Villages	Active Fishermen	No. of members involved in fishing allied activities						Other than fishing	Total occupied
		Marketing of fish	Making/ Repairing net	Curing/ processing	Peeling	Labourer	Others		
Handinbalu	17	11	2	0	0	5	0	5	40
Chandavara	7	5	0	0	0	8	0	25	45
Haladipura	71	94	0	0	0	303	0	26	494

Table 3-41: Gender-Wise Fishing Allied Activities

Name of The Village	Marketing of fish		Making/ Repairing Net		Curing/ Processing		peeling		labourer		Others	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Alvedande	0	3	0	0	0	0	0	0	0	0	0	0
Dareshwar	0	0	0	0	0	0	0	0	0	0	0	0
Devgiri	0	24	0	0	0	0	0	0	86	0	0	0
Karki	9	71	1	0	0	0	0	0	163	15	0	4
Kadatoka	0	2	0	0	0	0	0	0	2	0	0	0
Salkode	0	2	0	0	0	0	0	0	4	0	0	0
Mugwa	8	21	0	0	0	1	0	2	52	12	5	9
Mavinakurve	0	71	1	0	0	0	0	0	0	0	0	0
Manki	5	262	2	0	0	0	0	19	0	0	0	0
Kharva	10	8	0	0	0	0	0	0	6	5	0	0
Kelaginoor	7	12	13	1	2	0	15	1	68	31	2	0
Jalavalli	2	2	0	0	0	0	0	0	3	0	0	0
Idagungi	4	15	28	8	0	0	0	0	52	20	0	0
Honnavara	51	51	0	0	0	0	10	1	239	37	12	18
Handinbalu	5	6	2	0	0	0	0	0	3	2	0	0
Chandavara	0	5	0	0	0	0	0	0	8	0	0	0
Haladipura	3	91	0	0	0	0	0	0	293	10	0	0

Table 3-42: Religion Community

Name of Village	Religion			Total	Community
	Hinduism	Islam	Christianity		SC/ST
Alvedande	113	0	0	113	0
Dareshwar	81	0	0	81	0
Devgiri	87	0	0	87	0
Karki	222	0	0	222	0
Kadatoka	7	0	0	7	0
Salkode	10	0	0	10	10
Mugwa	84	0	16	100	0
Mavinakurve	78	0	55	133	0
Manki	559	165	2	726	108
Kharva	6	5	4	15	1
Kelaginoor	86	0	4	90	2

Name of Village	Religion			Total	Community
	Hinduism	Islam	Christianity		SC/ST
Jalavalli	72	0	0	72	0
Idagungi	100	0	3	103	0
Honnavara	373	2	1	376	3
Handinbalu	12	0	4	16	0
Chandavara	17	0	0	17	0
Haladipura	241	0	0	241	0

Table 3-43: Membership in Co-operatives

Name of Village	Members in		
	Fisheries Co-Operatives	Other Co-Operatives	Total
Alvedande	192	0	192
Dareshwar	142	0	142
Devgiri	198	83	281
Karki	321	174	495
Kadatoka	6	5	11
Salkode	0	3	3
Mugwa	133	60	193
Mavinakurve	159	103	262
Manki	973	215	1,188
Kharva	0	0	0
Kelaginoor	79	17	96
Jalavalli	64	78	142
Idagungi	161	1	162
Honnavara	657	9	666
Handinbalu	14	7	21
Chandavara	4	18	22
Haladipura	508	149	657

Table 3-44: Crafts owned by Fisher Folk (100% ownership)

Name of village	Mechanized	Inboard	Outboard	Non-Motorized	Total
Alvedande	0	0	47	9	56
Dareshwar	0	0	19	9	28
Devgiri	10	0	9	62	81
Karki	3	1	2	79	85
Mugwa	0	0	0	44	44
Mavinakurve	0	0	0	134	134
Manki	7	0	99	280	386
Kharva	0	0	0	2	2
Kelaginoor	1	0	0	24	25
Jalavalli	1	0	0	24	25
Idagungi	1	0	0	28	29
Honnavara	0	0	0	120	120
Handinbalu	0	0	0	2	2
Haladipura	11	1	19	169	200

Table 3-45: Fishing Craft in the Fishery

Name of fish Landing Center (FLC)	Mechanized				Motorized			Non-motorized	Total
	Trawlers	Gillnetters	Purse seiners	Total Motorized	Inboard	Outboard	Total Motorized		
Kasarkode F.H.	83	0	75	158	0	47	47	100	305
Manki-Madi	0	0	0	0	0	140	140	0	140
Dhareswar	0	0	0	0	0	37	37	40	77
Haldipur-Horabag	0	0	0	0	0	25	25	0	25

Name of fish Landing Center (FLC)	Mechanized				Motorized			Non-motorized	Total
	Trawlers	Gillnetters	Purse seiners	Total Motorized	Inboard	Outboard	Total Motorized		
Mavinkurve	0	0	0	0	0	63	63	60	123

Table 3-46: Infrastructure Profile

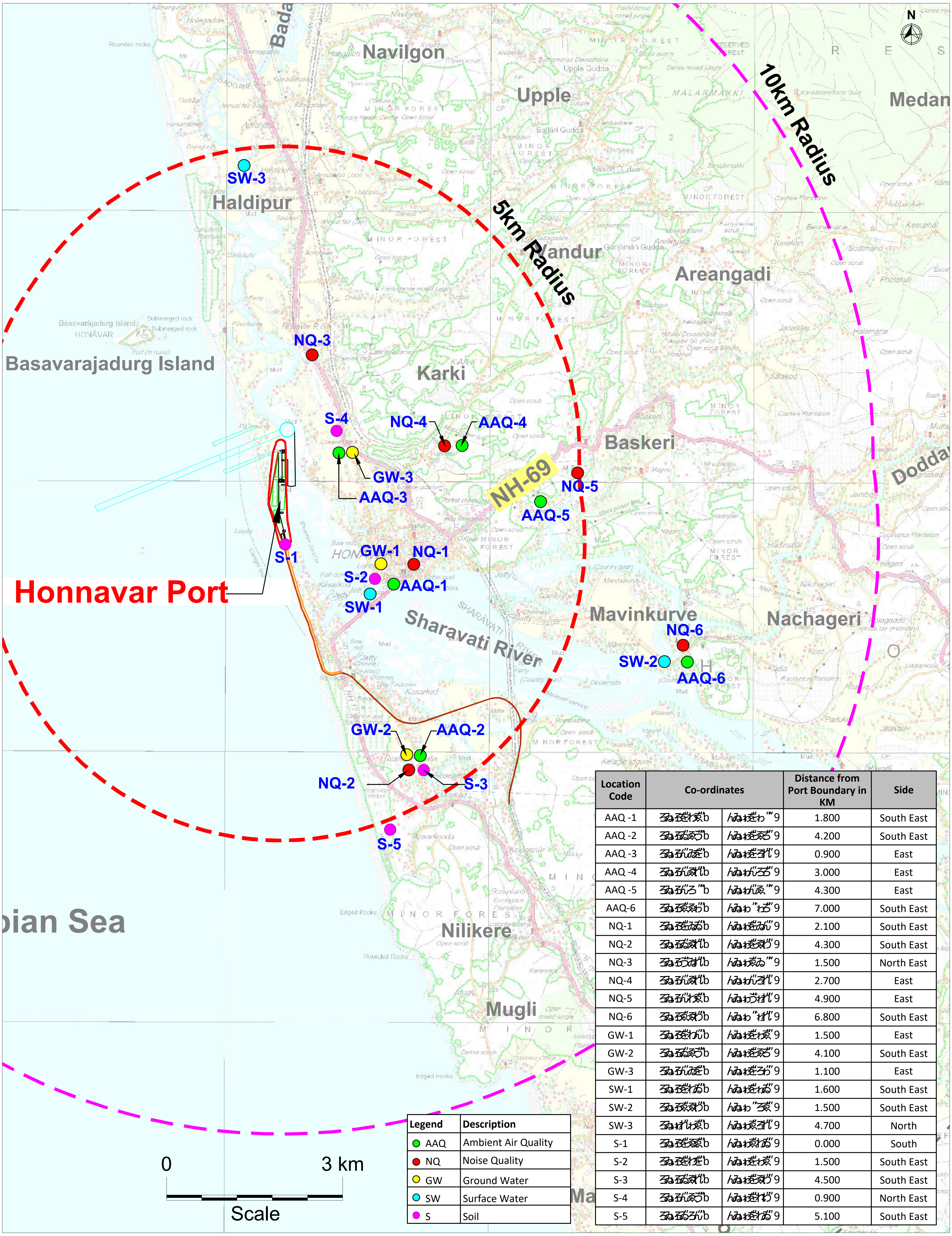
District	No fishing villages	Primary schools	secondary schools	colleges	Technical Institutions	banks	Fisheries Co-operative societies	other co-operative societies	community centers	cinema theatres	Liquor shops	petrol Bunks
Uttara Kannada	86	424	60	21	11	111	16	116	83	3	31	31

Table 3-47: Fisheries Infrastructure Profile

District	Boat yards	Cold storages	Ice factories	Freezing plants	Processing plants	Curing yards	Peeling sheds	Extraction Plants	Fish meal plants
Uttara Kannada	9	4	30	4	1	0	0	1	1

Table 3-48: Lifesaving & electronic equipment (No. of families)

District	Lifesaving equipment	Electronic/Communication gadgets				
		Mobile Phone	GPS	Radio Phone	Echo sounder	others
Uttara Kannada	4,125	14,423	796	1	324	103



Location Code	Co-ordinates		Distance from Port Boundary in KM	Side
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AAQ -2	[illegible]	[illegible]	4.200	South East
AAQ -3	[illegible]	[illegible]	0.900	East
AAQ -4	[illegible]	[illegible]	3.000	East
AAQ -5	[illegible]	[illegible]	4.300	East
AAQ-6	[illegible]	[illegible]	7.000	South East
NQ-1	[illegible]	[illegible]	2.100	South East
NQ-2	[illegible]	[illegible]	4.300	South East
NQ-3	[illegible]	[illegible]	1.500	North East
NQ-4	[illegible]	[illegible]	2.700	East
NQ-5	[illegible]	[illegible]	4.900	East
NQ-6	[illegible]	[illegible]	6.800	South East
GW-1	[illegible]	[illegible]	1.500	East
GW-2	[illegible]	[illegible]	4.100	South East
GW-3	[illegible]	[illegible]	1.100	East
SW-1	[illegible]	[illegible]	1.600	South East
SW-2	[illegible]	[illegible]	1.500	South East
SW-3	[illegible]	[illegible]	4.700	North
S-1	[illegible]	[illegible]	0.000	South
S-2	[illegible]	[illegible]	1.500	South East
S-3	[illegible]	[illegible]	4.500	South East
S-4	[illegible]	[illegible]	0.900	North East
S-5	[illegible]	[illegible]	5.100	South East

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PROJECT NO: C1241301

TITLE: TERRESTRIAL MONITORING LOCATION MAP

DATE: 23.08.2024

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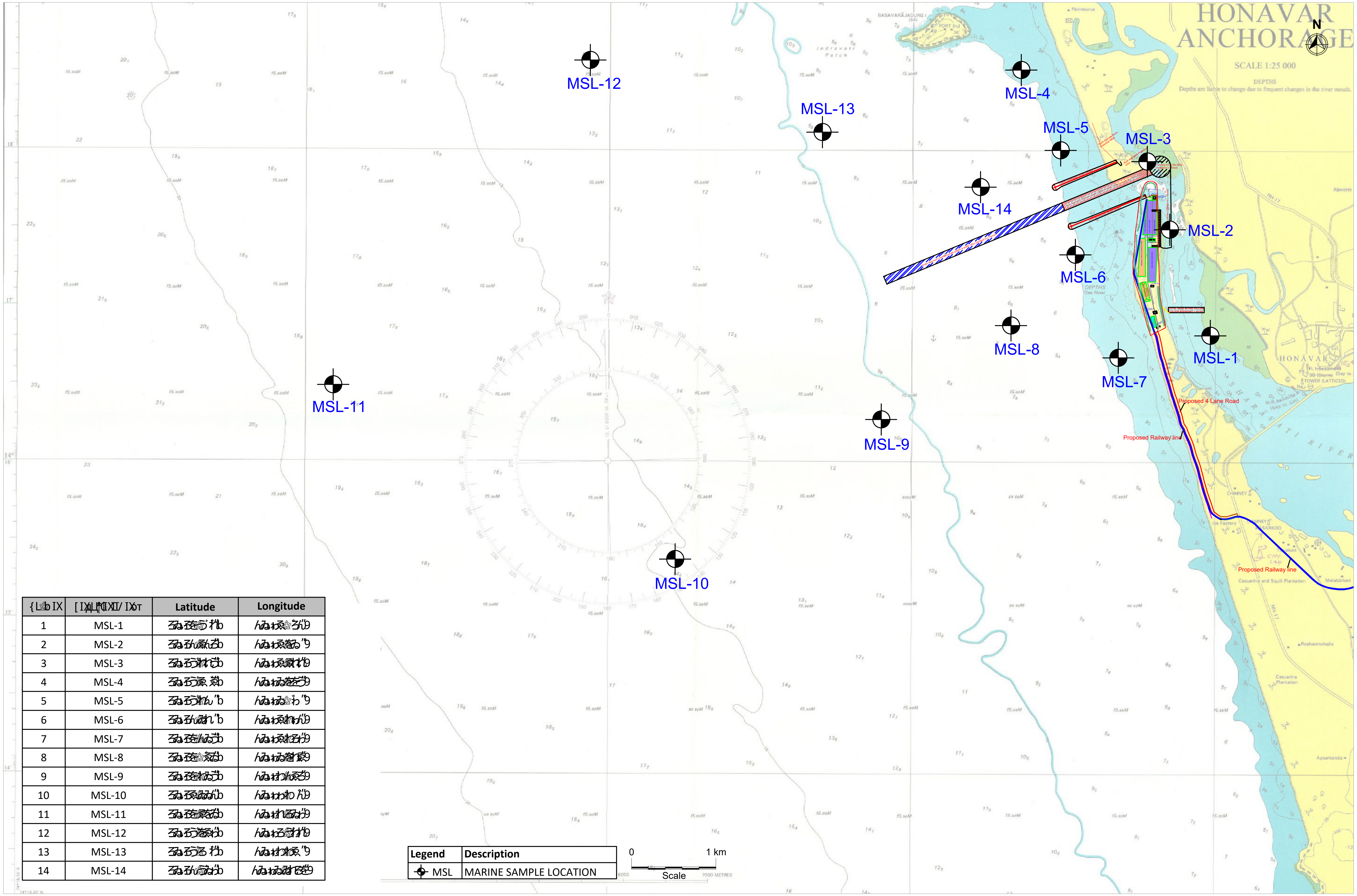
FIGURE NO: FD0301

REV: 0

AUTO PATH: I:\URBAN PLANNING & ENV DEPT\BUSINESS DEVELOPMENT 2024-25\10 -HONNAVAR PORT\FD0301-TERRESTRIAL MONITORING LOCATION MAP.DWG

TBA



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2	MSL-2	[illegible]	[illegible]
3	MSL-3	[illegible]	[illegible]
4	MSL-4	[illegible]	[illegible]
5	MSL-5	[illegible]	[illegible]
6	MSL-6	[illegible]	[illegible]
7	MSL-7	[illegible]	[illegible]
8	MSL-8	[illegible]	[illegible]
9	MSL-9	[illegible]	[illegible]
10	MSL-10	[illegible]	[illegible]
11	MSL-11	[illegible]	[illegible]
12	MSL-12	[illegible]	[illegible]
13	MSL-13	[illegible]	[illegible]
14	MSL-14	[illegible]	[illegible]

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Chapter 4
Anticipated Environmental Impacts and Mitigation Measures

Chapter 4 Anticipated Impacts and Mitigation Measures

4.1 General

The construction and operational phases of Honnavar Barge/ vessel loading facility involves various landside and marine side construction and operational activities. In this chapter, likely impacts of these activities on environmental attributes have been identified, assessed and presented. To mitigate likely environmental impacts during construction and operational phases due to landside and marine side activities, suitable mitigation measures are incorporated as a part of planning process. The impacts have been assessed both quantitatively and qualitatively for various terrestrial and marine environmental components and additional mitigation measures are proposed.

4.2 Land Environment

4.2.1 Potential Impact due to Project Location

4.2.1.1 Impacts due to Land Acquisition

Government of Karnataka has allotted the land for the proposed development on coastal land. For the proposed port development R&R is not envisaged.

No impacts are envisaged to land environment with respect to land acquisition due to the proposed project.

4.2.1.2 Impacts due to Changes in Land Use Pattern

Proposed project site comprises completely coastal sand and government land. The project area will be reclaimed up to (+) 4.30 m CD for the development of backup area, however development will be planned in such a way that the existing drainage pattern will not be disturbed. Road and Rail connectivity are proposed with the port layout. The existing land use and the proposed land use are discussed in Chapter 2 and Chapter 3 respectively.

4.2.1.3 Impacts due to Changes in Coastline/Shoreline

The shoreline/coastline changes such as erosion/accretion is usually expected due to the construction of marine structures such as breakwaters, groynes, etc. The natural setting if disturbed by construction of breakwaters or dredging a channel to deepen locally the seabed, causes imbalance in sand movement along the coast. It has been seen all along the west coast of India, that a breakwater construction causes accretion on the Northern side and erosion on the Southern side.

In the proposed development, a southern breakwater of length 865m and northern breakwater of length of 820 m will be constructed which may have impact on existing coastline/shoreline. The lengths of the breakwater may vary depending on the bathymetry at the time of execution. Mathematical model studies were carried out and the details are discussed in subsequent sections.

4.2.1.4 Impacts due to Land Reclamation

Land reclamation will be carried out within port limits. About 1.0 MCM of the dredged material will be used for reclamation. Land reclamation with capital dredged material is likely to impact the reclamation area/site with the turbid saline water. Areas to be reclaimed will be defined during detailed engineering stage and protective reclamation bunds will be constructed around the planned reclamation areas to avoid spreading of dredge material and to reduce turbidity. The dredged material will be pumped into the reclamation area enclosed by reclamation bunds wherein the solids will be allowed to settle, and the return water will be directed into sea through appropriate return channel/pipelines. The dredge fill will be covered by gravel before hard standing. After completion of the reclamation and hard standing, necessary development shall be carried out.

Predominantly the backup area to be reclaimed is coastal sand and low-lying area sloping towards sea. Hence, the impact due to this activity will not be significant. In order to study variations in groundwater quality of nearby villages due to reclamation, regular water quality monitoring will be carried out.

4.2.1.5 Mitigation Measures

Barge/ Vessel loading facility development will take place within the port limits and no agricultural land or settlements are included in the land proposed for development.

Existing drainage pattern will not be disturbed due to the proposed development. Storm water drainage network at appropriate places will be provided within the facility area.

Reclamation bunds and setting ponds shall be constructed, In order to prevent the seepage of return sea water into the groundwater, suitable impervious liners such as LDPE will be provided all along the return water channel, if necessary. Also, minimum required retention time of return water in the reclamation area as well as in the return channel will be ensured.

Regular monitoring of return water (turbid water) from the reclamation area will be carried out at nearby points in the sea.

Turbidity control screen shall be provided near the sensitive area. In addition, due care shall be taken during construction and reclamation.

In order to study variations in groundwater quality of nearby villages due to reclamation, regular water quality monitoring will be carried out.

4.2.2 Potential Impact during Construction

4.2.2.1 Impact on Local Infrastructure

Transportation of Construction and Cargo Material: Transportation of huge quantities of construction material for construction of breakwaters, berths, stockyards, operational and administrative buildings etc results in use of public infrastructure like roads, railways, drainage, water and power supply which in turn results in congestion.

Raw Materials and Product details:

Construction Phase: Basic raw material for construction is available near the vicinity of the Port. Raw materials will include water, steel, cement, rock for construction of breakwater, aggregate required for concrete structures such as berths, yard, buildings, etc.

Operational Phase: During the operation phase the only raw materials to be used are mostly oil and water. Oil will be used for vehicles and other maintenance purposes which will be sourced locally. Water will be supplied from local authorities.

Stones and aggregates required for construction of breakwaters, berths will be sourced from approved quarries nearby Sources. However, other quarry sites will also be explored if need during the execution of the project for which necessary permission from local competent authority will be obtained if required. Ready mix concrete will be made out of the basic raw material on site itself. Batching plants of respective size and capacity as per requirement will be installed at the site.

Transportation of raw materials from nearby areas is likely to result in increased road traffic but only temporary during construction phase. Details of the Raw materials are provided in the below table

Table 4-1: Raw Material Details

Material	Unit	Breakwater	Tetrapod	Berth and Approach Trestle
Cement	Bags	41,587	1,27,170	2,17,199
Sand	Cum	2,201	6,732	6,09,372
Aggregate 10mm	Cum	2,302	7,040	5,50,882
Aggregate 20mm	Cum	2,160	6,606	3,50,570
Water	Ltr	9,13,824	27,94,411	21,54,52,080
Admixture	Ltr	1,450	4,434	28,54,023
Steel	Mt	-	-	4,363
Concrete Grade		M30	M30	M10, M40

To mitigate impacts from transportation of stones and Construction materials, existing roads will be strengthened and widened to enable movement of dumpers. Hence, impacts would not be significant as quarries are accessible.

Also, as a part of infrastructure development for Honnavar Barge/ vessel loading facility, it is proposed to develop four lane road from km 0.00 (Kasarkod side of Honnavar port) to Km 2.580 (towards NH 66) connecting Honnavar Port with NH - 66 at Km 195.986 and to improve NH – 66 from Km 195.00 to Km 197.00 as part of Bharatmala Pariyojana Phase I programme and land for the road and rail corridor is under the Honnavar port limits and portion of proposed corridor is falling in the forest lands of ~0.76 ha with a length of 220m for the which Stage I clearance and final approval (Stage II) was also proposed by PC office, Forest Department, GoK (**Section 1.2**). The proposed road will consist of 3 under passes & 1 box culvert as a part of the development. The proposed road and rail connectivity is part of the proposed project.

A new railway line of 8.5 km is being proposed from port site to newly proposed Hospattana railway station. New Proposed railway line will run parallel to existing railway line for a length of about 8.5 km and then will take a turn towards seacoast which will then run parallel to the sea coast till the port site within declared port limits. In order to minimize the strain on the existing infrastructure in the region, dedicated road & rail corridor will be developed at the earliest. Until then existing road will be strengthened and widened to ease the traffic movement.

Construction Workers' Camp: There will be a requirement of about 500 work force during the construction phase. To ensure that there is no strain on the existing infrastructure, the worker camps will be self-sufficient and would not rely on any local resource. This would also ensure that there is no conflict with the local population. To mitigate impacts from health hazards, sanitation facilities will be provided. Further, the worker camps will be located away from the coast and habitations.

4.2.2.2 Mitigation Measures

- Temporary approach roads may be developed with prior permission from competent authority.

- Transportation Management will be adopted for movement of dumpers transporting quarry stones and construction materials and traffic will be regulated.
- Trucks with construction material susceptible for fugitive suspension will be covered with tarpaulin.
- Vehicles deployed will conform to emission norms (air/noise) of CPCB and with valid Pollution Under Control (PUC) certificates.
- Dumpers and trucks will comply with standards for exhaust emissions and noise levels
- The Worker camps will be adequately equipped with all the necessary facilities such as water supply, power supply, wastewater collection, solid waste collection and sanitation, fuel supply etc.
- The domestic wastes generated from the worker camps will be collected properly treated and disposed after complying with the norms stipulated by statutory authorities.
- No bore wells will be driven for the drinking water requirements to avoid impacts on groundwater resources
- If there are any accidental spillages of hazardous substances on soil that may pose the risk of contaminating run off, such areas will be immediately remediated
- Three underpass/tunnel & box culverts are proposed to allow the fishermen/cattle to pass safely under the road corridor.
- Proper lighting, signboards shall be provided at required locations

4.2.2.3 Quarry Site Management

The Materials required for construction shall be sourced from the nearby vendors on rate contract basis and necessary environment measures shall be followed by the contractor supplying the materials.

- Construction material shall be sourced from Government approved quarries and vendors/agencies
- Quarry operations will be restricted to daytime to reduce the impacts from increased noise and will be minimized to reach the threshold levels stipulated by CPCB at the nearest habitations.
- It will be ensured that quarry sites and borrow pits be of a regular shape and if possible, of equal size.
- Boundary of the quarry site shall be at least 50 m away from the nearest habitation.
- Siltation pond shall be created by constructing a check dam at the bottom of the quarry area to prevent the runoff of water and sediments by the contactor supplying the material.
- Only rocky outcrops will be quarried and quarrying below the general ground level, surrounding the rock will be avoided.
- Some localized road improvement measures shall be carried out near the quarries and near the project site to enable moving of the large quantity of stones by road using trucks.
- Contractor’s Quarry management plan shall be implemented

4.2.3 Potential Impact during Operations

4.2.3.1 Discharges from Barges on Land

No discharge of wastewater/waste from the Barges/vessel calling at Honnavar Barge loading facility.

The ships will have their own sewage reception/treatment facilities on board and no discharge of sewage will be allowed at the port area. In addition, the ships are expected to discharge sewage in deep seas as per defined procedures for International ship movements (MARPOL). This will ensure the ships have their own storage capacities in their on board sewage receptions to handle wastes generated during the period/days the ship is at the port. The sewage generated in the port area will be treated in the STP (2.3 KLD) which will be proposed within the operational area.

Sewage & wastewater will be generated from toilet blocks, office buildings, residential areas & Canteen blocks.

Due to site topography and coastal belt location it is proposed to have a combination of gravity & pressure sewer system to collect and convey sewage/wastewater from toilet blocks and other facilities to STP. Recycled water shall be used for greenbelt & horticulture purpose.

4.2.3.2 Soil Contamination

Soil contamination may be envisaged if proper measures are not taken for the following activity at port

- Used oil/Spent oil & Used Battery, Containers/Barrels/liners Contaminated with HW/Chemicals.
- Municipal wastes in the form of canteen wastes, domestic wastes, papers, etc
- Cargo and Other Spills
- Other hazardous and non-hazardous wastes generated from operations

4.2.3.3 Mitigation Measures

Good housekeeping and best practices of waste material handling shall be adopted to eliminate/minimise the risks of soil contamination. The provision for temporary storage of hazardous and other waste will be developed for a period of 90 days. The hazardous wastes generated at the Port will be disposed at nearby Treatment, Storage and Disposal Facility (TSDF). The nearest TSDF is located at Ramky Enviro Engineers, Dabaspet, Nelamangala, at a distance ~330km aerial. Accidental spills if any, it will be attempted to contain and recover at the earliest. However, possible waste minimisation techniques will be adopted in order to minimise the generation of wastes.

4.2.3.4 Shoreline Changes – Erosion/Accretion

Analysis of shoreline change and prediction of shoreline behaviour in the presence of coastal structures have become important for integrated coastal zone management. The shoreline occurring between land and sea is dynamic which undergoes short term and long term geomorphological changes under the influence of near shore coastal hydrodynamics. These changes to the coastal morphology are cyclic which have continued over the years.

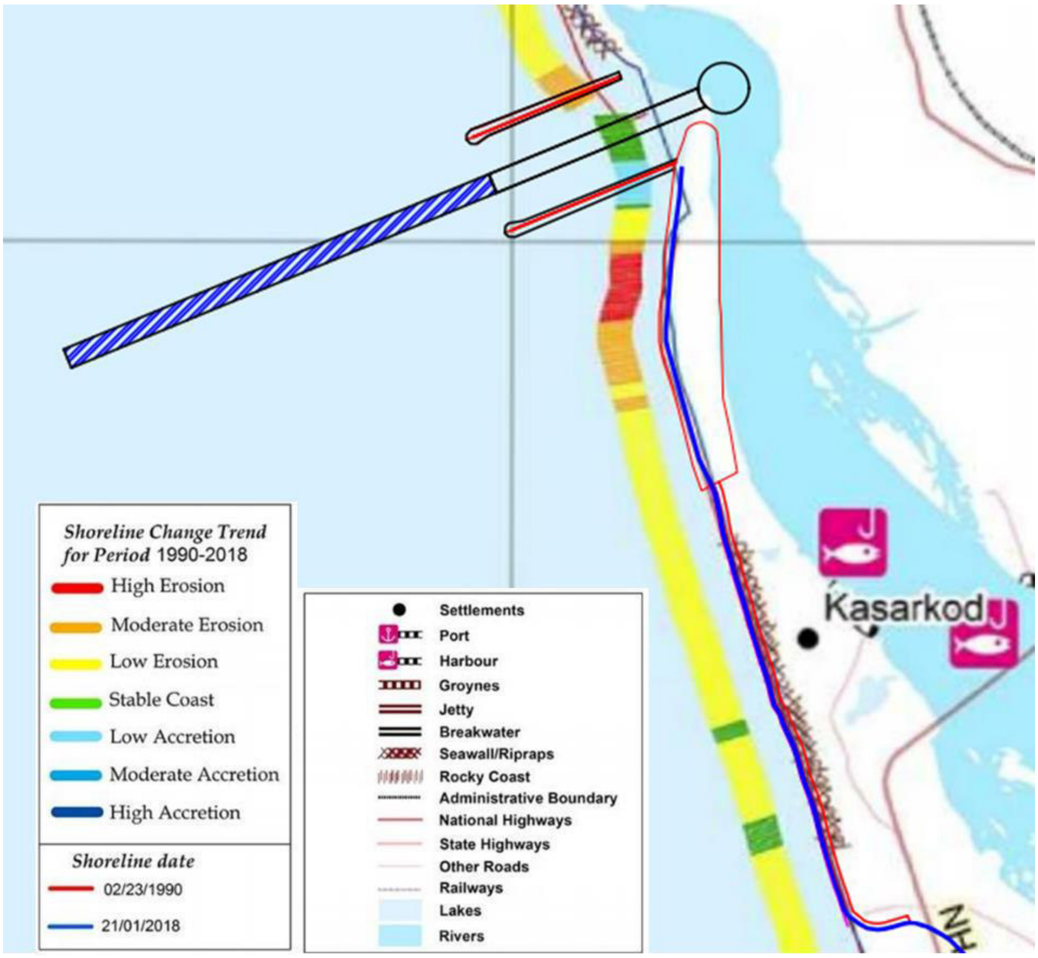


Figure 4-1: Shoreline change as per National Assessment of Shoreline Changes along Indian Coast, March 2022

<u>Assessment of Shoreline Evolution with Proposed Breakwaters</u>

Long shore sediment transport takes place when waves approach obliquely to the shore. This process of sediment transport is a cyclic process where river adds sediment to the coast which is transported by waves. The cycle of sediment transport by the waves to and from the coast is continuous which has aided in keeping the equilibrium of the coastline balanced over the geological times. Any change to the sediment transport cycle leads to imbalance to the prevailing shoreline dynamics.

In the normal condition the shoreline undergoes oscillation due to wave and wave induced current. The predominant quantity of sediment transport along shore takes place within the depth of closure. Coastal structure similar to groyne or a breakwater connected to the land when introduced into the sea obstructs the sediment transport resulting in accretion / erosion of sediment.

The proposed development consists of two breakwaters designated as northern (820 m) breakwater and southern (865 m) breakwater extending into the sea to a water depth of (-) 5.0 m respectively. The approach channel will be dredged to (-) 10 m CD. The Channel will be aligned in Southwest direction.

<u>Shoreline Change Modelling:</u>

Shoreline change simulations have been carriedout by considering the two scenarios:

- Scenario I: With breakwaters and without shore protection on the northern side of inlet

- Scenario II: With breakwaters and with sea wall on the northern side of inlet

Results:

Scenario I:

It is observed that erosion may occur towards northern side of the north-breakwater with shoreline recession of around 20-30m for 10 years (2-3 m/yr). Whereas, on the southern side, deposition occurs with a shoreline advancement of 50-60 m.

Scenario II:

When a shore protection strategy like sea wall is constructed on the northern side of the facility, it is observed that the coast is almost stable and no net change in shoreline towards northern side is observed. Whereas, on the southern side, slight deposition occurs with a shoreline advancement of 30-40 m after 10 years.

The predominant direction of alongshore sediment transport is towards north due to S, SSW and SW waves and the net transport of sediment is around $0.6x10^6$ m^3 directed towards north. Overall, the model studies show a general depositional trend along the coastline.

4.2.3.5 Mitigation Measures

Continuous monitoring of shoreline with the help of high-resolution satellite imageries shall be carried out, during operation phase and validated with ground truthing/Shoreline surveys.

4.3 Water Environment

4.3.1 Potential Impact due to Barge/ Vessel Loading Facility Location

4.3.1.1 Impact on Existing Water Resources

Water requirement during the construction is expected to be around 15 m^3/day. Water demand during operational phase of barge/vessel loading facility is estimated at 7 m^3/day. The water requirement will be met from Karnataka Rural Water Supply and Sanitation Agency which includes supply to Barge/vessels, staff and port users. In addition to that water required for dust suppression system and fire fighting will be sourced from Sharavati River

It is not envisaged to draw groundwater to avoid any possible impacts to local groundwater resources. A dedicated water supply system will be developed by the HPPL for dust suppression, potable water and fire fighting purpose. As water requirement is proposed to be met from water supply department and surface water resource through a dedicated system and not relying on existing facilities, significant impacts are not envisaged.

4.3.1.2 Impact due to Stagnation of Wastewater in Harbour

The construction of marine structures such as breakwaters will change the current patterns and results in tranquil conditions suitable for the operation of the facility. There are fishing vessel movements in the mouth of Sharavati River, the discharges from the barge/vessel loading facility visiting vessels and fishing vessels in the harbour may affect the harbour waters. Breakwaters shall be constructed in a way to maintain good tranquil conditions without disturbing the river flow. No discharges from the vessels will be permitted in the harbour area. Further, the area surrounding the barge/vessel loading facility location is undeveloped which will not generate significant sewage and industrial discharges into water resources.

4.3.1.3 Mitigation Measures

The wastewater and sewage generated during construction at site, at labour camp and operation phase will be collected in septic tank followed by soak pit.

4.3.2 Potential Impact due to Construction

4.3.2.1 Impact due to Land Reclamation/Wastewater Generation

Generally, reclamation of low lying areas with capital dredged material is likely to affect groundwater quality due to intrusion of sea water. But predominantly the barge/vessel loading facility land proposed to be reclaimed is coastal sand which is saline in nature and is separated by Sharavati River from the land located towards East. Hence, no significant impact is anticipated due to reclamation on ground water.

4.3.2.2 Mitigation Measures

The return sea water quality from the reclaimed area and groundwater quality of nearby villages will be monitored regularly.

General Mitigation Measures/ Wastewater Management during Construction Phase

The environmental management for sanitary wastewater, vehicle wash water, hydrotest water and storm water is addressed below:

- An adequate drainage system will be provided at the site with separate collection streams to segregate the storm run-off from roads, open areas, material storage areas, vehicle wash water and other wastewater streams. Suitable measures will also be taken to prevent the washing away of construction materials into the drainage system.
- Contaminated storm water will be collected and conveyed to settling tank for removing grit.
- Sewage generated at site will be collected in the septic tank followed soak pit.
- Run-off from project site will not be discharged into the river.

4.3.3 Potential Impact during Operation

4.3.3.1 Impact on Water Quality due to Cargo Operations

Storm water runoff will be directed into open concrete lined channels alongside the roads and paved areas in the cargo storage areas and other areas of the barge/vessel loading facility. The polluted runoff from berths and stockpiles of cargo storage areas will be intercepted and directed to septic tank .The runoff from uncontaminated areas will be discharged into the greenbelt area. Contaminated storm water will be collected and conveyed to settling tank for removing grit.

4.3.3.2 Mitigation Measures/Wastewater Management

Mitigation measures are proposed to be adopted to minimise the impacts from wastewater and runoff generated from cargo storage areas. The storage area will be provided with an extensive drainage system so that the contaminated water from the stockyard area does not flow directly into the natural water bodies or into the groundwater system.

The sewerage system will be provided to collect the sewage from administration building; canteen and operation buildings and sent to septic tanks followed by soak pits.

4.4 Marine Environment (Coastal Hydrology/Bottom Contamination, Sea/Harbour Water Quality)

4.4.1 Potential Impact due to Barge/ Vessel Loading Facility Location

4.4.1.1 Sediment Transport

Sediment transport takes place under the action of waves and currents. The oblique wave breaking, and currents mainly decides the sand movement in coastal areas. The action of wave is the principal cause of sediment transport as it initiates sediment motion generated by wave breaking current. The proposed barge/vessel loading facility includes breakwaters, navigational channel and turning basin planned near the Sharavati and Badgani river mouth may affect the wave and current pattern in the vicinity and in turn the local sediment transport pattern. The presence of Sharavati and Badgani river confluence points in the harbour area can also influence the local sedimentation pattern. Hence, to study the sediment movement in the near shore, estimate the maintenance dredging quantity and the erosion/deposition patterns, it is essential to include the environment parameters like waves and current during evaluation of sediment transport.

Flow Model description:

MIKE 21 Flow Model is a modelling system for 2D free-surface flows. MIKE 21 Flow Model is applicable to the simulation of hydraulic and environmental phenomena in lakes, estuaries, bays, coastal areas and seas. It may be applied wherever stratification can be neglected. The hydrodynamic (HD) module is the basic module in the MIKE 21Flow Model. It provides the hydrodynamic basis for the computations performed in the Environmental Hydraulics modules.

The hydrodynamic module simulates water level variations and flows in response to a variety of forcing functions in lakes, estuaries and coastal regions. The effects and facilities include:

- Bottom shear stress
- Wind shear stress
- Barometric pressure gradients
- Coriolis force
- Momentum dispersion
- Sources and sinks
- Evaporation
- Flooding and drying
- Wave radiation stresses

$$\frac{\partial \zeta}{\partial t} + \frac{\partial p}{\partial x} + \frac{\partial q}{\partial y} = \frac{\partial d}{\partial t}$$

$$\frac{\partial p}{\partial t} + \frac{\partial}{\partial x}\left(\frac{p^2}{h}\right) + \frac{\partial}{\partial y}\left(\frac{pq}{h}\right) + gh\frac{\partial \zeta}{\partial x}$$

$$+\frac{gp\sqrt{p^2+q^2}}{C^2 \cdot h^2} - \frac{1}{\rho_w}\left[\frac{\partial}{\partial x}(h\tau_{xx}) + \frac{\partial}{\partial y}(h\tau_{xy})\right] - \Omega_q$$

$$-fVV_x + \frac{h}{\rho_w}\frac{\partial}{\partial x}(p_a) = 0$$

$$\frac{\partial q}{\partial t} + \frac{\partial}{\partial y}\left(\frac{q^2}{h}\right) + \frac{\partial}{\partial x}\left(\frac{pq}{h}\right) + gh\frac{\partial \zeta}{\partial y}$$

$$+\frac{gq\sqrt{p^2+q^2}}{C^2 \cdot h^2} - \frac{1}{\rho_w}\left[\frac{\partial}{\partial y}(h\tau_{yy}) + \frac{\partial}{\partial x}(h\tau_{xy})\right] + \Omega_p$$

$$-fVV_y + \frac{h}{\rho_w}\frac{\partial}{\partial xy}(p_a) = 0$$

Flow Model Validation:

The HD model has been validated with the measured water levels inside the river as well as in the channel provided by Indomer Coastal Hydraulics, Chennai and are shown in **Figure 4-2.**

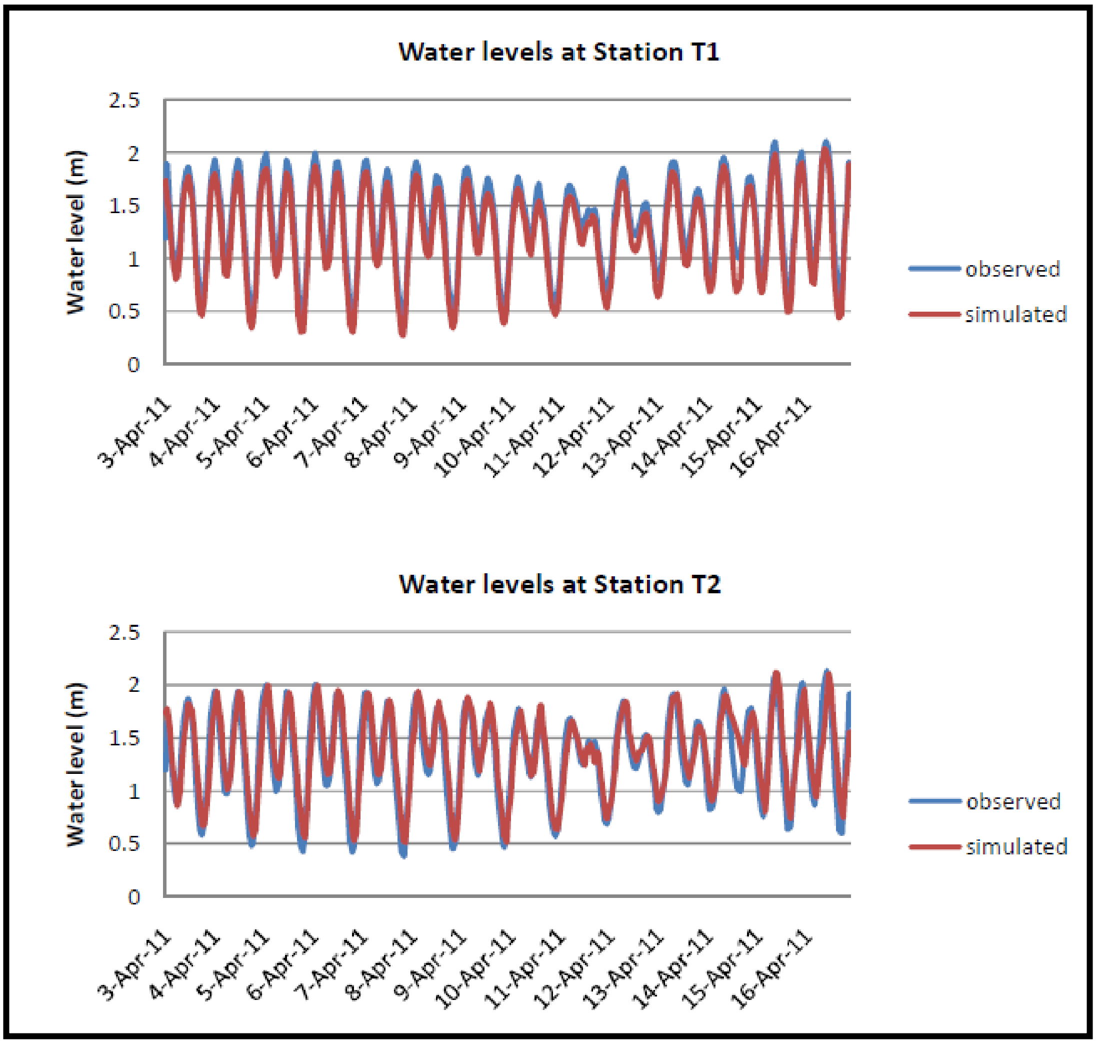


Figure 4-2: Validation of HD model results at tide stations T1 (river mouth) and T2 (inside the river)

Simulated currents for Case-I (without proposed Facility):

(a) Wet season:

The simulated currents for wet season with high river discharge conditions are shown in **Figure 4-3** for stations T1, T2 and T3. Peak discharge value of 300 m^3/s recorded in the month of August. At Gerusoppa dam has been used in the model. SW waves have been included into the model since they appear to be dominant during the wet season. The current patterns for ebb and flood phases of tide during springs and neaps are presented in **Figure 4-4 to Figure 4-7.**

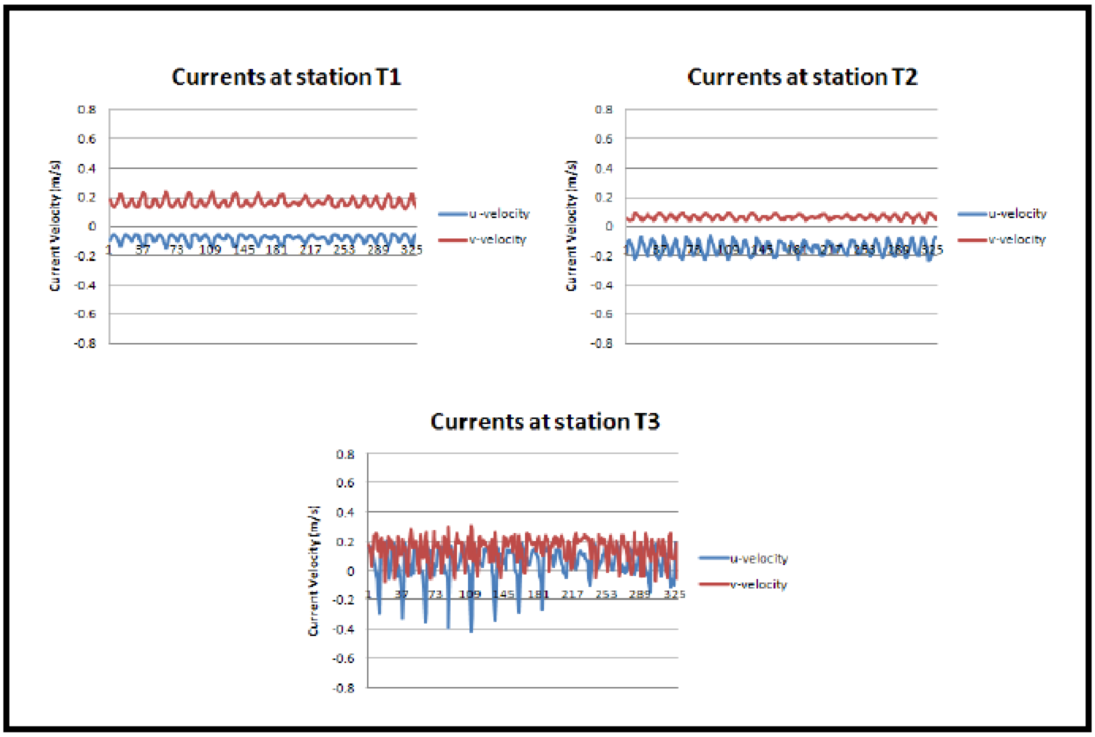


Figure 4-3: Simulated tidal currents during Wet season

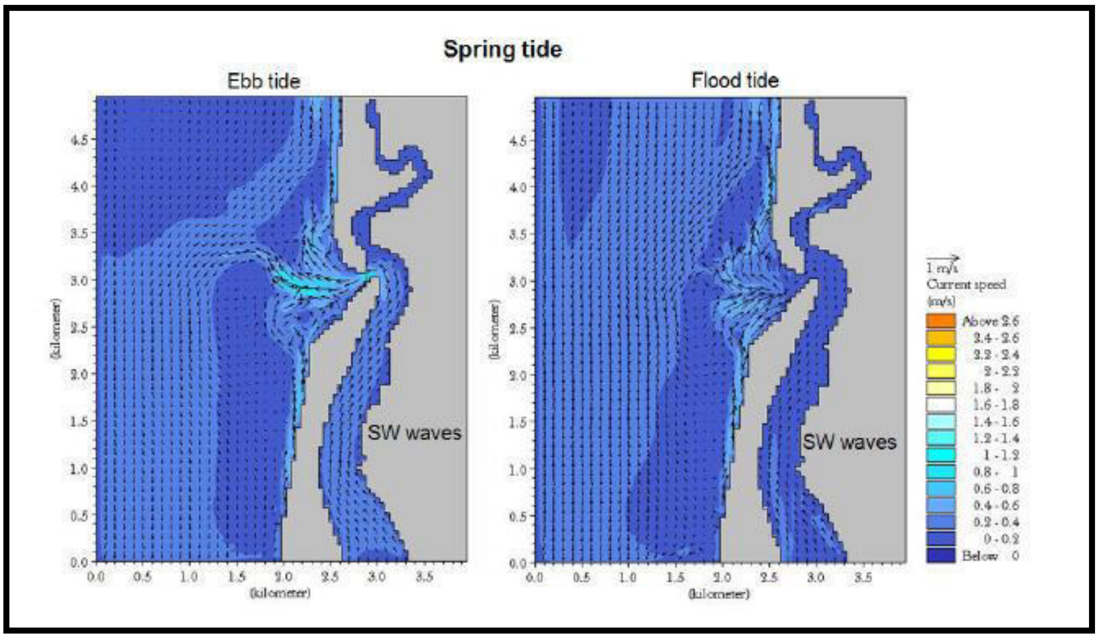


Figure 4-4: Currents for wet season during ebb and flood periods (Spring tide) case-I

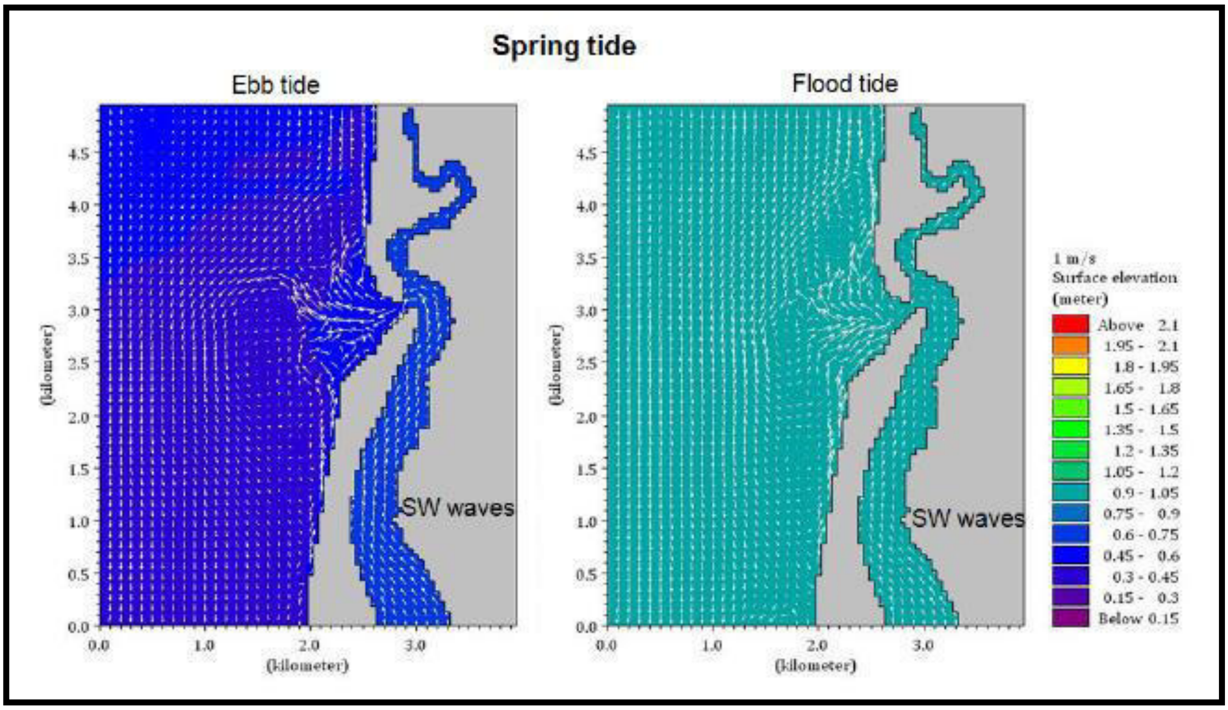


Figure 4-5: Water levels for Wet season during ebb and flood periods (Spring tide)

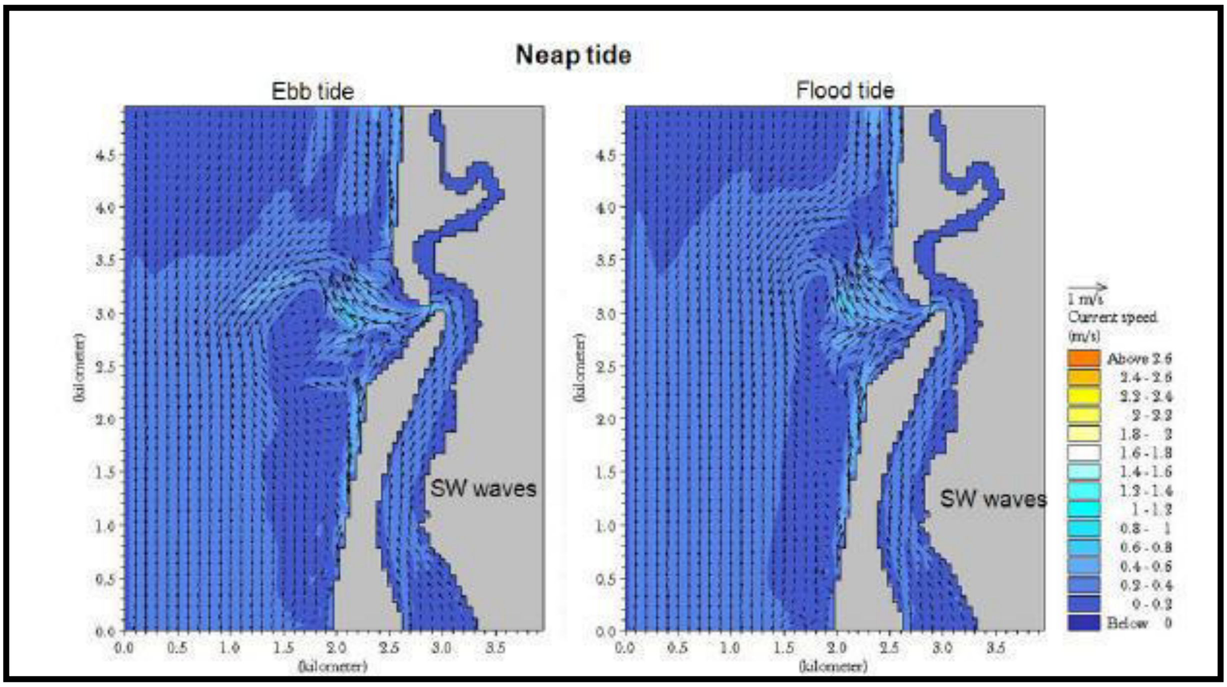


Figure 4-6: Currents for wet season during ebb and flood periods (neap tide)

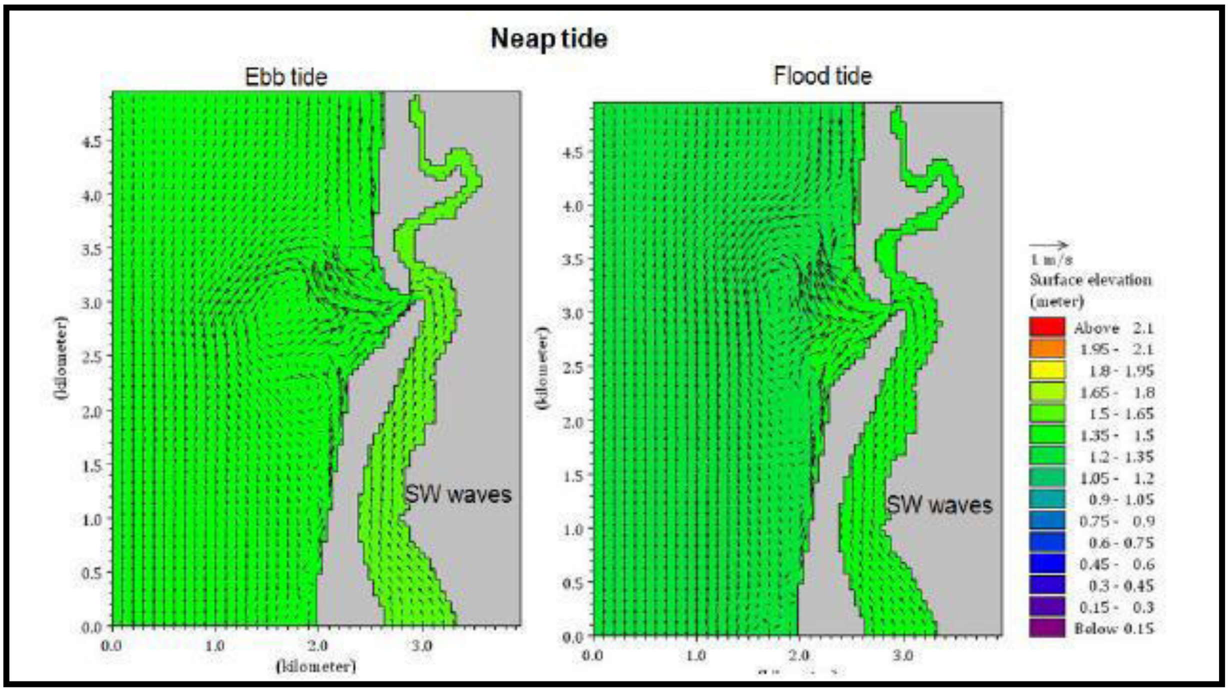


Figure 4-7: Water levels for wet season during ebb and flood periods (neap tide)

b) Currents in dry season:

The simulated currents for dry season at stations T1, T2 and T3 are shown in **Figure 4-8.** Minimum river discharge of 50 m^3/s and dominant wave direction of WNW have been used for this season. The current patterns for ebb and flood phases of tide during springs and neaps are presented in **Figure 4-9 to Figure 4-12.**

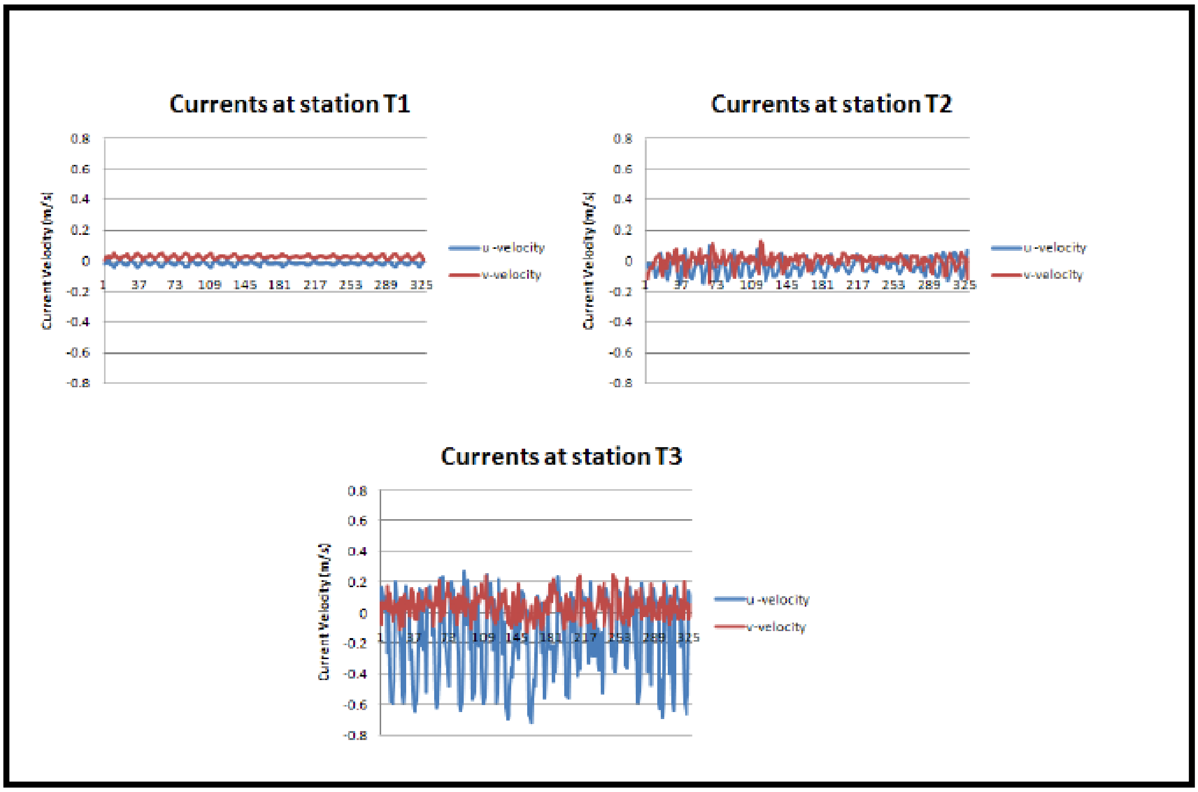


Figure 4-8: Simulated tidal currents during Dry season

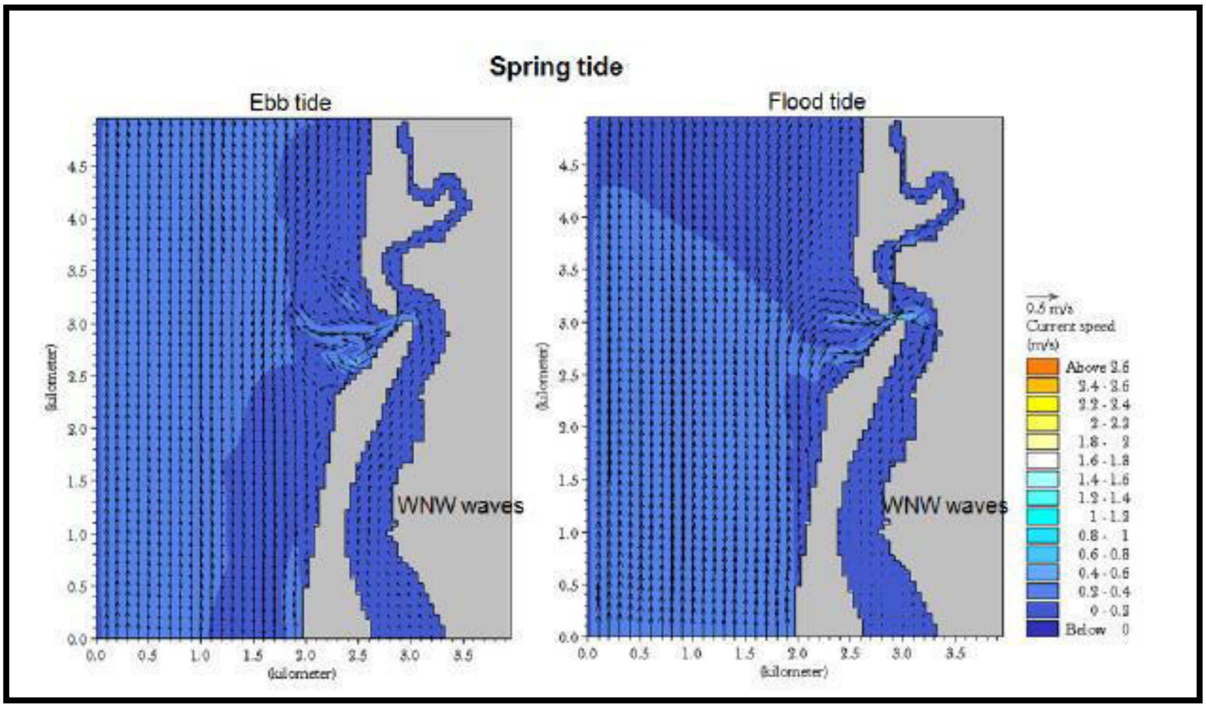


Figure 4-9: Current patterns for dry season during ebb and flood periods (Spring tide)

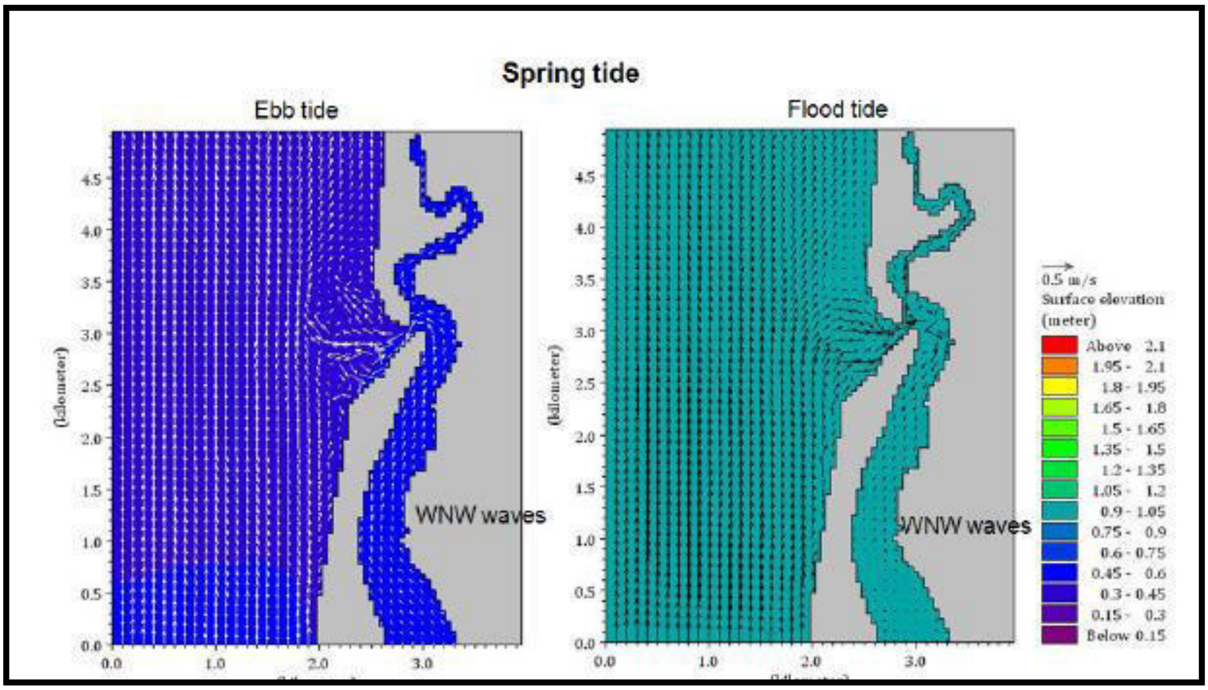


Figure 4-10: Water levels for dry season during ebb and flood periods (Spring tide)

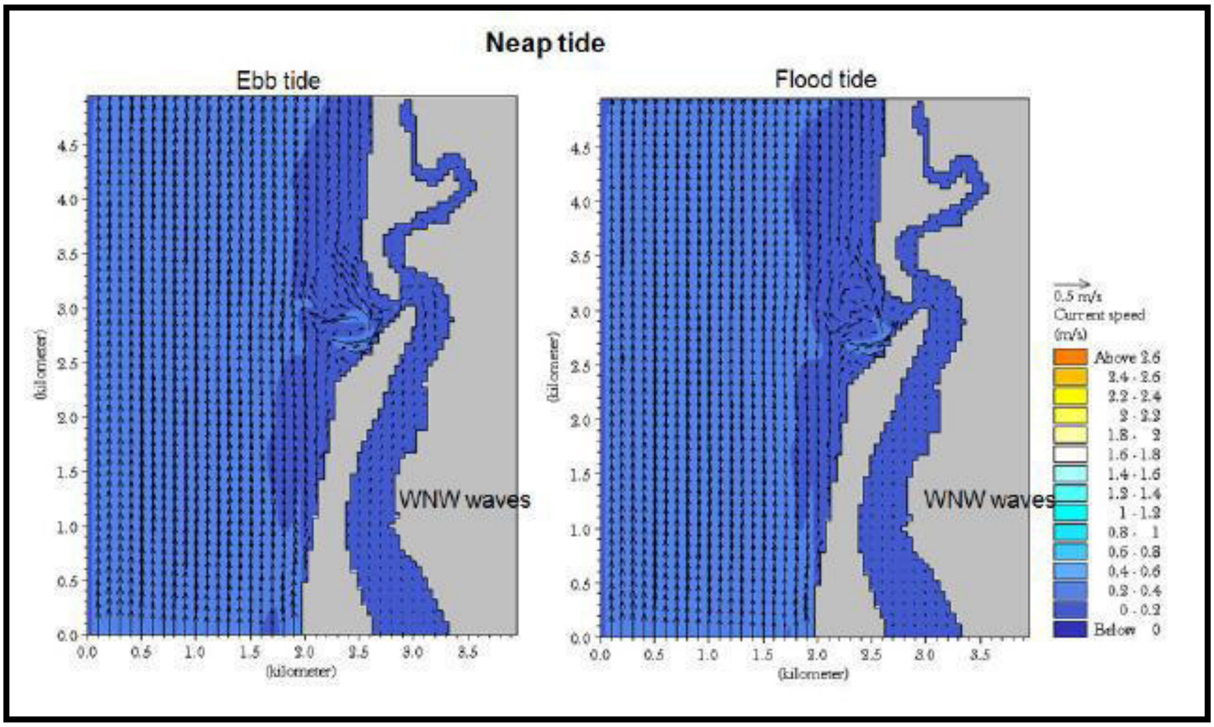


Figure 4-11: Current patterns for dry season during ebb and flood periods (Neap tide)

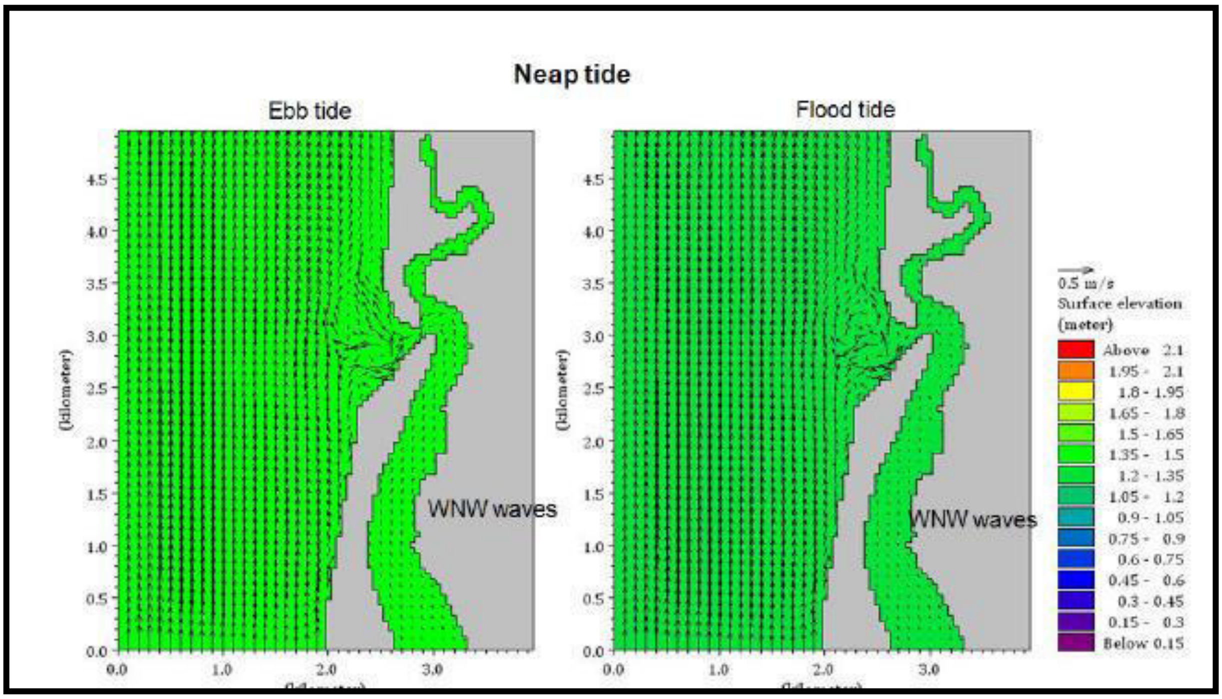


Figure 4-12: Water levels for dry season during ebb and flood periods (Neap tide)

Simulated currents for case-II (with proposed facility):

Wet season: The currents simulated for wet season at stations T1, T2 and T3 are shown in **Figure 4-13.**

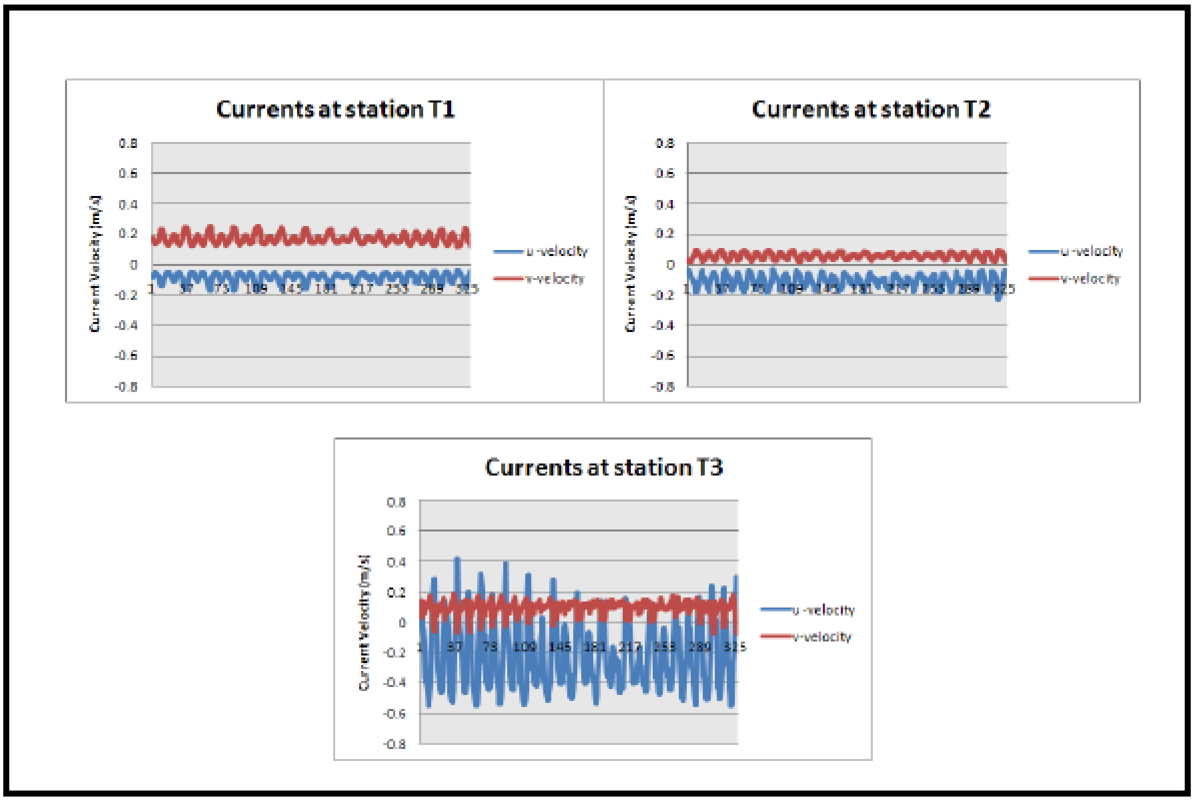


Figure 4-13: Simulated tidal currents during Wet season with proposed facility

Dry season: The currents simulated for dry season at stations T1, T2 and T3 are shown in **Figure 4-14.**

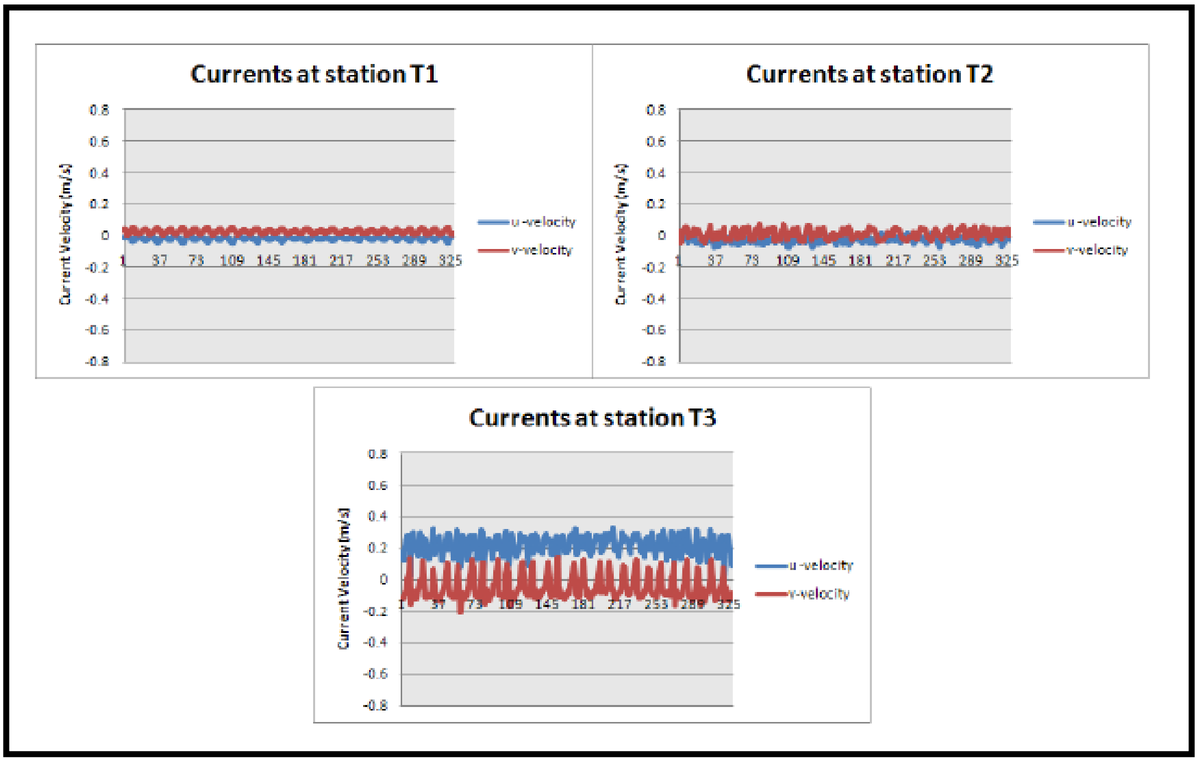


Figure 4-14: Simulated tidal currents during Dry season with proposed facility

The changes in the current patterns near the inlet - both on the seaside and riverside of the inlet are of interest to us. Similarly, the currents inside the river up to the point of the proposed barge/ vessel loading facilities are also important. The model results show that the ebb currents are strong during wet season when the river discharge is very high. The current strengths increase further during spring tide periods compared to neap tide. For case-I (without breakwaters), during wet season with peak river discharge (300 m^3/s) strong currents of about 1 to 1.2 m/s are noticed inside the channel as well as on the seaward side of the channel. Inside the river also up to 5 km upstream, the ebb currents are strong (0.4 to 0.6 m/s). During flood period, also the currents continue to be in the ebb direction and no reversal is found. However, there is slight reversal outside the channel to the south. The currents in the river also show no reversal with tide; they continue to be in the ebb direction even during flood period. This is due to the overwhelming effect of the river discharge, which totally controls the circulation. The currents might get reversed with tide at the bottom where sea water could flow up stream; however, the model doesn't give the bottom currents. Similar variations of currents are observed during neap tides also.

For case-I during wet season, the impoundment of water within the river and the inlet area is clearly noticed. During ebb period, the water levels in the river are at about 0.6 to 0.75 m while on the seaside, the water levels are around 0.3 to 0.45 m. However, during the flood period the water levels in the river and in the sea remain almost same at around 0.9 m. During dry season the magnitudes of currents have generally decreased to about 0.2 m /s and a clear reversal in tidal currents could be noticed.

For case-II in the wet season strong currents directed seaward are noticed near the inlet during ebb period. The ebb current strength in the river is found to be stronger compared to case-I. With the inclusion of breakwaters, the effective cross-sectional area at the entrance has decreased resulting in the increase of current strength. The water levels during the flood period remain almost same as case-I and so it may be inferred that the construction of breakwaters will have negligible effect on the water level changes in the facility.

The increase in current strengths prevents any increase in water levels and no flooding is expected. Since, the currents show higher values only during ebb period, the riverine sediments could be carried offshore by such currents and sedimentation problem within the facility is expected to be lesser. For case-II during dry season reversal of currents in the river are noticed from ebb to flood periods. The water levels also do not show any variations compared to case-I.

COHESIVE SEDIMENT TRANSPORT MODEL STUDIES

Cohesive or mud transport studies are essential for coastal regions where river or tidal inlets are present. Honnavar is such a place where monsoonal rivers discharge significant quantities of sediment into the coastal region. Here, the riverine flow (mud and water) changes rapidly with increase in rainfall and discharge. The cohesive sediment transport model has been simulated for different seasons with different wave approaches, thus including wave-current interactions.

Mud transport (MT) model description:

The MIKE 21 Flow Model, Mud Transport Module (MT) describes erosion, transport and deposition of mud or sand/mud mixtures under the action of currents and waves. MIKE 21 Flow Model, Mud Transport Module, is applicable for:

Mud fractions alone, and Sand/mud mixtures

The following processes can be included in the simulation:

- Forcing by waves

- Sliding
- Salt-flocculation
- Detailed description of the settling process
- Layered description of the bed, and
- Morphological update of the bed

In the MT-module, the settling velocity varies according to the salinity (if included) and the concentration taking into account flocculation in the water column. Waves, as calculated by MIKE 21 NSW for example, may be included.

HD and MT Models setup:

The Flow model (HD and MT) has been simulated for different wave directions obtained from wave radiation stresses output from NSW fine-resolution model simulations. The model setup is divided into two parts one with low discharge conditions (dry monsoon) and the other with high discharge conditions (wet monsoon). For dry monsoon season, the Sharavathi river discharge is very less (50 m^3/s) and for the wet monsoon season, it varies from 200-500 m^3/s during peak discharge periods (KPL river discharge data). We have subjected these values to sensitive analysis and found that the model performed reasonably well for peak discharge of 300 m^3/s. Peak discharge conditions mostly coincide with heavy rainfall events as well as with monsoonal periods. Simulations have been performed for 15 days covering spring and neap tide periods for different cases with open boundary set along the southern part in the riverside. As the riverine discharge in the northern branch of the Pavinkurve is almost negligible, the northern boundary is closed. Eddy viscosity has been considered constant based on velocity formulation to around 0.03 m^2/s. For bed resistance a constant Chezy number of 55 $m^{1/2}/s$ has been used.

For MT model setup, the grain size fraction is taken as 1 and the initial sediment concentration at all the boundaries except at the riverine side are put at 0.01 kg/m^3 (cold start). Dispersion in x and y directions have been taken as constant at a value of 1.5 m^2/s. The outputs obtained from the model results are total net deposition, total bed thickness change, total bed mass change and Total Suspended Sediment concentration (SSC).

Without facility (case-I):

(a) Suspended sediment concentration: The distribution of SSC along Honnavar region has been simulated for predominant wave directions of S, SSW and SW for wet season and with WSW, W and WNE for dry season. The variations at 5 day intervals are shown in below **Figure 4-15 to Figure 4-18.**

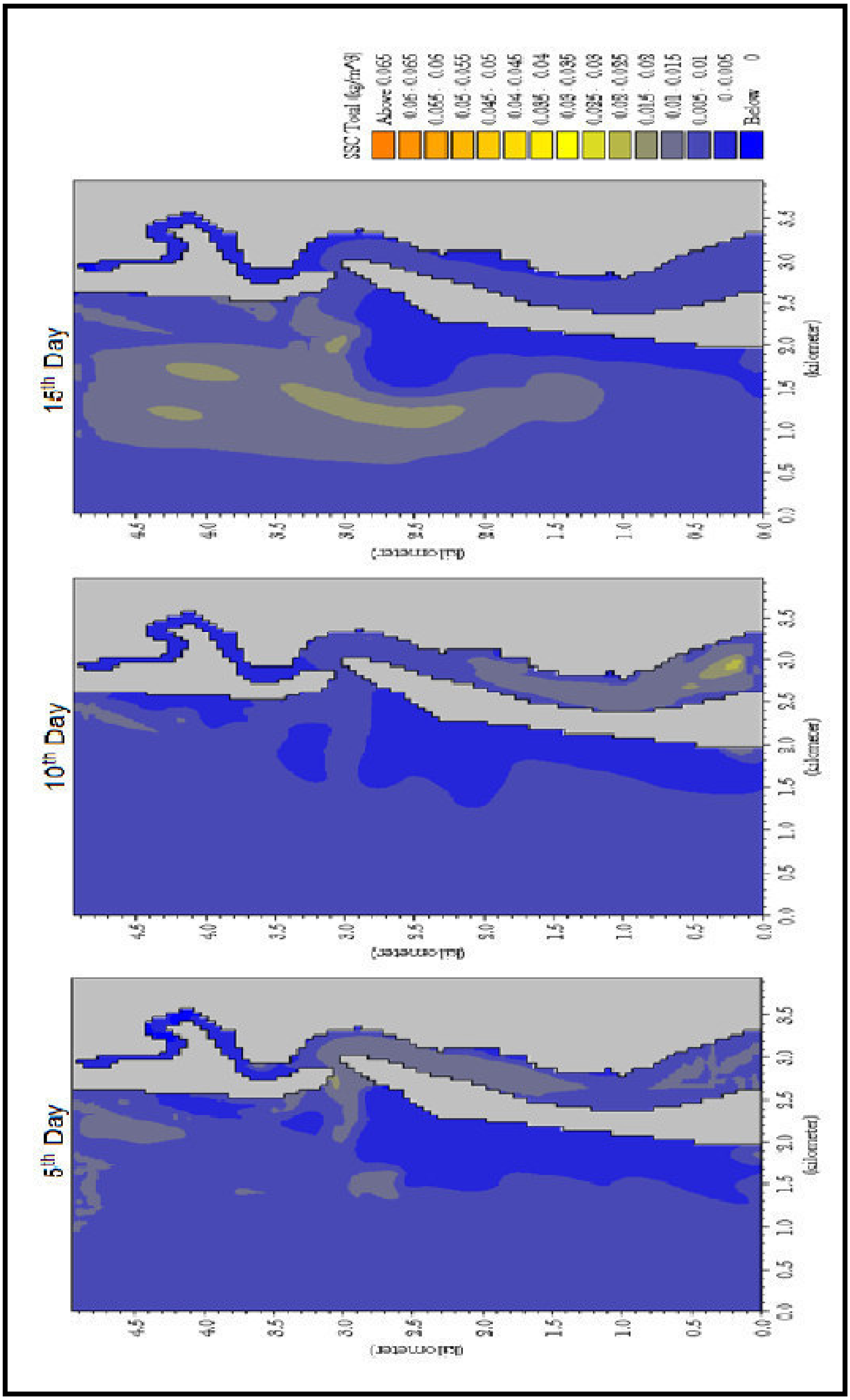


Figure 4-15: Suspended sediment concentration for wet season (SSW waves)

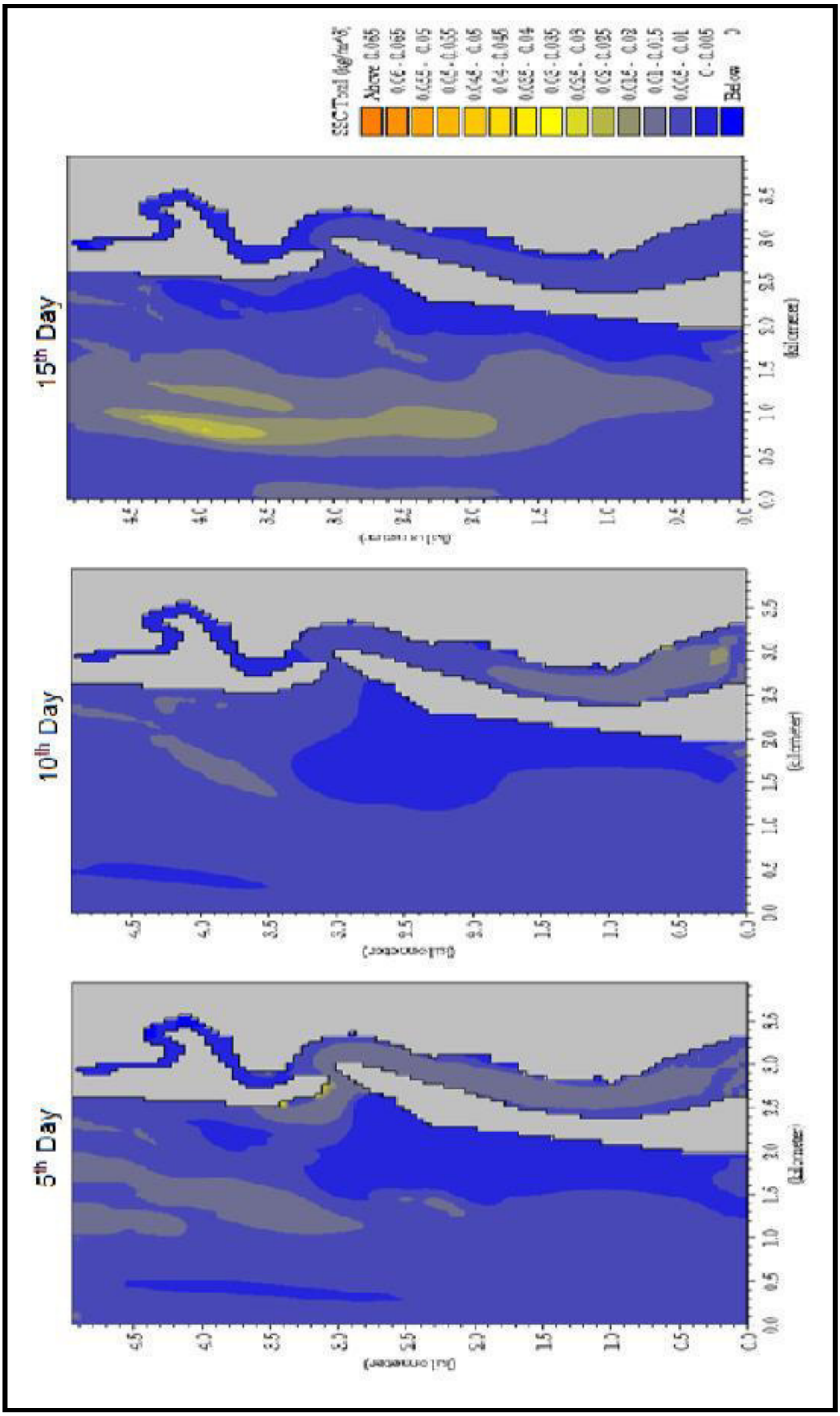


Figure 4-16: Suspended sediment concentration for wet season (SW waves)

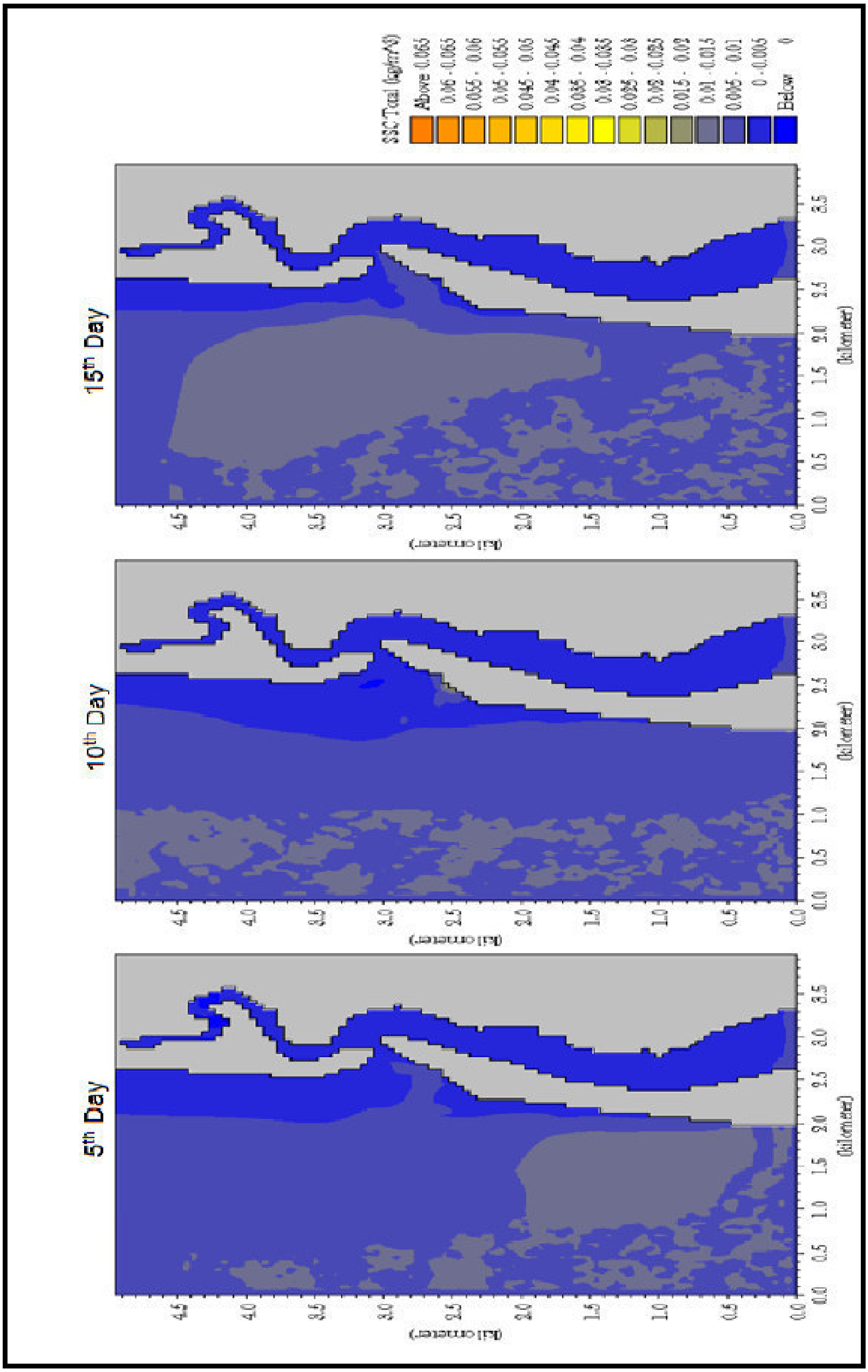


Figure 4-17: Suspended sediment concentration for dry season (WNW waves)

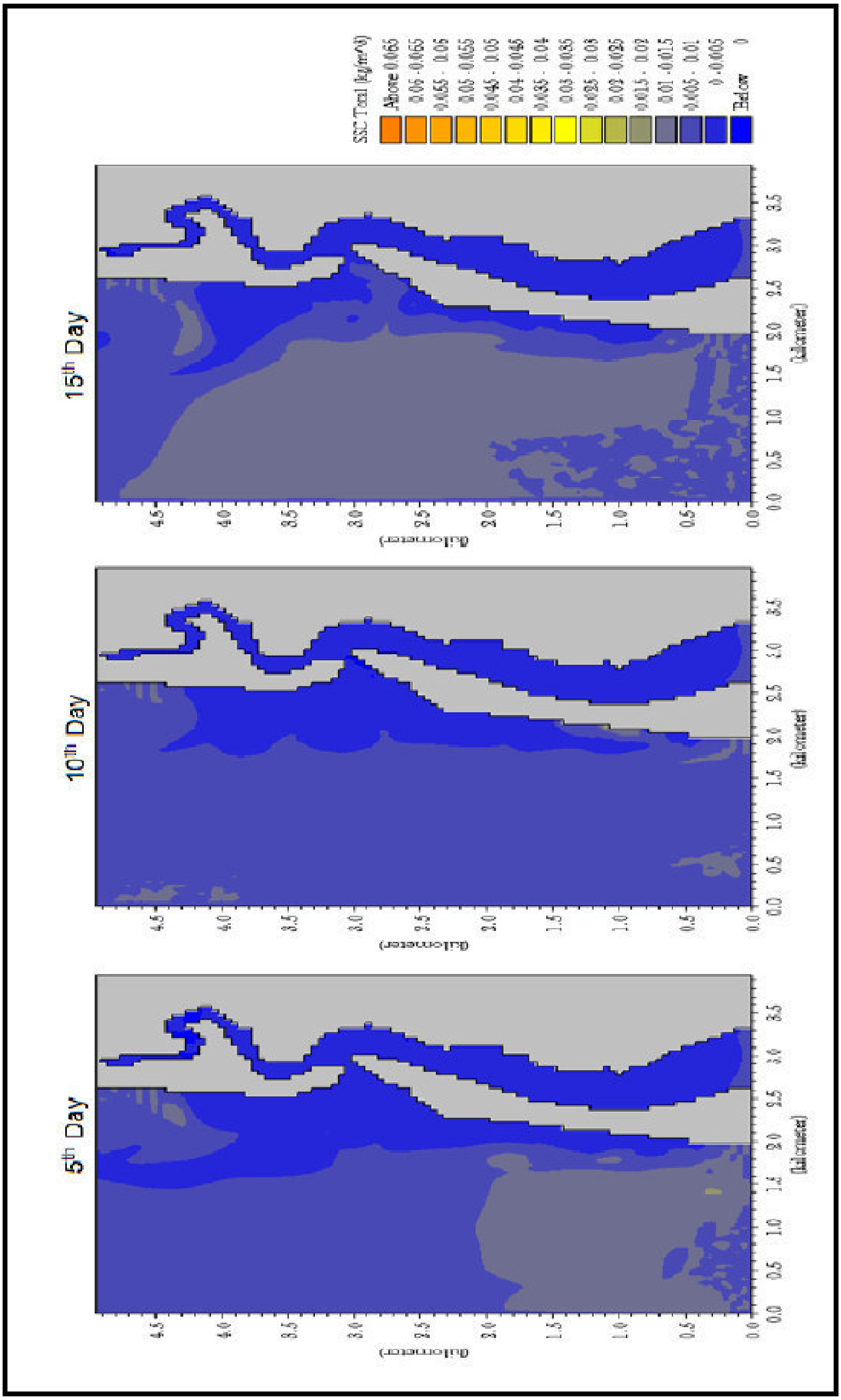


Figure 4-18: Suspended sediment concentration for dry season (W waves)

(b) Total bed thickness change: The total bed thickness change computed for 5 day interval with different directions of wave approach are shown in **Figure 4-19 to Figure 4-22.**

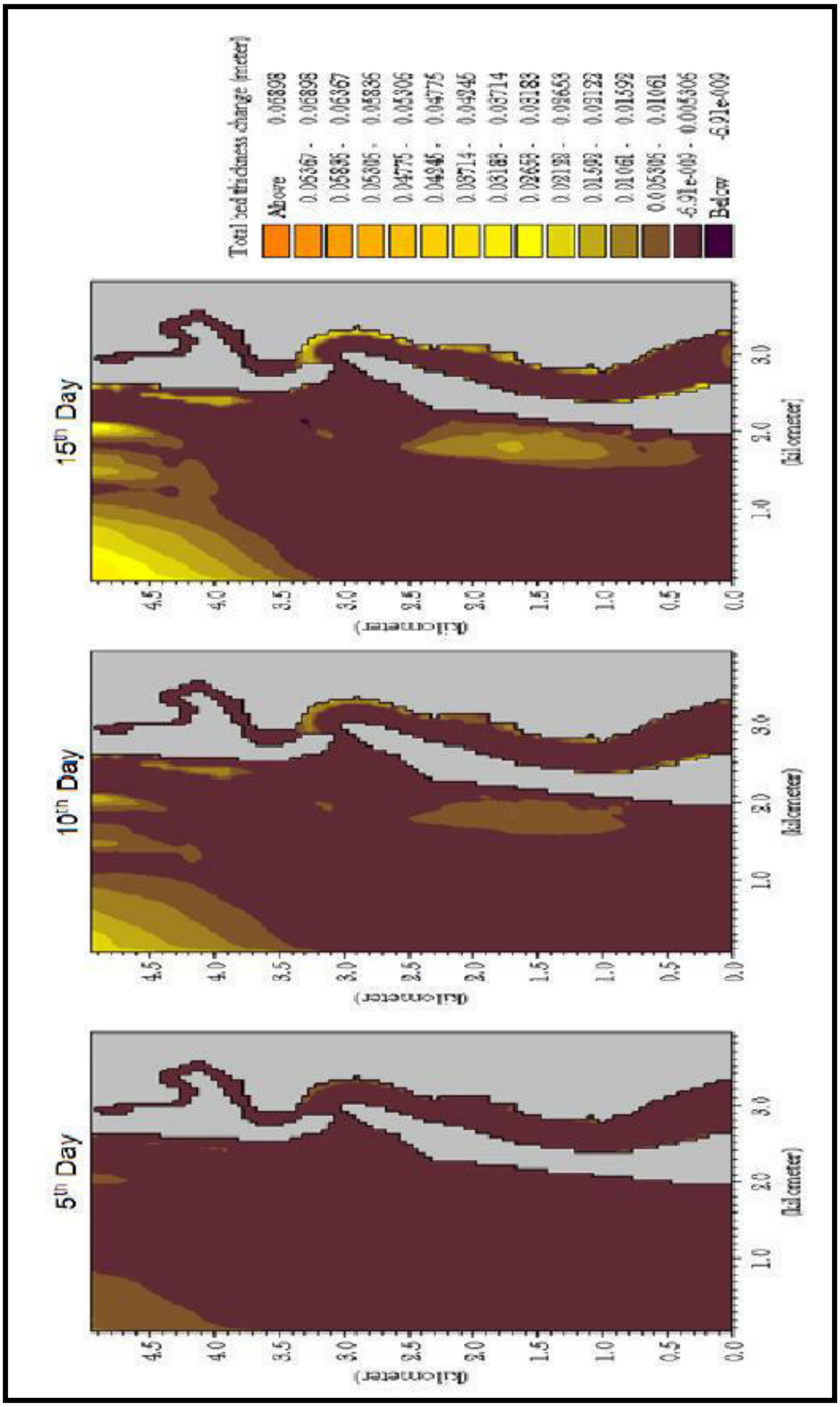


Figure 4-19: Total bed thickness change (m) for wet season (SSW waves)

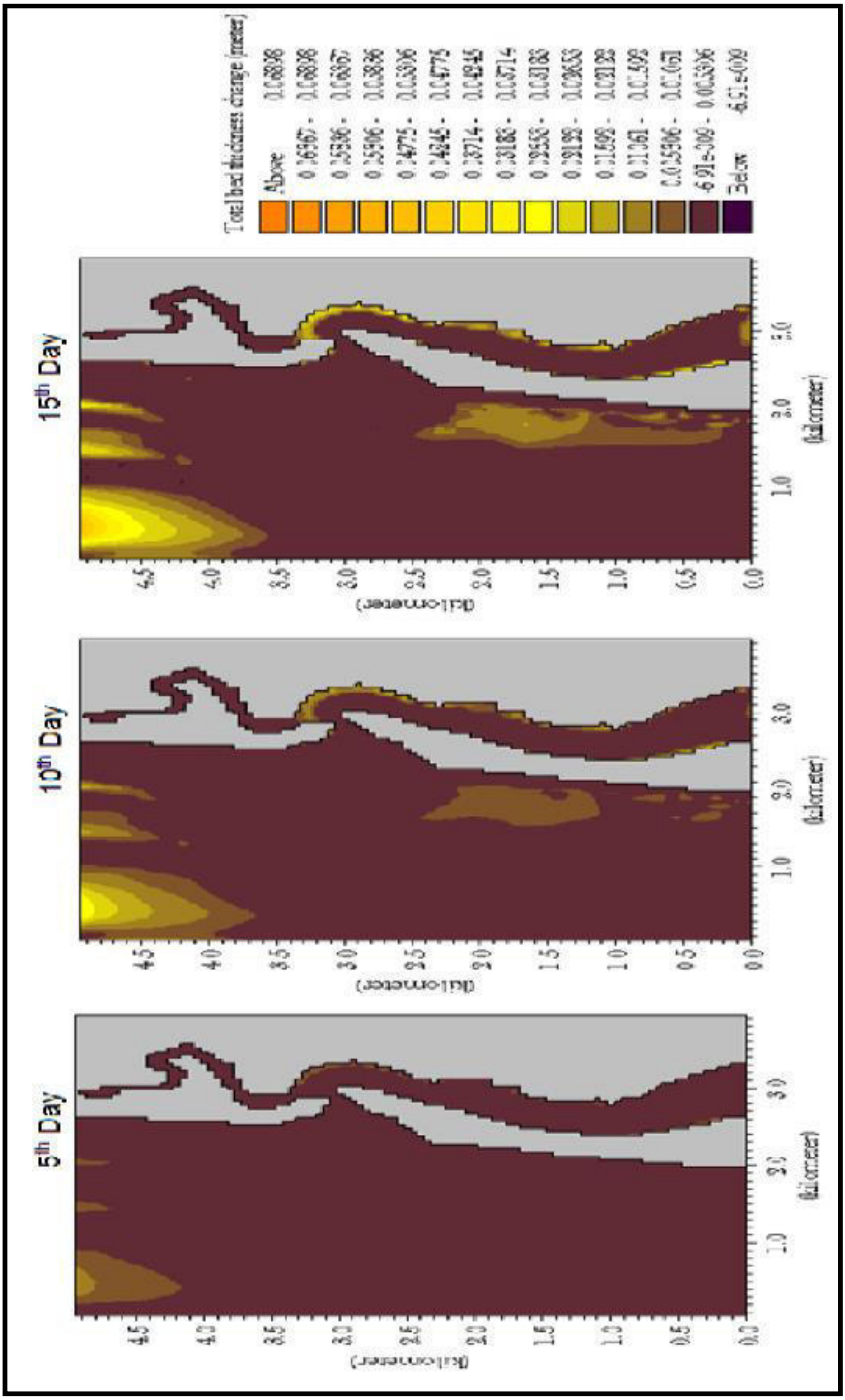


Figure 4-20: Total bed thickness change (m) for wet season (SW waves)

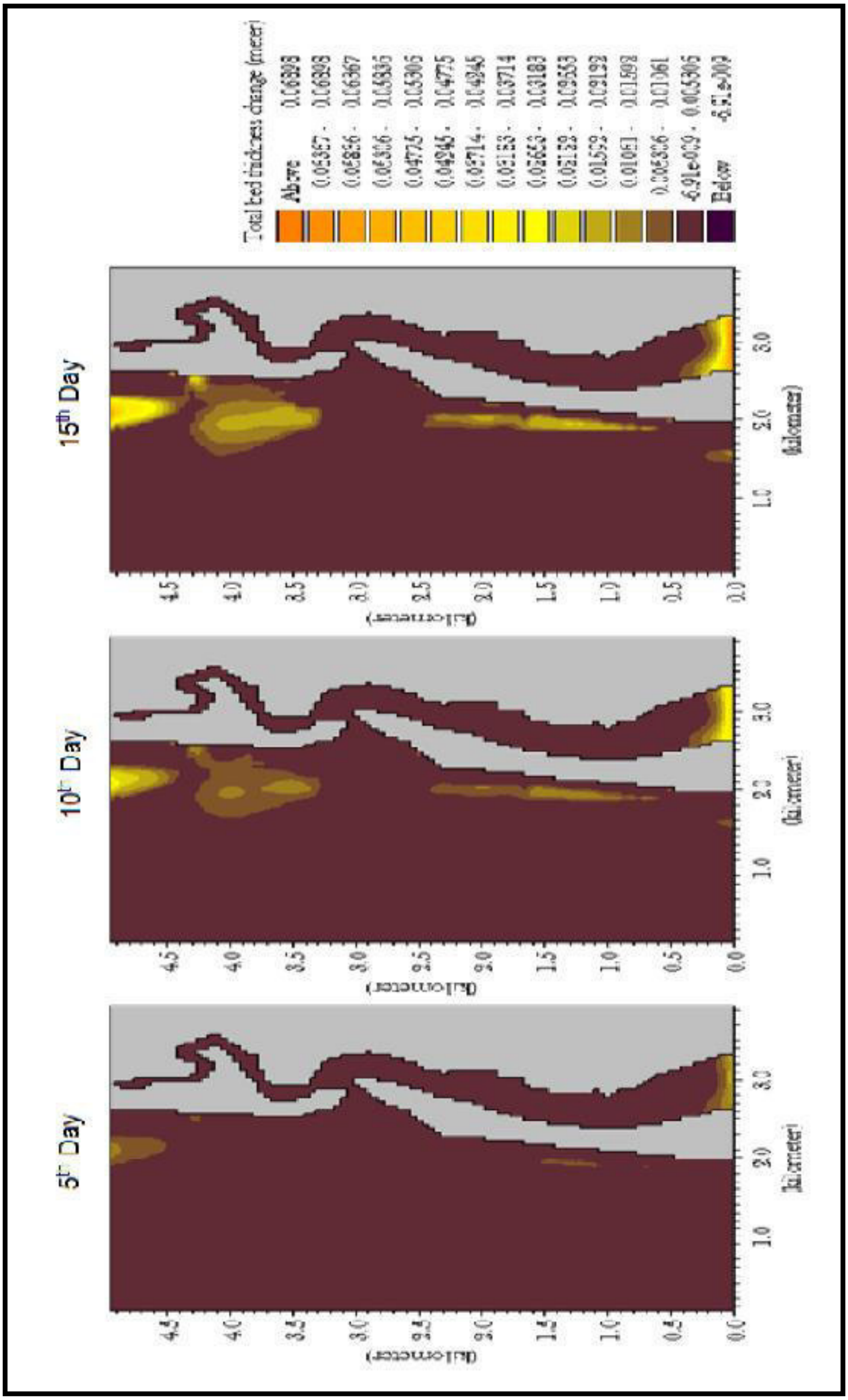


Figure 4-21: Total bed thickness change (m) for dry season (W waves)

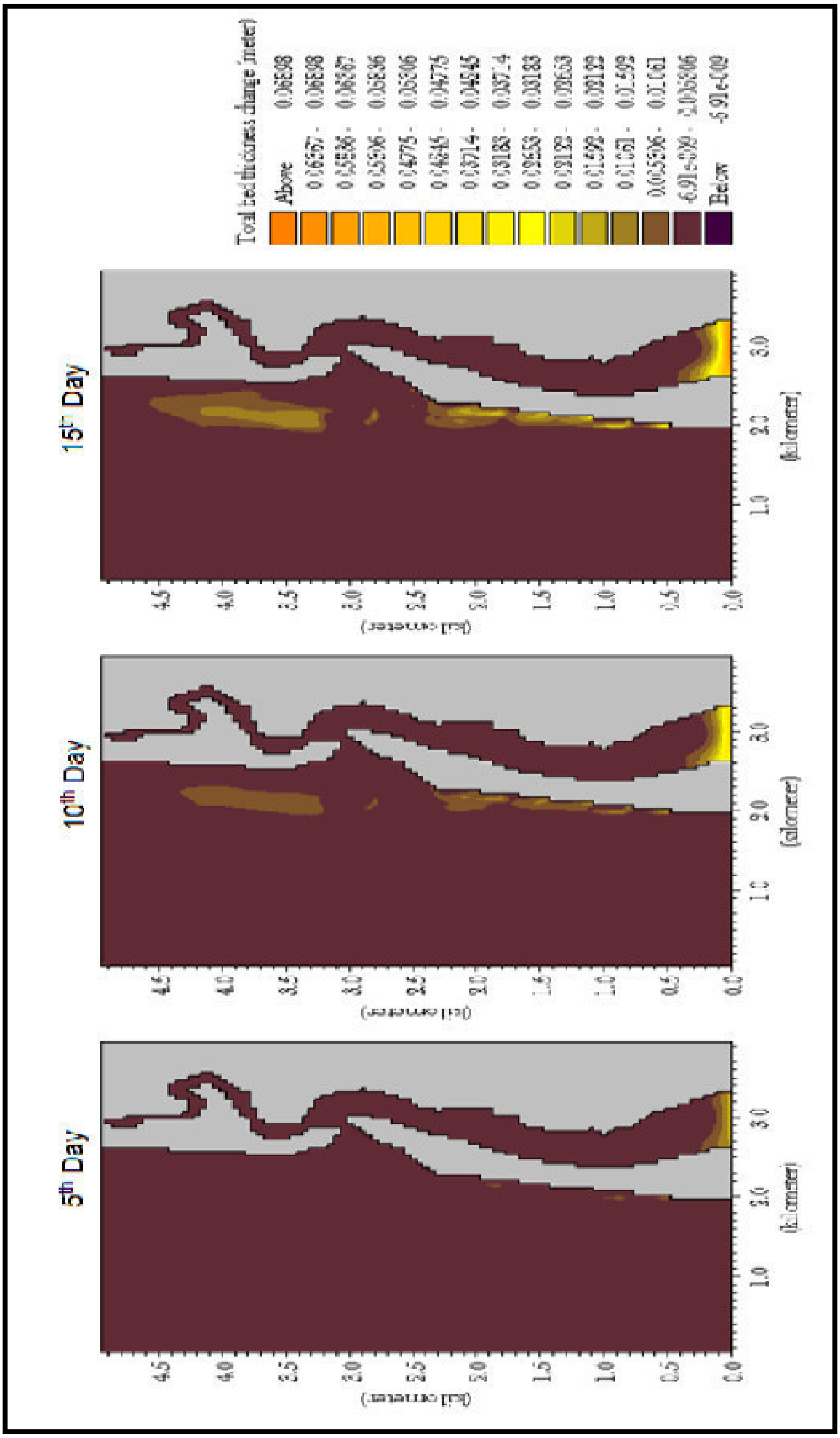


Figure 4-22: Total bed thickness change (m) for dry season (W NW waves)

With Proposed construction (case-II):

Suspended sediment concentration: The distribution of SSC along Honnavar region have been simulated for wet season with predominant directions of approach SSW and SW and for dry season W and WNE.

Conclusion:

For case-I (without breakwaters) in the wet season, on the 5^{th} day of the model run higher SSC values are noticed both inside the river and near the inlet entrance, which gradually decreased and by 10^{th} day became negligible except on the southern end of the river. By 15^{th} day the SSC is completely flushed out and higher SSC values are noticed only far away on the seaside of the channel. For dry season the SSC values continue to be less throughout the model run up to 15 days. The model run for bed level changes shows negligible bed level changes up to 5^{th} day throughout the entire area; but by 10^{th} day slight deposition is noticed on the right bank of the river to the north of the channel entrance and by 15^{th} day the deposition seems to have increased further. For dry season however the bed level changes are negligible for the entire area.

For case-II (with breakwaters) during wet season slightly higher values of SSC are noticed inside the region of breakwaters and also inside the river. But by 10^{th} day the SSC is flushed out and by 15^{th} day the entire area is free of any SSC. During dry season the SSC is negligible throughout the study area. The bed level changes during wet season indicate the sedimentation is negligible up to 10^{th} day; but by 15^{th} day slight deposition appears on the right bank of the river facing the channel inlet. But this siltation is not severe and it can be concluded that the construction of breakwaters will not have any significant effect on siltation in the proposed facility area.

NON- COHESIVE SEDIMENT TRANSPORT MODEL STUDIES:

Honnavar coast is affected mainly by wind waves during all seasons. During wet season swells from south-west predominantly hit the coast and the sediment (sand) is lifted into suspension all along the coast. Since the inlet at Honnavar is very shallow, the waves break frequently on the shoals and cause varying degrees of sedimentation transport. This phenomenon can be examined using MIKE 21 Non-cohesive sediment transport model.

Non-cohesive Sediment transport (ST) model description:

MIKE 21 ST is a module in the MIKE 21 application suite for calculating non-cohesive sediment (sand) transport rates. We can calculate sand transport based on pure current information or with only wave impact. In addition to sand transport rates, a simulation will give the initial rates of bed level changes as well. This is sufficient to identify potential areas of erosion or deposition. MIKE 21 ST can simulate sand transport rates in a wide array of settings, including natural environments like tidal inlets, estuaries and coastlines, and man-made constructions like harbours and bridges. Tide, wind, wave and current can all be taken into consideration for optimum precision in the simulations.

ST model Setup:

For ST model setup, we considered both currents and wave simulations as the coast is exposed to open sea where combined action of waves and currents are important. The HD simulation output for different wave conditions are given separately for executing the ST model. Bjiker's method has been adopted for performing sediment transport calculations with constant relative sediment density taken as 2.65 and water temperature to be 28^{o}C. Bed load transport coefficient has been considered spatially constant. For bed resistance, the Chezy number with value 55 has been used. Sediment porosity is considered as 0.4 with size 0.2 mm, gradation factor of 1.1.

Results:

Without proposed facility (case-I):

The seasonal distribution of sediment transport (wet and dry seasons) for six predominant deep-water wave directions have been considered.

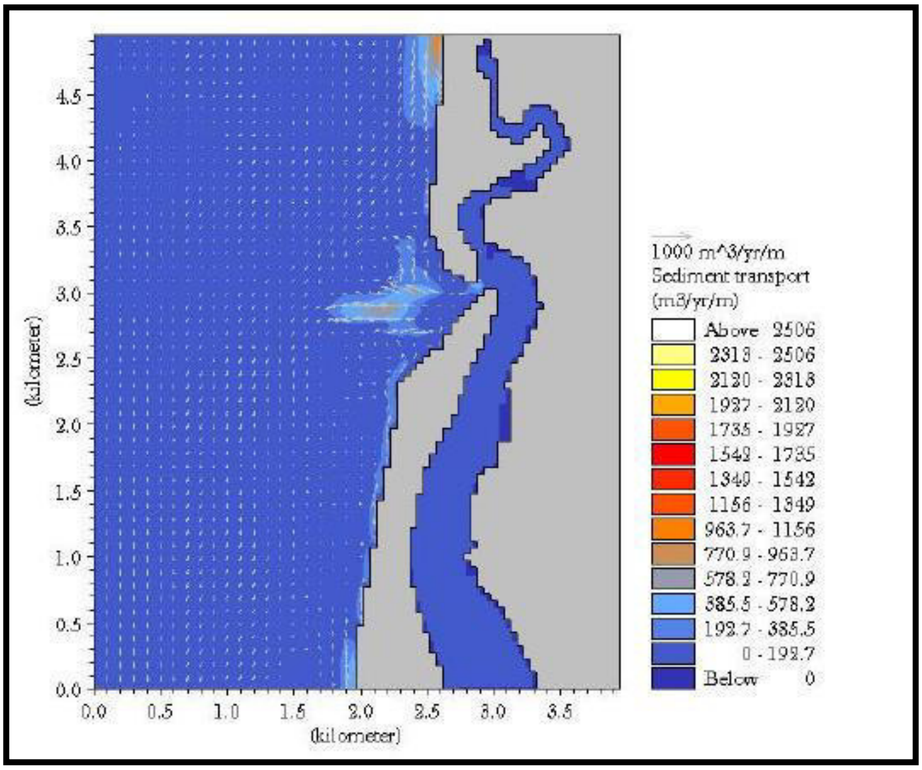


Figure 4-23: Rate of non-cohesive sediment transport during Wet season for S waves

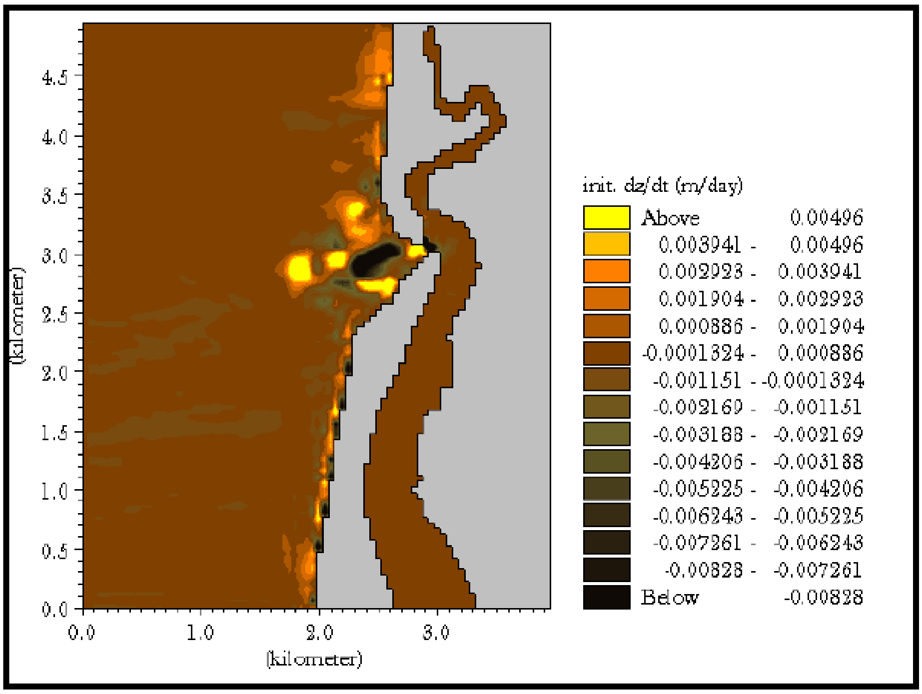


Figure 4-24: Bed level changes (Non-cohesive) from initial condition during wet season (S waves)

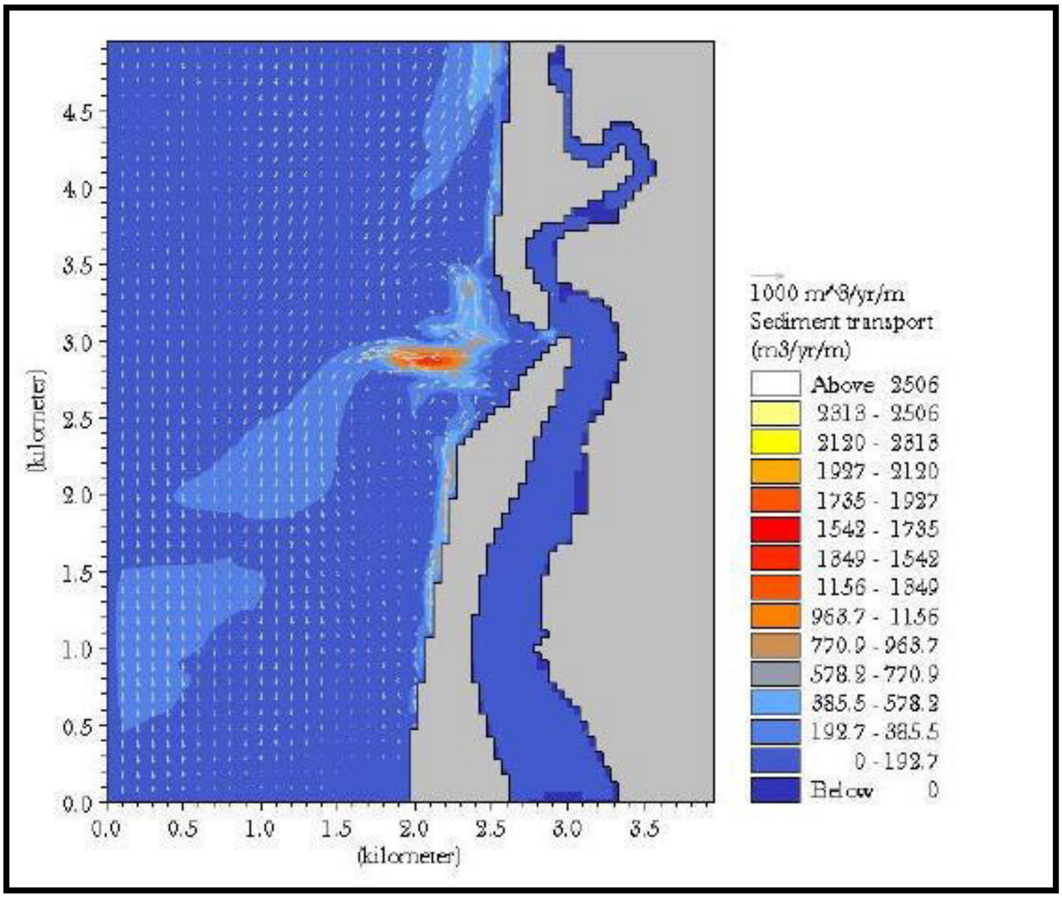


Figure 4-25: Rate of non-cohesive sediment transport during wet season for SSW waves

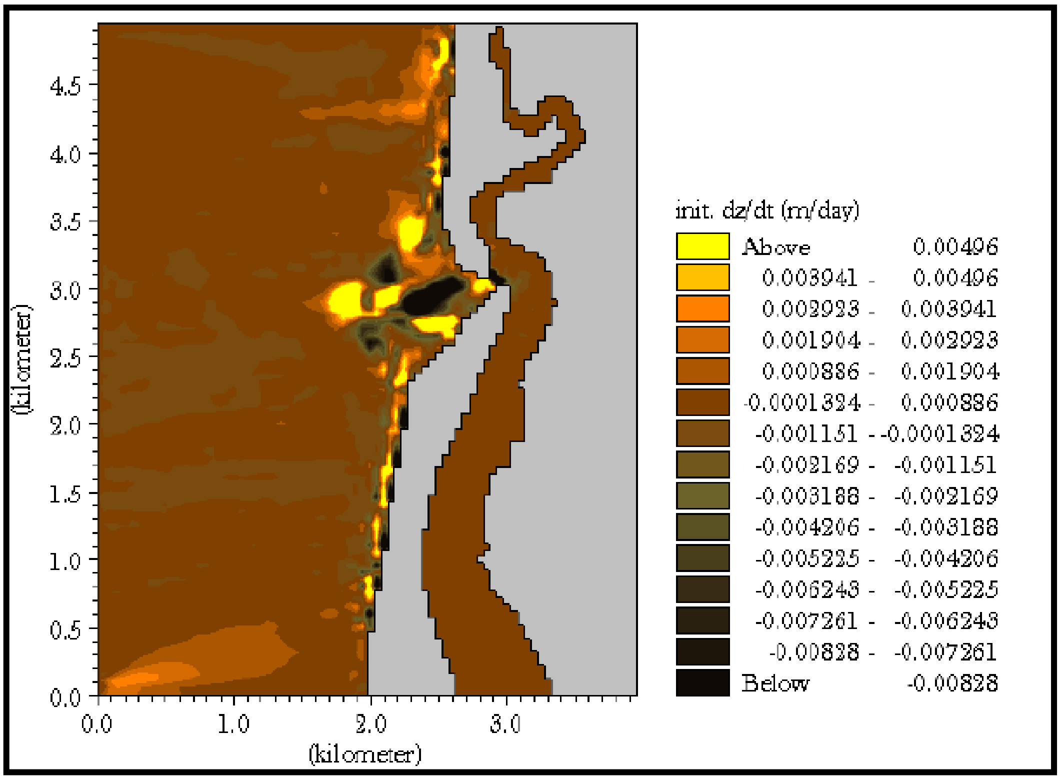


Figure 4-26: Bed level changes (non-cohesive) during wet season (SSW waves)

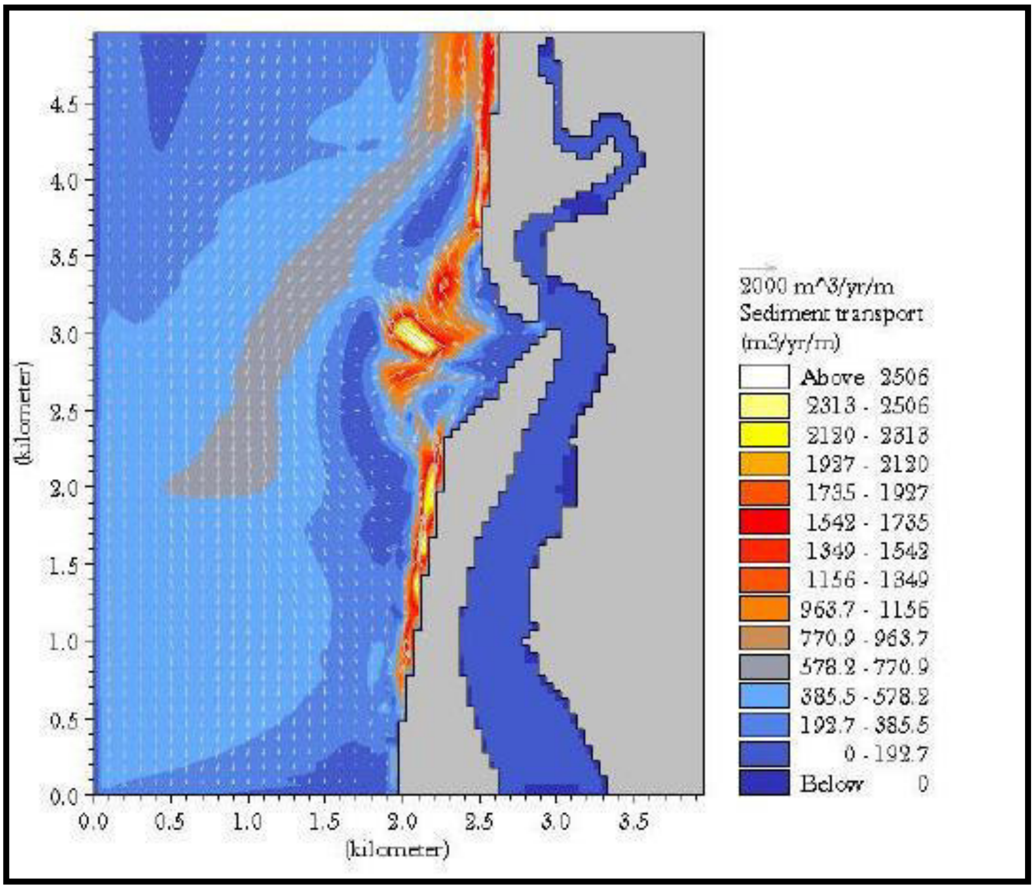


Figure 4-27: Rate of non-cohesive sediment transport during wet season for SW waves

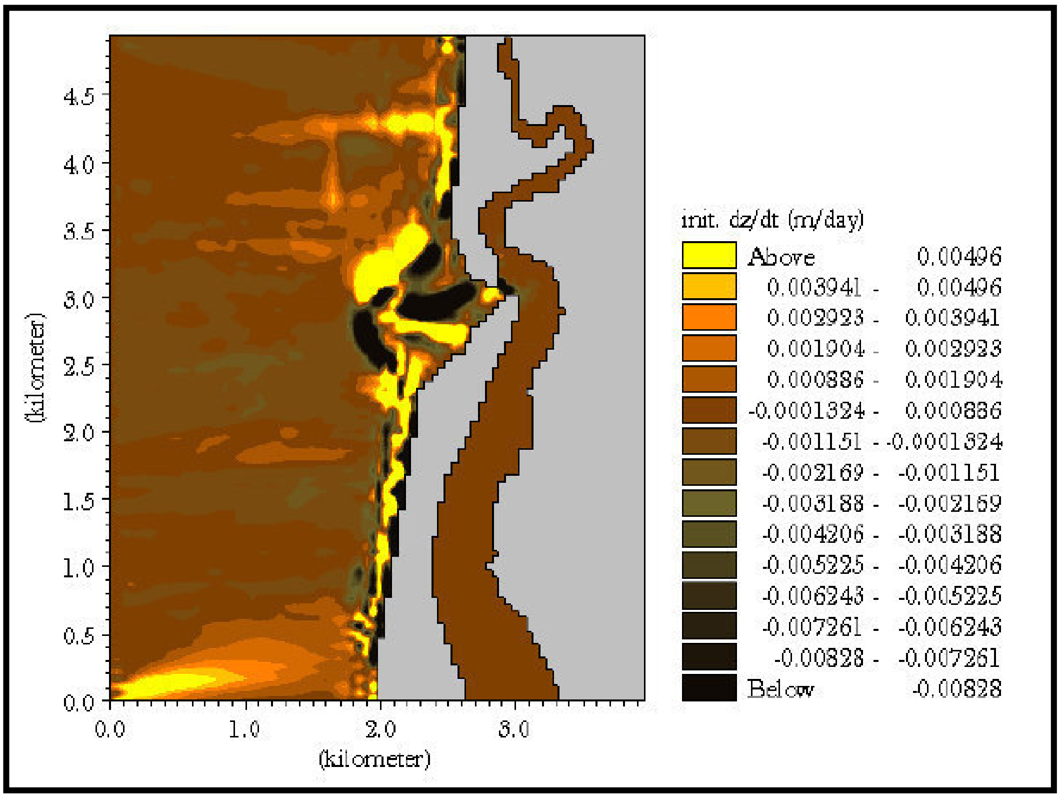


Figure 4-28: Bed level changes (non-cohesive) from initial condition during wet season (SW waves)

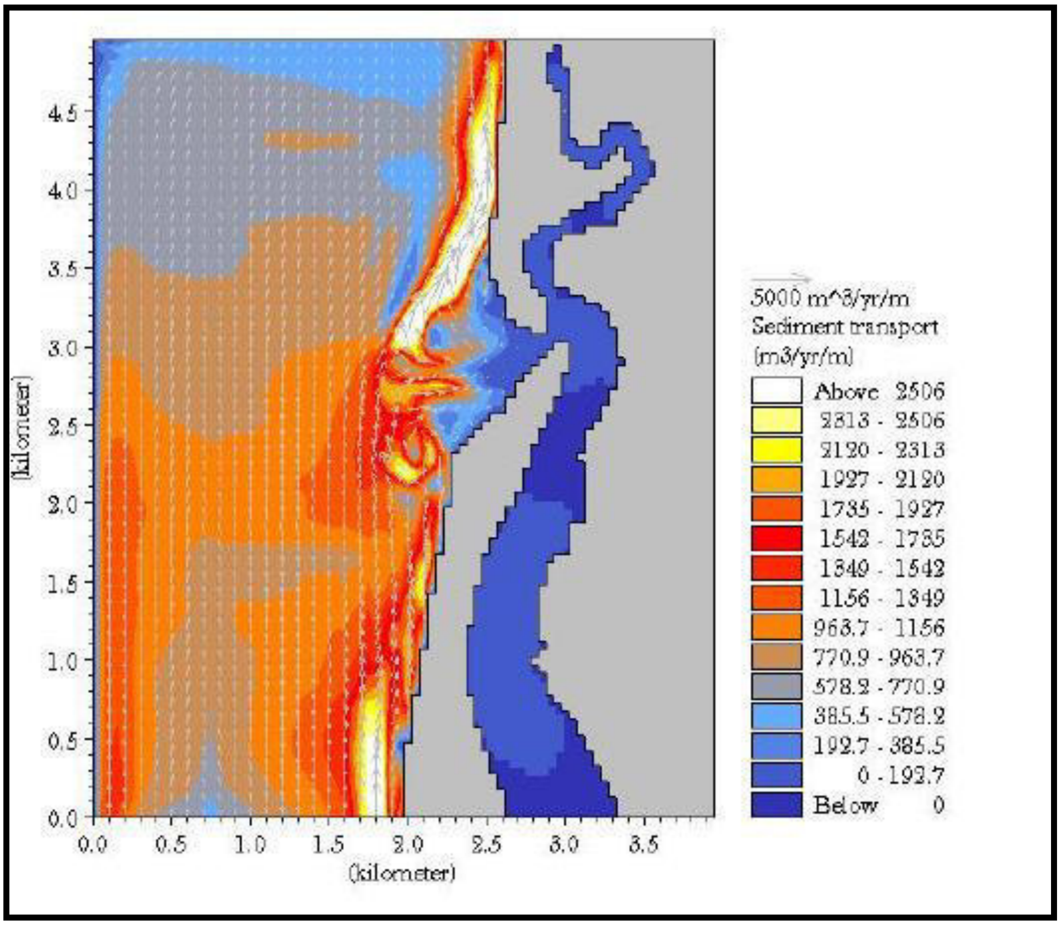


Figure 4-29: Rate of non-cohesive sediment transport during dry season for WSW waves

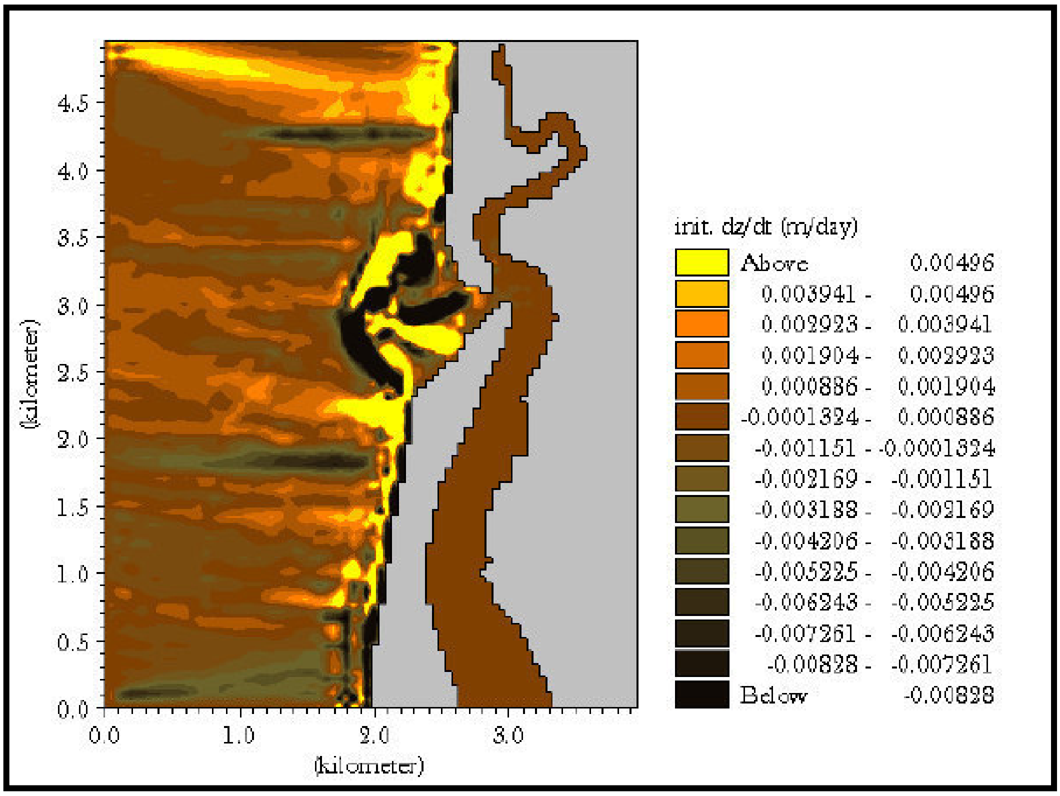


Figure 4-30: Bed level changes (non-cohesive) during dry season (WSW waves)

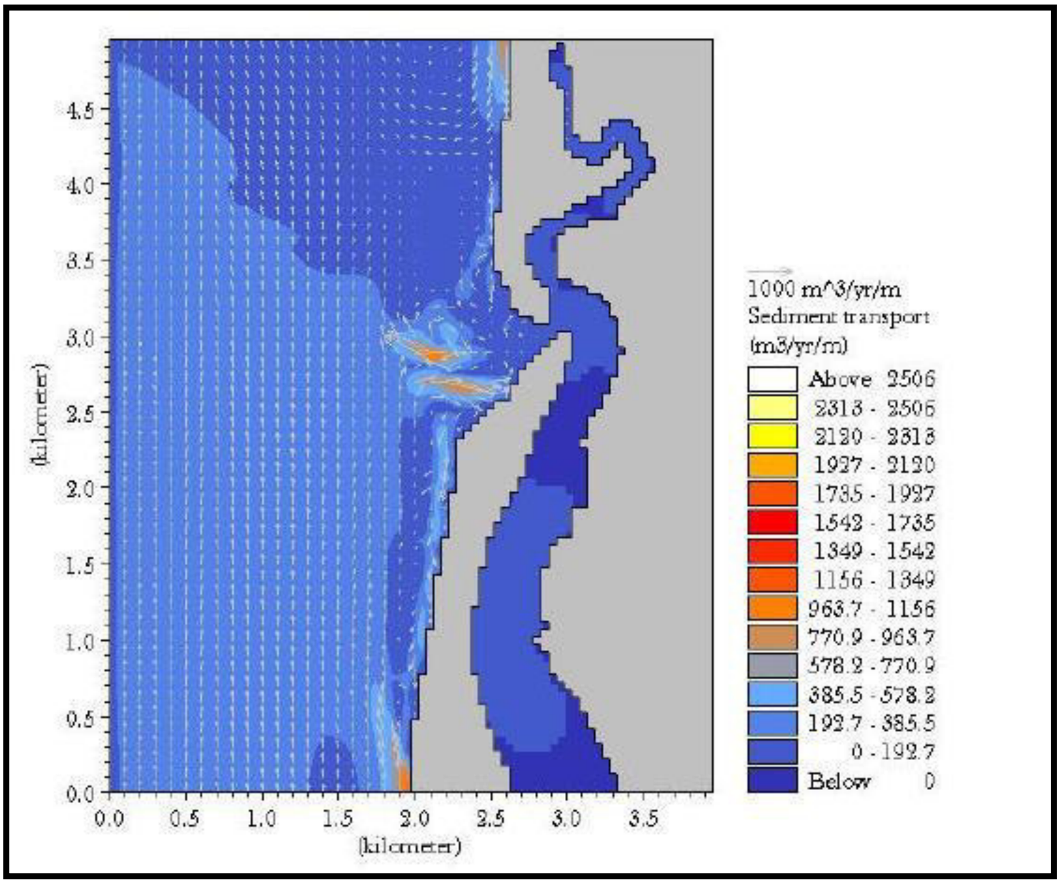


Figure 4-31: Rate of non-cohesive sediment transport during dry season for W waves

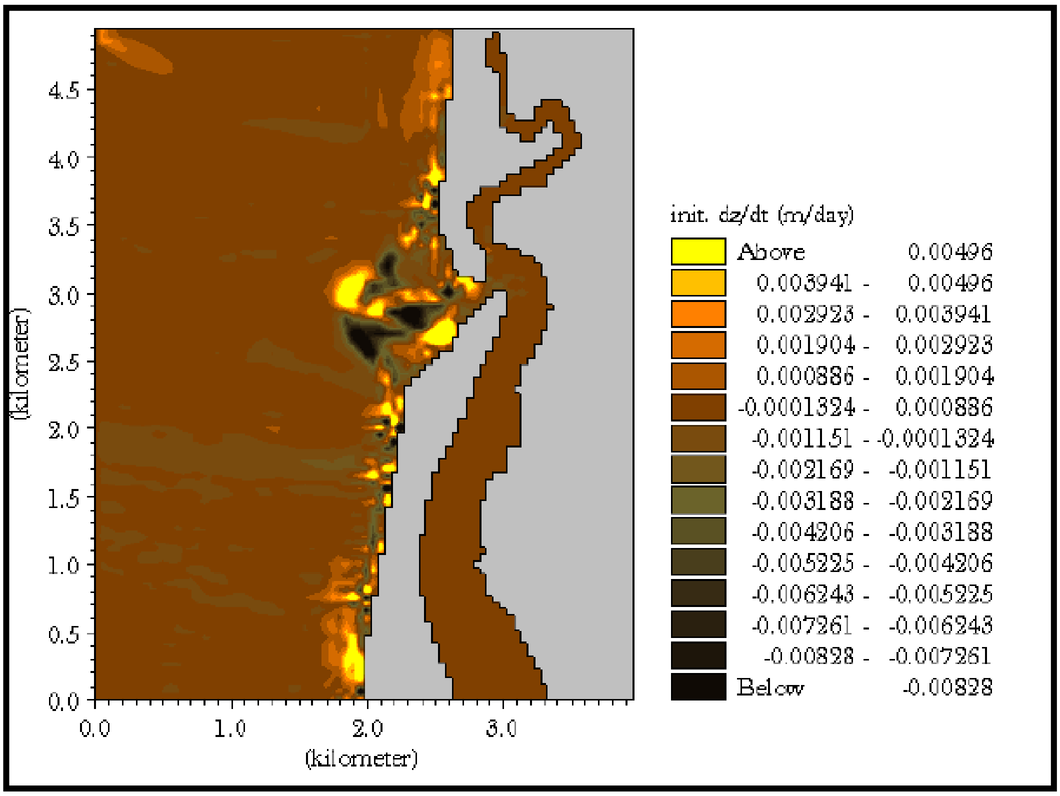


Figure 4-32: Bed level changes (non-cohesive) from initial condition during dry season (W waves)

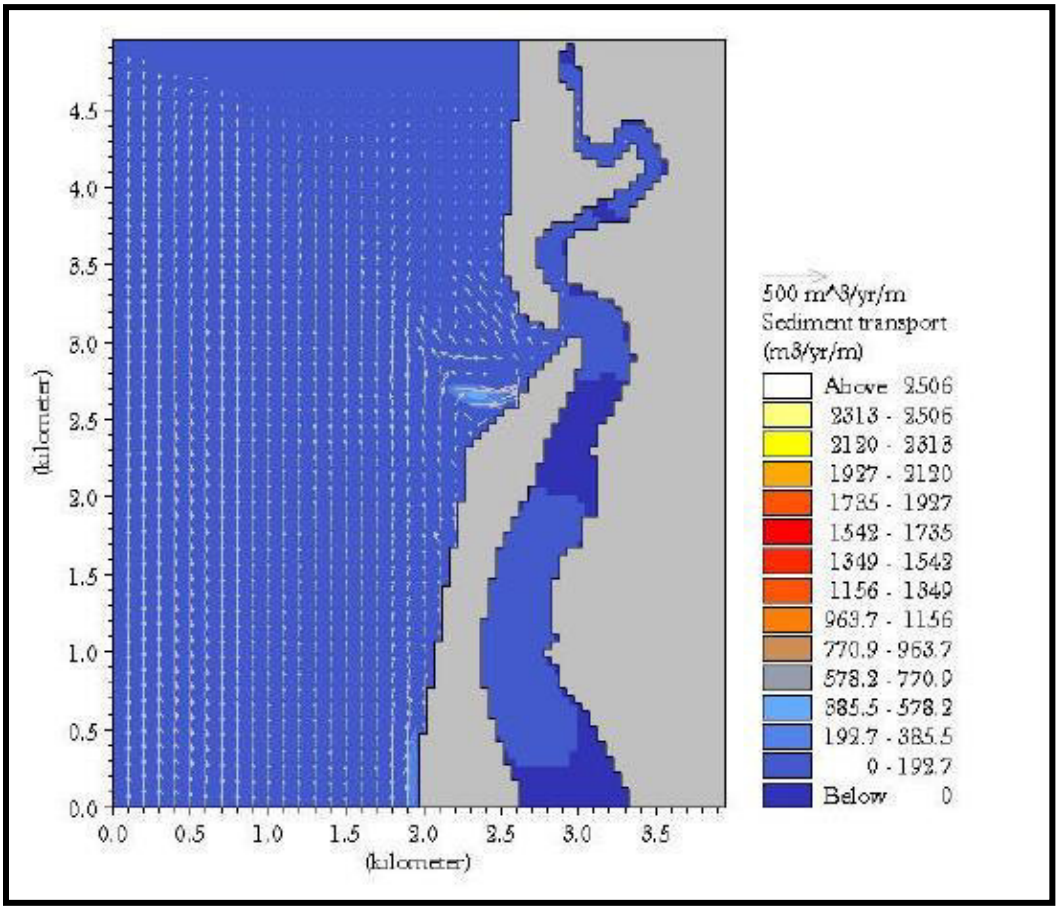


Figure 4-33: Rate of non-cohesive sediment transport during dry season for WNW waves

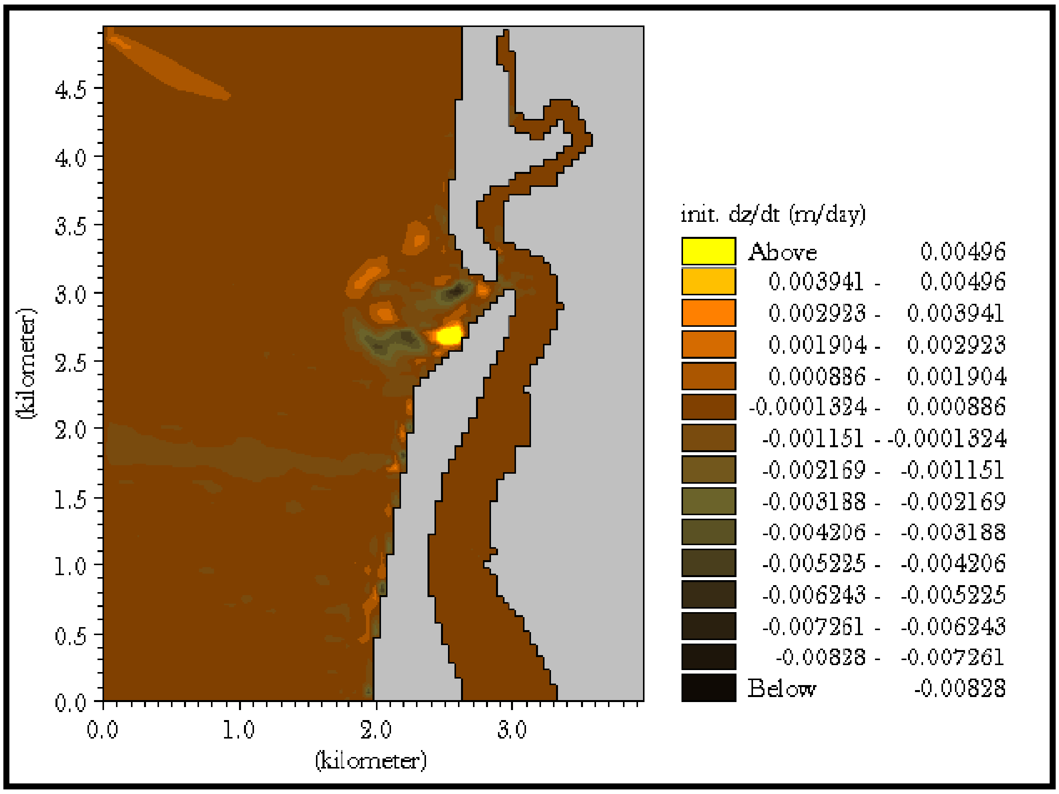


Figure 4-34: Bed level changes (non-cohesive) during dry season (WNW waves)

With proposed Facility (Case-II):

The seasonal distribution of sediment transport (wet and dry seasons) for six predominant wave directions.

Conclusion:

For case-I the rates of sediment transport for deep water waves from S and SSW are much less (< 200 m^3/yr/m) along the entire coastal stretch. However slightly higher values (about 400) are noticed on the seaward side of the entrance where shoals are present. The bed level changes indicate deposition at the mouth and to the south of the inlet. For SW and SSW waves during monsoon season high values of sand transport (>2000 m^3/yr/m) are noticed along the entire coastal stretch due to high and steep waves during this season. The bed level changes indicate significant deposition (0.005 m/day) both to the south and north of the entrance channel. During non-monsoon season, when W and WNW waves prevail the sediment transport as well as the bed level changes are not significant.

For case-II (with breakwaters) during monsoon season when SW and WSW waves prevail the sediment transport is significant (>2000 m^3/yr/m) to the north as well as to the south of breakwaters. Bed level changes indicate deposition to the northern and southern coastline in general; but there is also erosion just to the north of northern breakwater, some deposition is noticed inside the breakwaters zone just at the mouth of the entrance channel, which must be cleared periodically in maintenance dredging. Model studies indicate an annual deposition of about 10,300 m^3/yr in the dredged channel. Again, during non monsoon months there is no significant deposition. On the whole, the sand transport model studies indicate depositional trend near the mouth of the channel as well as to the north of the channel for case I. But for case II, the depositional trend in the channel has somewhat decreased due to breakwaters while some erosional trend is noticed towards the northern shores.

4.4.1.2 Wave Induced Littoral Drift

The littoral currents are mainly responsible for transport of sediments in the surf-zone causing erosion or deposition along a beach. Therefore, wave induced littoral drift (with no interaction of coastal currents) has been modelled in ST model for different wave approaches and are presented in below Figures for case-I and case-II.

Littoral drift without Proposed Facility (case-I):

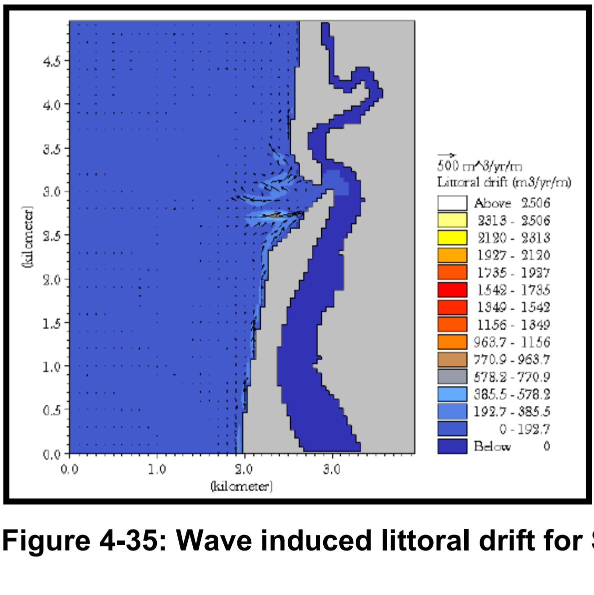


Figure 4-35: Wave induced littoral drift for S waves

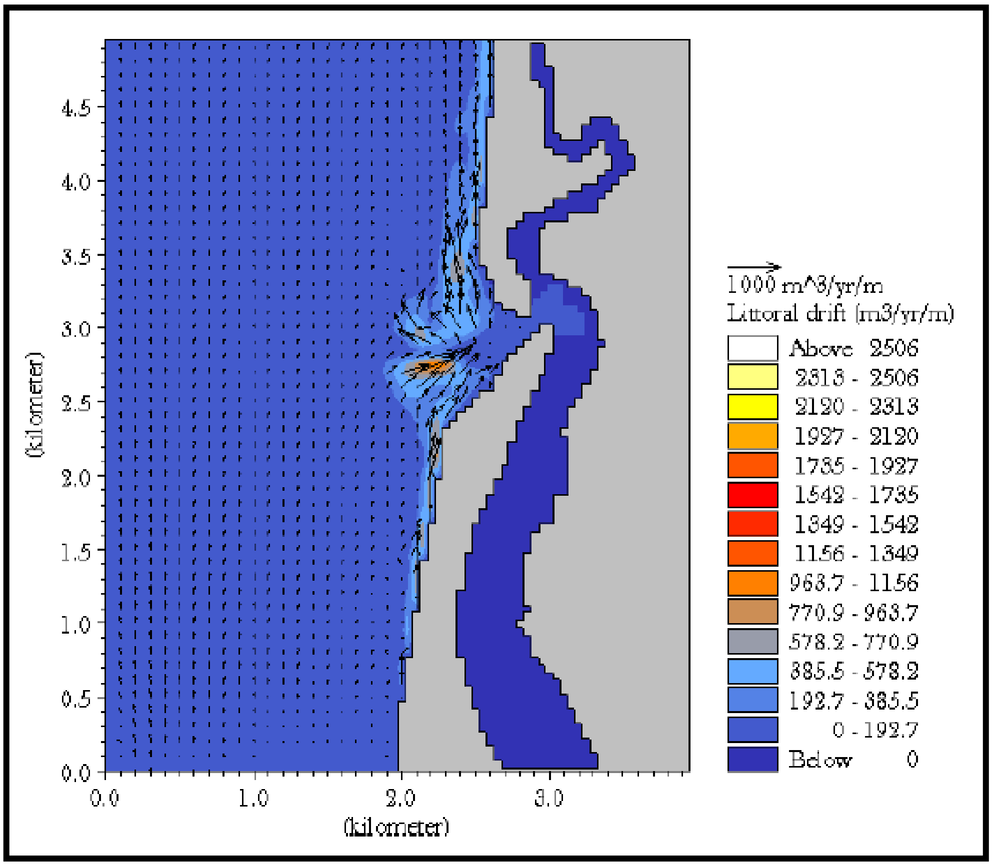


Figure 4-36: Wave induced littoral drift for SSW waves

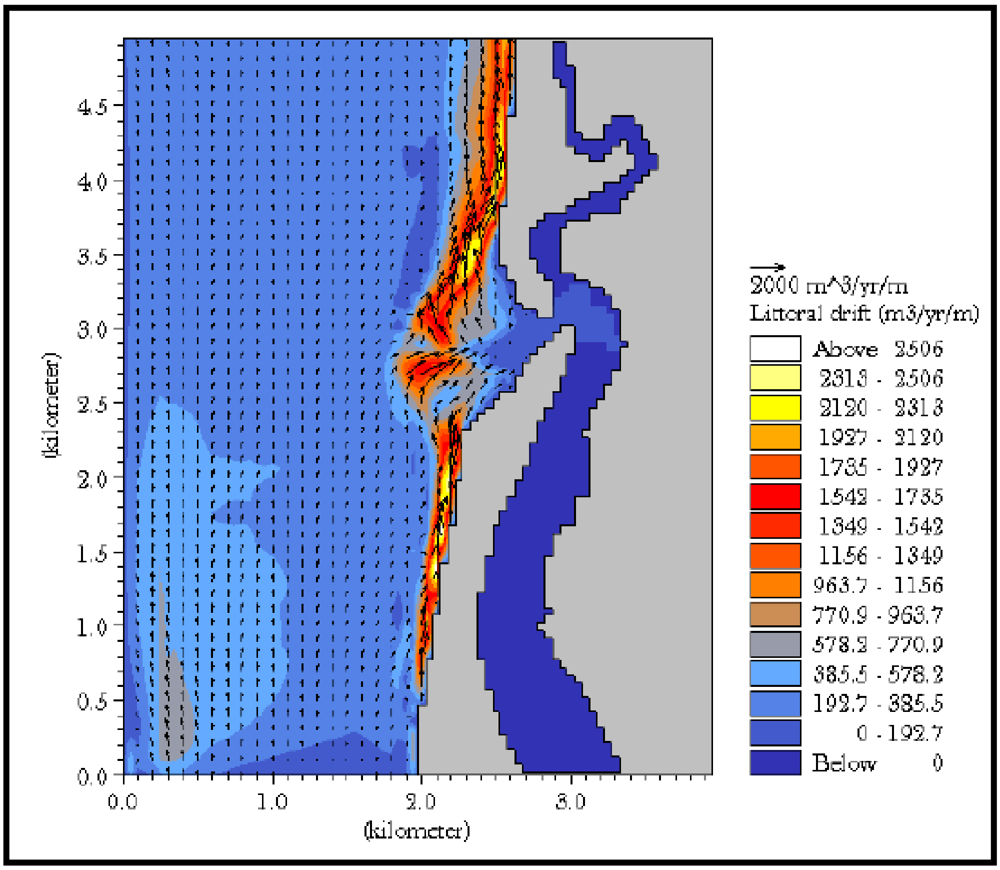


Figure 4-37: Wave induced littoral drift for SW waves

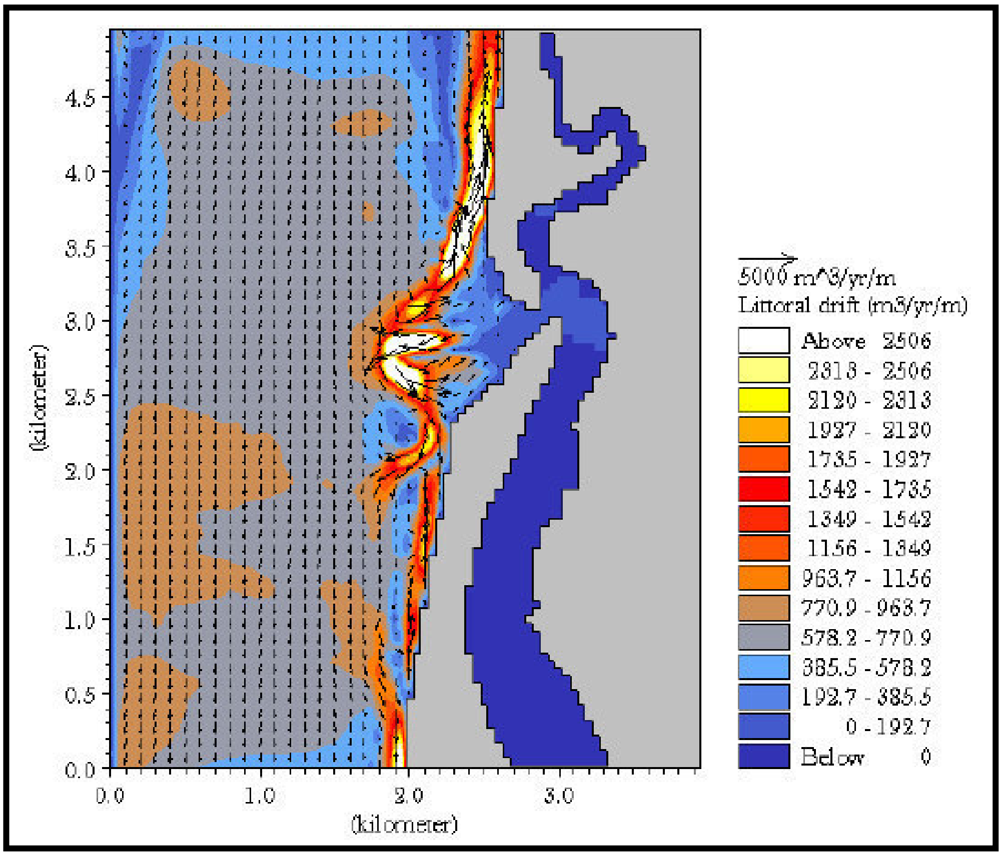


Figure 4-38: Wave induced littoral drift for WSW waves

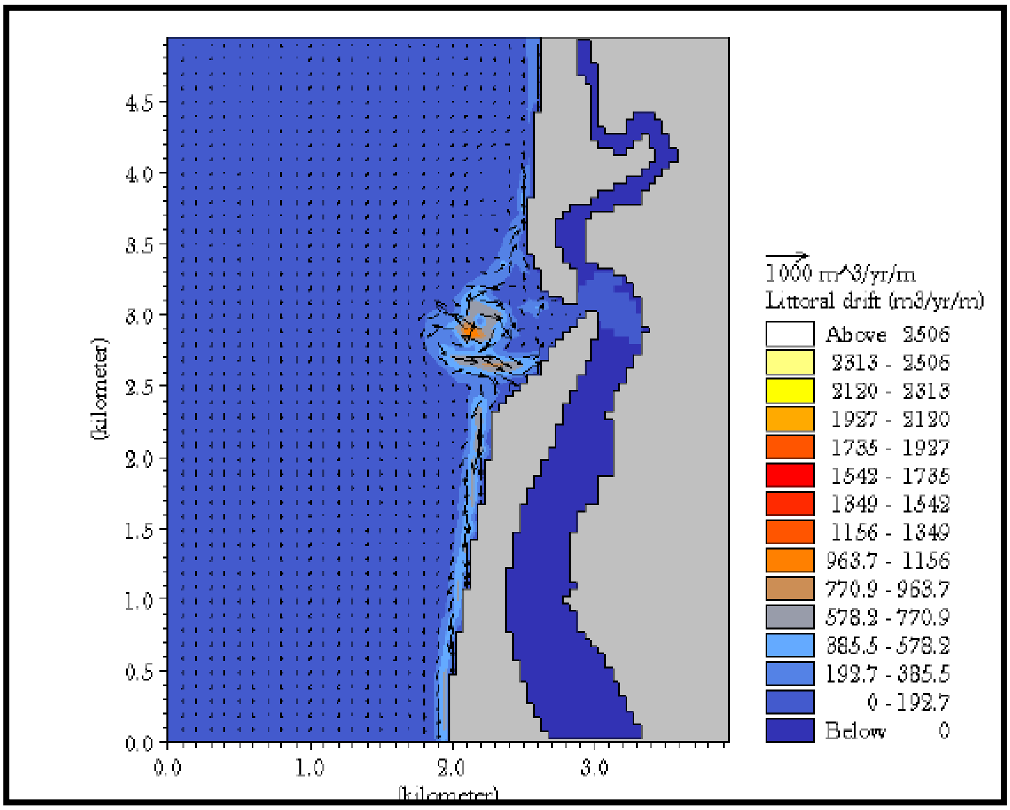


Figure 4-39: Wave induced littoral drift for W waves

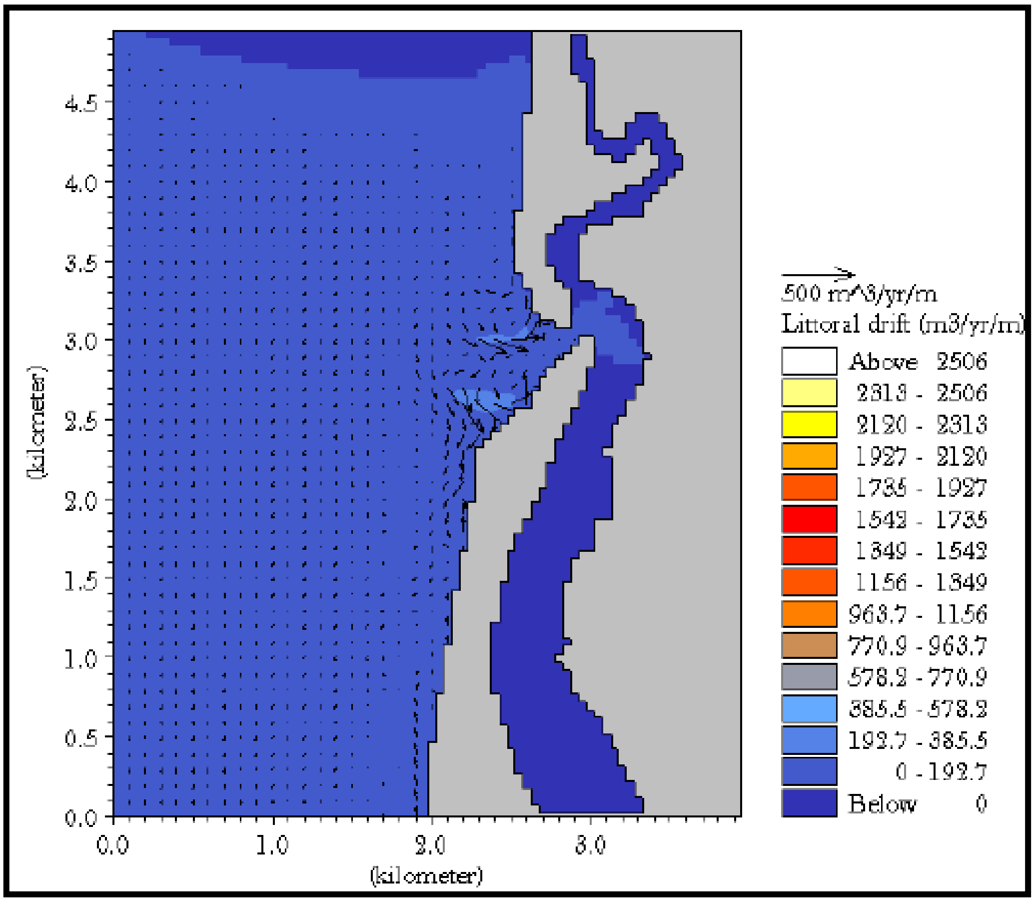


Figure 4-40: Wave induced littoral drift for WNW waves

Littoral drift with proposed facility (case-II):

The drifts computed for different directions of wave approach are shown in **Figure 4-41** and **Table** 4-2**.** The figure shows that the predominant direction of alongshore sediment transport is towards north due to S, SSW and SW waves and the net transport of sediment is around $0.6x10^6$ m^3 directed towards north.

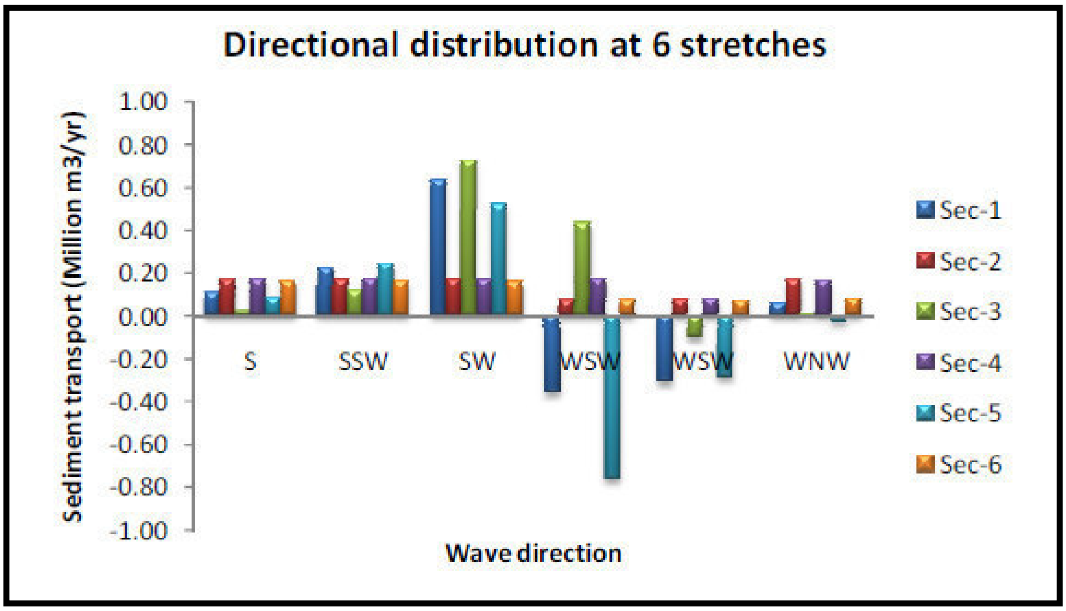


Figure 4-41: Sediment transport rates at 6 coastal stretches along Honnavar coast

Table 4-2: Sediment transport along the Honnavar coast derived from ST model

Station/ Stretch	Southerly transport (Million m3/yr)	Northerly transport (Million m3/yr)	Net transport (Million m3/yr)	Gross transport (Million m3/yr)
1	-0.677	1.023	0.347	1.700
2	0.000	0.822	0.822	0.822
3	-0.106	1.306	1.200	1.412
4	0.000	0.932	0.932	0.932
5	-1.088	0.849	-0.239	1.938
6	0.000	0.709	0.709	0.709
Net	-0.312	0.940	0.629	1.252

Note: (+ve) values indicate northerly drift and (-ve) values indicate southerly drift. Net drift is 0.6 x10^6 cubic meters towards north.

4.4.2 Potential Impact due to Construction

Developmental activities such as capital dredging, dredged material disposal and construction of approach channel and cargo berths will result in disturbance to marine environment. During these activities, particularly dredging, localised and short-term impacts on marine water quality are likely to occur due to increased turbidity from suspended sediment. Further, marine sediment quality indicates that it is free from any significant pollution.

4.4.2.1 Capital Dredging and Disposal of Dredged Material

Capital dredging is required to create inner navigation channel, outer navigation channel, turning circle and berthing areas. During the construction stage and operation stage the dredging volume is estimated about 3.9 MCM. About 1.0 MCM of the dredged material will be used for reclamation. Remaining quantity of 2.9 MCM dredged material will be disposed off at the approved designated offshore area of 2 Km north of the north breakwater.

The choice of dredging equipment depends primarily on dredge material, disposal methodology and distance of disposal location. The dredgers are mainly classified as Mechanical (Grab, Dipper and Bucket), Hydraulic (Plain suction, Cutter Suction, Wheel, Barge/ Vessel unloading and Trailer suction) and Pneumatic dredgers. The selection of equipment mainly depends on Size of the Project (quantity in cum), Nature of the material (hard rock, sandy or clay), Volume of the material, Topography of the area with reference to accessibility etc., Distance of disposal ground from the dredging area, Environmental factors at the site and also other environmental aspects and Accuracy of the work required.

Based on the soil conditions appropriate suction dredger will be used for the development of Honnavar Barge/vessel loading facility.

Generally, coarse material quickly settles to the bottom, while fine material is removed during its descendent to the bottom and transported by currents to adjoining areas.

The disposed material will settle down depending on its own bulk size and grain size with different settling velocity. Hence, the environmental conditions at the location of the disposal site should be such that it is not subjected to high near-bottom current velocities which would cause the disposed material to return to areas of interest like the approach channel. Moreover, the shuttle distance between the disposal site and the areas of dredging should not be too large, as this would increase cost of disposal and consequently the dredging cost. Hence, the selection of the disposal site has to be the result of a balance between the environmental factors and economy of cost.

The dredge spoils will be disposed through a hopper or suitable dredger at the disposal site. The impacts due to disposal of dredged material such as the spreading of turbidity at disposal location, suspension & re-suspension of sediment in the bulk of water column.

Numerical modelling studies for Dredge disposal

The dredging schedule will be covering both the wet season and the dry season. Numerical modelling studies have been conducted with a view to determine the ideal site for the dredge disposal. The studies have been carried out for the predominant waves in the respective seasons; SW waves for wet season and WNW waves for dry season. The peak river discharge values corresponding to wet and dry seasons are set to 300 m^3/s and 50 m^3/s respectively. Boundary conditions and other required parameters (bed resistance, eddy viscosity etc) are set in a way similar to the simulations described in Sediment transport study sections.

As the sediment transport and littoral drift studies revealed that the net transport along this coast is towards north, an appropriate disposal site towards north of the northern breakwater is chosen such that the disposed material does not come back towards the port entrance and at the same time it could be helpful in nourishing the eroding beaches in the area. After examining several locations along the northern coast, the most suitable site for dredge disposal is recommended at a distance of about 2.0 km to the north of port entrance channel located at latitude 14.308ºN and longitude 74.415ºE as shown in **Figure 4-42**.

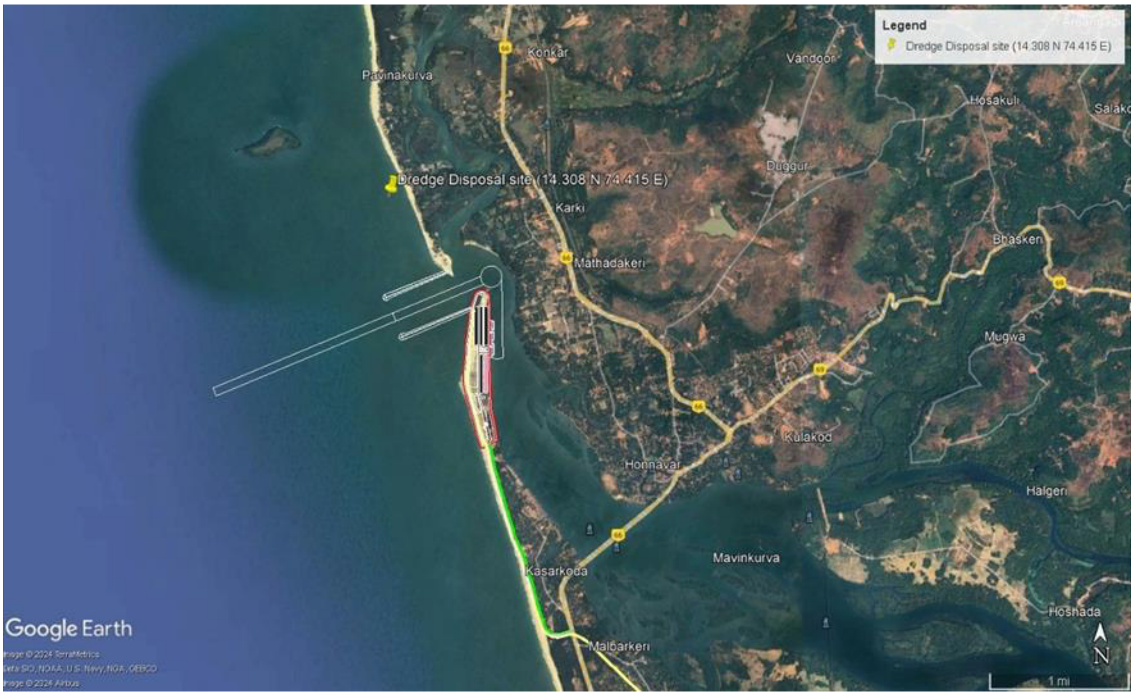


Figure 4-42: Location of the proposed disposal site (Image courtesy: Google Earth)

MIKE 21 hydrodynamic model (with mud transport) has been used to simulate the suspended sediment concentration (SSC) and bed level changes when the dredged material is discharged at a rate of 150 m^3/s with a velocity of 5 m/s in the outlet direction of 10° relative to true North.

Dredge Spoil Disposal Study – Results and Discussions:

It is observed that during wet season, the suspended sediment concentration (SSC) is relatively high for a few days after dredge disposal but later it spreads along the coast towards north without any impact to the port entrance area and the nearby environment. However, during dry season with WNW waves, the discharged sediment (SSC) spreads along the coast towards south, but it does not extend up to the entrance channel.

It is evident from the rate of bed level change during wet season; there is very little increase in bed level in the near shore regions at the disposal site. During dry season, the supplied sediment is carried towards south supplying sediment to the northern part of the north breakwater. This positive feedback from the natural near shore current system is quite helpful for nourishing the northern beaches.

The hydrodynamic model indicates that the current speed remains less than 0.37 m/s under various conditions, including fair weather and monsoon seasons. The direction of flow varies with tidal conditions and monsoon influences, but overall, there is no significant change in the flow field at the project location.

During periods of strong near shore currents (during peak wet season), it is suggested to dispose the sediment offshore at greater depths (>30 m). Based on the studies it is concluded that the dredge disposal at the recommended site will not cause any natural imbalance to the nearby shoreline and will not affect the coastal eco-system in any way.

4.4.2.2 Impact on Marine Water Quality

Marine water quality will be impacted due to dredging and disposal, construction of breakwaters, and cargo berths during construction phase. Direct impact of these activities on marine water quality would be increased turbidity due to suspended sediment and will be predominant during dredging.

Turbidity due to dredging operation varies with depth and lateral distance from dredger location. During dredging, transport of sediment depends on velocity and fine material concentration. Very fine cohesive material will remain in suspension for a long time and is independent of hydrodynamic conditions. Due to above factors, there will be an increase in turbidity due to suspended sediment in water column. Thus, it can be inferred that dredging would cause a short-term and localised impact on marine water quality.

Apart from turbidity, the marine water quality may be affected due to aqueous discharge (oily wastes, sanitary wastes, etc.) from the dredgers, barges and workboats involved in the activities. No discharge from the dredgers or work boats shall be allowed into marine waters. The dredging activity will be confined within the project site and the impact due to dredging will cease upon completion. The impact due to dredging can be minimised with the implementation of a dredge management programme.

4.4.2.3 Impact on Estuarine and Marine Ecology

Capital dredging and construction of approach channel, breakwaters and cargo berths will result in disturbance to estuarine and marine ecology.

Turbulence – Changes in Dissolved Oxygen (DO) Levels: During dredging, oxygen-demanding compounds, nutrients and sediments from the sea bed enter into water column. Since concentrations of oxygen-demanding compounds are normally much higher in pore water than in water column, it will cause a drop in oxygen concentration. Nutrients may stimulate primary production when light and temperatures are sufficient; and may cause eutrophication problems when released in favourable conditions. DO levels in bottom sediments, which are usually low would increase during dredging period. Changes in DO levels and noise are likely to result in localised and short-term impacts on marine ecology.

Removal of Benthic Communities associated with Bottom Sediments: Dredging would result in removal of benthic communities associated with bottom sediments. During dredging, sessile forms are removed along with sediments and mobile species tend to move away and are likely to increase species diversity in areas adjoining dredging site. Further, it is observed that due to movement of mobile species and transfer of nutrients during dredging, there will be an increase in species diversity and density in areas adjoining dredging site.

To mitigate impacts on marine ecology, measures such as selection of equipment and dredgers, environmental monitoring and regulating activities based on monitoring results will be adopted.

Smothering Effect Due to Settling of Sediment: Settlement of the suspended sediments can result in the smothering or blanketing of sub-tidal communities and/or adjacent inter-tidal communities. Presently, the biota in the Indian estuaries and coast of India is already subjected to considerable changes in turbidity due to large-scale littoral movement, which is a recurring regular natural phenomenon. Therefore, it would be able to withstand localised turbidity induced during the dredging.

4.4.2.4 Changes in Seabed Profile

Changes in seabed are envisaged due to the proposed project.

The morphodynamics (study of the seabed changes over long period of time) a coastal sea is studied by using ST model sub-module of CAMS. ST is used for assessing the probable zones of erosion/accretion and the initial bed level changes due to wave action in the proposed harbour vicinity. The results are discussed in **Section 4.4.1.1**.

4.4.2.5 Mitigation Measures

Prior to commencement of dredging, a Dredging Management Programme will be prepared and implemented, which will include the following details.

- A schedule for dredging shall be prepared and list of DO (s) and DO NOT (s) shall be circulated among the people involved in the construction activities
- It will be ensured that suitable dredging equipment is deployed to minimise the suspension of fine sediments at the dredge site.
- Dredging activity will be regulated during rough sea conditions.
- Currently, there are no standards in India to regulate turbidity levels during dredging. It is proposed to check turbidity levels during construction phase with baseline turbidity levels as a reference during dredging.
- Additional Environmental Monitoring Programme comprising of monitoring of marine water quality, marine sediment quality and marine ecology will be initiated one week prior to commencement of dredging and will be carried out throughout dredging period.
- It will be ensured that barges/workboats have slop tanks for collection of liquid/solid waste generated on board. Discharge of wastes into sea will be prohibited.

- Spill control measures will be adopted while fuelling dredgers, barges, workboats, etc.
- Post dredging monitoring program will carried out to assess effect of dredging and disposal on marine ecology.
- Dredging and dredged material disposal will be monitored for compliance with proposed mitigation measures.

4.4.3 Potential Impact during Operation

4.4.3.1 Impact on Marine Water Quality and Ecology in Harbour Basin

Due to Aqueous Discharges: During the operation phase there will be continuous movement of cargo Barges and port crafts round the clock. There is a possibility of aqueous discharges from the cargo Barges such as dumping of Barges wastes (sullage)/sewage, bilge water, solid wastes, etc. if not regulated.

Barges/vessels calling at Honnavar Barge/vessel loading facility will not be permitted dump the wastes during the berthing period. In addition, land-based sources of pollution such as runoff from the cargo berths, waste water, sewage and effluents from the Barge loading operations would also affect the marine water and sediment qualities in the harbour basin, if disposed without proper treatment. To avoid impacts on the marine water quality, it is proposed to prevent discharges from certain areas and regulate the discharges from other areas. Accordingly, storm water runoff will be directed into open concrete lined channels. The runoff from uncontaminated areas will be discharged directly into the sea. The runoff from berths and other areas liable for pollution will be intercepted and directed to septic tank followed by soak pit.

Due to Maintenance Dredging: During the operational phase, maintenance dredging of the approach channel and the harbour basin will be carried out in order to maintain the required draft in the channel for the free movement of the vessels. The maintenance dredge quantity is estimated at 10,300 cubic meter/year. The maintenance dredge spoil will be dumped at approved distance of about 2.0 km to the north of port entrance channel.

Localised and short term impacts on marine water quality are anticipated from increased turbidity during maintenance dredging. The magnitude of impact due to the maintenance dredging and disposal is dependent on the quality of the dredged material.

As Dredge Management Programme proposed to be adopted, no significant impact are anticipated from maintenance dredging on water quality except locally due to suspension of bottom sediment resulting in increased turbidity levels. Further, during the disposal of the dredge spoil at the identified disposal ground, the dredger hopper will be shifted to minimize the increase in turbidity/suspended solids concentration and built up of the bed material.

Due to Cargo Spills during Handling: Spills do not occur during normal operations, as the cargo will be handled by specialised barge-loaders. In the event of accidental spills of cargo during transfer from/to the ships, the marine water quality, sediment quality and ecology in the harbour basin will be impacted.

Due to Oil Spills during Fuelling: Oil spills do not occur during normal fuelling operations. In the event of accidental oil spills during fuelling of the barges / port crafts, the marine water quality in the harbour basin will be impacted. To minimise the impacts on marine water quality, the spills will be recovered.

4.4.3.2 Mitigation Measures

Barges/Vessel will comply with MARPOL convention and avoid the discharges.

Settling Tanks will be provided for containment/treatment of runoff from cargo storage areas and other areas liable for pollution. Lime will be added in the settling ponds to neutralise the heavy metals if any in the runoff from the stockyards and the settled waste will be disposed of complying with the norms stipulated by statutory authorities.

It will be ensured that the dumping of the maintenance dredge spoil would be uniform.

Along with the operational phase environmental monitoring, an additional Environmental Monitoring Programme comprising of monitoring of marine water quality, marine sediment quality and marine ecology will be initiated one week prior to commencement of maintenance dredging and will be carried out during the dredging period.

In case of any cargo spillage during transfer from/to ships, it will be attempted to recover the spills.

Oil spill control equipment such as booms/barriers will be provided for containment.

As the accidental spills will be in harboured waters, it would not spread spatially and the response time for shutting down the fuelling, containment and recovery will be quicker.

4.5 Biological Environment (Coastal and Marine Ecology)

4.5.1 Potential Impact due to proposed Facility Location

4.5.1.1 Impact on Mangrove Areas

The land identified for the development of Honnavar Barge/Vessel loading facility does not entail mangroves, however mangrove patches are observed at a distance of 300m.

Mangroves in the project area are shown in the **Figure 4-43**.

Figure 4-43: Mangroves patches in the project area

4.5.1.2 Mitigation/Mangrove Conservation Measures

- Awareness will be given to workers in the Barge/vessel loading facility about the importance of mangroves and their conservation
- Discharge of handling materials during the construction and operation would not be allowed
- During dredging the water quality near the mangrove area will be ensured by adopting suitable mitigation measures.

4.5.1.3 Impact on River Confluence Point/River Mouth

Breakwater construction will lead to accretion/erosion on coast adjacent to that. These will change the morphodynamics of the river mouth/inlet which leads to reduction in tidal water flow in the water body. Reduction in tidal exchange will affect the biodiversity. Studies with MIKE 21 mud transport (MT) model give the details of sedimentation and siltation due to the riverine flow. The model results show that by and large there is a negligible siltation due to riverine flow. Although slight siltation is noticed during wet season at the northern end of the river facing the river mouth, this is not significant.

The model studies show that the tranquillity conditions have improved on the riverside where barge/ vessel loading facilities is proposed, when the breakwaters are incorporated in the model. During wet season slightly higher values of SSC are noticed inside the region of breakwaters and also inside the river. But by 10th day the SSC is flushed out and by 15th day the entire area including river side is free of any SSC. During dry season the SSC is negligible throughout the study area. The bed level changes during wet season indicate the sedimentation is negligible up to 10th day; but by 15th day slight deposition appears on the right bank of the river facing the channel inlet. But this siltation is not severe and it can be concluded that the construction of breakwaters will not have any significant effect on siltation.

Hydrodynamic Model Studies and other model studies ensures that changes the morphodynamic of the river mouth is not significant. This will ensure the tidal water exchange and thereby maintain the biodiversity.

As a part of EMP, both water quality monitoring and shoreline monitoring is proposed.

4.5.2 Potential Impact due to Construction

4.5.2.1 Impact due to Capital Dredging and Disposal

Capital dredging is required to create inner navigation channel, outer navigation channel, turning circle and berthing areas which may cause temporary disturbance to biological environment. Dredging removes bottom biota and dumping of dredged material covers bottom habitat. Piles, rubble mounds and concrete surfaces will form new habitat. The likely impacts on marine ecology are discussed in Section 4.4.2.1.

4.5.2.2 Mitigation Measures during Dredging and Disposal

In addition to the mitigation measures followed in **Section 4.4.2.5,** the following will be adopted:

- Appropriate selection of equipment for pile driving and dredging
- Uniform disposal of dredged material at identified disposal location

4.5.2.3 Impact on Ecology due to Reclamation

The Barge/Vessel loading facility areas proposed to be reclaimed is mostly Coastal sand and small portion of intertidal area which is devoid of vegetation. These areas are going to be reclaimed with 1.0 MCM of dredged material.

4.5.2.4 Mitigation Measures during Reclamation

While reclaiming the existing area, bunds will be provided with a suitable overflow facility so that only clean water will be returned to the sea.

4.5.3 Potential Impact due to Operation

4.5.3.1 Impact due to Aqueous Discharges and Mitigation Measures

During the operation phase there will be continuous movement of cargo Barges and Barge/Vessel loading facility crafts round the clock. There is a possibility of aqueous discharges from the cargo vessels such as dumping of Barges wastes (sullage)/sewage, bilge water, solid wastes, etc. if not regulated. The likely impacts and corresponding mitigation measures to be followed are discussed in **section 4.4.3.2**.

4.5.3.2 Potential Impact due to Cargo Operations

Due to Cargo Spills during Handling: Spills do not occur during normal operations, as the cargo will be handled by specialised mechanised Barge/ Vessel -loaders/un-loaders. In the event of accidental spills of cargo during transfer from/to the Barges/ Vessel, the marine water quality, sediment quality and ecology in the harbour basin will be impacted.

4.5.3.3 Mitigation Measures

- Spill contingency plan as a part of Disaster Management Plan will be prepared in accordance to the cargo will be handled.
- Spill recovery/immediate response measures will be displayed at cargo handling areas.
- Material Safety data Sheet (MSDS) of cargo being handled will be displayed.
- Mock drills will be conducted at periodic intervals.

4.5.3.4 Impact due to Lighting and Mitigation Measures

The glare of the port complex lighting system may cause adverse impacts on the Nocturnal fauna and marine creatures. During the hatching of eggs laid by Olive Ridely turtle, the glare of light may destruct their movement to landward side causing desiccations and death. Considering these ecological issues, HPPL shall adopt DARK SKY LIGHTING SYSTEM an exemplary activity for the coastal eco system.

This system of lighting doesn’t allow the glares to outside and to the sky.

4.5.3.5 Mitigation Measures for Light Pollution

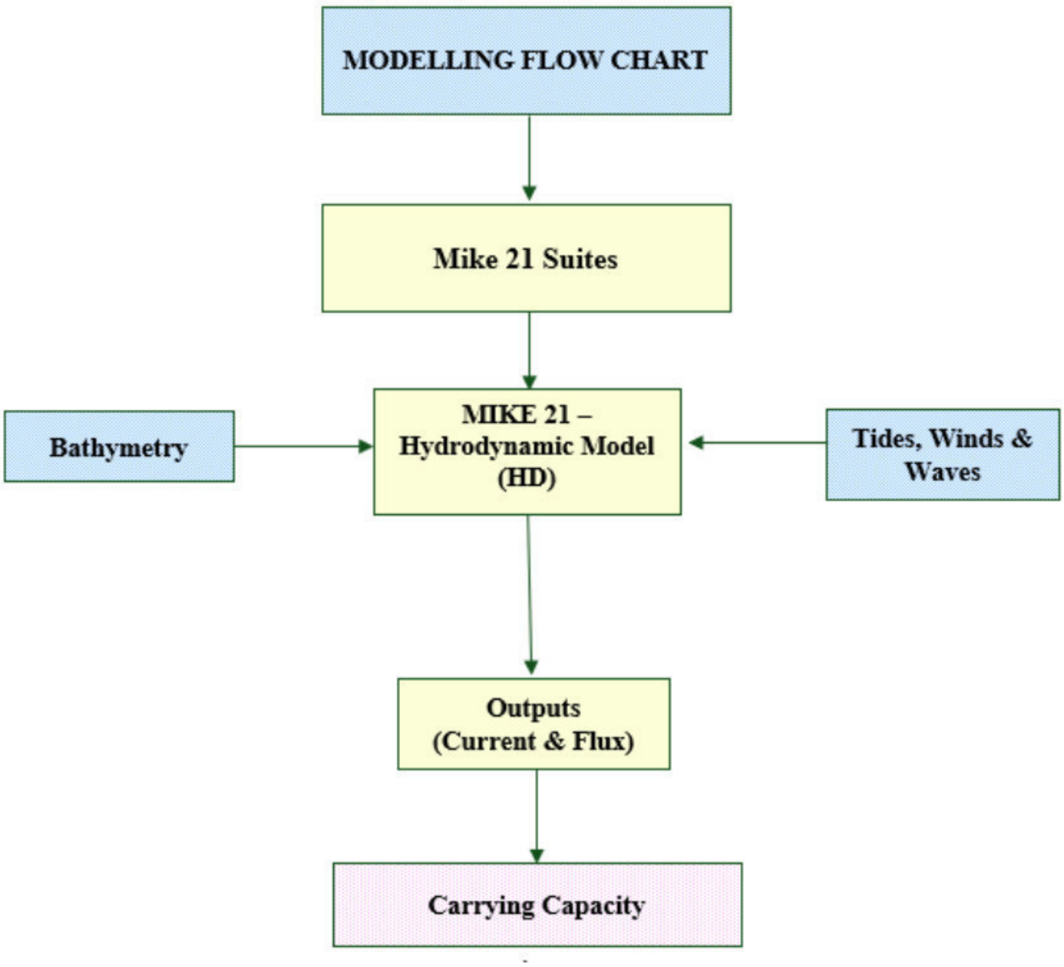
- All outdoor lighting, roadway lighting, wharf lighting, and lighting mounted on masts or other elevated structures will include no other luminaries except full cut-off luminaries. Full cut-off luminaries shall meet the (Illuminating Engineering Society of North America) IESNA classification for “full cut-off,” which describes a luminary having a light distribution with zero candela intensity at or above an angle of 90° above nadir and with no more than 10% of candela intensity at or above a vertical angle of 80° above nadir. All full cut-off luminaries will be mounted horizontally so that the angle of 90° above nadir equals the Earth’s horizon.

- All outdoor lighting, roadway lighting, wharf lighting, and lighting mounted on masts or other elevated structures will be of the minimum lamp wattage to achieve required safety within the lighted area.
- No area lighting or any lighting mounted on masts or other elevated structures will include fluorescent lamps, mercury vapour (MV) lamps, metal halide (MH) lamps, or other broad-spectrum high-intensity discharge lamp types.
- No lighting of grounds, building walls, signs, cranes, or other elevated structures will employ flood lighting, up lighting, or other forms of directional lighting aimed above the horizon.
- Lighting of elevated walkways or conveyors will use luminaries that are <70 W HPS and shielded, so that candela intensity above an angle of 90° above nadir is 10% or less.
- Wherever possible, use low-pressure sodium vapour lamps or other light sources that exclude wavelengths less than 520 nm.

4.5.4 Carrying capacity studies

Indomer Coastal Hydraulics (P) Ltd., Chennai has conducted mathematical modelling study on estimating the carrying capacity study of Sharavathi River Estuary. The detailed report is enclosed in **Appendix J**. The summary of the results shown below:

DHI - MIKE 21 HD module has been used to study the variation of tides and currents in the project region. DHI - MIKE 21 models are being used worldwide for many coastal engineering applications. The flow chart of the model describing the approach followed in the present study is given below.



The summary of the results shown below:

Flow field

In order to assess the influence of breakwaters in the nearshore region, the flow field has been simulated over the project region for the existing scenario (without the presence of breakwater) and the scenario after the construction of the breakwater. The time series variations of simulated tide, current speed, and direction were extracted at three points for both scenarios, as shown in **Figure 4-44.**

Figure 4-44: Location Of Extraction Points - Honnavar

These points correspond to the entrance of the estuary (Stn. E1), near the turning circle (Stn. E2), and inside the river (Stn. E3).

4.5.4.1 Flow field without breakwater

Fairweather

Spring tide: The tide induced flow fields on a *spring tidal day* in case of without breakwater, when the wind effect is absent during flood and ebb tides are shown in **Figure 4-45.** At station E1, the maximum current speed during the flood tide on a spring tidal day showed around 0.21 m/s and directed towards east. At station E2, the current speed showed around 0.25 m/s and directed towards northeast. At station E3 inside the river, the current speed is 0.33 m/s, and the direction is towards southeast. On the other hand, during the ebb tide, the maximum current speed at station E1 was 0.16 m/s and it is directed towards west. At station E2, the current speed remained at 0.21 m/s and directed towards north. At station E3 inside the river, the current speed is 0.29 m/s, and the direction is towards northwest.

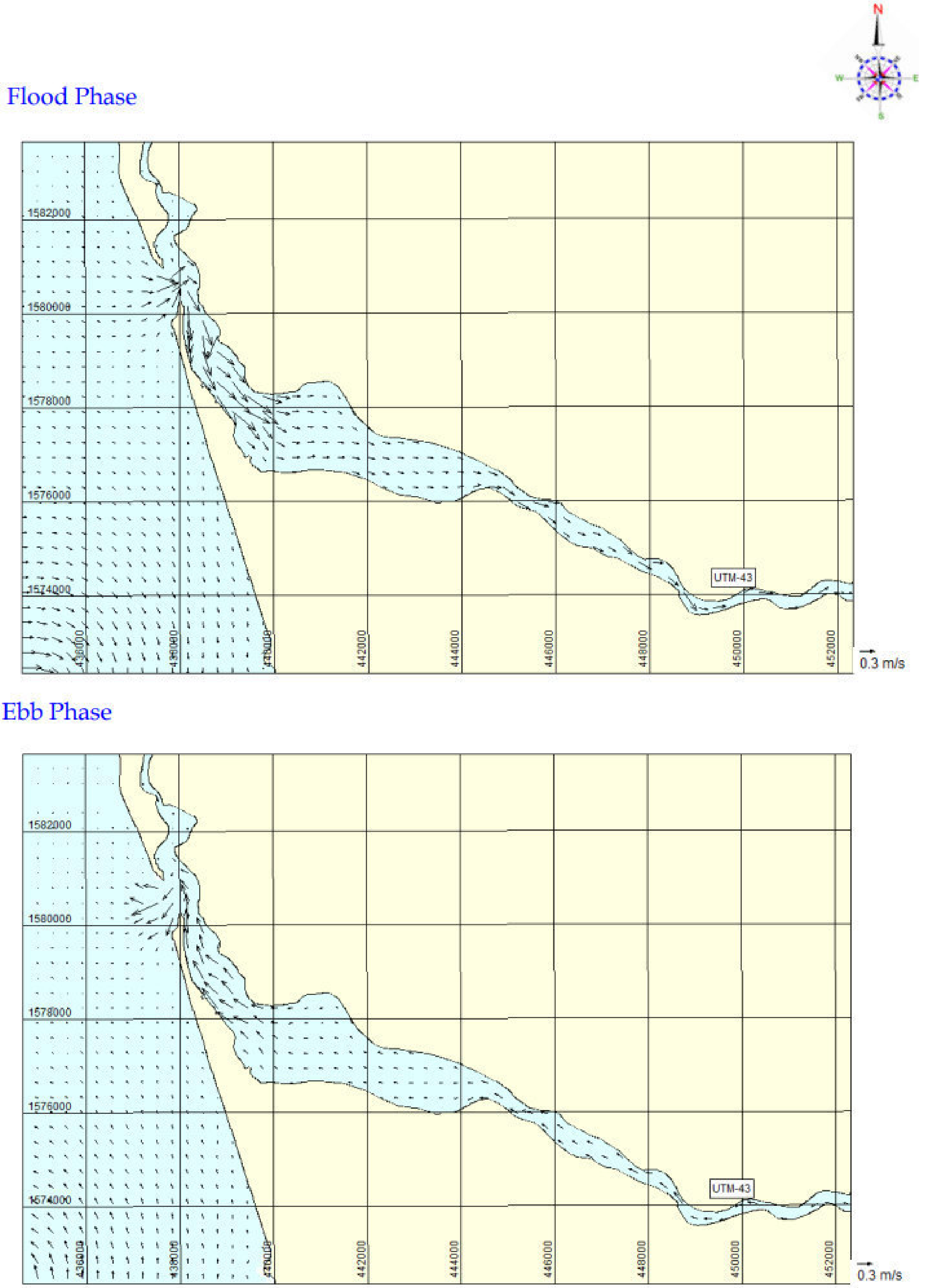
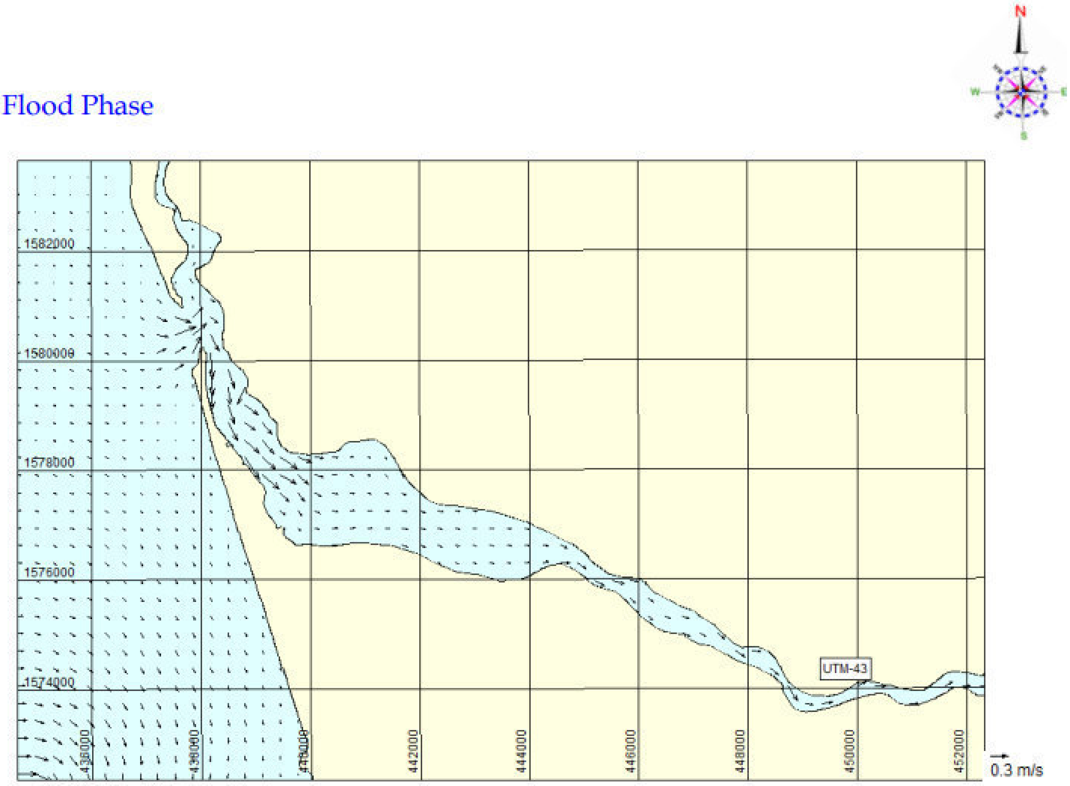


Figure 4-45: Flow Field – Fair Weather – Spring Tide- Without Breakwater

<u>Neap tide</u>: The tide induced flow fields on a *neap tidal day* in case of without breakwater, when the wind effect is absent during flood and ebb tides are shown in **Figure 4-46.** At station E1, the maximum current speed during the flood tide on a spring tidal day showed

around 0.13 m/s and directed towards east. At station E2, the current speed showed around 0.17 m/s and directed towards northeast. At station E3 inside the river, the current speed is 0.24 m/s and the direction is towards southeast. On the other hand, during the ebb tide, the maximum current speed at station E1 was 0.10 m/s and it is directed towards west. At station E2, the current speed remained at 0.13 m/s and directed towards north. At station E3 inside the river, the current speed is 0.18 m/s and the direction is towards northwest.

Flood Phase



Ebb Phase

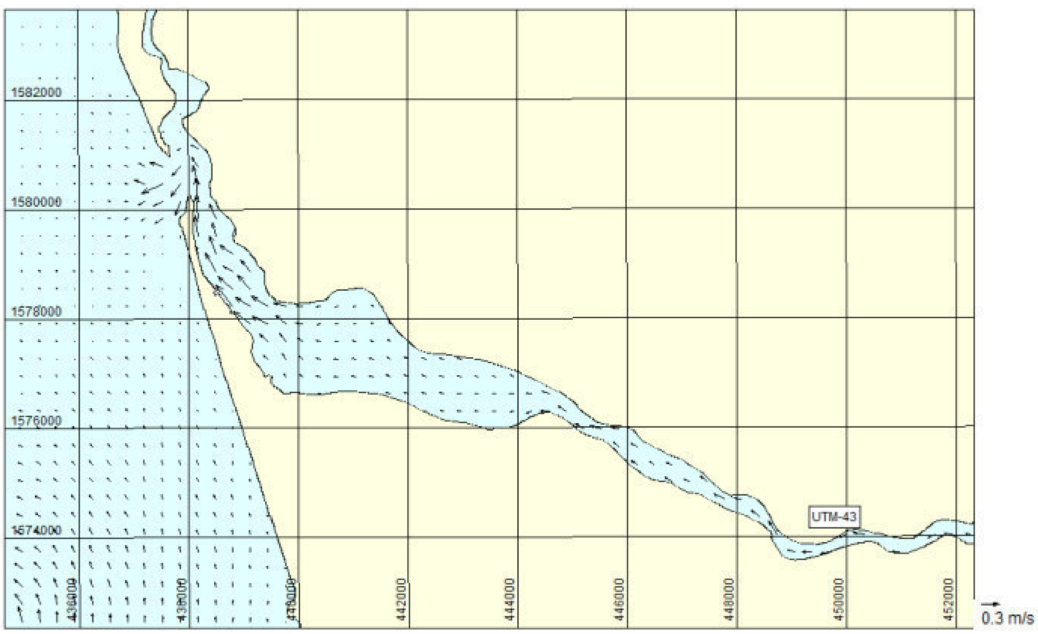


Figure 4-46: Flow Field – Fair Weather – Neap Tide- Without Breakwater

Southwest monsoon

Spring tide: The tide induced flow fields on a spring tidal day in case of without breakwater, when the wind effect is maximum during southwest monsoon in case of flooding and ebbing tides are shown in **Figure 4-47.**

At station E1, the maximum current speed during the flood tide on a spring tidal day showed around 0.25 m/s and directed towards northeast. At station E2, the current speed showed around 0.27 m/s and directed towards northeast. At station E3 inside the river, the current speed is 0.37 m/s and the direction is towards southeast. On the other hand, during the ebb tide, the maximum current speed at station E1 was 0.18 m/s and it is directed towards southwest. At station E2, the current speed remained at 0.21 m/s and directed towards southwest. At station E3 inside the river, the current speed is 0.32 m/s and the direction is towards northwest.

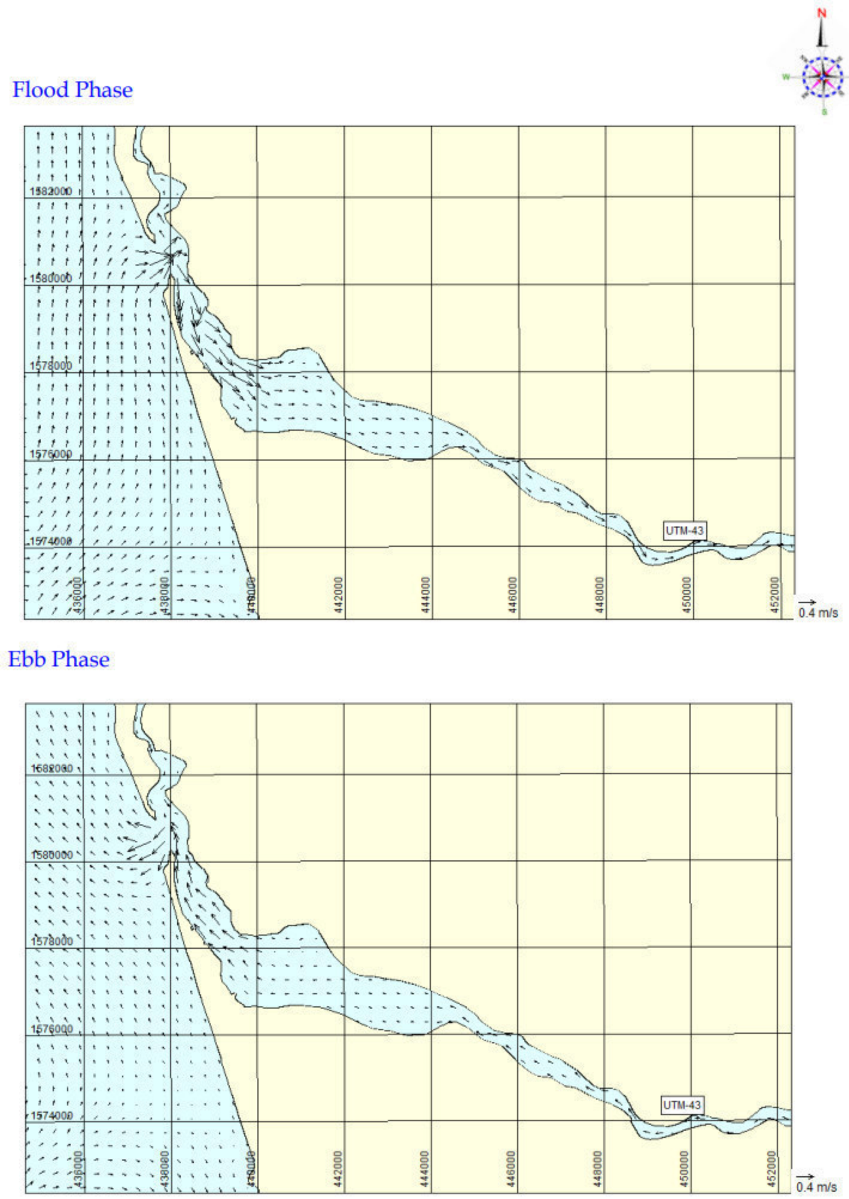


Figure 4-47: Flow Field – SW Monsoon – Spring Tide- Without Breakwater

Neap tide**:** The tide induced flow fields on a *neap tidal day* in case of without breakwater, when the wind effect is maximum during southwest monsoon in case of flooding and ebbing tides are shown in **Figure 4-48**. At station E1, the maximum current speed during the flood tide on a spring tidal day showed around 0.13 m/s and directed towards northeast. At station E2, the current speed showed around 0.18 m/s and directed towards northeast. At station E3 inside the river, the current speed is 0.26 m/s, and the direction is towards southeast. On the other hand, during the ebb tide, the maximum current speed at station E1 was 0.10 m/s and it is directed towards southwest. At station E2, the current speed remained at 0.13 m/s and directed towards southwest. At station E3 inside the river, the current speed is 0.20 m/s, and the direction is towards northwest.

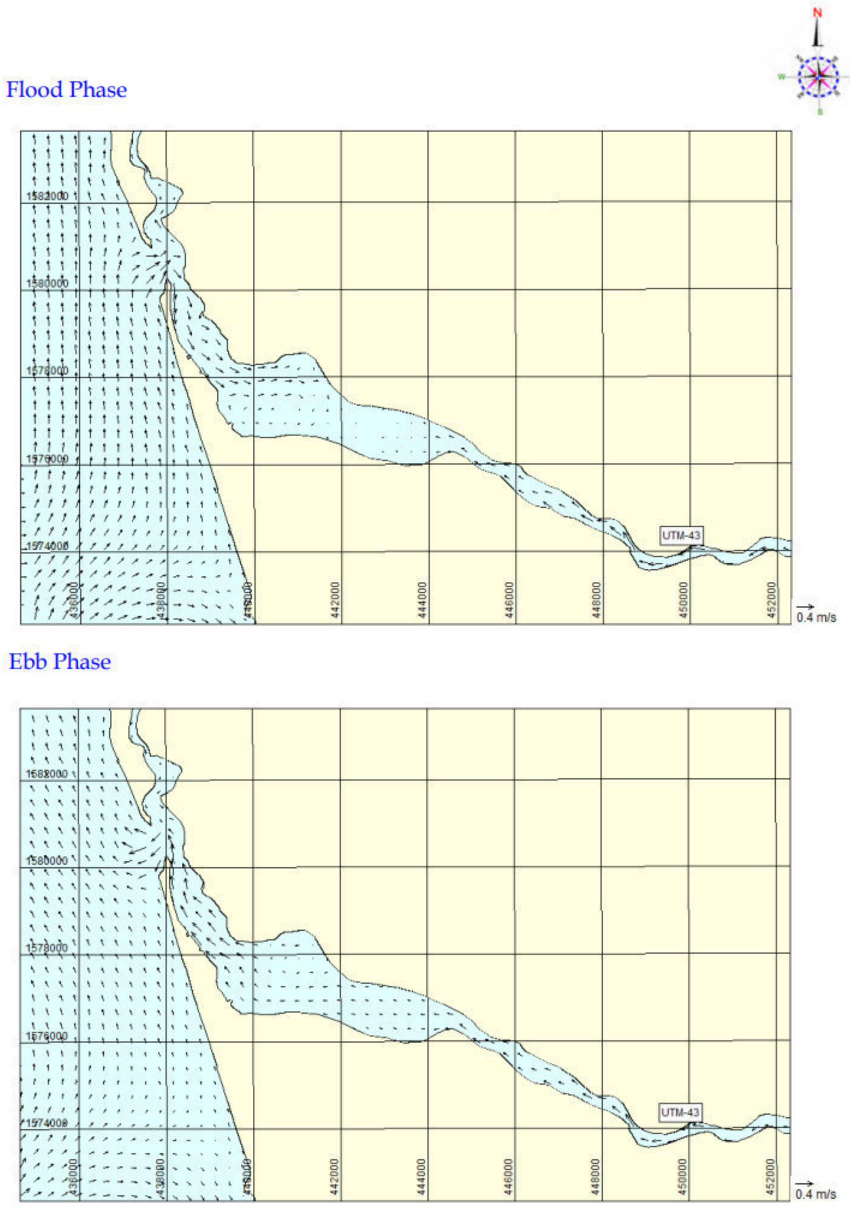


Figure 4-48: Flow Field – SW Monsoon – Neap Tide- Without Breakwater

Northeast monsoon

Spring tide: The tide induced flow fields on a *spring tidal day* in case of without breakwater, when the wind effect is maximum during northeast monsoon in case of flooding and ebbing tides are shown in **Figure 4-49.** At station E1, the maximum current speed during the flood tide on a spring tidal day showed around 0.23 m/s and directed towards southeast. At station E2, the current speed showed around 0.26 m/s and directed towards northeast. At station E3 inside the river, the current speed is 0.35 m/s and the direction is towards southeast. On the other hand, during the ebb tide, the maximum current speed at station E1 was 0.17 m/s and it is directed towards southwest. At station E2, the current speed remained at 0.21 m/s and directed towards southwest. At station E3 inside the river, the current speed is 0.26 m/s, and the direction is towards northwest.

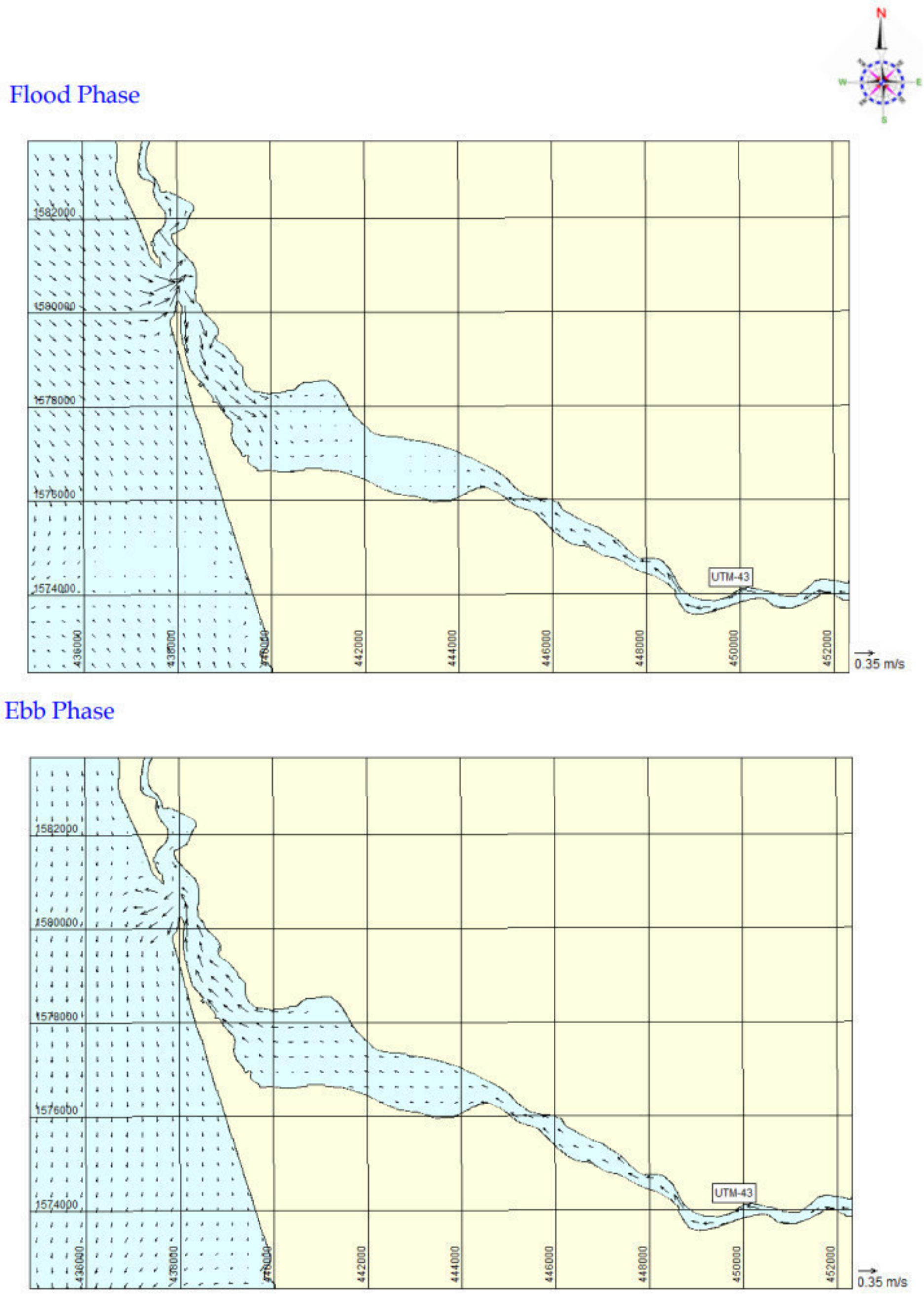


Figure 4-49: Flow Field – NE Monsoon – Spring Tide- Without Breakwater

Neap tide**:** The wind and tide induced flow fields on a neap *tidal day* in case of without breakwater, when the wind effect is maximum in northeast monsoon are shown in case of flooding and ebbing tides in **Figure 4-50.** At station E1, the maximum current speed during the flood tide on a spring tidal day showed around 0.13 m/s and directed towards southeast. At station E2, the current speed showed around 0.17 m/s and directed towards northeast. At station E3 inside the river, the current speed is 0.25 m/s, and the direction is towards southeast. On the other hand, during the ebb tide, the maximum current speed at station E1 was 0.10 m/s and it is directed towards southwest. At station E2, the current speed remained at 0.13 m/s and directed towards southwest. At station E3 inside the river, the current speed is 0.19 m/s, and the direction is towards northwest.

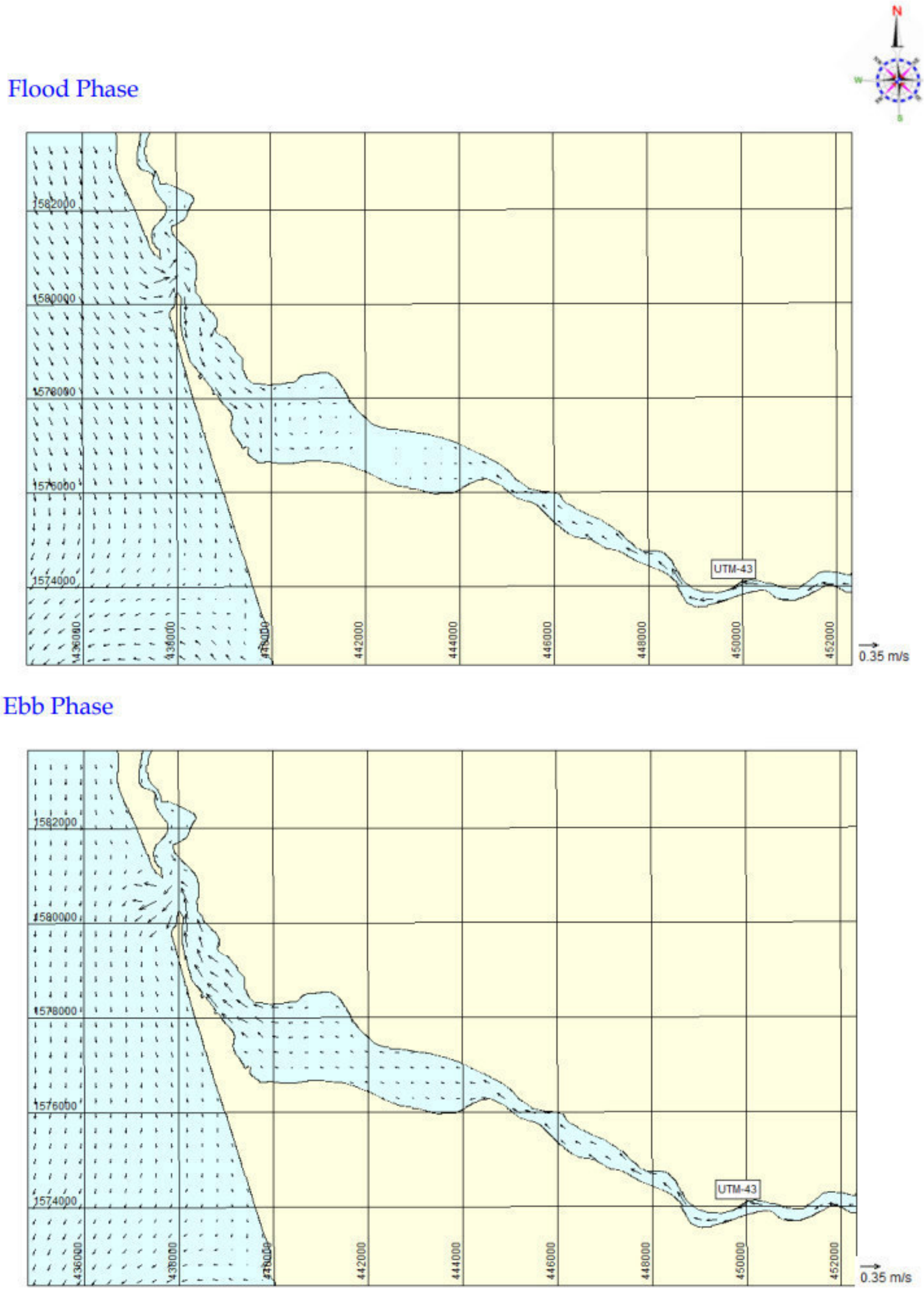


Figure 4-50: Flow Field – NE Monsoon – NeapTide- Without Breakwater

The time series variation of simulated tides, current speed, and direction for each extraction points during during fair weather, southwest monsoon and northeast monsoon are shown in **Figure 4-51 to Figure 4-59** respectively.

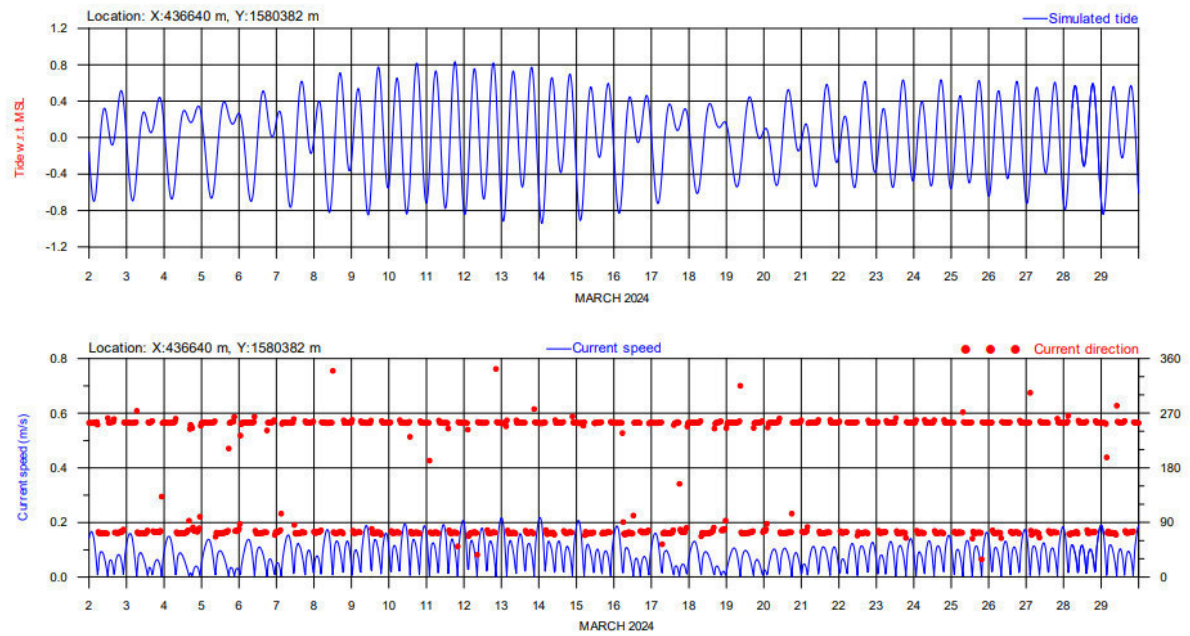


Figure 4-51: Variation of Simulated Tides & Currents at Station E1- Without Breakwater- Fair Weather

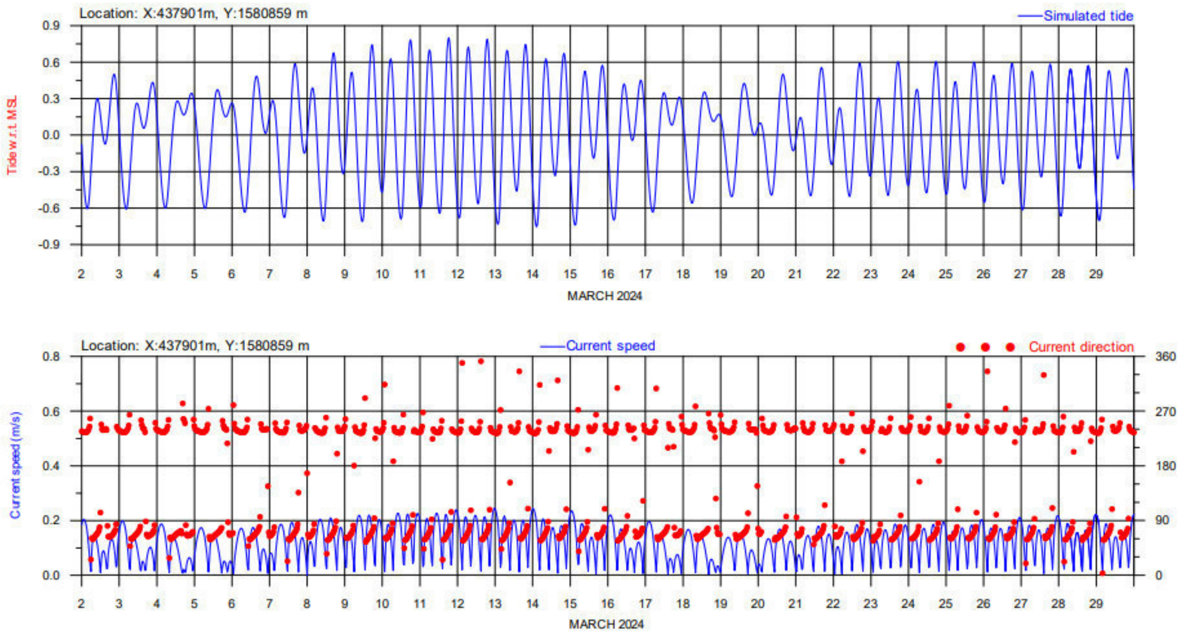


Figure 4-52: Variation of Simulated Tides & Currents at Station E2- Without Breakwater- Fair Weather

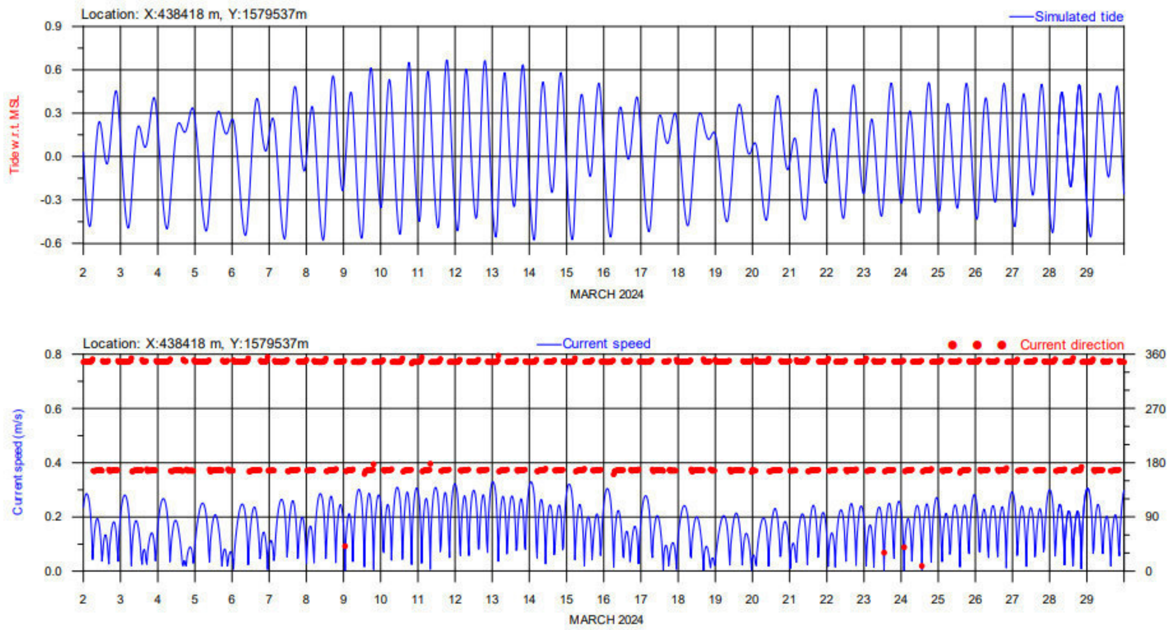


Figure 4-53: Variation of Simulated Tides & Currents at Station E3- Without Breakwater- Fair Weather

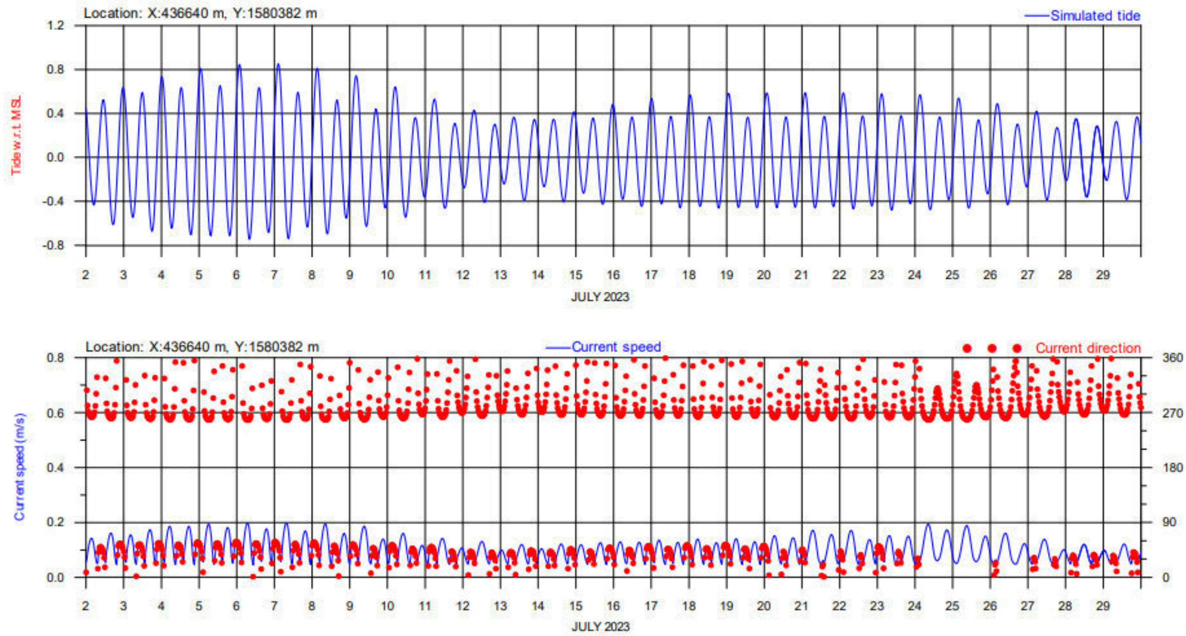


Figure 4-54: Variation of Simulated Tides & Currents at Station E1- Without Breakwater- SW Monsoon

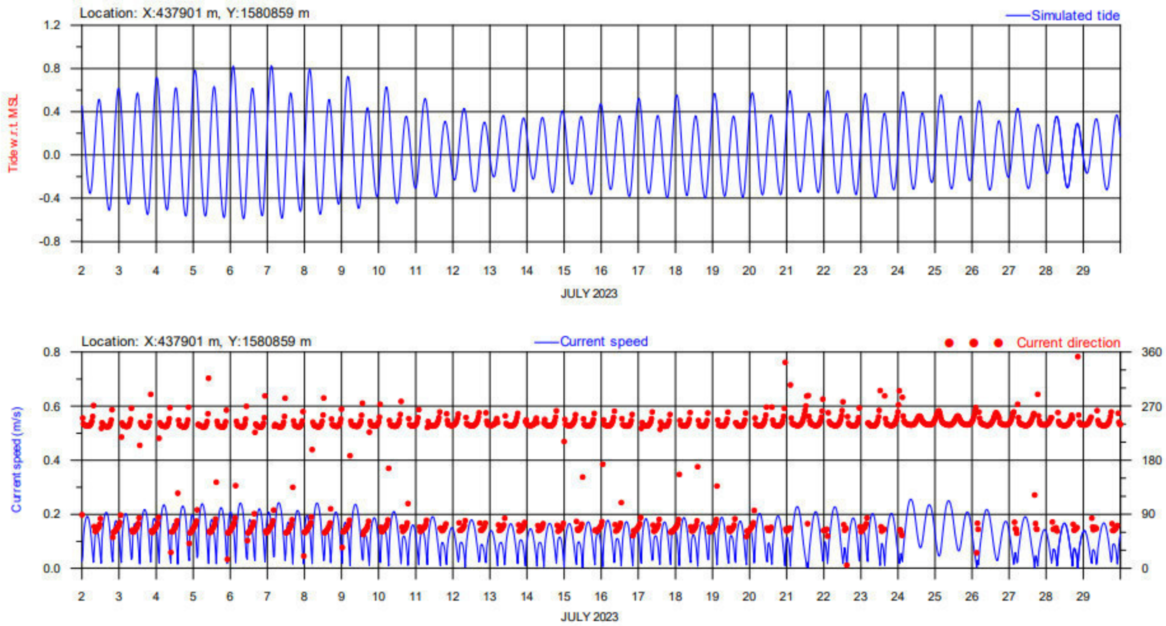


Figure 4-55: Variation of Simulated Tides & Currents at Station E2- Without Breakwater- SW Monsoon

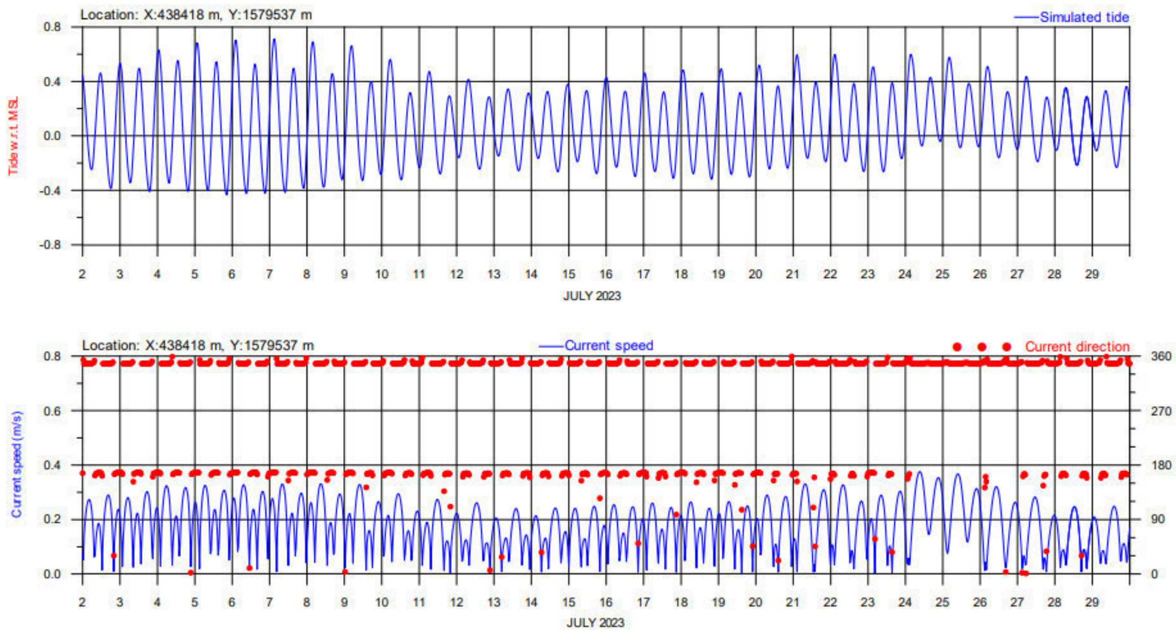


Figure 4-56: Variation of Simulated Tides & Currents at Station E3- Without Breakwater- SW Monsoon

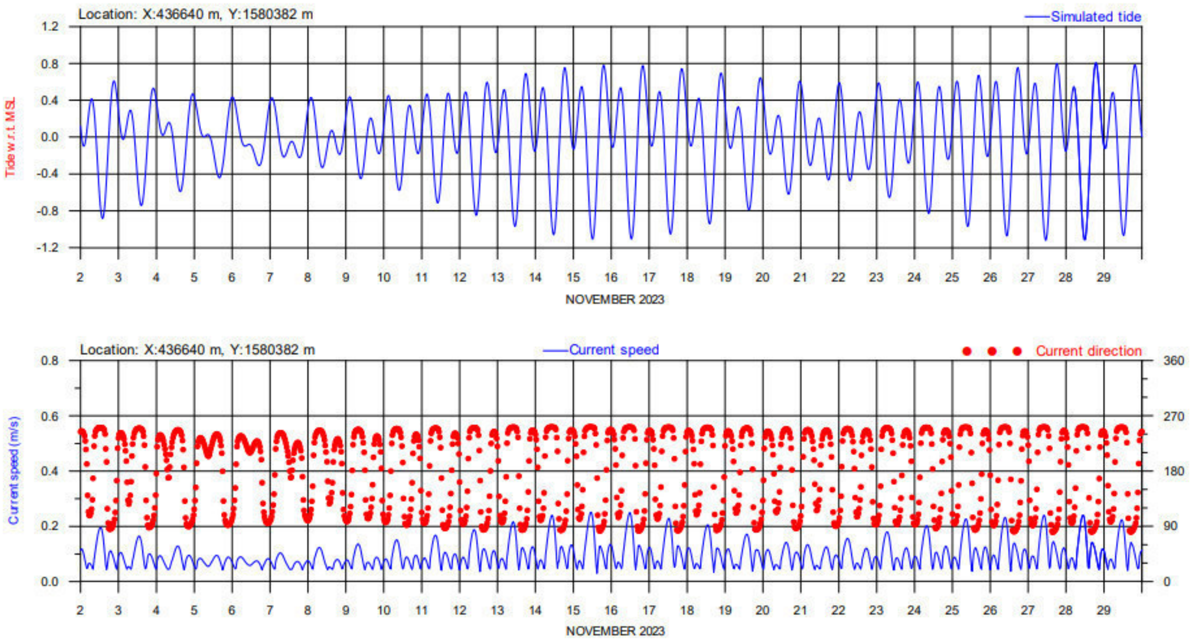


Figure 4-57: Variation of Simulated Tides & Currents at Station E1- Without Breakwater- NE Monsoon

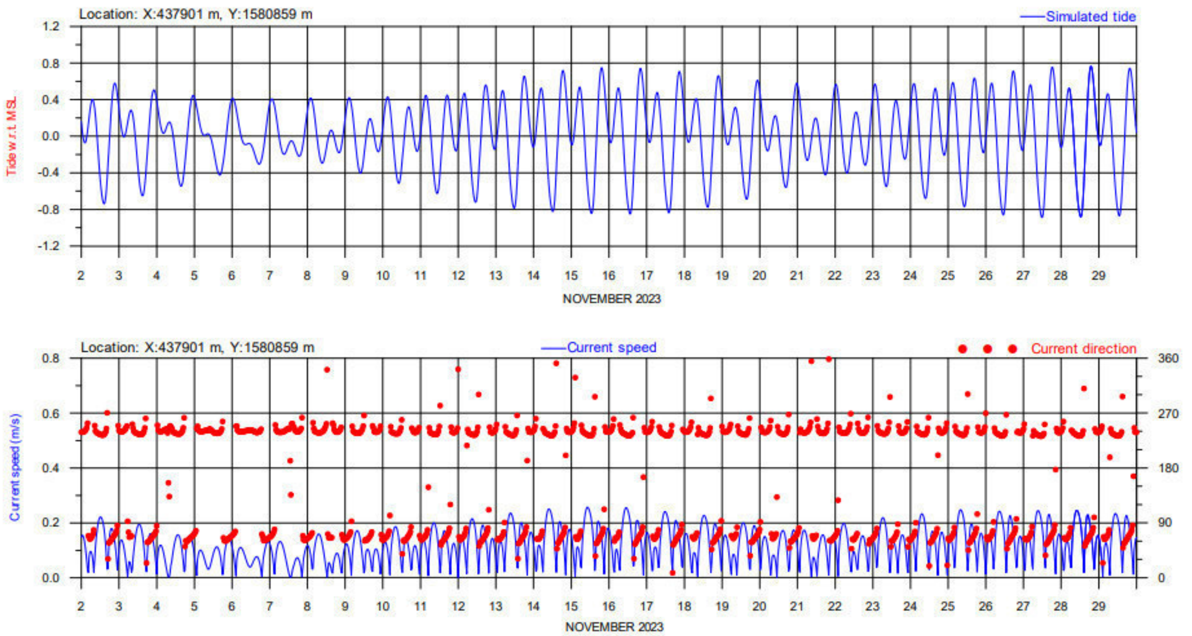


Figure 4-58: Variation of Simulated Tides & Currents at Station E2- Without Breakwater- NE Monsoon

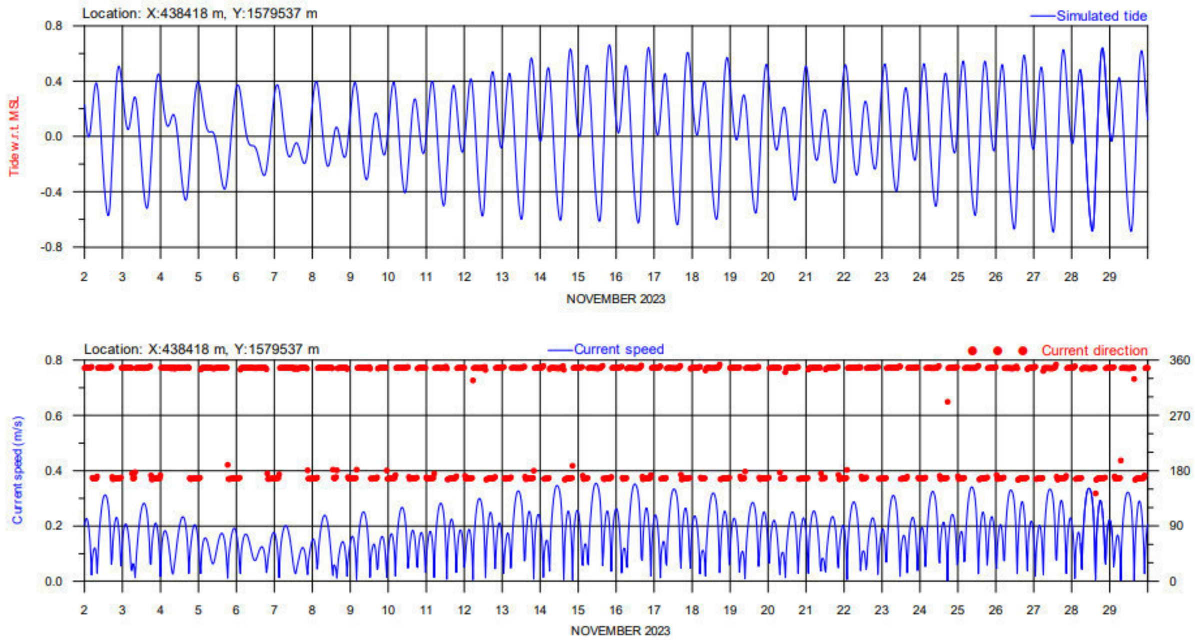


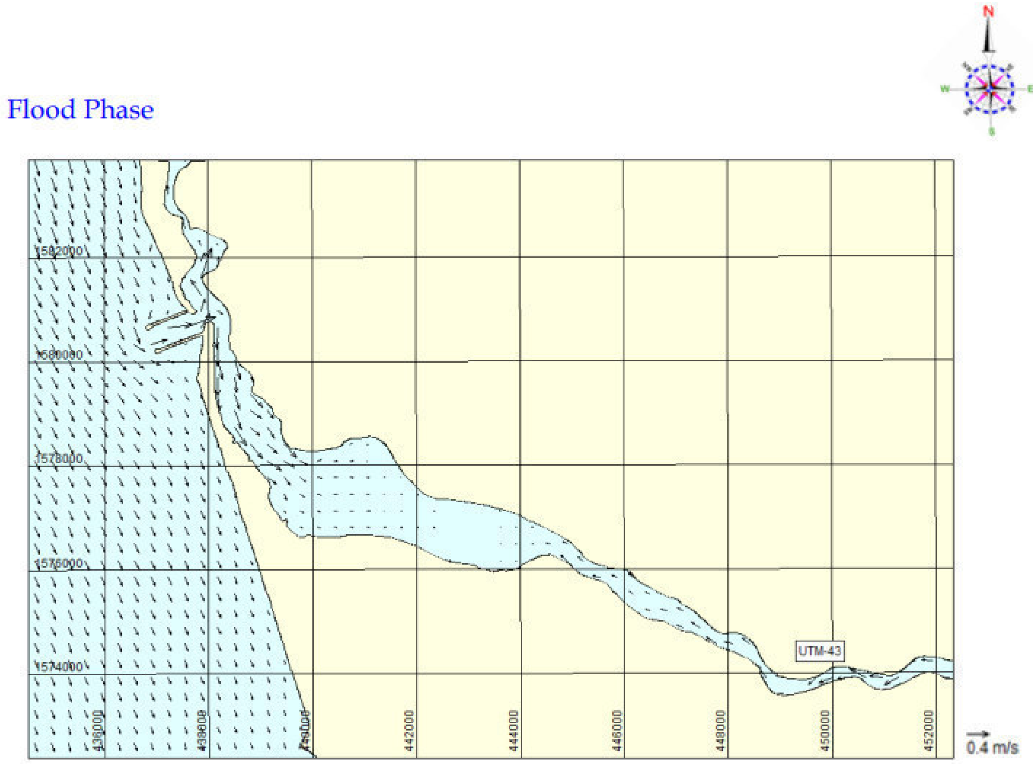
Figure 4-59: Variation of Simulated Tides & Currents at Station E3- Without Breakwater- NE Monsoon

4.5.4.2 Flow field with breakwater

Fairweather

Spring tide: The tide induced flow fields on a *spring tidal day* in case of with breakwater, when the wind effect is absent during flood and ebb tides are shown in **Figure 4-60**. At station E1, the maximum current speed during the flood tide on a spring tidal day showed around 0.22 m/s and directed towards southeast. At station E2, the current speed showed around 0.46 m/s and directed towards northeast. At station E3 inside the river, the current speed is 0.36 m/s, and the direction is towards southeast. On the other hand, during the ebb tide, the maximum current speed at station E1 was 0.17 m/s and it is directed towards southwest. At station E2, the current speed remained at 0.39 m/s and directed towards north. At station E3 inside the river, the current speed is 0.30 m/s, and the direction is towards northwest.

Neap tide: The tide induced flow fields on a *neap tidal day* in case of with breakwater, when the wind effect is absent during flood and ebb tides are shown in **Figure 4-61**. At station E1, the maximum current speed during the flood tide on a spring tidal day showed around 0.15 m/s and directed towards southeast. At station E2, the current speed showed around 0.31 m/s and directed towards northeast. At station E3 inside the river, the current speed is 0.24 m/s and the direction is towards southeast. On the other hand, during the ebb tide, the maximum current speed at station E1 was 0.12 m/s and it is directed towards southwest. At station E2, the current speed remained at 0.24 m/s and directed towards north. At station E3 inside the river, the current speed is 0.18 m/s and the direction is towards northwest.



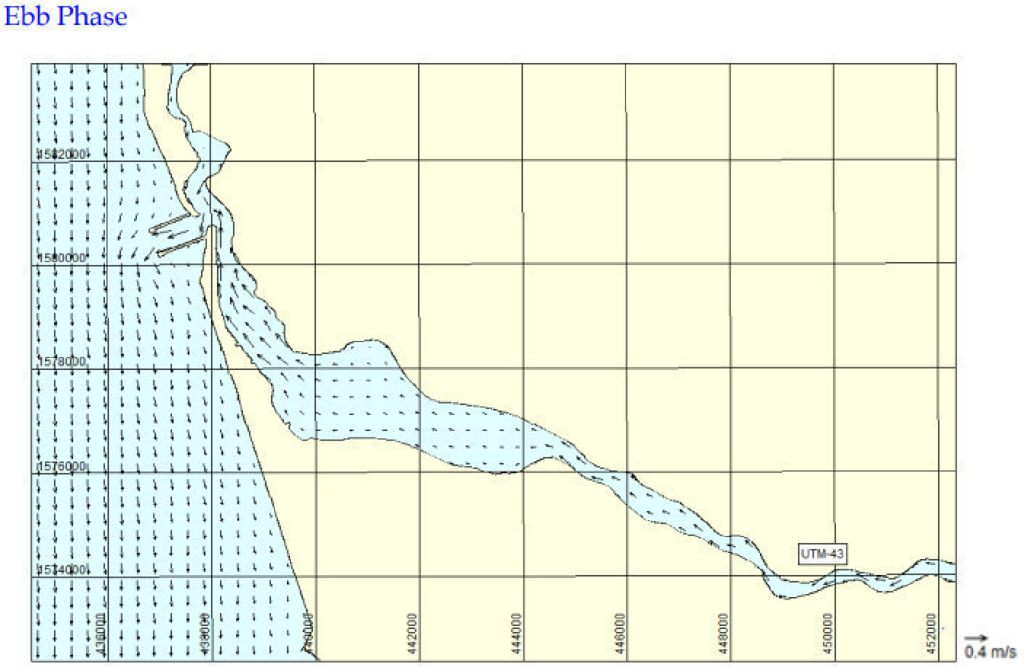


Figure 4-60: Flow Field- Fair Weather-Spring Tide- With Breakwater

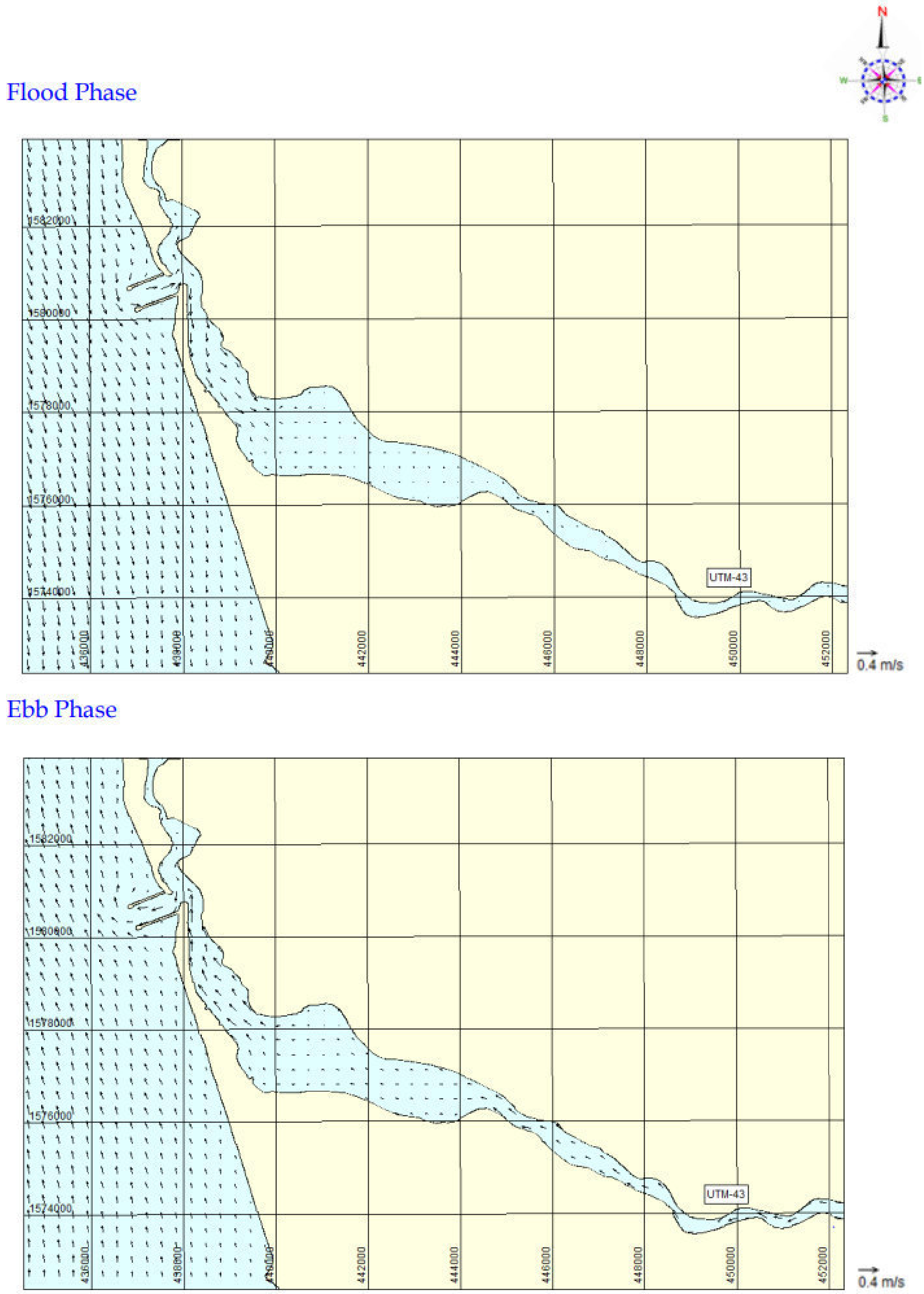


Figure 4-61: Flow Field- Fair Weather-Neap Tide- With Breakwater

Southwest monsoon

Spring tide: The tide induced flow fields on a *spring tidal day* in case of with breakwater, when the wind effect is maximum during southwest monsoon in case of flooding and ebbing tides are shown in **Figure 4-62.** At station E1, the maximum current speed during the flood tide on a spring tidal day showed around 0.25 m/s and directed towards northeast. At station E2, the current speed showed around 0.57 m/s and directed towards northeast. At station E3 inside the river, the current speed is 0.42 m/s and the direction is towards southeast. On the other hand, during the ebb tide, the maximum current speed at station E1 was 0.20 m/s and it is directed towards southwest. At station E2, the current speed remained at 0.50 m/s and directed towards southwest. At station E3 inside the river, the current speed is 0.38 m/s and the direction is towards northwest.

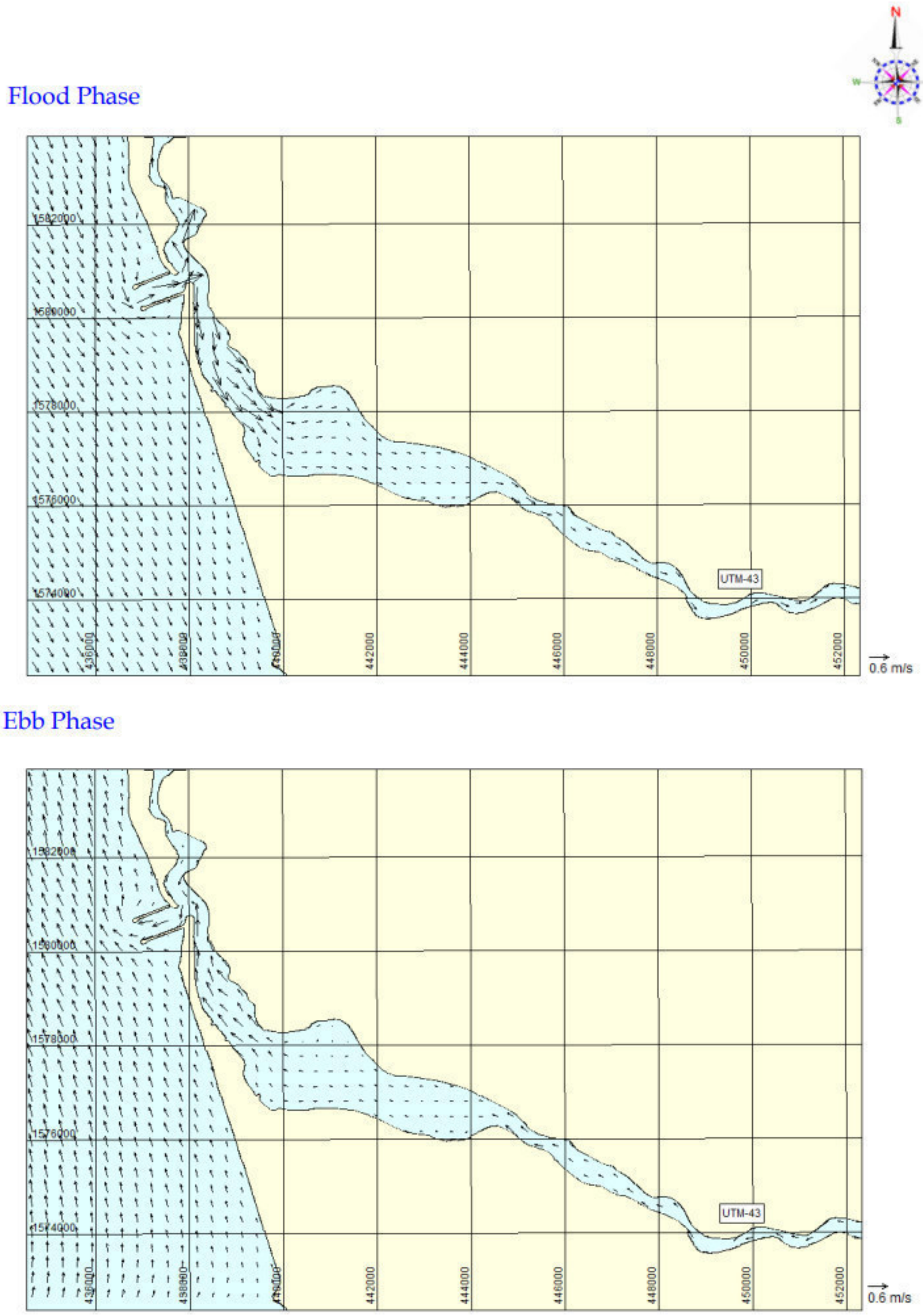


Figure 4-62: Flow Field- SW Weather-Spring Tide- With Breakwater

<u>Neap tide</u>**:** The tide induced flow fields on a *neap tidal day* in case of with breakwater, when the wind effect is maximum during southwest monsoon in case of flooding and ebbing tides are shown in **Figure 4-63.** At station E1, the maximum current speed during the flood tide on a spring tidal day showed around 0.22 m/s and directed towards northeast. At station E2, the current speed showed around 0.47 m/s and directed towards northeast. At station E3 inside the river, the current speed is 0.38 m/s, and the direction is towards southeast. On the other hand, during the ebb tide, the maximum current speed at station E1 was 0.18 m/s and it is

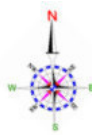
directed towards southwest. At station E2, the current speed remained at 0.41 m/s and directed towards southwest. At station E3 inside the river, the current speed is 0.29 m/s, and the direction is towards northwest.

Figure 4-63: Flow Field- SW Monsoon-Neap Tide- With Breakwater

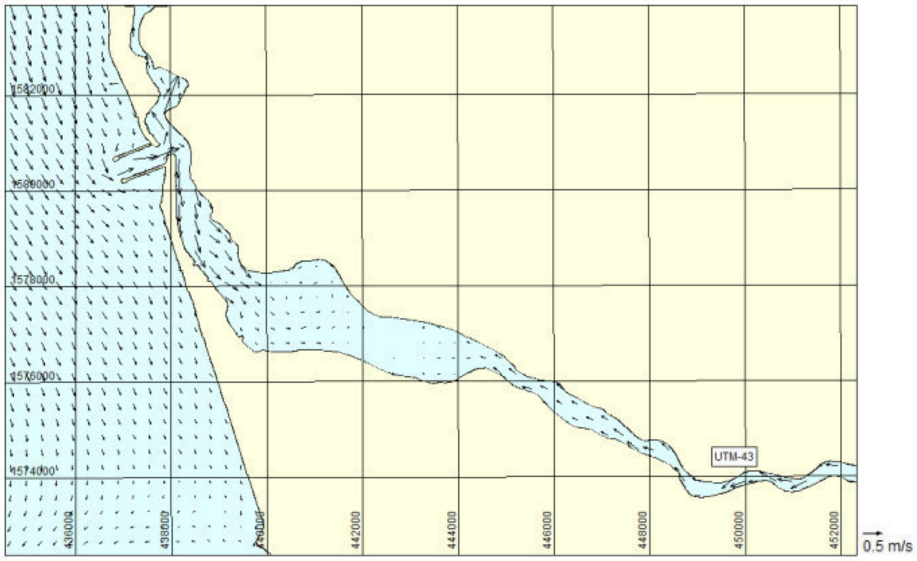
Northeast monsoon

<u>Spring tide:</u> The tide induced flow fields on a *spring tidal day* in case of with breakwater, when the wind effect is maximum during northeast monsoon in case of flooding and ebbing tides are shown in **Figure 4-64.** At station E1, the maximum current speed during the flood tide on a spring tidal day showed around 0.23 m/s and directed towards southeast. At station E2, the current speed showed around 0.54 m/s and directed towards northeast. At station E3 inside the river, the current speed is 0.41 m/s and the direction is towards southeast. On the other hand, during the ebb tide, the maximum current speed at station E1 was 0.18 m/s and

it is directed towards southwest. At station E2, the current speed remained at 0.46 m/s and directed towards southwest. At station E3 inside the river, the current speed is 0.37 m/s, and the direction is towards northwest.



Flood Phase



Ebb Phase

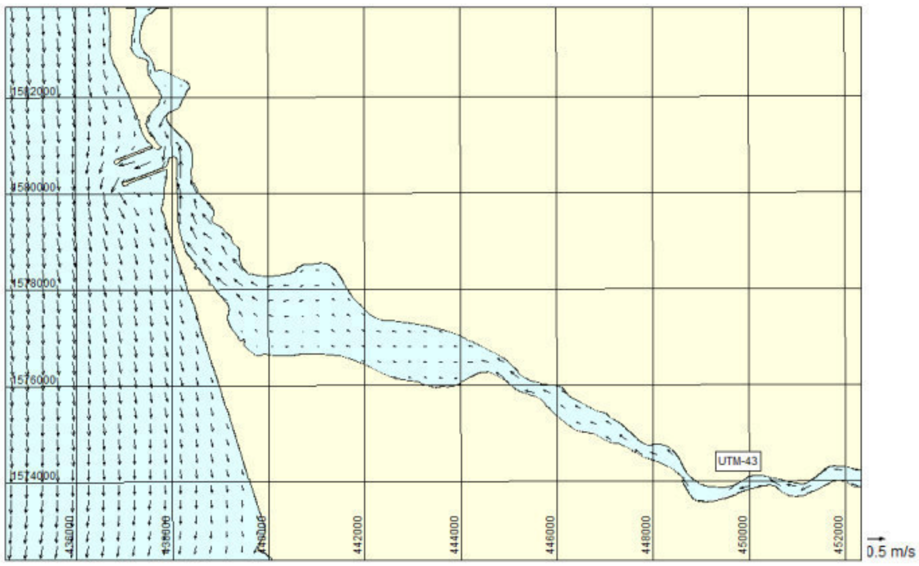


Figure 4-64: Flow Field- NE Monsoon-Spring Tide- With Breakwater

Neap tide**:** The wind and tide induced flow fields on a neap *tidal day* in case of with breakwater, when the wind effect is maximum in northeast monsoon are shown in case of flooding and ebbing tides in **Figure 4-65.** At station E1, the maximum current speed during the flood tide on a spring tidal day showed around 0.17 m/s and directed towards southeast. At station E2, the current speed showed around 0.39 m/s and directed towards northeast. At station E3 inside the river, the current speed is 0.31 m/s, and the direction is towards southeast. On the other hand, during the ebb tide, the maximum current speed at station E1 was 0.14 m/s and it is directed towards southwest. At station E2, the current speed remained at 0.34 m/s and directed towards southwest. At station E3 inside the river, the current speed is 0.29 m/s, and the direction is towards northwest.

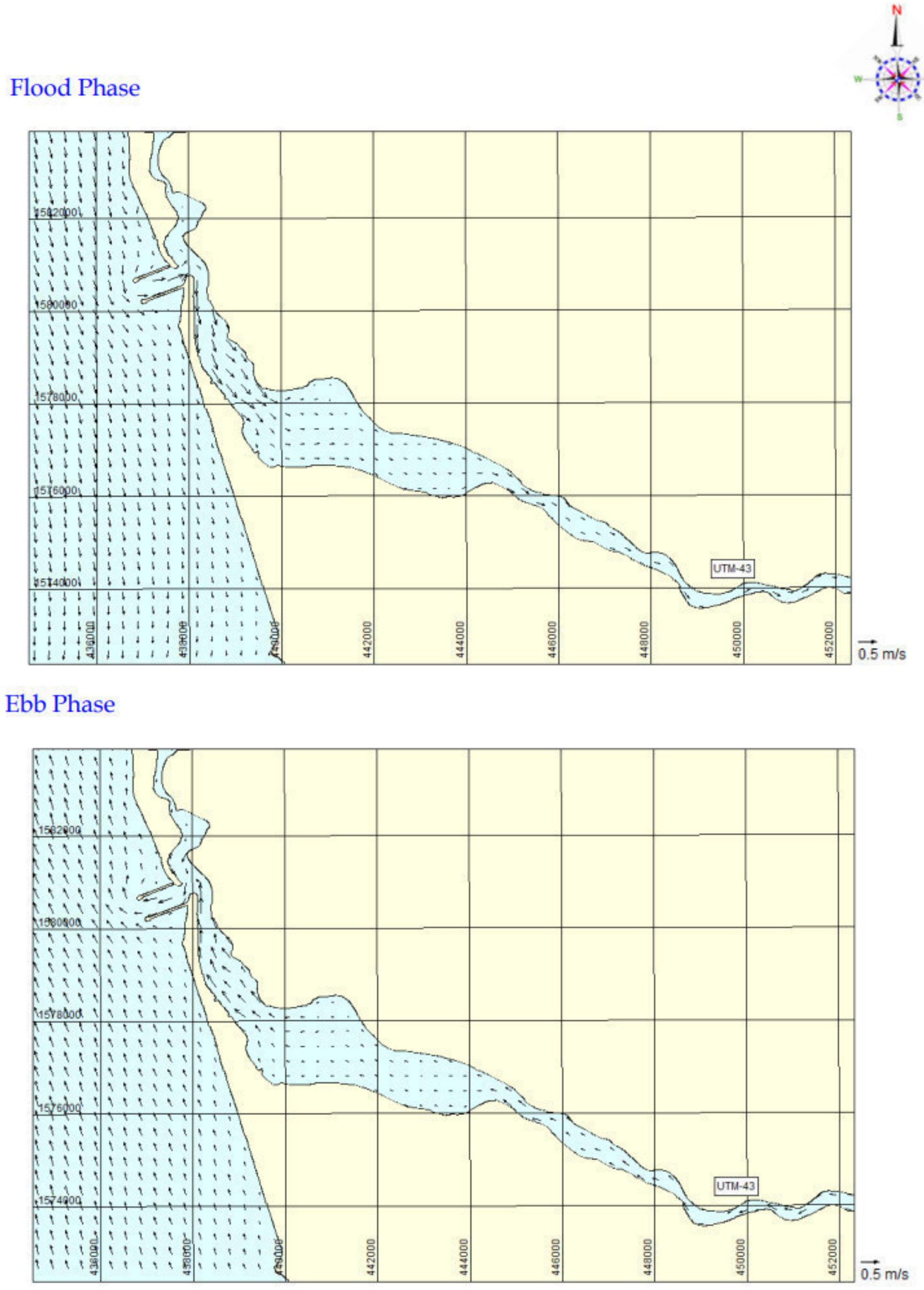


Figure 4-65: Flow Field- NE Monsoon-Neap Tide- With Breakwater

The time series variation of simulated tides, current speed, and direction for each extraction points during during fair weather, southwest monsoon and northeast monsoon are shown in **Figure 4-66 to Figure 4-74** respectively.

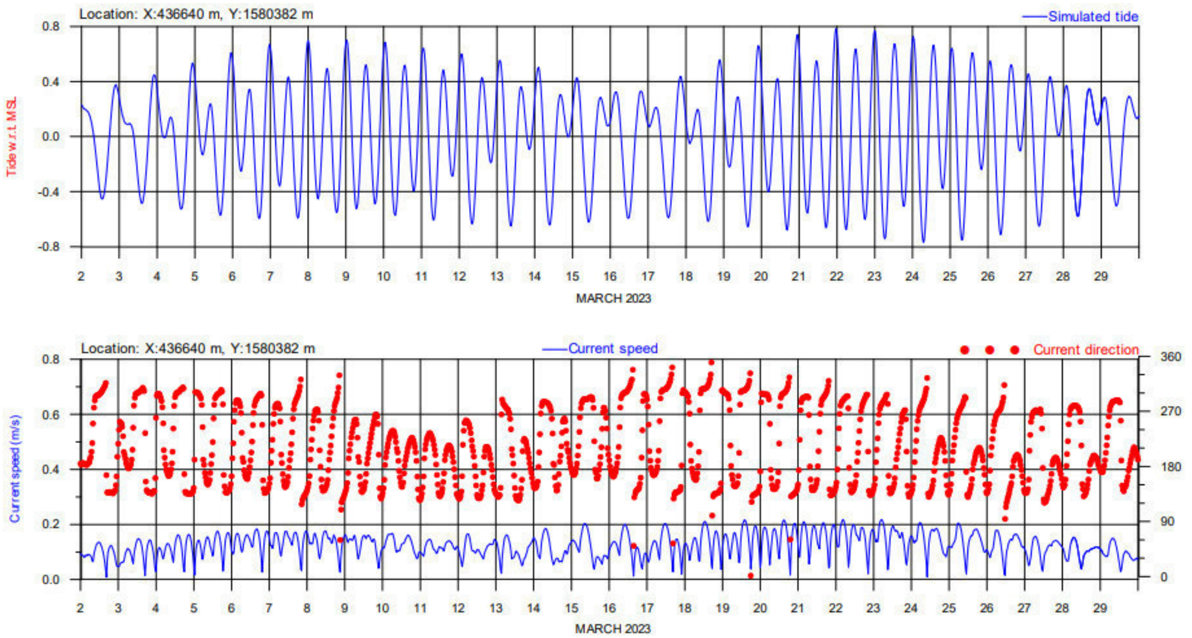


Figure 4-66: Variation of Simulated Tides & Currents at Station E1- with Breakwater-Fair Weather

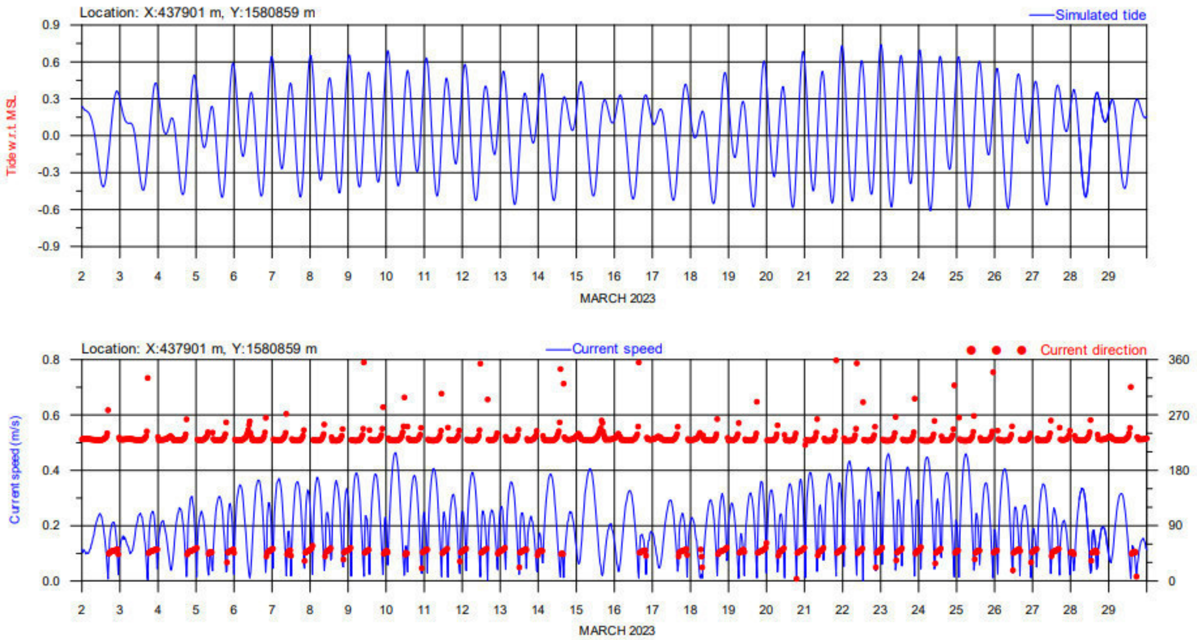


Figure 4-67: Variation of Simulated Tides & Currents at Station E2- with Breakwater-Fair Weather

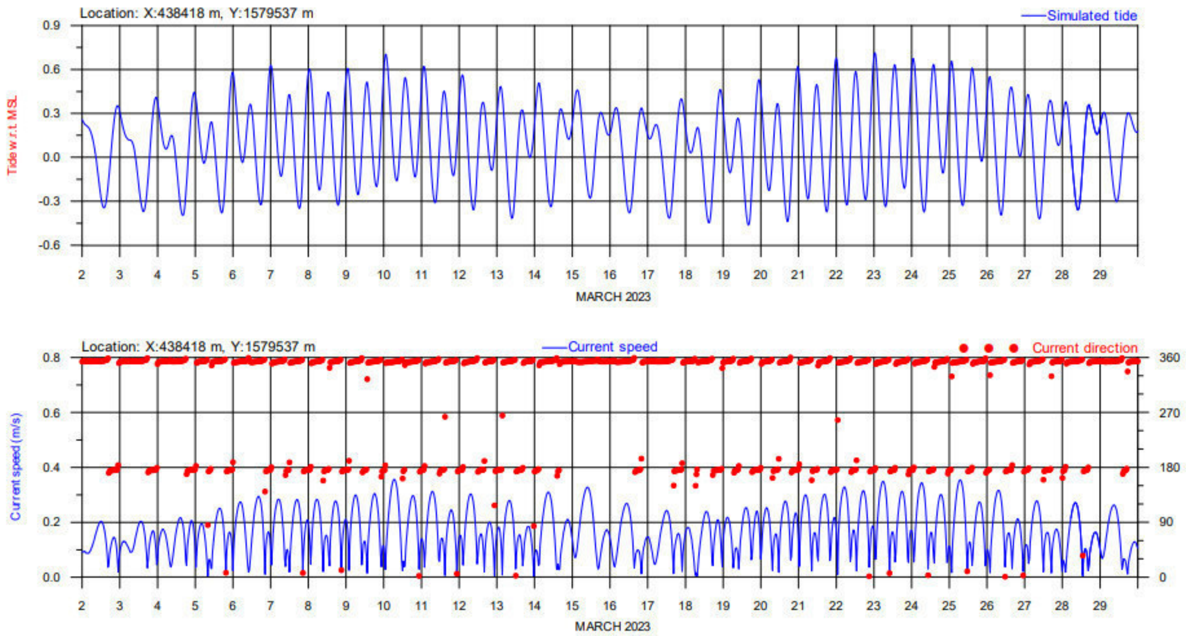


Figure 4-68: Variation of Simulated Tides & Currents at Station E3- with Breakwater-Fair Weather

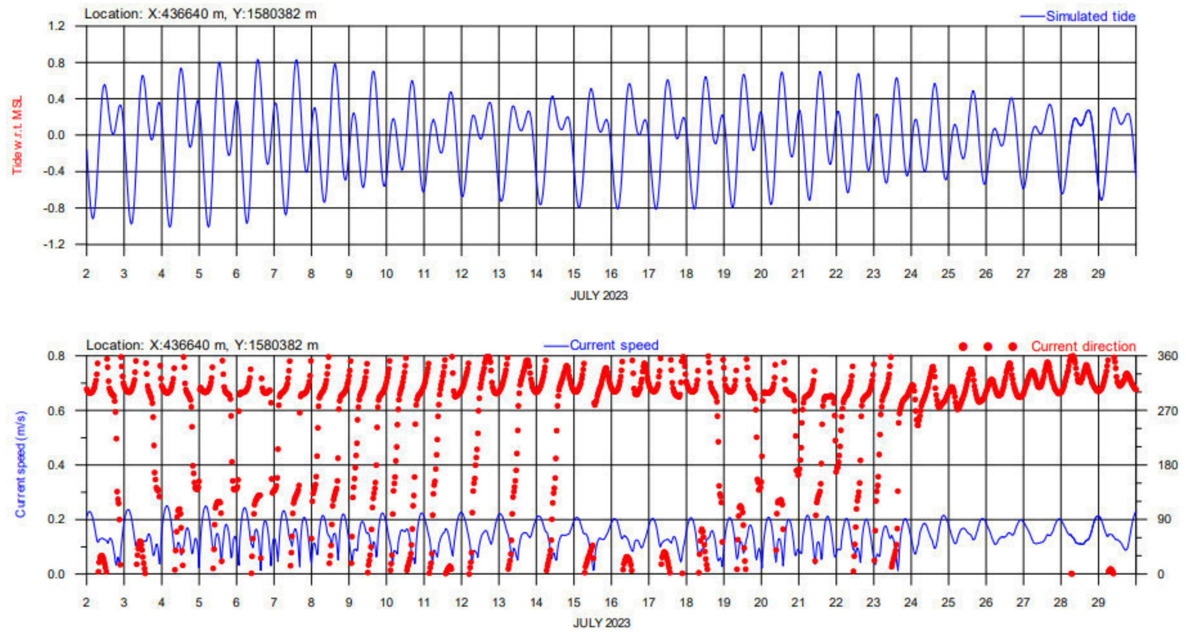


Figure 4-69: Variation of Simulated Tides & Currents at Station E1- with Breakwater-SW Monsoon

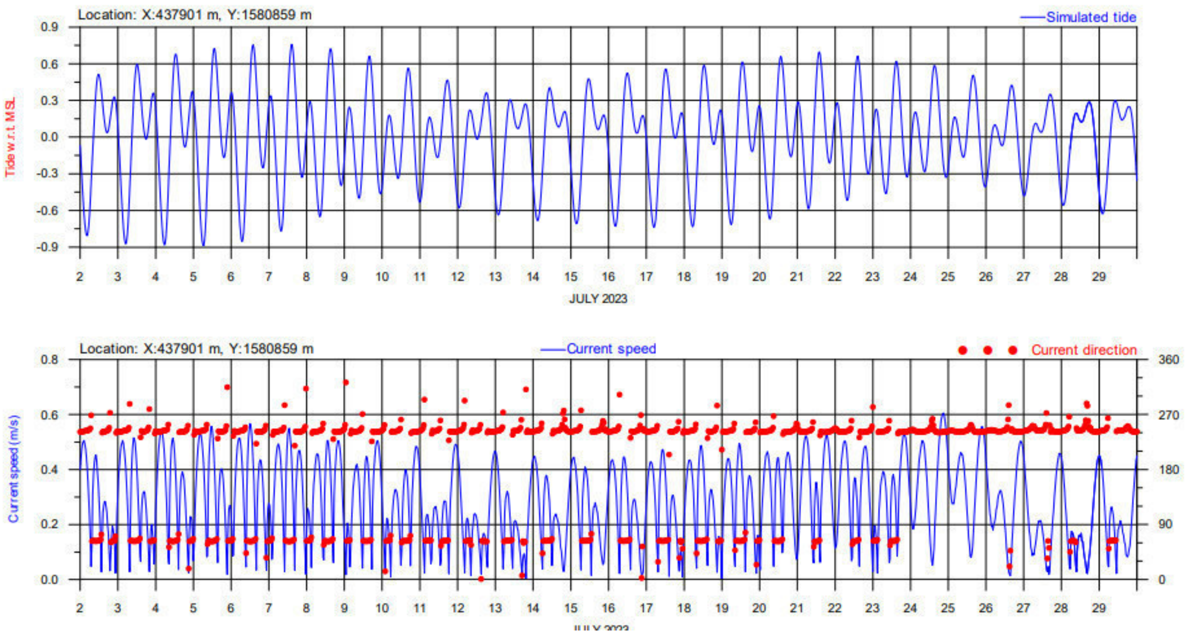


Figure 4-70: Variation of Simulated Tides & Currents at Station E2- with Breakwater-SW Monsoon

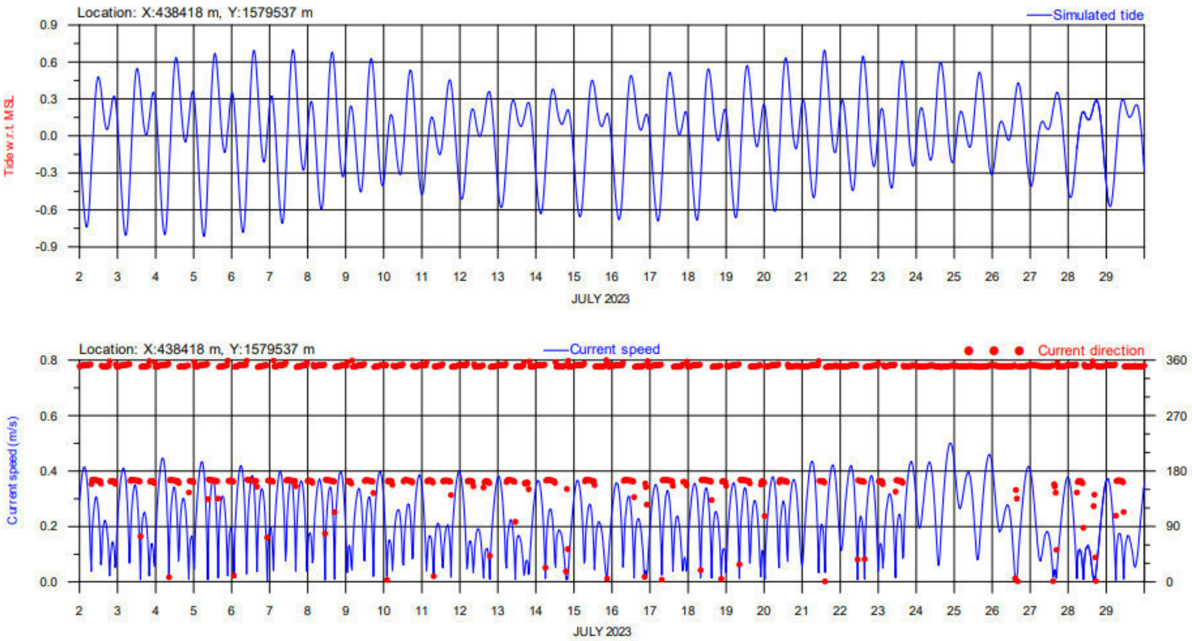


Figure 4-71: Variation of Simulated Tides & Currents at Station E3- with Breakwater-SW Monsoon

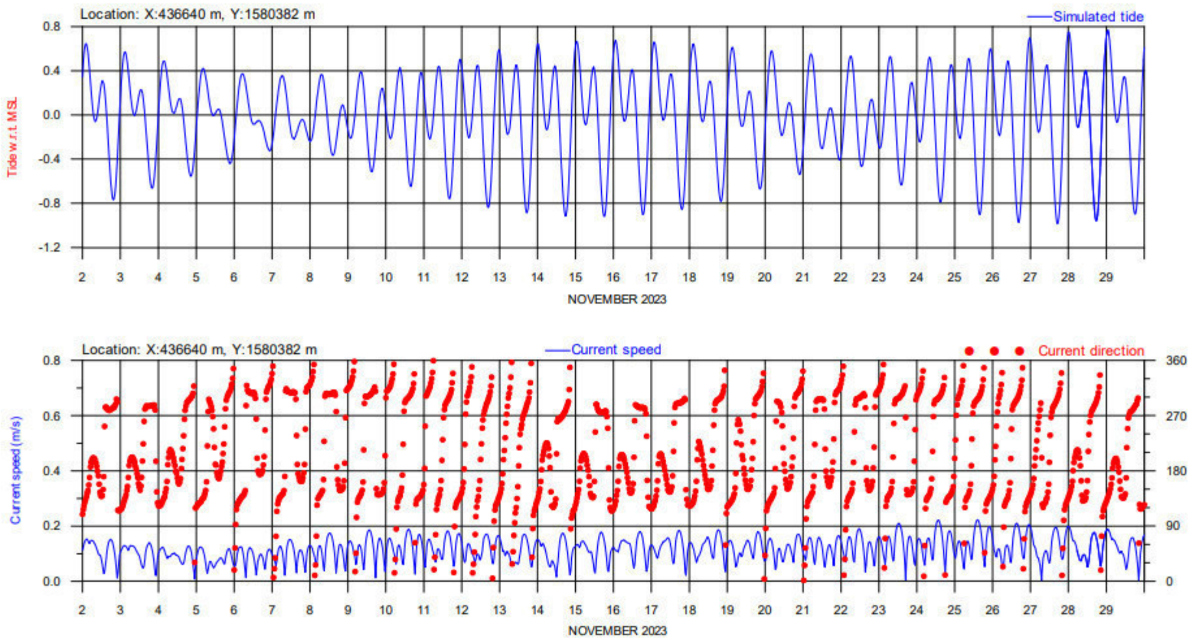


Figure 4-72: Variation of Simulated Tides & Currents at Station E1- with Breakwater- NE Monsoon

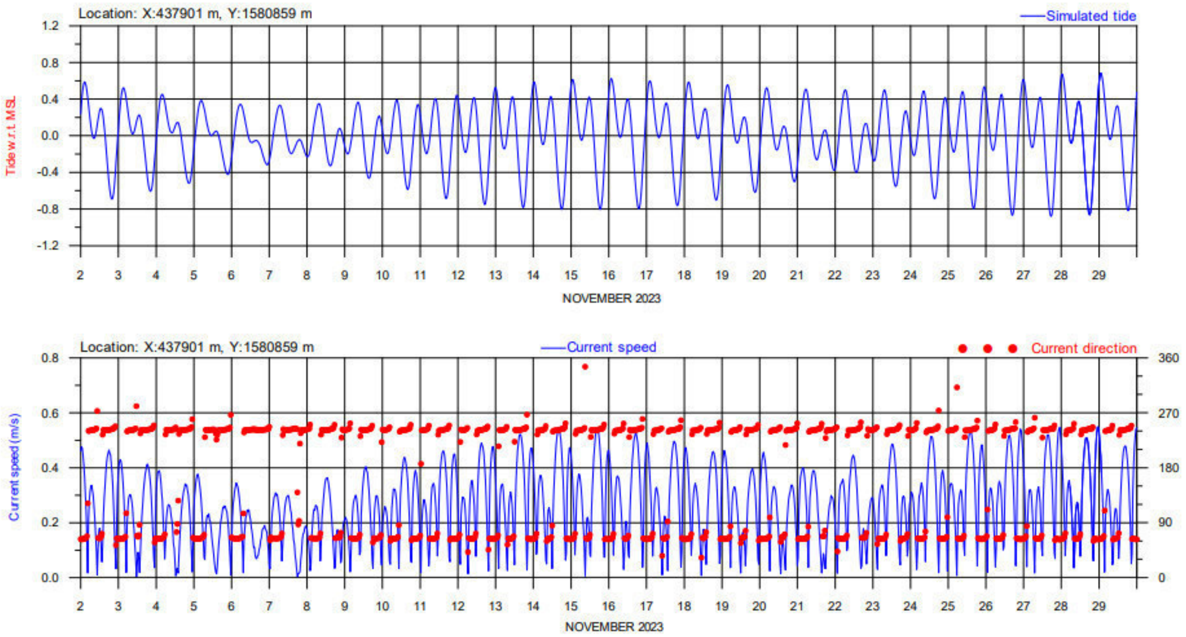


Figure 4-73:Variation of Simulated Tides & Currents at Station E2- with Breakwater- NE Monsoon

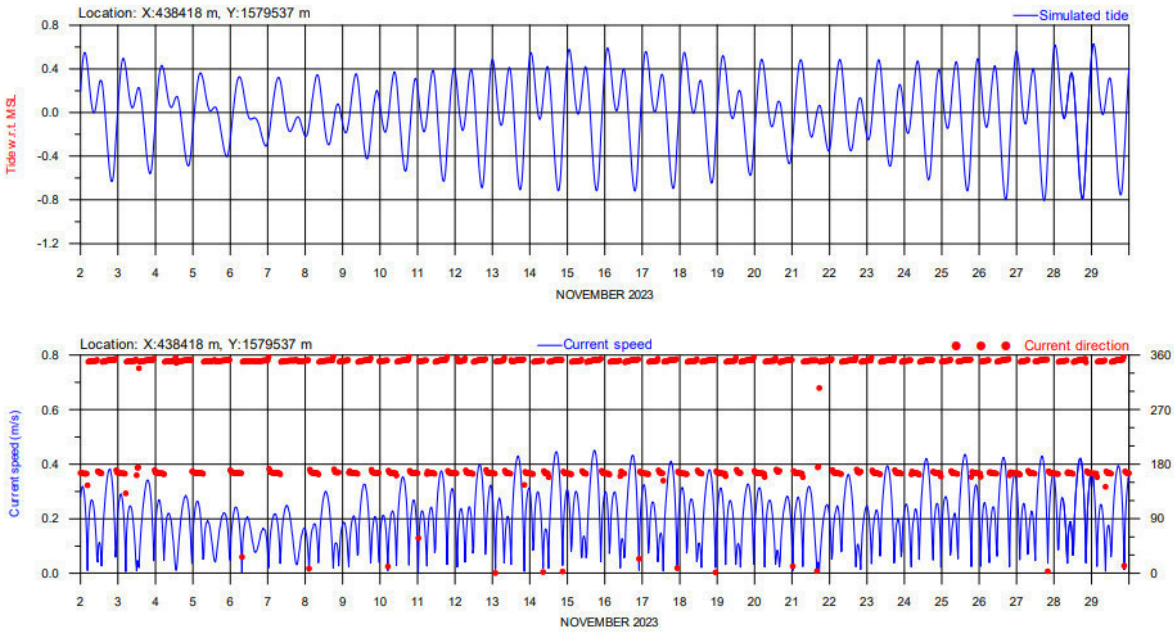


Figure 4-74:Variation of Simulated Tides & Currents at Station E3- with Breakwater- NE Monsoon

4.6 Conclusions

- The hydrodynamic model indicates that the current speed remains below 0.57 m/s under various conditions, including fair weather and monsoon seasons.
- There is no significant change in the flow field outside the port facilities before and after the construction of breakwater & associated facilities. While the direction of flow varies with tidal conditions and monsoon influences, the overall flow field at the project location remains largely unchanged.
- The construction of the proposed port facilities results in only a minor change in current speed near the project region. However, some current variation is observed at the river mouth between the breakwaters which is located in the navigational channel attributed to dredging activities.
- Based on the flow model for both scenarios, with and without the construction of port facilities, it is inferred that there is no significant change in the overall flow conditions, and a stable condition would prevail after the construction of the port facilities.

4.7 Air Environment

4.7.1 Potential Impact during Construction

4.7.1.1 Impact due to transportation of construction material

Construction material may cause fugitive emissions during its transportation; therefore it shall be covered during transportation.

The existing roads will be utilised for the transportation of raw materials during construction phase.

4.7.1.2 Emission during construction at site

During the construction activities, the sources of potential impacts on the air environment at the construction site can be categorised as:

- Exhaust emissions from diesel run engines, construction machinery and vehicles
- Dust suspension during site preparation, construction and material transport

Area development will involve developing the reclamation, internal road, utilities and services etc. Fugitive dust is expected particularly during dry weather conditions due to the site preparation and movement of transport vehicles for materials and personnel. Emissions from diesel power generators, construction equipment and transport vehicles will affect the air quality within the work areas, if not adequately managed. Movement of materials such as cement, steel, sand, etc. will cause disturbance to the adjoining communities/communities enroute.

Further, because of the prevailing strong winds along the coastal region and the resulting dispersion, the impact on air quality from pollutants would be reduced. The impacts during construction are short-term in nature and will cease on completion of the construction. Further, adoption of suitable mitigation measures will ensure that these impacts are rendered insignificant.

4.7.1.3 Mitigation Measures

<u>Construction Yard</u>

- During planning, it will be attempted to prevent / minimise disturbance to adjacent properties / habitations.
- Adequately sized construction yard will be provided at the site for storage of construction materials, equipment tools, earthmoving equipment, etc. In addition, temporary field offices and worker amenities will be provided. Appropriate spill control measures and labelling / handling procedures will be maintained.
- Construction sites will be provided with enclosures on all sides to prevent dispersion of dust and transmission of noise.
- Drainage system will be provided at construction yard. Measures will be taken to prevent silting of natural drainage due to runoff from construction areas.
- Proper area will be demarcated for storage of construction material. This will enable proper management of the materials including control of seepage and spillage thereby preventing contamination of the project area.

<u>Movement of Machinery and Equipment</u>

- Movement of material will be mostly during non-peak hours and regulated during peak hours. Mobile equipment such as intermittently used machines and transport vehicles will be either switched off or throttled down to a minimum.
- On-site vehicle speeds will be controlled to reduce excessive dust suspension in air and dispersion by traffic.
- Only PUC certified vehicles will be used for the transportation of material and equipments etc.
- Construction equipment and transport vehicles will be periodically washed to remove accumulated dirt.
- Vehicles transporting construction material susceptible for fugitive suspension will be covered with tarpaulin and will be prohibited from stopping near settlements.

Dust suppression

- Water sprinkling will be carried out to suppress fugitive dust during earthworks and along unpaved sections of access roads.

Environmental Awareness

- Environmental awareness program/training will be organised to the personnel involved in developmental works.

4.7.2 Potential Impact during Operation

The impact on air environment due to the operation of port has been predicted based on air quality modelling studies. The AAQ model studies covered the following:

- Point sources: emissions from vessels berthed during loading and unloading operations.
- Area Source: cargo storage in the port premises (coal and iron ore)
- Volume Sources: unloading/loading of coal/iron ore from vessel, unloading/loading of iron ore/coal in stockyards.
- Line Sources: emissions from trucks within the port that are used to transport the cargo.

4.7.2.1 Point Sources

Number of vessels visiting the port has been arrived based on the cargo handling rate and berth occupancy. Number of vessels expected to be berthed continuously are two vessels per day with maximum engine capacity and occupancy.

Potential sources of emissions of vessels are from the Main Engine (ME) and Auxiliary Engines (AE) and others such as boilers, emergency diesel engines and waste incinerators and emissions from these are relatively very small and can be considered negligible.

Main Engine (ME) will be used primarily for ship propulsion. Normally MEs are shut down in port, while Auxiliary Engine (AE) will be used for Electric power generation on board for lighting, ventilation, cranes, pumps etc. Pollutants are emitted when a shaft generator on the MEs is used and this has been considered in the model.

The emission of AE from the vessels that will be berthed each day at the Port has been considered for the point source emissions. It is assumed that the fuel used is MDO/HSD and the auxiliary engines will be running for 15 hours during loading and unloading at berths.

The details of emission factors, auxiliary engine capacity of the point source considered are given in **Table 4-3 and Table 4-4.**

Table 4-3: Details of Emission Factors

Description	Main/Auxiliary Engine Capacity (KW)	Fuel Type	Emission Factor (g/kwh)		
			PM	SO_2	NO_X
Vessel	364.37	MDO/HSD	0.3	4.3	10.9

Table 4-4: Details of Point Source

Auxiliary Engine of Vessels during Berthing					Emissions (g/s)			
Stack Code	Stack Height (m)	Stack Velocity (m/s)	Stack Dia (m)	Exit Temp (K)	PM_{10}	$PM_{2.5}$	SO_2	NO_2
P1, P2	18	25	0.8	593	0.27	0.11	6.53	16.55

4.7.2.2 Area Sources

The cargos proposed to be stored at the port are coal, iron ore, molasses, edible oil, fertilizers, granite and steel. Coal stockyard, iron ore stockyard and general cargo storage (open and closed) and liquid terminal are proposed within the port for the storage of these cargos. Out of these storages, significant fugitive emissions due to wind arise from coal and iron ore stockyard. Hence the fugitive emissions only from coal and iron ore stockyard are considered in the model.

Due to the fugitive dust emission from the stockpile, the dust particles will be carried by the wind and causes pollution. This would pollute other clean areas of the port.

Coal is susceptible to spontaneous combustion, most commonly due to oxidation of pyrite or other sulphidic contaminants in coal. Coal reacts with atmospheric oxygen even at ambient temperatures and this reaction is exothermic. If the heat liberated during the process is allowed to accumulate, the rate of the above reaction increases exponentially and there is a further rise in temperature. When this temperature reaches the ignition temperature of coal, the coal starts to burn and the phenomena is described as spontaneous combustion.

The spontaneous combustion of the coal as shown below would take place due to the voids in the pile and free flow of air. Initiation of spontaneous combustion is through development of hot spots in the coal stockpiles. This results in degradation of the coal. Wind and moisture in the coal play a major role in the spontaneous combustion of the coal. Wind supplies more oxygen for combustion. When the coal absorbs moisture, heat is generated. This heat increases the temperature of the coal. During the spontaneous combustion of coal, some gases would be produced. This gas is also carried by the wind and causes pollution in the surrounding environment.

Exhibit 4-1: Spontaneous Combustion of Coal

The significant factors to be considered for prevention of this development are as follows:

- Ventilation
- Coal Quality: low carbon content and large amounts of volatile components support combustion
- Particle Size: the smaller the particles, the larger the surface, the higher the risk
- Stockpile Design
- Humidity

- Frequent spraying of water at coal stockyard

Coal dust is prone to ignition depending on its concentration in air and presence of ignition sources. Coal dust therefore represents a significant explosion hazard in coal storage and handling facilities where coal dust clouds may be generated in enclosed spaces. The significant factors which contribute to the dust explosion are:

- Concentration of dust in suspension
- Sufficient oxygen to enable combustion
- Source of energy for ignition
- A certain degree of confinement of the suspended dust mixed with oxygen

Coal dust poses a possibility of reduced lung function. Workers exposed to coal dust may develop lung damage and pulmonary fibrosis.

Wet suppression has proved to be the most effective means for controlling fugitive dust emissions and spontaneous combustion from stockpiles. Moisture is added to capture the dust particles that are already airborne. It is basically designed to prevent lift off of dust from stockpile and road area. The nature and particle size of dust generated in the material handling system changes with change in size and characteristic of the material. In practice, the size of the dust particles has a very wide spectrum. A careful control of Air and Water Flow & Pressure is therefore necessary to obtain optimum dust suppression results. For this purpose, pressure regulators are provided in the system. Water is sprayed in at regular intervals depending on the site condition. The dust control is achieved by the agglomeration of dust particles with finely atomized water droplets equal to / close to / larger than the dust particles as the case may be, the collision between the water droplets and dust particles plays an important role in the process of agglomeration and heavier mass thus formed settles down to the source. Plain water dust suppression has been considered for top of Mobile hopper & Truck receipt area discharge chute. The system has been designed to control dust nuisance of the working environment during un-loading of coal from Grab & at the peripheral location of discharge chute of belt feeder towards truck receipt.

The fugitive emission from coal and iron ore stockyards are worked out considering the proposed air pollution control measures such as dust suppression measures and greenbelt etc.

The details of emission from storage area are given in **Table 4-5.**

Table 4-5: Area Sources Emission Details

Details of Emissions	Coal Stockpile				
	1	2	3	4	Iron Ore Stockpile
Wind Erosion TSP Emission Factor (kg/ha/Year)	260.46	260.46	260.46	260.46	434.11
Silt Content (%)	3	3	3	3	5
Storage Duration (Days)	365	365	365	365	365
Dry Days Per Year (No. of rainy days are 110.4 as per IMD data)	254.6	254.6	254.6	254.6	254.6
% Time of Wind >5.4 m/s (As per Met data Received)	2.6	2.6	2.6	2.6	2.6
Total Stockyard Area (m^2)	17830.4	17830.8	17776.8	17773.4	17773.4
Number of Stockpiles	1	1	1	1	1
Wind Erosion from Stockyard ($kg/m^2/year$)	0.026	0.026	0.026	0.026	0.043
Emission in $g/m^2/sec$	8.26E-07	8.26E-07	8.26E-07	8.26E-07	1.38E-06

Details of Emissions	Coal Stockpile				
	1	2	3	4	Iron Ore Stockpile
Emission due to Wind Erosion from Stockyard (g/s) WOC	**0.015**	**0.015**	**0.015**	**0.015**	**0.024**
Total Emissions with control (g/s-m^2) (80% of total Emissions)	1.65E-07	1.65E-07	1.65E-07	1.65E-07	2.75E-07
PM_{10} Emissions after Incorporating Control measures (g/s-m^2)	9.91E-08	9.91E-08	9.91E-08	9.91E-08	1.65E-07
$PM_{2.5}$ (g/s-m^2)	3.96E-08	3.96E-08	3.96E-08	3.96E-08	6.61E-08

4.7.2.3 Volume Sources

The fugitive emissions from loading and unloading of coal and iron ore are considered as they are significant when compared to fugitive emissions because of loading and unloading of other cargos. The loading of iron ore to vessel (export) and unloading of coal from vessel (import) are considered as volume sources.

Coal Handling

The coal from barges will be unloaded on the trucks with the help of mobile harbour cranes. Then from the truck it will be unloaded into stockpile in the designated coal storage area. The fugitive emissions which are likely to be generated during these operations are considered.

Iron Ore Handling

The Iron Ore brought from Bellary-Hospet region will be stored in the designated iron ore stackyard. From here the iron ore will be loaded to the trucks and unloaded onto the barges. The fugitive emissions which are likely to be generated during these operations are considered.

Covered and mechanized unloading points with dust suppression system are adopted which will reduce the fugitive emissions to the minimum.

The details of fugitive emissions[19] considered due to the above operations are given in **Table 4-6.**

Table 4-6: Emission Details due to unloading points at berths

S. No	Emission Scenario	Details
	COAL	
1	**Unloading from barges to trucks**	
	Unloading Emission Factor kg/t	1.9E-05
	Handling Capacity MTPA	2.7
	Emission due to unloading (kg/year)	51.18
	PM 10 Emission due to Unloading (g/s) WoC	0.002
	PM 10 Emission due to Unloading (g/s) WC (70% Control)	0.0005
	PM2.5 Emission due to Unloading (g/s) WC (40% of PM10)	0.0002
2	**Unloading at Stockyard from trucks**	
	Unloading Emission Factor kg/t	0.0017
	Handling Capacity MTPA	2.7
	Emission due to unloading (kg/year)	4590
	PM_{10} Emission due to Unloading (g/s) WoC	0.15
	PM_{10} Emission due to Unloading (g/s) WC (70% Control)	0.04
	$PM_{2.5}$ Emission due to Unloading (g/s) WC (40% of PM10)	0.02

[19] Emission factor source: National Pollutant inventory emission estimation technique manual for mining

S. No	Emission Scenario	Details
	COAL	
	IRON ORE	
1	**Loading to trucks**	
	Unloading Emission Factor kg/t	0.013
	Handling Capacity MTPA	1
	Emission due to unloading (kg/year)	13000
	PM_{10} Emission due to Unloading (g/s) WoC	0.41
	PM_{10} Emission due to Unloading (g/s) WC (70% Control)	0.12
	$PM_{2.5}$ Emission due to Unloading (g/s) WC (40% of PM10)	0.05
2	**Loading to barges from trucks**	
	Unloading Emission Factor kg/t	1.9E-05
	Handling Capacity MTPA	1
	Emission due to unloading (kg/year)	94.78
	PM 10 Emission due to Unloading (g/s) WoC	0.0030
	PM 10 Emission due to Unloading (g/s) WC (70% Control)	0.0009
	PM2.5 Emission due to Unloading (g/s) WC (40% of PM10)	0.0004

These emissions are assumed as continuous in nature for Air Quality modelling for prediction of impacts.

4.7.2.4 Line Sources

It is proposed that the cargo will be transported by road through the proposed NH-66 to port connectivity.

The emission due to the proposed cargo trucks has been considered. The emission factors for heavy vehicles are taken from the report published by CPCB. EURO VI emission factors are assumed to be implemented and are considered for calculating the vehicular exhaust emissions.

The details of the emissions from the heavy vehicles are given in **Table 4-7**.

Table 4-7: Emission Details of vehicles travelling from within the port till NH-66

Parameter	Within the Port	Port entry to NH-66	Road Proposed for strengthening
Vehicle Trips per Day	1320	1320	1320
Emission factor of SO_2 (g/km)	0.0040	0.0040	0.0040
Emission rate of SO_2 (g/s)	0.0002	0.00017	0.00013
Emission factor of PM (g/km)	0.0300	0.0300	0.0300
Emission rate of PM_{10} (g/s)	0.0008	0.0007	0.0006
Emission rate of $PM_{2.5}$ (g/s)	0.0003	0.0003	0.0002
Emission factor of NO_x (g/km)	0.6900	0.6900	0.6900
Emission rate of NO_x (g/s)	0.03	0.027	0.02

These emissions are assumed as continuous in nature and the line source is considered as a string of volume sources for Air Quality modelling for prediction of impacts.

4.7.2.5 Other Emissions

Other emissions include fugitive emissions from emergency DG set etc., which can be controlled by selecting suitable equipment, appropriate handling methods etc., and hence no emissions from these sources were considered.

As all the above emissions are expected only during emergency situation, they were not considered in the air quality modelling study.

4.7.3 AERMOD Model

AERMOD is a 'near-field, steady-state' Gaussian model. It uses boundary-layer similarity theory to define turbulence and dispersion coefficients as a continuum, rather than as a discrete set of stability classes. Variation of turbulence with height allows a better treatment of dispersion from different release heights. AERMOD requires Surface as well as Upper Air data as meteorological input.

4.7.3.1 Model Assumptions

The following are the assumptions for the air quality modelling:

a. Uses rural dispersion

b. Stack-tip downwash

c. Model assumes receptor on flat terrain

d. Uses calms processing routine

e. Uses missing data processing routine

f. No exponential decay

g. No Dry and Wet Depletion

4.7.3.2 Input Data

The following data was used as input to the AERMOD model:

a. Point Source inputs as given in **Table 4-4**
b. Area Source Inputs as given in **Table 4-5**
c. Volume Source Inputs as given in **Table 4-6**
d. Line Source Inputs as given in **Table 4-7**

4.7.3.3 Meteorological Data Considered

For the purpose of carrying out the air quality modelling study, site specific meteorological data (pre-processed from MM5) for the year of 2023 (1st January 2023 -31st December 2023) obtained from Lakes Environment was used. The raw met data have been processed in AERMET view to create surface and upper air data which can be used as inputs to AERMOD.

The wind roses were drawn for the met files obtained on a sixteen-point compass (N, NNE, NE, ENE; E, ESE, SE, SSE; S, SSW, SW, WSW; W, WNW, NW, and NNW). Wind pattern representing 24 hours for the entire year of 2023 is discussed. The frequency occurrence of wind at various speeds was calculated on the basis of total number of observations recorded in the respective wind speed category. The overall wind pattern recorded for 24 hours during the year 2023 is given **in Figure 4-75.** The predominant wind directions observed were from West followed by West North West; calm conditions prevailed for 0.96% of the total time. The average wind speed was observed to be 2.79 m/s.

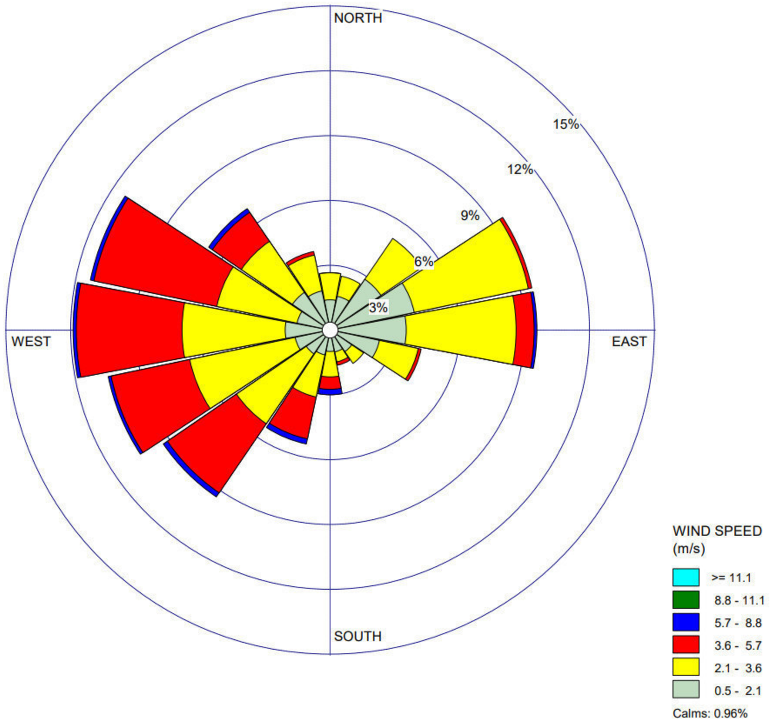


Figure 4-75: Annual Wind Rose Diagram

4.7.3.4 Receptor Location

The details of the receptors which are monitored for the baseline data as a part of EIA Study within 10.0 km radius from project boundary are given in **Table 4-8**.

Table 4-8: Receptor Details

Location No.	Receptors	Distance (km)	Azimuth Directions
AAQ-1	Honnavar	1.8 km	SE
AAQ-2	Kasarkod	4.2 km	SE
AAQ-3	Karki	0.9 km	E
AAQ-4	Ramtirth	3.0 km	E
AAQ-5	Kulkod	4.3 km	E
AAQ-6	Hosad	7.0 km	SE

Note: Distances and Directions have been taken from the project boundary

4.7.3.5 Model Results

The 1st highest 24 hour and annual average incremental and the resultant concentration for PM_{10}, $PM_{2.5}$, SO_2 and NO_2 for AAQ monitoring locations for the proposed development are given in **Table 4-9 to Table 4-12.**

Table 4-9: 1st 24-hour Average Incremental and Resultant Concentration of PM_{10}

Receptor	Baseline Concentration (µg/m³)	1st 24 Hour Average Incremental Concentration (µg/m³)	Resultant Concentration (µg/m³)	NAAQ Standard (µg/m³)
AAQ-1	56.90	0.73	57.63	100
AAQ-2	46.30	0.32	46.62	
AAQ-3	41.90	1.06	42.96	
AAQ-4	43.40	0.52	43.92	
AAQ-5	36.40	0.53	36.93	
AAQ-6	38.90	0.24	39.14	

Table 4-10: 1st 24-hour Average Incremental and Resultant Concentration of $PM_{2.5}$

Receptor	Baseline Concentration (µg/m³)	1st 24 Hour Average Incremental Concentration (µg/m³)	Resultant Concentration (µg/m³)	NAAQ Standard (µg/m³)
AAQ-1	27.80	0.32	28.12	60
AAQ-2	22.50	0.14	22.64	
AAQ-3	19.10	0.68	19.78	
AAQ-4	22.20	0.22	22.42	
AAQ-5	18.50	0.22	18.72	
AAQ-6	20.40	0.10	20.50	

Table 4-11: 1st 24-hour Average Incremental and Resultant Concentration of SO_2

Receptor	Baseline Concentration (µg/m³)	1st 24 Hour Average Incremental Concentration (µg/m³)	Resultant Concentration (µg/m³)	NAAQ Standard (µg/m³)
AAQ-1	9.60	5.53	15.13	80
AAQ-2	8.20	2.00	10.20	
AAQ-3	6.20	22.33	28.53	
AAQ-4	7	7.94	14.94	
AAQ-5	5.60	5.71	11.31	
AAQ-6	6.40	3.64	10.04	

Table 4-12: 1st 24-hour Average Incremental and Resultant Concentration of NO_2

Receptor	Baseline Concentration (µg/m³)	1st 24 Hour Average Incremental Concentration (µg/m³)	Resultant Concentration (µg/m³)	NAAQ Standard (µg/m³)
AAQ-1	22.60	14.07	36.67	80
AAQ-2	16.90	5.10	22.00	
AAQ-3	14.70	56.63	71.33	
AAQ-4	19.60	20.13	39.73	
AAQ-5	15.70	14.50	30.20	
AAQ-6	17.30	9.25	26.55	

Table 4-13: Annual Average Incremental Concentration

Receptor	Annual Average Incremental Concentration (µg/m³)			
	PM_{10}	$PM_{2.5}$	SO_x	NO_x
AAQ-1	0.09	0.04	0.70	1.80
AAQ-2	0.02	0.01	0.21	0.56
AAQ-3	0.22	0.09	2.60	6.63
AAQ-4	0.05	0.02	0.69	1.75
AAQ-5	0.05	0.02	0.53	1.35
AAQ-6	0.01	0.01	0.20	0.50
NAAQ Standard (µg/m³)	**60**	**40**	**50**	**40**

4.7.3.6 Isopleths

The Isopleths for 1st incremental 24-hour Average Concentration of all the parameters due to the emissions are given in **Figure 4-76 to Figure 4-80.**

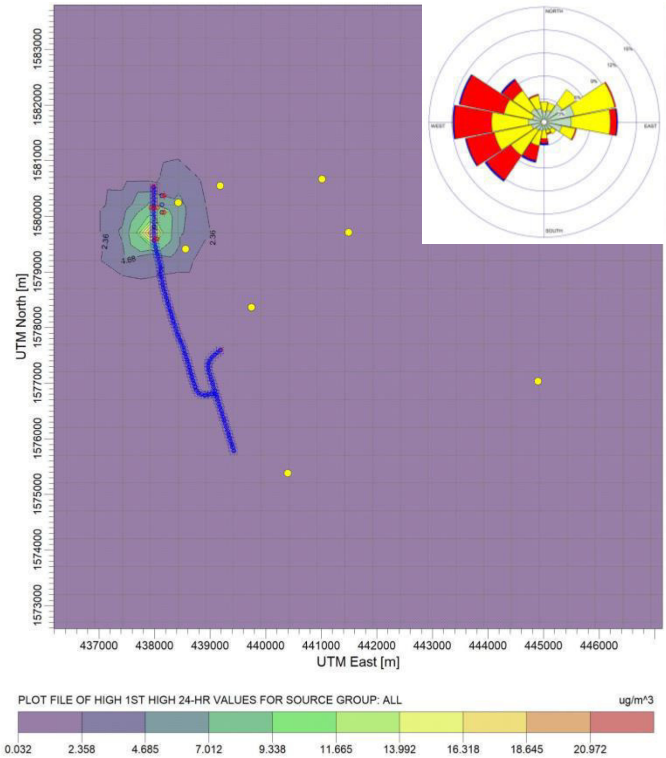


Figure 4-76: Isopleth for 1st 24-Hr Average Incremental Concentration of PM_{10}

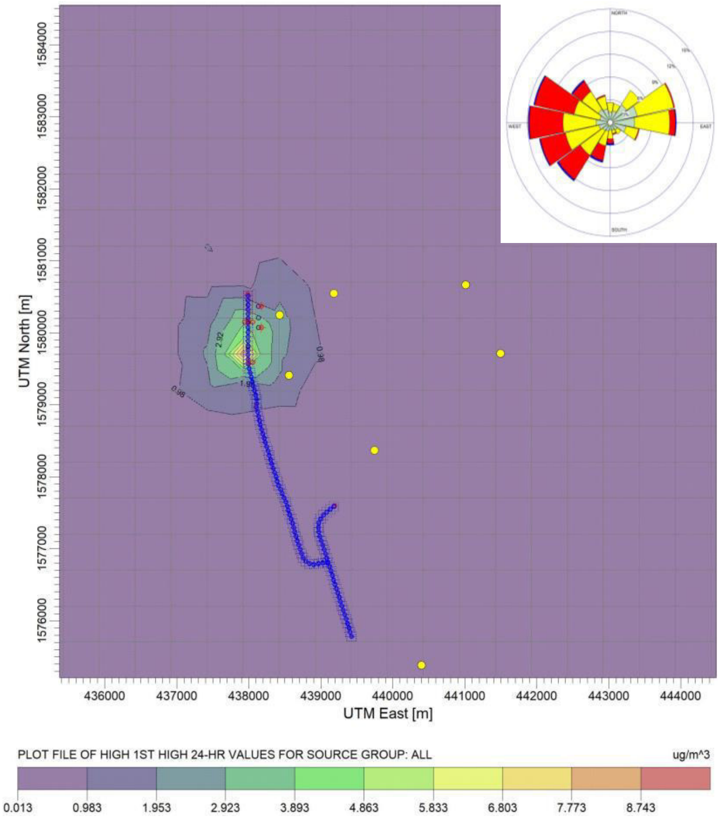


Figure 4-77: Isopleth for 1st 24-Hr Average Incremental Concentration of $PM_{2.5}$

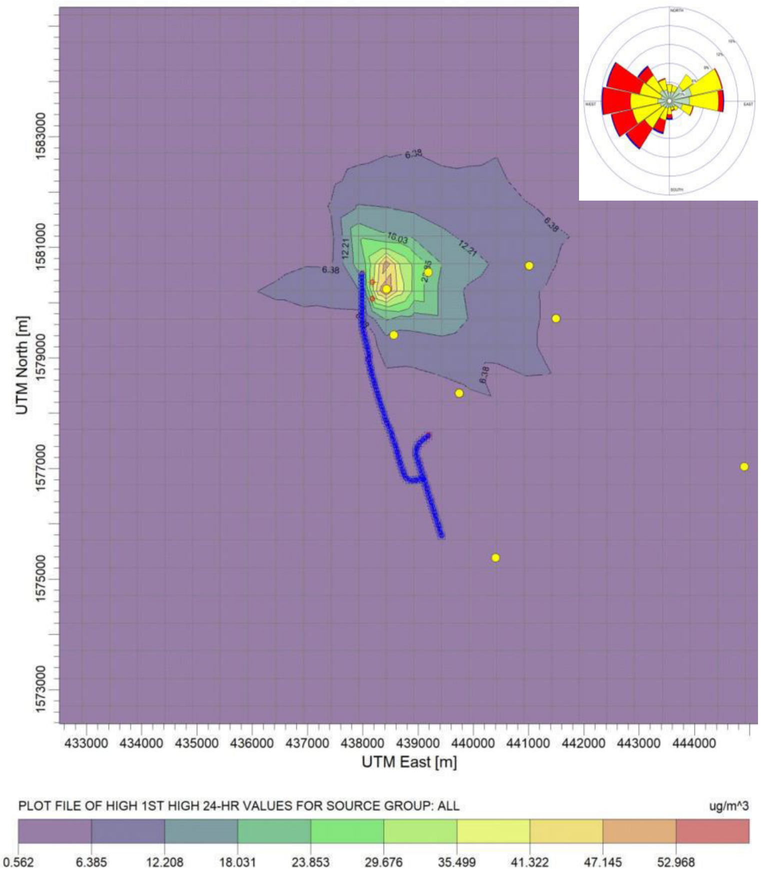


Figure 4-78: Isopleth for 1st 24-Hr Average Incremental Concentration of SO_2

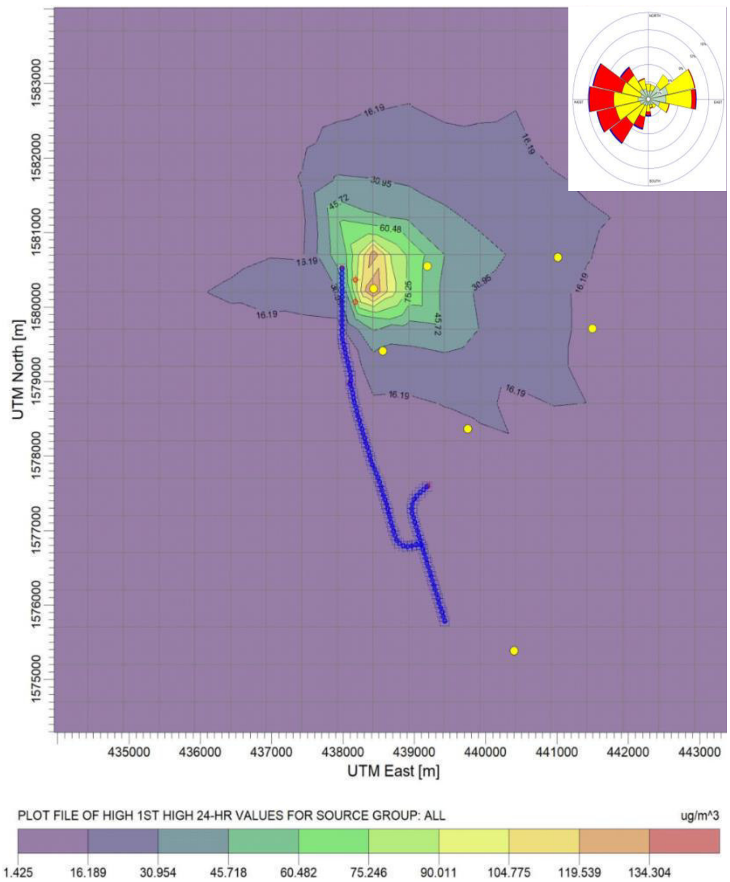


Figure 4-79: Isopleth for 1st 24-Hr Average Incremental Concentration of NO_2

4.7.3.7 Observations at Receptors

The 1st highest 24 hour average resultant concentrations of PM_{10}, $PM_{2.5}$, SO_2 and NO_2 for AAQ monitoring receptors locations are found to be well within the National Ambient Air Quality Standards (NAAQS), 2009 for the entire scenarios considered.

The Annual average resultant concentrations of PM_{10}, $PM_{2.5}$, SO_2 and NO_2 for AAQ monitoring receptors locations are found to be within the National Ambient Air Quality Standards (NAAQS), 2009.

4.7.4 Mitigation Measures

- Ambient air quality monitoring will be carried out regularly at selected locations in the predicted maximum impact zone in order to check and compare the predicted concentrations with the measured concentrations.
- Provision of avenue plantation along the roads and greenbelt development along the layout boundary.
- Provisions of adequate green buffers between facilities and utilities/common areas
- All the vehicles and other equipment will be periodically checked to ensure compliance to the emission standards
- Water sprinkling will be carried out on road surfaces and to suppress fugitive dust emission during multi-purpose cargo handling in the project area.
- The open stockpile of the bulk cargo shall be covered with HDPE sheets
- Wagons shall be covered to the extent permissible by Indian Railways.
- Plantation/Greenbelt shall be considered all along the periphery of the port
- Atomized water sprinkling shall be carried out on the top of the heap at regular intervals as required.
- Regular sweeping of cargo dust from internal and main road and also ensure that there is adequate space for free movement of vehicles
- Dust suppression measures (such as at Ship unloader discharging in to hoppers, Stockyards, Discharge and feeding points of conveyors, Rapid loading system etc.) shall be implemented

The Annex VI of MARPOL Convention deals with the “Regulations for the Prevention of Air Pollution from Ships”. It sets limits on NO_2 and SO_2 emissions from ship exhausts, and prohibits deliberate emissions of ozone depleting substances. It also prohibits the incineration on board ships of certain products, such as contaminated packaging materials and polychlorinated biphenyls (PCBs). The vessels are required to comply with the regulations and should have the “International Air Pollution Prevention Certificate”. The project proponent will take all appropriate measures to comply exhaust emission from vessels in accordance with MARPOL regulations and Euro Emission standard norms so as to reduce pollution load in the air environment.

4.8 Noise Pollution

4.8.1 Potential Impact during Construction

Construction activities increase ambient noise levels. There would be impact on noise levels due to the following:

- Vehicles transporting construction and Cargo material
- Diesel run engines of construction machinery and dredgers
- Pile driving activities during construction of cargo berths.

Noise is an inherent part of construction activity and response of species / communities would be either attracted or diverted away from the region. Noise generated from diesel engines of dredgers, workboats, etc. could result in movement of mobile faunal species away from area of operation.

There would be a degree of avoidance behaviour exhibited by marine species initially and they would eventually be expected to return once they become accustomed to increased noise levels or once the noise source has moved or ceased. Noise generating sources are mobile and hence, the impact will be localised and short-term in nature.

Marine species in the vicinity of project site are accustomed to noise generated from movement of fishing vessels and are likely to tolerate increased noise generated from workboats and construction activities.

Noise generated from construction activities will be predominantly confined within project site and will impact construction workers at site. Impacts due to these activities would be short-term in nature and localised.

4.8.1.1 Mitigation Measures

The following mitigation measures will be followed to minimise the noise generation and the associated impacts:

- During construction, noise levels will be maintained below threshold levels stipulated by Central Pollution Control Board (CPCB) by selecting appropriate equipment, machinery and using enclosures. Procurement of machinery / construction equipment will be done in accordance with specifications conforming to source noise levels less than 75 dB (A).
- Only well-maintained construction equipment, which meets the regulatory standards for source noise levels, will be used. Any equipment emitting high noise, wherever possible, will be oriented so that the noise is directed away from sensitive receptors.
- Noise attenuation will be practised for noisy equipment by employing suitable techniques such as acoustic controls, insulation and vibration dampers. The attenuation devices will be properly maintained throughout the construction period.
- High noise generating activities such as piling and drilling will be scheduled to minimise noise impacts.
- Personnel exposed to noise levels beyond threshold limits will be provided with protective gear like earplugs, muffs, etc. especially construction personnel involved in pile driving operations. Rotation of personnel will also be adopted.
- Periodic maintenance of the equipment to be used in the developmental works will be carried out. Worn out parts will be replaced and rotating parts will be lubricated to minimise noise emissions.
- Ambient noise levels will be monitored at regular intervals during construction phase of the project.
- All haul roads (for truck transport and other vehicles) within the boundary and outside will be sealed and maintained properly to avoid excessive noise levels from Engine acceleration and deceleration

4.8.2 Potential Impact during Operation

During the operational phase, noise will be generated due to the operation of the generators, pumps, engines of boats and barges, cranes for handling of goods, cargo and shipment vehicles. Noise will also be generated considerably from the warehouse, repair and maintenance block, service area, goods loading and unloading.

Workers exposed to excessive noise will use appropriate Personal Protecting Equipment (PPE) including ear plugs, muffs, or both when engineering or administrative controls are not feasible to reduce exposure. Hence, it is anticipated that there would not be significant impact of noise on the work personnel.

Impact on noise environment

For the proposed Barge / vessel loading facility the following are the principal source of noise considered for this study

- Diesel Generates
- Barge/vessel, Loaders/unloaders
- Pay loaders
- Harbour Crane

The stationary sources are considered for the present noise modelling study. The noise emission standard for individual unit / equipments as prescribed by central pollution control board is 85dB (A).

$L_s= L_w-8-20\log(S)-D1+K_o+ðL$............................(2)

L_S= Expected sound pressure level from the measuring point (receptor)

L_W= Cumulative sound pressure level at the source

S=Distance between the surface noise source and receptor

D1= surface directivity factor due to different radiation angle

K_0= reflection effect from the surrounding environment / building

ðL= Correction factor for other effects (wind, temperature, relative humidity)

Addition of different are based on the following thump rule

$L_1 - L_2$, dB	Add to L_1
0 or 1	3 dB
2 or 3	2 dB
4 - 8	1 dB
9 or more	0 dB

<u>Basic Assumption</u>

Reflection factor of the surrounding environment / buildings= 3db(A) to 4 db(A)
surface directivity factor due to different radiation angle =3db(A)
Correction factor for the other factors such as Wind, Temperature and Relative humidity etc=5 db (A) to 7 db (A).
$\beta^0=65^0$ Horizontal angle for hemisphere propagation
$\gamma^0= 10^0$ vertical angle for hemisphere propagation
$S_=$ = assuming 20 M height

<u>Calculation</u>

- Cumulative sound pressure level from the proposed facility = 112.1 db (A) calculated from the equation (1).
- From the equation (2) the expected sound pressure level at the receptors are presented in the below table
- Predicted sound pressure level at receptors

Observations

The resultant noise levels at all monitoring stations are found to be well within the Central pollution control board(CPCB). From the predicted Noise level and the corresponding resultant noise level, it can be concluded that there is no significant increase over the baseline levels. It must be noted that since the Honnavar barge/ vessel loading facility site is area source and Noise barriers/ other natural noise attenuations are not considered for computations in practice, the actual noise levels are likely to be lower than indicated or equal to the measured baseline value at respective locations

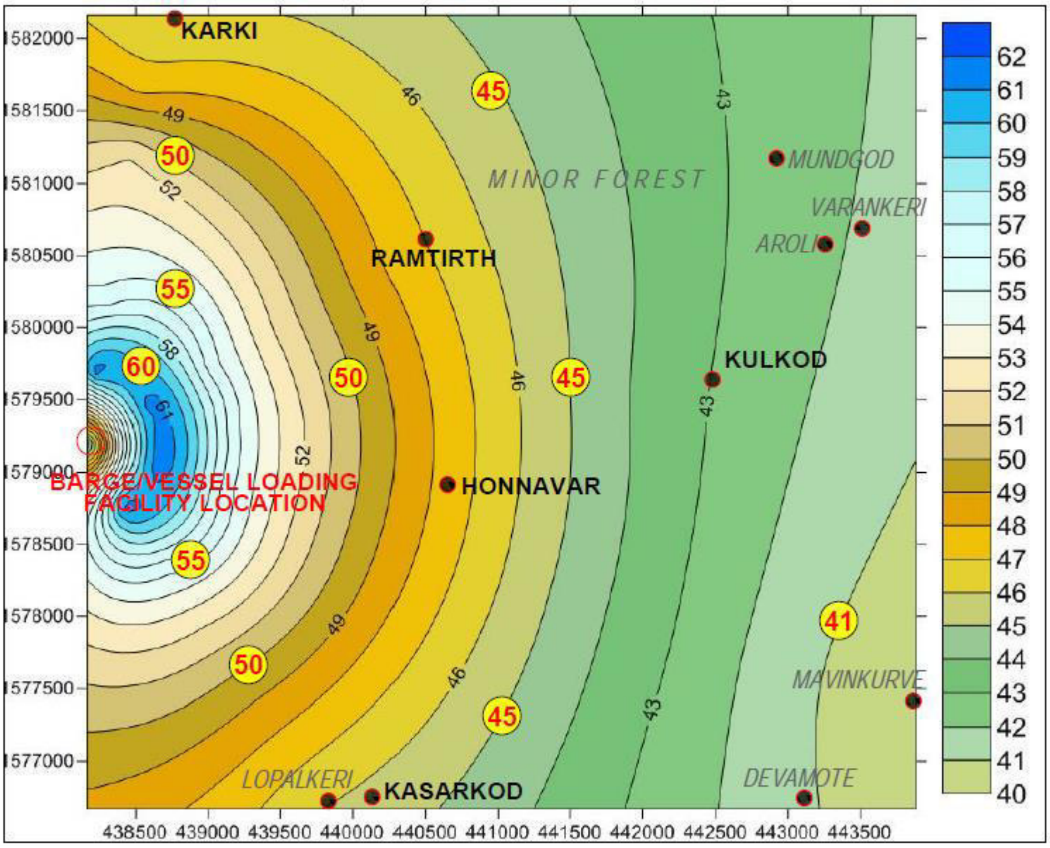


Figure 4-80: Isopleths for noise level-day (L_D) & night (L_N)

4.8.2.1 Mitigation Measures

- Noise attenuation will be practised for noisy equipment by employing suitable techniques such as acoustic controls, insulation and vibration dampers. The attenuation devices will be properly maintained throughout the construction period.
- Personnel exposed to noise levels beyond threshold limits will be provided with protective gear like earplugs, muffs, etc. especially construction personnel involved in pile driving operations. Rotation of personnel will also be adopted.
- Periodic maintenance of the equipment to be used in the developmental works will be carried out. Worn out parts will be replaced and rotating parts will be lubricated to minimise noise emissions.
- Ambient noise levels will be monitored at regular intervals during operational phase of the project.

4.9 Solid Waste Management

4.9.1 Potential Impact during Construction

4.9.1.1 Construction and Other Wastes

Construction waste will be re-used within project site for filling of low lying areas. Composted bio-degradable waste will be used as manure in greenbelt. Other wastes which can be re-cycled will be sold. Hazardous wastes will be disposed through approved KSPCB vendors. Hence, significant impacts are not envisaged.

4.9.1.2 Mitigation Measures/Solid Waste Management

- The various types of solid wastes generated during the construction phase will be segregated into two main categories, viz., non-hazardous and hazardous. All non-hazardous waste will be covered under solid waste management.
- Construction waste will be used within project site for filling of low lying areas. Composted bio-degradable waste will be used as manure in greenbelt. Other wastes which can be re-cycled will be sold.
- Excavated soil will be stockpiled in a corner of the site in bunded area to avoid run off with storm water.
- General refuse generated on-site will be collected in waste skips and separated from construction waste.
- A local authorised waste handler will be employed to remove general refuse from the site, separately from construction waste and hazardous wastes, on regular basis to minimise odour, pest and litter impacts.
- The burning of refuse at construction sites will be prohibited.

4.9.1.3 Hazardous Materials Management

- Hazardous materials such as lubricants, paints, compressed gases, and varnishes etc., will be stored as per the prescribed/approved safety norms.
- The construction site will be secured by fencing with controlled/limited entry points.
- Hazardous wastes will be disposed through approved KSPCB vendors. Hazardous materials will be stored as per prescribed safety norms in locations with restricted entry and with fire-fighting facilities.
- Medical facilities including first aid will be available for attending to injured workers Occupational Health Construction Equipment and waste.

4.9.2 Potential Impact during Operation

Waste generated from cargo operations such as remains of bulk cargo storage, rubbish from unpacking, and canteen wastes from daily activities. Solid waste will be generated from the canteen and administrative area during the operation stage. Wastes will generate odour and health impacts if not managed properly.

4.9.2.1 Mitigation Measures

- Proper collection and disposal of solid waste from office establishment based on the Central Public Health and Environmental Engineering Organization (CPHEEO) manual on “Municipal Solid Waste Management, 2016.
- The solid waste from the utilities like canteen shall be segregated as biodegradable and non-biodegradable waste and collected separately by providing bins at respective places.

- The collected biodegradable waste shall be subjected to composting and the compost will be used as manure for the development of green belt within the Barge/vessel loading facility
- The non-biodegradable waste like plastic shall be disposed off to approved vendors of KSPCB/CPCB in a scientific manner.
- Anticipated Potential impacts due to the proposed Rail/Road alignment

4.9.2.2 Environmental Aspects of Proposed Road/Rail Corridor

The proposed Road /Rail alignments of road/rail are completely a new link connecting the proposed Barge/Vessel loading facility with exiting NH 66/ Hosapattna railway line.

4.9.2.3 Ambient Air quality

The proposed alignment is a new link connecting Barge/vessel loading facility with NH66/ Hosapattana station. The baseline ambient air quality is well within the prescribed NAAQ standards due to the less human activity and low industrial activity. During the construction phase ambient air quality along the adjacent villages will get disturbed due to the various construction related activities such as:

- Site Clearance and use of heavy vehicles and Machinery
- Transport of Raw materials, borrow and quarry material to construction site
- Earthworks
- Handling and Storage of aggregates
- Asphalt mixing plant operations

These activities mainly generate dust and emissions such as CO, SO_2, NO_X from construction machineries and also due to other vehicular movements during construction.

During the operation phase the anticipated impacts to the Air quality is due to the movement of vehicles used for transportation of Cargo and transport of other materials.

<u>Mitigation Measures:</u>

- The asphalt plants, crushers will be sited at least 1 km in the down wind direction of human settlement along the Rail/Road corridor.
- During and after compaction of the sub grade, water will be sprayed at regular interval in order to avoid fugitive dust generation
- Vehicles carrying fine and coarse aggregate shall be covered with tarpaulin in order to avoid the spills.
- Pollution Under Control (PUC) certified construction machinery and equipments will be used and checked at regular intervals.
- During the operation stage dust generation will be minimum, because most of surface will be covered by paved shoulder.
- Tree plantation along the Right of way also will act as a major sink of pollutant due to the plying vehicle through corridor
- Regular maintenance of the road, during the operation phase will reduce any negative impacts to an absolute minimum.
- Adequate vehicle maintenance and not to use adulterated fuels shall be confirmed with the contractors.
- Ambient air quality will be monitored at regular intervals during construction and operations phase of the rail/road corridor.

4.9.2.4 Ambient Noise Level

The baseline ambient Noise levels are well within the prescribed CPCB standards. During construction phase, there will be significant increase in the Ambient Noise Level due to the various construction activities and use of the large number of heavy machineries. However, these construction phase impacts are short term in nature, realised in the immediate vicinity and will cease upon completion of construction. This will be occurred along the construction corridor as well as in the secondary site includes construction camps, asphalt mixing plant etc. During the operation stage, incremental noise level is due to the increased traffic volume and Cargo movements.

Mitigation Measures

- During construction, noise levels will be maintained below threshold levels stipulated by Central Pollution Control Board (CPCB) by selecting appropriate equipment, machinery and using enclosures.
- Procurement of machinery / construction equipment will be done in accordance with specifications conforming to source noise levels less than 75 dB (A).
- Only well-maintained construction equipment, which meets the regulatory standards for source noise levels, will be used.
- Noise attenuation will be practised for noisy equipment by employing suitable techniques such as acoustic controls, insulation etc.
- Personnel exposed to noise levels beyond threshold limits will be provided with protective gear like earplugs, muffs, etc.
- During operation phase noise levels will be significantly less because of smooth paved shoulders and presence of trees along the Right of way.
- Ambient noise levels will be monitored at regular intervals during construction and operations phases of the rail/road corridor

4.9.2.5 Inland water quality

During construction phase, anticipated impacts are due to spillage of construction materials such as cement, POL and Bitumen etc., falling in to the water bodies and drainage channels from workshops, construction camps etc. During construction phase the natural drainage system will get disturbed and reduction in the capacity of the natural stream. Extraction of the water for the construction activities and labour camp will disturb the local water supply in the contiguous village. Runoff from the construction sites and labour camp will increase the risk of pollution in the natural watercourse. During operation phase there will not be a chance of degradation of water quality during normal operations and spillages will impact the water quality during the accidents if any. Also the entry of vehicles to streams/nallah/rivers for cleaning could be an impact during operation phase. Surface runoff will be expected due to paved surface.

Mitigation Measures:

- Construction along the water courses will be carried out in the lean flow periods.
- Water will not be extracted from the local resources. Requirement of the water will be met from the ample resource.
- Construction site will not be sited nearer to the surface water or ground water resources.
- Control of the access of Vehicles to the water bodies will be ensured
- Road Safety will be strictly ensured to keep the accident quite low.
- Water Quality will be monitored at regular intervals during construction and operation phase of the project

4.9.2.6 Land

The proposed Road/Rail alignment will traverse across the coastal sand and barren land. During the construction stage accidental spills of fossil fuel and other Hazardous material will increase the risk of soil pollution. Contamination of soil may takes place due to solid waste generated from labour camps. Soil compaction will take place due to the movement of Heavy vehicles and Other Vehicles. During operation phase there will not be degradation of soil quality during normal operations and spillages will impact the soil quality during the accidents if any.

Mitigation Measures

- All the topsoil up to 150 mm shall be blended with other barren land to convert in to arable land and will be utilized for land scaping along the corridor,
- Restriction of the plant moving vehicle and machineries in the Agricultural land
- During operational phase, the impacts expected will be minimum due to the proposed green belt
- Soil Quality will be monitored during construction and operation phase of rail/road corridor.

Flora and Fauna

There is no protected Reserve Forest, Wild life sanctuaries and National Parks located in the land proposed for rail/road corridor. The impact on the Flora and Fauna due to this development is insignificant.

Green Belt Development along Road/Rail Corridor

Proposed plantation pattern along the rail/ road corridor will be as follows

- The first row will be of small to medium sized ornamental trees.
- Subsequent rows will comprise of shade bearing species of more height than those in the first row.
- Planting of dwarf shrubs in the median, provide glare free travel to the road user during nighttime
- Planting of herbaceous species as ground cover in the median, special landscape and the embankment slopes
- Turfing with grass in the median, special landscape and embankments

Following are the recommended species for roadside plantation

Table 4-14: Species Recommended for First Row

S. No	Botanical name	Importance
1	*Acacia auriculiformis*	Tall Evergreen drought resistant Avenue tree
2	*Ailanthus excelsa*	Tall branched semievergreen tree.
3	*Albizia lebbeck*	Branced evergreen leguminous tree
4	*Alstonia scholaris*	Beautiful medicinal tree.
5	*Neolamarckia cadamba*	Beautiful tree with large leaves.
6	*Azadirachta indica*	Neem oil & neem products
7	*Bauhinia racemosa*	Ornamental tree
8	*Cassia fistula*	Ornamental and bark is a source of tannin
9	*Cassia siamea*	Ornamental avenue tree
10	*Cocos nucifera*	Coconut palm
11	*Dalbergia sissoo*	Avnue and timber tree
12	*Dendrocalamus strictus*	Bamboo products
13	*Casuarina equisetifolia*	Pulp and construction material

S. No	Botanical name	Importance
14	*Delonix regia*	Ornamental avenue tree
15	*Eucalyptus sp*	Grown in high density along the boundary
16	*Ficus benghalensis*	Shade and a source of food for birds
17	*Ficus racemosa*	Edible fruits
18	*Ficus religiosa*	Shade and a source of food for birds
19	*Gmelina arborea*	Timber
20	*Grewilia robusta*	Avenue tree
21	*Holoptelia integrifolia*	Fibre and timber
22	*Leucaena leucocephala*	Fodder and pulp wood
23	*Mangifera indica*	Edible fruit
24	*Michelia champaca*	Scented flowers
25	*Mimosops elengi*	Shade and edible fruit
26	*Muntingia calabura*	Shade and edible fruit
27	*Phoenix sylvestris*	Palm and the grown up palms can be easily transplanted. Good soil binder.
28	*Pongamia pinnata*	Source of biodiesel
29	*Polyalthia pendula*	Majestic tree with drooping branches
30	*Polyalthia longifolia*	Avenue tree
31	*Samania saman*	Shade, timber and fruits are a good live stock feed.
32	*Shorea robusta*	Tall and locally adapted Timber tree.
33	*Spathodea companulata*	Ornamental avenue tree
34	*Terminalia bellerica*	A common local tree of timber vlue.
35	*Syzygium cumini*	Edible fruits
36	*Tamarindus indica*	Tamarind fruit and leaf
37	*Tectona grandis*	Timber
38	*Terminalia arjuna*	Timber and shade tree
39	*Terminalia catappa*	Edible almond nuts

Table 4-15: Shrubs recommended for Median and Embankments

S. No	Botanical name
1	Bougainvellia
2	Bauhinia alba
3	Bauhinia acuminata
4	calliandra
5	crosandra
6	Gardenia floria
7	Hibiscus SPS
8	Hamelia
9	Musanda
10	Mangnolia SPS
11	Nerium oleander
12	Tecoma stans
13	Tecoma Capensis
14	TMS single and double
15	Thevetia nerifolia

4.10 Vehicular traffic

4.10.1 Potential impact during construction stage

During the construction stage average truck movement is calculated about 150 trucks/day. Potential impacts due to the truck movements are as follows

- Fugitive dust generation during loading and un loading of the construction material
- Vehicular emissions
- Traffic congestion in the existing road
- Increase in noise level due to the movement of vehicles

Mitigation measures

- Trucks will be covered with tarpaulin to avoid fugitive dust generation
- All the vehicle should be warranted with Pollution under control (PUC) certificate
- Usage of appropriate fuels and proper maintenance of vehicles.
- Prohibition of sound horn will significantly reduce the noise level.
- All the vehicles are allowed to use the existing road in the non peak hours.
- Care should be taken by the contractor during the hauling of the construction materials in the project site.

4.10.2 Potential impact during operation stage

During the operation stage average truck movements are given below

S. No	Cargo	Truck/day
1	Coal	770
2	Iron ore	250
3	General	300

Potential impacts due to the truck movements are as follows

- Fugitive dust generation during loading and un loading of the construction material
- Vehicular emissions
- Traffic congestion in the existing road
- Increase in noise level due to the movement of vehicles

Mitigation measures

- Trucks will be covered with tarpaulin to avoid fugitive dust generation
- All the vehicle should be warranted with Pollution under control (PUC) certificate
- Usage of appropriate fuels and proper maintenance of vehicles.
- Prohibition of sound horn will significantly reduce the noise level.
- All the vehicles are allowed to use the existing road in the non peak hours.
- Care should be taken by the operator during the hauling of the cargoes in the stock yard.

4.11 Socio-Cultural Impact

4.11.1 Potential Impact due to proposed Facility Location

4.11.1.1 Relocation of Local People

Due to the proposed project, there is no relocation of the local people as the project area is completely on coastal sand.

4.11.2 Potential Impact during proposed Facility Operation

4.11.2.1 Impacts due to Inland Cargo Movement

Proposed Barge/ Vessel loading facility at Honnavar will handle 4.9 MTPA. Proposed road / rail corridor will be used to transport the cargo from/to barge/ vessel loading facility. Hence there will be no congestion of traffic and disturbance to level of service to the existing infrastructure facility

4.11.2.2 Vessel Movement and Impact on Beaches

Barge traffic may disturb fishing activities like fishing nets getting entangled with the moving vessels in outer harbour areas which may cause financial losses to fishing communities. The possibility of accidents in the barge/vessel traffic may affect local people.

Barge/ Vessel loading facility activities may result in the hiring of local labour and procurement of various commodities from a local market. The local economy will be boosted by Barge/ Vessel loading -related activities and be greatly involved in urbanization and industrialization.

Mitigation Measures

- In case of any accident spills, spill recovery will be attempted. A contingency plan will be developed and followed.
- Safe navigation routes will be earmarked for movement of fishing vessels and the route will be finalised in consultation of fishing harbour authorities and fishing communities.

4.12 General Impact Matrix

Table 4-16 presents the general/typical activities and its associated nature/extent of potential impacts envisaged due to the proposed developmental activities of the Honnavar Port.

Table 4-16: General Impact Matrix

Activity	Degree of Impacts		Duration of Impact	
	Positive	Negative	Short Term	Long Term
CONSTRUCTION PHASE				
Site clearance	---	Yes	---	---
Generation of debris	---	Yes	Yes	---
Non-Concrete waste	---	Yes	Yes	---
Hot Mix/Ready Mix Concrete waste	---	Yes	Yes	---
Planning Traffic diversion	---	Yes	Yes	---
Quarries/Borrow Areas	---	Yes	Yes	---
Transportation of construction material	---	Yes	Yes	---
Material storage	---	Yes	Yes	---
Natural drainage	---	Yes	Yes	---
Dredging	---	Yes	Yes	---
Construction of jetty	---	Yes	Yes	---
Breakwater	---	Yes	Yes	---
Overall port development/construction works	---	Yes	Yes	---
Environmental Attributes				
Air	---	Yes	Yes	---
Water	---	Yes	Yes	---
Noise	---	Yes	Yes	---
Soil	---	Yes	Yes	---
OPERATION PHASE (Vessel/Ship movement, cargo movement by road/rail)				
Environmental Attribute				
Maintenance dredging (disturbance of bottom sediments and/or destruction of spawning grounds, Sediment re-suspension; maintenance dredging is to be carried out in areas where ship movements are already happening and in the existing anchorage areas. As such no new area is likely to get impacted due to maintenance dredging)				
Vessel movements (discharge of bilge, cargo residues, operational wastewater, impacts to fishing activities, etc. are likely				

Activity	Degree of Impacts		Duration of Impact	
	Positive	**Negative**	**Short Term**	**Long Term**
impacts; ships/vessels calling at the port will not be permitted to dump the wastes/bilge water during the berthing period. HPPL port operations are not envisaged to bring negative impacts or hindrance in movement of boats/carrying out fishing activities)				
Social Environment				
Increase in property Value	Yes	---	---	Yes
Employment Opportunities	Yes	---	---	Yes

Chapter 5
Analysis of Alternatives

Chapter 5 Analysis of Alternatives

Honnavar Minor Port operated by Government of Karnataka functioned as a fair weather lighterage port. Environmental sustainability, Social, Engineering aspects and Economic viability are the criteria considered to study the various possible options of Barge/ vessel loading facility development and their advantages and disadvantages. Accordingly various possible layouts have been prepared utilising the results of traffic study, environmental aspects in the area, field surveys, model studies, and economic viability which enabled to short list the most promising alternatives.

Advantages of the Honnavar Location

The following are the advantages of identified project site which favours the development of barge/vessel loading facility:

- The location is already declared as a minor port by GoK
- Development proposed inside the river, a stable environment for operation
- Honnavar PWD, GoK recommended the breakwater construction for the benefit of the local fishermen boat movements
- Sufficient Land Availability.
- No R&R is envisaged.
- Better Connectivity
- No ASI Listed Monuments
- No Tourist Beaches
- Minimal Impact on river mouth and Minimal disturbance to fishing activities.
- Required Draft (~15 m) availability closer to Shore
- Strategically located in Karnataka Coast, which is half way between Gujarat and Kerala

Based on the above analysis on environmental and social aspects, Honnavar is found to be the best suitable site for Barge/Vessel Loading Facility development.

Accordingly, EC & CRZ Clearance was obtained vide No. SEIAA: 22: IND: 2011 dated 21st Sep 2012. Further, EC & CRZ clearance validity extension for three years was obtained vide File No. SEIAA: 22: IND: 2011 dated July 01, 2019 and further EC & CRZ clearance validity extension for further one year was obtained vide File No. SEIAA: 22: IND: 2011 dated September 20, 2023.

There is no change in the proposal for which EC & CRZ clearance and regular compliance being submitted. Certified compliance report from RO, MoEF&CC has been obtained (Attachment). Present proposal is to get the valid EC for completion of the initiated construction activity. HPPL has obtained fresh Terms of Reference (ToR) from SEIAA, Karnataka through vide File No: SEIAA 02 IND 2024 dated August 12, 2024 and accordingly EIA study has been carried out. Hence, analysis of alternative site and construction of port on the west side of the coastal sand pit is not envisaged for the proposed proposal.

Chapter 6
Environmental Monitoring Programme

Chapter 6 Environmental Monitoring Programme

Environmental Monitoring Programme is an important component during environmental management of the project. An environmental monitoring programme for the proposed Honnavar Barge/ vessel loading facility is formulated as shown in **Section 6.1.** The institutional mechanism to implement the planned mitigation and monitoring measures during all stages of the project is discussed in **Chapter 10**. The project management especially the Environmental Management Cell (EMC) (described in **Chapter 10**) should always go for a rational approach with regards to environmental monitoring. This includes judicious decision making in consultation with responsible agencies (e.g. Karnataka State Pollution Control Board (KSPCB)) or reputed environmental consultants for appropriate changes in the monitoring strategy, changes in the monitoring frequency, and any new requirements if needed from time to time. The efficacy of the mitigation measures being followed during construction and operational phases can be assessed and shall be revised or made more stringent and reinforced based on the monitoring results. The environmental attributes to be monitored during construction and operational phases of the project, specific description details of environmental monitoring including the monitoring parameters, methodology, sampling locations and frequency of monitoring are presented in **Section 6.1** of this chapter.

6.1 Environmental Monitoring Programme

6.1.1 Monitoring Plan for Construction Phase

From a monitoring point of view, the important parameters are water, air, noise, soil, sediment, plankton, benthos and occupational health. The suggested detailed monitoring plan is given in **Table 6-1.** The sampling and analysis proposed in the monitoring plan shall be carried out by the construction contractor under the supervision of HPPL.

The monitoring of water bodies inclusive of coastal sea water, inland surface water, groundwater, sewage, effluent and storm water etc., will be a very important focal point of monitoring mechanism to ensure that there is no contamination/pollution in the water bodies.

a. Monitoring and analysis shall be as per the guidelines of GoI-MoEF&CC/CPCB. Only laboratories approved by MoEF&CC or National Accreditation Board for Testing and Calibration Laboratories (NABL), Government of India shall be appointed for implementation of this monitoring plan.
b. Monitoring of sourcing of material (Quarry material from Quarry and Borrow material from borrow areas) although this could be away from the PIA for all regulatory clearances and approvals, this also being project induced impacts need to be monitored to avoid any potential impacts to the local communities.
c. Monitoring details for quarrying are not included in the aforementioned frame, it is given separately, which shall be implemented and supervised by quarry operator. The following parameters shall be monitored during quarrying.
    - Noise (except blasting) shall be monitored continuously in compliance with the Ambient Air Quality Standards and in Respect of Noise, The Noise Pollution (Regulation and Control) Rules, 2000.
    - Record of occupational accidents, diseases, and dangerous occurrences, etc. shall be kept.
    - HPPL is undertaking the continuous monitoring of various environmental aspects as per the accorded EC & CRZ clearance and CFE orders. Regular compliance repots are being submitted to competent authorities.

6.1.2 Monitoring during the Operational Phase

During the operational phase, HPPL shall be responsible for monitoring project activities. The suggested detailed monitoring plan is given in **Table 6-1.** The implementation of the Environmental Monitoring Programme should be the responsibility of the EMC within the project complex, which reports on a regular basis (e.g. monthly) to the management.

The main tasks of this EMC and CSR management Cell are in the field of:

a. In case on contracting of Environmental monitoring during pre-construction and construction phase, HPPL should ensure that consultants are sufficiently experienced capable and committed for best results.
b. Monitor environmental quality: This monitoring is related to various aspects, such as air quality, water quality (supply and wastewater), marine water quality and noise. Environmental conditions shall comply with the respected standards prescribed by CPCB/ respective statutory bodies.
c. Prior to project operations, HPPL should formulate a plan for monitoring ambient quality parameters, in consultation with the relevant authorities.
d. Implement the Health and Safety Management Plan, which is directed at the well-being (health and safety) of the employees, labourers and the population in the project's vicinity, directly affected by the project.

Table 6-1: Environmental Monitoring Programme

Environmental Attributes	Parameters to be monitored	No. of Sampling Locations	Frequency of Monitoring	Standards Methods for Sampling & Analysis	Compliance
Construction Phase					
Air Quality	PM_{10}, $PM_{2.5}$, SO_2,NO_x CO, HC	✓ Five (5) • Project site • Kasarkod • Honnavar • Kulkod • Ramthirth ✓ DG Stacks	Once a month during entire construction period.	As per standard methods of measurement as suggested in NAAQS (2009).	National Ambient Air Quality Standards released during November, 2009 as given in **Appendix K.**
Noise Levels	Day and night noise levels	Five (5) • Project site • Kasarkod • Honnavar • Kulkod • Ramthirth	Once a month during entire construction period	Portable hand-held integrated noise level meter.	National Ambient Noise Standards, 2000 as given in **Appendix L**
Water Quality	Physical, Chemical and Bacteriological	Groundwater (2) • Honnavar • Kasarkod Surface water (2) • Sharavati river • Badgani River	Once a month during entire construction period	Grab sampling and analysis by using standard methods.	IS10500, 2012 as amended for Groundwater/potable water as given in **Appendix M.** Designated Best Use Classification of Inland Surface Water as per IS2296;1982 as given in **Appendix N.**
Soil	Soil texture, type, electrical conductivity, pH, infiltration, porosity, etc.	Three (3) • Port Site • Honnavar • Kasarkod	Once a year during construction period	Collection and analysis of samples as per IS:2720	Baseline data
Marine Water Quality	Physical, Chemical and Biological	Six (6) • Dredge Spoil Disposal Areas • Near Northern Breakwater	Once a month both for low tide and high tide periods during entire construction period	Bottom sampler (Nishkin Sampler) and analysis by using standard methods.	Baseline data

Environmental Attributes	Parameters to be monitored	No. of Sampling Locations	Frequency of Monitoring	Standards Methods for Sampling & Analysis	Compliance
		• Near Southern Breakwater • Inner Navigation Channel • Saravathi river, near berthing area • Saravathi/Badagani river Mouth (near confluence point)			
Plankton and Benthic Communities	Phytoplankton, Zooplankton and Benthic Communities	Six (6) • Dredge Spoil Disposal Area • Near Northern Breakwater • Near Southern Breakwater • Inner Navigation Channel • Saravathi river, near berthing area • Saravathi/Badagani river Mouth (near confluence point)	Once a month during entire construction period	Plankton net of diameter of 0.35 m, No.25 mesh size 63 μ and analysis by using standard methods.	Baseline data
Sediment Quality	Physical, Chemical and Biological	Six (6) • Dredge Spoil Disposal Area • Near Northern Breakwater • Near Southern Breakwater • Inner Navigation Channel • Saravathi river, near berthing area • Saravathi/Badagani river Mouth (near confluence point)	Once a month during entire construction period	Peterson's Grab Sampler and analysis by using standard methods	Baseline data
Operation Phase					
Air Quality	PM_{10}, $PM_{2.5}$, SO_2,NO_x CO, HC	Five (5) • Project site • Kasarkod • HonnavarKulkod	Once a month	As per standard methods of measurement as suggested in NAAQS (2009)	National Ambient Air Quality Standards released during November, 2009 as given in **Appendix K.**

Environmental Attributes	Parameters to be monitored	No. of Sampling Locations	Frequency of Monitoring	Standards Methods for Sampling & Analysis	Compliance
		• Ramthirth			
Noise Levels	Day and night noise levels	Five (5) • Project site • Kasarkod • Honnavar • Kulkod • Ramthirth	Once a month	Portable hand-held noise level meter.	National Ambient Noise Standards, 2000 as given in **Appendix L**
Water Quality	Physical, Chemical and Biological	Groundwater (2) • Honnavar • Kasarkod Surface water (2) • Sharavati river • Badgani River	Once in a month	Grab sampling and analysis by using standard methods.	IS10500, 2012 as amended for Groundwater/potable water as given in **Appendix M.** Designated Best Use Classification of Inland Surface Water as per IS2296;1982 as given in **Appendix N.**
Sewage Treatment Plant	Physico – chemical Parameters (pH, BOD, TSS, Fecal Coliform)	STP Outlet	Once a month	Sampling and analysis by using standard methods.	STP outlet standards. General standards for discharge of Environmental Pollutants, G.S.R 422 (E) - The Environmental (Protection) Rules 1986 schedule VI as given in **Appendix O.**
Soil	Soil texture, type, electrical conductivity, pH, infiltration, porosity, etc.,	Three (3) • Port Site • Honnavar • Kasarkod	Once a year	Collection and analysis of samples as per IS 2720	Baseline data
Marine Water Quality	Physical, Chemical and Biological	Six (6) • Dredge Spoil Disposal Area • Near Northern Breakwater • Near Southern Breakwater • Inner Navigation Channel	Once a month	Bottom sampler (Nishkin Sampler) and analysis by using standard methods.	Baseline data

Environmental Attributes	Parameters to be monitored	No. of Sampling Locations	Frequency of Monitoring	Standards Methods for Sampling & Analysis	Compliance
		• Saravathi river, near berthing area • Saravathi/Badagani river Mouth (near confluence point)			
Plankton and Benthic Communities	Phytoplankton, Zooplankton and Benthic Communities	Six (6) • Dredge Spoil Disposal Area • Near Northern Breakwater • Near Southern Breakwater • Inner Navigation Channel • Saravathi river, near berthing area • Saravathi/Badagani river Mouth (near confluence point)	Once a month	Plankton net of diameter of 0.35 m, No.25 mesh size 63 μ and analysis by using standard methods.	Baseline data
Sediment Quality	Physical, Chemical and Biological	Six (6) • Dredge Spoil Disposal Area • Near Northern Breakwater • Near Southern Breakwater • Inner Navigation Channel • Saravathi river, near berthing area • Saravathi/Badagani river Mouth (near confluence point)	Once a month	Peterson's Grab Sampler and analysis by using standard methods	Baseline data

6.2 Compliance Reports

As a part of environmental monitoring programme, following compliance reports shall be submitted to KSPCB and Regional Office of MoEF&CC:

- Half yearly compliance reports in respect of the stipulated prior environmental/CRZ clearance terms and conditions on June 01 and December 01 of every calendar year.
- Environmental statement for the financial year ending March 31, to KSPCB on or before September 30 of every year.
- Format for maintaining records of hazardous waste if any in Form 3 as per Hazardous and other Wastes (Management & Transboundary Movement) Rules, 2016.
- Format for maintaining hazardous waste imported and exported in Form 10 as per Hazardous and other Wastes (Management & Transboundary Movement) Rules, 2016.
- Format for maintaining notification of major accident in schedule 6 as per MISHC rules, 1989 (amended 2000).
- Safety data sheet for hazardous chemicals shall be maintained as per schedule 9 of MSIHC rules, 1989 as amended.
- Format for maintaining records of E waste in Form 2 as per E-Waste (Management) Rules, 2022.

A MoEF&CC and NABL accredited Laboratory shall be appointed by project proponent for conducting regular monitoring of air quality, noise levels, water quality, sediment quality, biological parameters, primary conductivity, chlorophyll estimation and bacterial estimation. Monitoring during construction and operation phases will be carried out by engaging authorized agencies.

6.3 Plantation Monitoring Programme

Environmental Management team will monitor the following activities of greenbelt development:

- Watering
- Fencing and Nursery shed
- Transport of seedlings
- Weeding and soil working
- Application of insecticides
- Pruning (trimming of plant)
- Replacement/ Inter planting

During Operation phase periodic monitoring of application of insecticides, pruning, and replacement will be performed in order to properly maintain vegetation, greenbelt and green cover.

6.4 On-site Mock Drills

On-site mock drills are very important as employees should know how to react during the time of crisis. Conducting mock drills at regular intervals enhances preparedness and checks the viability of environmental/ disaster management plan. Mock drills are essential for the following reasons

- Helps in revising/ improving the environmental/ disaster management plan
- Helps to evaluate whether the responsible officials are trained efficiently for the unforeseen event

- Helps in evaluating whether HPPL maintains all the emergency equipment

To ensure efficient environmental/ disaster management, HPPL shall conduct periodic on-site mock drills in case of occurrence of the following activities:

- Fire
- Natural calamities (cyclones, floods, tsunami, earthquakes)
- Collision of vessels calling at port
- Power break down
- Oil spill
- Bomb threats
- War alerts/ terrorist attacks

Mock drills should also involve fire department, police, municipal authorities, hospitals and other department/ agencies that are mandated to provide emergency support to Honnavar Barge/ vessel loading facility. Documenting the outcome of mock drills is an important aspect as this helps in revising the existing plan more efficiently.

Chapter 7
Additional Studies

Chapter 7 Additional Studies

As per the requirements of EIA Notification 2006 (as amended) for Category B1 projects, public hearing was conducted as a part of previous EC/CRZ Clearance at Project Site, kasarkod-tonka, honnavar taluk, Uttara Kannada district for the proposed Barge/Vessel Loading Facility development. The Public Hearing was conducted on January 27, 2012 by KSPCB in the presence of Dy. Commissioner & District Magistrate, Uttar Kannada District, Karwar Regional State Pollution Control Board Officer.

The proponent informed that there is no change from the original proposal for which EC/CRZ was obtained from SEIAA and no changes in pollution load and the CCR from RO, MoEF&CC dated 29.05.2024 obtained which mentions that about five percent of the project has been undertaken. Now, HPPL intends to obtain the valid EC/CRZ clearance for completion of initiated construction activities which are delayed due to various PIL's fielded in various Honourable courts and verdicts were disposed in favour of construction of Port by GoK/HPPL. SEIAA accorded the ToR on August 12, 2024 with exception from public hearing for present proposal.

As per the accorded, ToR dated August 12, 2024 public hearing action plan as a part of the EIA report needed to addressed and the details of previous public hearing queries raised, and the responses are provided in **Table 7-1.**

Table 7-1: Public Hearing Action Plan

Name of the Speaker & Place	Issues Raised	Response from HPPL
Smt. Laxmi Algod	She stated that, 90% of the local populations are fishermen. They are practicing traditional fishing and depend on it for their livelihood. She stated that, the project proponents have not given clear information about the project.	• The details of the project and its components were well described in Chapter 2 of Draft EIA report as well as in Executive Summaries both in English and Kannada Languages were displayed by KSPCB as per the law of the country. During Public Hearing also the project development details were spelt in vernacular language out clearly and presented. • The details of the Fishing villages, Fish landing centres, number of families, Fishermen population etc., in the study area and fish catch details were provided in the DEIA report. The details have been collected from the Department of Fisheries and National Information Centre.
	She expressed concern about adverse effect on public health in case of accidents occurring due to loading of cargo from barges to ship, dust pollution and other problems due to handling of different cargo.	• Proposed facility is barge/vessel loading facility and planned to handle coal, Iron Ore and General Cargo. The loading/ unloading of Barges to ship will not be carried out at the Harbour and will be done at deep waters where the mother ship used to be anchored by taking necessary well accepted pre cautionary measures and adopting best available Technologies and when concerned with the Berth/Vessel loading of cargos, technologically advanced mobile loader cranes will be used which suppress the dust to a maximum extent/captures the dust. • In the event of accidental spills of cargo during transfer from/to the ships, the Spill contingency plan provided in the EIA will be adopted to contain and recover the same at the earliest possible. If the accidental spills will be in harboured waters, since the harbour will be protected by Breakwaters, it would not spread spatially and the response time, containment and recovery (i.e, remedial measures) will be quicker. • If the accidental spills due to liquid cargo such as Edible oil and fuels for barges/vessel, the oil spill contingency plan provided in the EIA report will be adopted. Depends on the quantities of spill, necessary assistance will be sought from the nearby ports/ coast guard. • The necessary mitigation measures such as Green Belt development and Water Sprinkling etc., to suppress the dust while handling and storage will be followed as a part of Environmental Management Plan. Proper dust suppression will be ensured in the port premises and carried during the construction phase
	She also expressed that, the study on the said project has been carried out by outside agencies instead of local agencies and University.	• As per MoEF&CC Requirement, QCI NABET Accredited and Experienced consultant in Port EIA studies has carried out EIA Study for Proposed Barge/Vessel Loading facility. • Baseline terrestrial and marine monitoring has been carried out by NABL accredited labs. • CRZ/HTL/LTL demarcation studies has been carried out by NCSCM which is one of the seven agencies authorised by MoEF&CC.

Name of the Speaker & Place	Issues Raised	Response from HPPL
	She expressed doubts on whether the study has been carried out properly or not.	• The study has been carried out as per the ToR prescribed by KSEIAA and the Guidance Manual for Ports and Harbours published by MoEF&CC.
	She also stated that, there was no clear information in the presentation regarding road, railway track etc. made by the project proponent. She also expressed that, they were already put into a lot of inconveniences due to the Sharavati project and felt that they are again being made a scape goat and felt it was not justifiable.	• Proposed Dedicated Rail/Road Corridor details are provided in the EIA report, Executive Summaries disclosed for public scrutiny before Public Hearing as per the EIA Notification, 2006 (as amended). • Proposed Rail corridor connecting project site from Konkan Railway line of 8.5 km and proposed road connecting project site to NH-66 of 2.58 km will be constructed as a part of proposed development. • New Railway Station at Hosapattana is proposed between existing Manki and Honnavar Railway stations • The proposed facility will be developed strictly adhering the Environmental Management Plan suggested in the EIA to ensure the development as a sustainable one.
	She further expressed that it was justified to give good health facilities as assured by the project proponent after spoiling the health of the local community by establishing this kind of project.	• As a part of Corporate Social Responsibility (CSR), to improve the medical facilities and Health Environment conditions, HPPL has proposed to provide better health services such as Strengthening area Government hospitals by assisting them in procurement of essential medical equipment's and Providing quality health care through regular medical camps. • An amount of INR 70 Lakhs has been allocated for health camps and strengthening of Government hospitals. • The impacts due to the proposed development and necessary mitigation measures to render these impact as insignificant was addressed in the EIA report and the respective budgetary provision to implement the mitigation measures is made as a part of EMP.
	She expressed that, the project proponent has mentioned that, the main cargo handled in the project is coal, but at present situation, there is already scarcity of coal to the industries that use it as raw material, in this situation the coal handling as main activity is false and they have hidden plans to handle Iron Ore.	• The proposed barge/vessel loading facility is planned to handle coal, Iron Ore and Other General cargo and the same was mentioned in the EIA report, Executive Summaries and During Public Hearing Presentation also. The developer is committed to the national regulations and therefore Iron ore will be handled as and when the handling is legally permitted. • As true to the report submitted handling coal will be major cargo and which is imported to fulfil the requirement of the hinterland coal dependent industries. This will cater to the scarcity of the coal in the hinterland.
	She further expressed the project cost INR 450 Crores will be collected from local community and fishermen in the form of taxes.	• The project will be developed by HPPL and the company is registered under the laws of the country. HPPL is committed to follow all the regulatory requirements of the country only. Entire investment of Rs.450 Crores is made by HPPL only. The government is not investing anything therefore the question of imposing taxes does not arise. • Cost estimate for the present proposal as per existing rates is INR 607.03 Crores.
	She also informed that, they have seen fishing activity	As per our EIA/EMP commitments, no discharge of wastewater/waste from the Barges/vessel calling at Honnavar

Name of the Speaker & Place	Issues Raised	Response from HPPL
	suffered due to discharge of wastewater by fish processing unit in the areas during earlier days.	Barge loading facility will be permitted into the area. There will not be any discharge in to the sea from the proposed barge/vessel loading facility.
	Further, she also expressed that, public hearing notification is given like tender notification & failed to attract attention of the public.	Advertisement regarding the date of public hearing, venue and project detail etc, were given in Newspapers in local and English Languages by KSPCB as per the procedure for conduct of public hearing given in the EIA Notification 2006 (as amended).
	She expressed that; the project proponents have planned to establish the project without giving information to public. Hence, on behalf of public and women organizations is opposing the said project.	
Smt. Laxmi Naik, Snehakunja, Honnavar	She expressed that; it is not right to organize public hearing without giving proper report of the project to the public.	Advertisement regarding the date of public hearing, venue and project detail etc, were given in Newspapers in local and English Languages by KSPCB as per the procedure for conduct of public hearing given in the EIA Notification 2006 (as amended). The necessary Document such as Executive Summaries (Both in English and Kannada), Copy of DEIA were submitted to KSPCB and the same were displayed in following Govt. Offices ○ Deputy commissioner's office, Karwar ○ Chief Executive officer - Karwar ○ District Industries Center,Karwar ○ Thasildhar's office - Karwar. ○ Thasildhar's Office - Honnavar. ○ Taluk/Town Panchayat - Honnavar. ○ Gram Panchayat – Kasarkod, ○ Zilla panchayat - Karwar. ○ Library – Karwar, ○ Library - Honnavar. ○ KSPCB - Karwar. ○ KSPCB – Bengaluru, ○ CRZ office - Karwar. ○ Asst Commissioner - Bhatkal. ○ Asst Commissioner - Kumta. (Acknowledgement for the same is also obtained by KSPCB)
	Further she expressed that, this project will create local	• It is estimated that during construction stage & operation stage the employment generation will be about 500

Name of the Speaker & Place	Issues Raised	Response from HPPL
	employment only during the construction phase and is doubtful whether locals will be employed once the project is operational.	& 50 people respectively. • Based on the skill set of the people such as skilled, semi-skilled and unskilled, the preference will be given to the local people during the operation stage.
	Further she mentioned that the project proponent is misleading the public by stating this project will help local fishing boats in their activity because once the project is completed and is in full operation, this area will become prohibited area and local fishing boats will not have access to the area.	• Fishing boat/Vessel movements and access will not be prohibited during both construction/operation phases. This is one of the commitments to the state and HPPL bound to follow these and more over need support and well wishes of all sections of the local communities • There is a capsizing of fishing vessels near the river mouth due to insufficient depth. Creation of approach channel and provision breakwater as a part of the development which will rule out the capsizing incidence. • Safe navigation routes will be earmarked for movement of fishing vessels and the route will be finalized in consultation of fishing harbour authorities and fishing communities. • Awareness will be given to fisherman about the barge/vessel movement's time schedule and clearances required for safe manoeuvring etc., During berthing of barges/vessels, necessary clearances shall be made available to ensure the fishing vessels movements.
	She informed that, the proposed project proponent have not given clear picture of survey number of the 109 acres of land to be acquired by the project.	Survey no. 305 was allotted by revenue department.
	She also shared her experiences during the health survey conducted by their organization in the Kaiga area and stated that, the local people of the Kaiga area were not provided medical facilities by Kaiga authorities, though there is a very good hospital in Kaiga established by Kaiga authorities. She expressed fear that the same will be repeated in the present project.	• HPPL is not aware of the Kaiga situation but are committed to provide the promised services to the local communities. • As a part of Corporate Social Responsibility (CSR), to improve the medical facilities and Health Environment conditions, HPPL is proposed to provide better health services such as Strengthening area Government hospitals by assisting them in procurement of essential medical equipment's and providing quality health care through regular medical camps. • An amount of INR 70 Lakhs has been allocated for health camps and strengthening of Government hospitals.
	She objected to the acquisition of land for development of railway line and road for the project as land holdings of local people are very less.	• A new independent access road is being developed for the traffic to and from the facility, without disturbing the existing roads by the facility traffic • The alignment is planned in such a way that it has minimum disturbance to the local communities. Moreover the road is not an access controlled therefore the local public also can use the road for their needs.
	She insisted to give detail project report of the said	Before Public Hearing, the necessary Documents such as Executive Summaries (Both in English and Kannada),

Name of the Speaker & Place	Issues Raised	Response from HPPL
	project to the local fishermen community.	copy of DEIA were submitted to KSPCB and the same were distributed by KSPCB and displayed at Thashildhar's office, Honnavar, Town Panchayat Honnavar, Gram panchayat, Kasarkod (Acknowledgement for the same is also obtained by KSPCB) for Public access.
Shri. K. Ramesh, Snehakunja, from Ankola	He stated that, project proponents are misleading the locals by stating that, the proposed project is only for barge and vessel loading facility, instead they are trying to handle hazardous cargo like Iron ore, Oil, Coal etc	The proposed facility is a Barge/Vessel Loading facility only and planned to handle 4.9 MTPA of cargo. This facility will handle coal, Iron Ore and Other General cargo and the same was mentioned in the EIA report, Executive Summaries and During Public Hearing Presentation also.
	• Trying to conduct public hearing under heavy police protection creating fear among local people to express their factual opinions. • He complained that the activities viz. handling of iron ore, coal, oil are not mentioned in the paper notification published.	Advertisement regarding the date of public hearing and venue and project detail etc, were given in Newspapers in local Kannada and English Languages as per the procedure for conduct of public hearing given in the EIA Notification 2006 (as amended). The Public Hearing was conducted by KSPCB as per the procedures and the proceedings of the same were forwarded to respective authorities.
	He explained that, while he was residing at Ankola he has experienced the adverse effect on the environment and safety problems faced during handling of iron ore at Belekeri. He explained details of environmental pollution and nuisance to public during handling of iron ore at Belekeri Port which has caused financial loss to Govt and other problems faced by common public is well known to the entire nation. He complained that the local people who handed over their land to project like Kaiga, Sea bird did not get benefit from the project and also are not made a part of the decision making process in the said project and expressed fear that, same will be repeated in the said project also. He stated that he totally oppose the proposed project, which is proposed to handle commodities like iron ore and coal because this activities will create environmental damage in the area and also health	• The proposed facility will be developed strictly adhering the Environmental Management Plan suggested in the EIA to ensure the development as a sustainable one. • The EMP and monitoring programme as mentioned in Chapter 10 and Chapter 6 is being followed during construction phase and shall be followed during operation phase also. • Monitoring of air quality in five locations, noise levels in five locations, water quality in four locations, soil quality in three locations and marine water & sediment quality in 6 locations is being carried out as a part of the monitoring programme and the certified compliance report is also attached with the EIA report. • Fishing Vessel movements and access will not be prohibited even during the construction/operation phase. • Safe navigation routes will be earmarked for movement of fishing vessels and the route will be finalized in consultation of fishing harbour authorities and fishing communities. • Awareness will be given to fisherman about the barge/vessel movement's time schedule and clearances required for safe manoeuvring etc., During berthing of barges/vessels, necessary clearances shall be made available to ensure the fishing vessels movements.

<table>
<tr><th>Name of the Speaker & Place</th><th>Issues Raised</th><th>Response from HPPL</th></tr>
<tr><td></td><td>problems to the local people besides traffic congestion in the area and affect traditional fishing activity of local fishermen on which they depend for their livelihood.</td><td></td></tr>
<tr><td rowspan="3">Shri Abdul Hussain, Masjid Secretary, Honnavar</td><td>He stated that, project proponents have not given detailed report regarding the requirement and usability of land for the proposed project.</td><td>The land required for the development of Barge/ Loading Facility is 44 Ha. The layout showing the same is presented in the DEIA report. The proposed land use Pattern is given below.
<table>
<tr><th>S. No</th><th>Description</th><th>Area (Ha)</th></tr>
<tr><td>1.</td><td>Coal Stockyard</td><td>7.00</td></tr>
<tr><td>2.</td><td>Iron Ore Stockyard</td><td>1.80</td></tr>
<tr><td>3.</td><td>General Cargo Storage (Open)</td><td>4.00</td></tr>
<tr><td>4.</td><td>General Cargo Storage (Closed)</td><td>2.00</td></tr>
<tr><td>5.</td><td>Liquid cargo storage</td><td>0.10</td></tr>
<tr><td>6.</td><td>Roads and Circulation Area</td><td>8.15</td></tr>
<tr><td>7.</td><td>Operation Building</td><td>0.05</td></tr>
<tr><td>8.</td><td>Canteen</td><td>0.02</td></tr>
<tr><td>9.</td><td>Vehicle Parking</td><td>0.09</td></tr>
<tr><td>10.</td><td>Substation</td><td>0.02</td></tr>
<tr><td>11.</td><td>Gate House/Security/Weigh Bridge</td><td>1.50</td></tr>
<tr><td>12.</td><td>Truck Parking</td><td>5.40</td></tr>
<tr><td>13.</td><td>Fuel Station</td><td>0.02</td></tr>
<tr><td>14.</td><td>Control Tower</td><td>0.01</td></tr>
<tr><td>15.</td><td>Green Belt</td><td>3.10</td></tr>
<tr><td></td><td>Sub total</td><td>33.26</td></tr>
<tr><td>16.</td><td>Area available for other Operations and area earmarked for future expansion</td><td>6.72</td></tr>
<tr><td>17</td><td>Rock armour area (approx..)</td><td>4.00</td></tr>
<tr><td colspan="2" align="right">Total</td><td>44.00</td></tr>
</table></td></tr>
<tr><td>He added that, the project proponents have not included mitigation measures for oil spillages problem due to operation of project in the area.</td><td>Mitigation measures for oil spillages were addressed in the EIA report. The barge/vessel loading facility will be equipped with minimum equipment to contain and recover oil spills. Oil spill control equipment such as booms / barriers will be provided for containment and skimmers will be provided for recovery. In case of any cargo spillage during transfer from/to mother ships, Barges/ Vessels, it will be attempted to recover the spills. If the accidental spills will be in harbour waters, it would not spread spatially and the Response time for shutting down the fuelling, containment and recovery will be quicker.</td></tr>
<tr><td>He expressed concern that the sea eco system in</td><td>• The impact on Biological Environment (Estuarine, Coastal and Marine Ecology) due to the proposed</td></tr>
</table>

Name of the Speaker & Place	Issues Raised	Response from HPPL
	vicinity of the project would be disturbed due to operation of said project and there may lead to extinction of certain species of fishes which are observed only in this area.	barge/vessel loading facility and respective mitigation measures is addressed in the EIA report. The proposed port will be developed strictly adhering the Environmental Management Plan suggested in the EIA to ensure the development as a sustainable one. • The post project monitoring covering marine environment monitoring will also be carried out.
	He complained that, the project proponents have not informed the local Panchayat, so as to prevent public from attending the public hearing and expressed strong objection to the proposed project in the area.	• Advertisement regarding the date of public hearing and venue and project detail etc, were given in Newspapers in local and English Languages as per the procedure for conduct of public hearing given in the EIA Notification 2006 (as amended). • Before Public Hearing, the necessary Documents such as Executive Summaries (Both in English and Kannada), Copy of DEIA were submitted to KSPCB and the same was distributed and displayed at following Govt. offices o Deputy commissioner's office, Karwar o Chief Executive officer – Karwar o District Industries Center, Karwar o Thasildhar's Office - Karwar. o Thasildhar's Office - Honnavar. o Taluk/Town Panchayat - Honnavar. o Gram Panchayat - Kasarkod. o Zilla panchayat - Karwar. o Library – karwar o Library - Honnavar. o KSPCB - Karwar. o KSPCB - Bengaluru. o CRZ office - Karwar. o Asst Commissioner - Bhatkal. o Asst Commissioner - Kumta. (Acknowledgement for the same is also obtained by KSPCB) by KSPCB for Public. • English & Kannada Executive Summary, DEIA report were placed in the respective office on 22nd December 2011. • Pamphlet distribution and Auto announcement was conducted in the local region (specifically giving more priority to Kasarkod area) on 25th January 2012.

Name of the Speaker & Place	Issues Raised	Response from HPPL
Shri M. N. Subramanya, Advocate, Honnavar	• He stated that the location is ecologically sensitive as it is an estuary point of Sharavati river joining the Arabian Sea and that the location is critically sensitive for marine ecology as big fish and particular species of fishes depend on this area for their breeding activity. • He expressed fear that there would be ecological imbalance of marine ecology due to development and operation activities of the project and requested presiding officer not to allow such project in the area in the larger interest of sustaining ecological balance of marine life in the region.	• Impact on River Confluence Point/River Mouth due to the proposed barge/vessel loading facility is studied by appropriate mathematical modelling and other marine biological studies and addressed in the EIA report. • Breakwater construction will lead to accretion/erosion on coast adjacent to that. These will change the morpho dynamics of the river mouth/inlet which leads to reduction in tidal water flow in the water body. Reduction in tidal exchange will affect the biodiversity. Hydrodynamic Model Studies and other model studies ensure that changes the morpho dynamic of the river mouth is not significant. This will ensure the tidal water exchange and thereby maintain the biodiversity. • However, as a part of EMP, both water quality monitoring and shoreline monitoring is being carried out during construction phase and the same shall be carried out during operation phase also.
	• He also expressed that the project proponent have not mentioned about the applicability of CRZ Notification, 2011 for the said project at the said area. • He questioned that the CRZ notification was applied to construction of houses for fishermen and not done in the case of big projects like this.	• Coastal Regulation Zone compatibility of the proposed barge/vessel loading facility is discussed in Chapter 2 of EIA report. • Physical demarcation of HTL, LTL and delineation of CRZ setbacks for the project site were carried out by Centre for Earth Science Studies (CESS). Based on the perusal of the CRZ Notification, 2011 and the HTL/LTL survey outcome, following are the inferences arrived: ○ Proposed site falls on the sandy beach near the river mouth. ○ CRZ Setback lines indicate that the proposed barge/ vessel loading site falls within the CRZ-IB, CRZ-III NDZ, CRZ-IVA, CRZ-IVB ○ Proposed location does not contain environmentally sensitive areas such as National parks / marine parks, sanctuaries, wildlife habitats, corals / coral reefs. It also does not include breeding and spawning grounds of fish and other marine life, area of outstanding natural beauty / historically / heritage area, area rich in genetic diversity. • Based on perusal of Coastal Regulation Zone (CRZ) Notification, 2011 and Karnataka Coastal Zone Management Plan (CZMP), Proposed Honnavar barge/vessel loading is a permissible activity in CRZ as it requires waterfront and foreshore facilities. • For the present proposal, CRZ/HTL/LTL demarcation studies have been carried out by NCSCM as per CRZ notification 2019. The project is a permissible activity as per CRZ notification 2019 (as amended). • The project falls under CRZ-IB, CRZ-III, CRZ-IVA and CRZ-IVB as per CRZ notification 2019 (as amended). • The project layout superimposed on HTL, LTL and CRZ setbacks are given the EIA Report.

Name of the Speaker & Place	Issues Raised	Response from HPPL
	He expressed fear that, the operation of such project would create shortage of electricity in the entire Honnavar Taluk.	Power requirement during construction phase is expected to be around 1 MVA. The power demand is estimated at 1 MVA during operation. Construction phase power requirement will be met from DG sets and operation phase power will be drawn from Substation located at Honnavar (~2 km) after obtaining the necessary permissions from respective Electricity department. Hence, no competitiveness with the local people is envisaged.
	He expressed his dissatisfaction over absence of information on rehabilitation, alternative business to affected fisherman community due to the proposed project. He also expressed dis-satisfaction over the information given with regard to employment generation to local people and expressed strong objection to proposed project in the area.	• HPPL has been allotted to use the government land of 44 hectares by Government of Karnataka near Sharavati river mouth in Kasarkod Tonka village to develop a barge/vessel loading facility. There are no land acquisition and encroachers involved. • It is estimated that during construction stage & operation stage the employment generation will be about 500 & 50 people respectively. • Based on the skill set of the people such as skilled, semi-skilled and unskilled, the preference will be given to the local people during the operation stage.
Shri. Nivel Fernadis, Secretary Pershian Boat owners association, Honnavar	• He expressed pollution of the sea and surrounding area due to operation of said project, which would directly affect the fishing activity in the area. • He opined that, project will create water scarcity in the area.	• No discharge of wastewater/waste from the Barges/vessel calling at Honnavar Barge loading facility will be permitted into the area. There will not be any discharge in to the sea from the proposed barge/vessel loading facility. • Water requirement during the construction is expected to be around **15m^3/day.** Water demand during operational phase of barge/ vessel loading facility is estimated as **7m^3/day**. The water requirement will be met from Karnataka Rural water supply and sanitation agency which includes supply to Barge/vessels, staff and users. In addition to that water required for dust suppression system and firefighting will be sourced from Sharavati River. Hence, no competitiveness with the local people is envisaged.
	He expressed doubt of controlling generation of dust by proposed tarpaulin cover on ore storage heaps as wind velocity in the area is very high and expressed fear of dust nuisance to the surrounding areas	• Dust suppression equipment will be provided for efficient control of dust pollution on environment during storage and handling of Coal and Iron ore at berth and stockyard. An efficient dust suppression system will contain dust particles before it is airborne. • A common system consisting of suitable pump, storage tank, nozzles have been proposed for efficient dust control system. Dust control is envisaged at following locations: ○ Barge/ vessel loading /unloading area ○ Stockyards • Water sprinkling system at high pressure with swivelling type nozzles will be installed to cover entire stockpile. Nozzles will be installed on pipes at different levels from ground. Nozzles will be installed along stockpile at regular intervals to cover stockpile height and width.
	He requested to construct break water in the alive area (River joining Sea) area which would facilitate the fishermen.	As a part of development, construction of Southern and Northern Breakwater are envisaged and navigational channel was planned in between the breakwater as well as in the said alive area (river joining sea). Hence this arrangement of breakwater as well as navigation channel will help the fisher folk to navigate their fishing vessels very safely.

Name of the Speaker & Place	Issues Raised	Response from HPPL
	• He pointed out that, project proponent have not given a clear picture of vehicular movement and proposed route for the project area and proposed mitigation methods to avoid nuisance created due to movement of heavy vehicles during development and operational phase • He objected to the said project in order to avoid environmental damage and to avoid problems that would be created due to vehicular movement of the project.	• Proposed road connectivity starts from NH 66 at Kasarkod. This road will then run southeast for some distance and then aligns parallel to the shoreline till it reaches the proposed project site. This will be parallel to the existing single lane road at an offset distance of 100 m. The total length of this road from NH 66 to the proposed site is 2.58 km. This road connectivity will have a width of 30 m. • The rail connectivity to the Port site is proposed to be provided with Broad gauge single line of 8.5km long, from a new railway station proposed at Hosapattana under section of Konkan Railway broad gauge line. • Anticipated Potential impacts due to the proposed Rail/Road alignment and respective mitigation measures are provided in the EIA report.
Shri. Abdul Khadar, local resident, Honnavar:	• He stated that, maximum fisherman living in this area have migrated from Mallukurva area which was destroyed due to flood and till date have not obtained their land rights from the Govt. • He informed that, most of the fishermen in the area are holding small lands and expressed fear that, their land may be acquired for the said project and they may be evacuated from the area without suitable rehabilitation as they do not have land records in their names.	As there is no land acquisition, rehabilitation is not envisaged.
	He expressed his dis-satisfaction on preparation of project report by the people who have no knowledge of local geology.	QCI NABET Accredited and experienced consultant in port EIA studies is engaged to carry out EIA Study for Proposed Barge/Vessel Loading facility.
	Further, he questioned the permission given for the project since the same is denied for local poor people since 1974.	• Directorate of Ports and Inland Water Transport Department, Government of Karnataka signed a lease agreement with HPPL to develop Honnavar Port. • Based on perusal of Coastal Regulation Zone (CRZ) Notification, 2019 and Karnataka Coastal Zone Management Plan (CZMP), Proposed Honnavar barge/vessel loading is a permissible activity in CRZ as it requires waterfront and foreshore facilities.
Shri. Basha Ahmed Patel, Gram Panchayat Member, Honnavar	He informed that, he came to know about the proposed project very recently as a result of which he could not understand the project as there was lack of publicity given about the proposed project.	• Advertisement regarding the date of public hearing and venue and project detail etc, were given in Newspapers in local and English Languages as per the procedure for conduct of public hearing given in the EIA Notification 2006 (as amended). • Before Public Hearing, the necessary Documents such as Executive Summaries (Both in English and Kannada), Copy of DEIA were submitted to KSPCB and the same were distributed and displayed at following Govt. offices

Name of the Speaker & Place	Issues Raised	Response from HPPL
		○ Deputy commissioner's office, Karwar ○ Chief Executive officer – Karwar ○ District Industries Center, Karwar ○ Thasildhar's office - Karwar. ○ Thasildhar's Office – Honnavar ○ Taluk/Town Panchayat - Honnavar. ○ Gram Panchayat - Kasarkod. ○ Zilla panchayat - Karwar. ○ Library - karwar. ○ Library - Honnavar. ○ KSPCB - Karwar. ○ KSPCB - Bengaluru. ○ CRZ office - Karwar. ○ Asst Commissioner - Bhatkal. ○ Asst Commissioner - Kumta
	• He also informed that school, masjid, temples and residential area are situated on the way to the proposed project as well as the proposed road and railway track. • He also informed that the school, religious places and residential areas will be affected if the project is allowed to come up. • He objected to the development of road and railway track as it will affect local ecosystem. • He expressed surprise over Govt. officers attending the public hearing when they failed to visit the area during the recent floods. He welcomed the Deputy Commissioner for her first visit to the area and requested for basic infrastructure for the fishing activities and also strongly objected to the proposed project.	• Proposed road connectivity starts from NH 66 at Kasarkod. This road will then run southeast for some distance and then aligns parallel to the shoreline till it reaches the proposed project site. This will be parallel to the existing single lane road at an offset distance of 100 m. The total length of this road from NH 66 to the proposed site is 2.58 km. This road connectivity will have a width of 30 m. • The rail connectivity to the Port site is proposed to be provided with Broad gauge single line of 8.5km long, from a new railway station proposed at Hosapattana under section of Konkan Railway broad gauge line. • Rail/road corridor shall be developed within the allocated port land and small portion of forest land for which Stage I clarence was obtained and recommendation for Stage II by PC, Forest department, Govt. of Karnataka details are provided in EIA report. • Proposed road/rail alignment will traverse across the coastal sand and barren land. The alignment is selected such a way that there will not be any disturbance to the existing structures. The proposed road connectivity is not an access controlled private facility and hence local people will be allowed to use as required. • Anticipated Potential impacts due to the proposed Rail/Road alignment and respective mitigation measures are provided in the EIA report.
Shri. Umesh Mesta, Society	He stated that, project proponent have not obtained	• Final EIA report is prepared based on the proceedings of the public hearing with necessary responses for the

Name of the Speaker & Place	Issues Raised	Response from HPPL
Chairman, Honnavar	clearance from CRZ as CRZ notification is applicable to the project. He also expressed that the proponents have failed to present clear picture of the proposed project. He also objected for the project on behalf of the Society.	clarifications raised by the public. The same will be submitted to the respective CZMA authorities to obtain CRZ Clearance. • The proponent is legally bound to obtain all clearances as per the regulatory frame work of the country. This public hearing is also part of the legal process to obtain all clearances required for the project. • The details of the project and its components were well described in Chapter 2 of Draft EIA report as well as in Executive Summaries both in English and Kannada Languages. During Public Hearing also the project development details were spelt out clearly and presented.
Shri. J.D.Naik, MLA, Honnavar	• He informed that, he was attending the public hearing as a public representative. • He expressed that he was in support of the project if it fulfils long pending demand for development works such as construction of break water, Dredging, harbor development which will facilitate the local fishermen community in their fishing activity.	As a part of proposed development, construction of breakwater, dredging etc., will be carried out.
	• However, he was opposed to the project if the life of the local community, their profession & business are likely to be affected. • He also informed that the final say on the proposed project was entirely dependent on the will of the local community and that he would stand by their decision.	• Construction activities involve dredging, construction of cargo berths which may likely to disturb the fishing activity at nearby villages. However, necessary marker buoys shall be installed and interactions shall be initiated with the fishing communities about the marker buoys indicating the areas of operation so that they may avoid those areas during construction period. • During operation phase, barges/vessels movements may hinder the fishing vessels approach to the fish landing wharf and to the sea. Awareness will be given to the fishermen about the barges/vessels movement's time schedules and clearances required for safe manoeuvring etc., During berthing of barges/vessels, necessary clearances shall be made available to ensure the fishing vessels movements.

7.1 Social Impact Assessment

7.1.1 Social Impacts during Construction Phase

7.1.1.1 Land Acquisition

HPPL has been allotted to use government land of 44 hectares by Government of Karnataka near Sharavati river mouth in Kasarkod Tonka village to develop a barge/vessel loading facility. Hence, further no land acquisition envisaged.

7.1.1.2 Impact on Nearby Settlements

The impact on nearby settlements during construction phase will be due to air pollution and the noise generating activities. However, the activities are limited to the construction phase and will cease upon completion of the construction. Hence, this impact is considered to be negligible and therefore can be classified as insignificant.

The dust suppression measures such as sprinkling of water and suitable enclosures around the high noise generating areas within construction area will be provided.

The noise generating equipment will be provided with suitable enclosures such that cumulative noise will be within permissible limits.

7.1.1.3 Fishing Activity

The construction activities involve dredging, construction of cargo berth which may likely impact the fishing activity at nearby fishing villages. There are no major fishing zones in the study area. The fish landing centres in the study area are Kasarkode ~1km, Mavinkurve ~3.4km, Haldipur ~3.8km, Dhareshvar ~7.6km, Manki-Madi ~13.2km and fishing settlements within 5km radius are Karki ~0.97km, Honnavar ~1.2km, Mavinkurve ~2.5km and Haldipur ~4.3km.

However, necessary marker buoys shall be installed and interactions shall be initiated with the fishing community about the marker buoys indicating the areas of operation so that they may avoid those areas during construction period. Hence, minimal hindrance to fishing activity is anticipated during construction phase of the proposed barge/vessel loading facility.

7.1.1.4 Employment Potential

The employment potential from the construction phase of the proposed port is estimated as 500 persons.

7.1.2 Social Impacts during Operational Phase

7.1.2.1 Fishing Activity

During operation phase, barges/vessels movement may hinder the fishing vessels approach to the fish landing wharf and to the sea. Awareness will be given to fisherman about the barge/vessel movement’s time schedule and clearances required for safe manoeuvring etc., during berthing of barges/vessels, necessary clearances shall be made available to ensure the fishing vessels movements.

Necessary marker buoys shall be installed and interactions shall be initiated with the fishing community about the marker buoys indicating the areas of operation so that they may avoid those areas during construction period.

7.1.2.2 Employment Potential

The expected direct employment will be 50 persons. The proposed project is likely to have positive impact on socio-economic condition of the region overall.

7.1.2.3 Public Health and Safety

The proposed Barge/ Vessel loading facility handles coal and other cargoes which can be classified as non-hazardous. However suitable safety procedures will be followed by HPPL during handling and transportation of cargo.

An effective Disaster Management Plan (DMP) which includes Onsite and Offsite emergency plan will be prepared and followed to minimize the probability of occurrence of emergency situations and mitigate the impacts.

7.2 Traffic and Transportation Study

Proposed: The Proposed project alignment section traverses along the sea coast from the proposed Honnavar port in the North-South Direction before merging back on to the NH-66 with a total length of 2.58km.

Strengthening: The section from Km. 195+000 to 197+000 takes off from the end approach of Sharavati River Bridge travelling from KarwarMangalore Direction. The embankment height in this two-kilometre section along the existing road is varying from 0.5m to 8m. The Project Road is having 4-Lane divided carriageway with paved and earthen shoulders throughout the length of the stretch for two kilometres. It is proposed to strengthen this stretch of the road. The pavement condition of the existing road (NH-66) is generally good/fair. The surface of existing road section is having bituminous pavement throughout the length of the alignment.

Since there is no past traffic data for the proposed access Road from Honnavar Port as it is newly proposed, the expected traffic data for the next five years has been considered.

7.2.1 Design Period

Four-laning manual through (IRC SP 84-2019) specifies the minimum design period of 15 years or the operation period, whichever is more. The rigid pavement is designed for 30 years as per clause 5.4.2, para (i) of IRC SP 84-2019.

7.2.2 Anticipated Road Traffic

It is anticipated that total yearly forecast for Honnavar Port is around 4.9 MTPA. The traffic forecast in terms of PCU's is around 4722 PCU's for Cargo Quantity of 4.9 MTPA. Hence considering the above capacity, lane configuration of four lane with Paved Shoulders (4L+PS), has been proposed.

Around 300 day of annual production takes place, and the cargo is transported by 2 axle & Multi axle trucks. Due to this, overloading of these vehicles is considered. So the standard axle is taken as 20% more of the standard legal axle. The estimated truck movement on road for the proposed port is given in **Table 7-2.**

Table 7-2: Annual Average Daily Traffic (AADT)

S. No	No of Truck Movement on Road		PCU (Vehicle)		Total PCU
	2 Axle	MAV	Up	Down	
1.	564	149	2361	2361	4722

7.2.3 Recommendations

Following are the recommendations from the traffic study:

- Due care shall be taken for Protection works for the port road on the sea side at the execution stage.
- Rigid Pavement has been proposed considering the port traffic and coastal weather conditions which are subjected to heavy rainfalls, maintenance etc.
- A toll collection office is proposed at Ch. 0+000 at the entry gate of the Port.
- Since majority of the road alignment for runs along the seashore, provision for bank protection shall be made by providing sheet piles

7.3 Spillage and Contingency Plan

The purpose of this plan is to identify, prevent and control all probable spillages in Barge/ vessel loading facility for safe and healthy working of facility personnel and machinery.

Probable spillage:

- Electrical equipment area (Transformer oil and cable filling compounds)
- Liquid and solid wastes
- Cargo (coal and Iron Ore) spills
- Oil during bunkering, from Ships, Barge/ vessels, tugs and other facility crafts

Spillages in the Barge/ vessel loading facility can lead to:

- Causing loss of property
- Interfaces with safe moving of personnel
- Damage to equipment when left unattended
- Health hazard i.e., toxic when released in air or mixes with the main Barge/ vessel loading facility drain system and further to sea.
- Fire hazard

Prevention of spillage:

Routine checks of the system have to be made to ensure that no leak or spill starts. Any minor leakage has to be reported to the concerned person (Shift In-charge, Operation & Maintenance team member). Leakage has to be arrested in the shortest possible time. Necessary arrangements have to be made to collect the leakage and to store in proper place.

In case of spillage the following measures would be adopted:

- Oil spill on the land should be properly cleaned using absorbents, cotton waste, sand, saw dust, etc.
- The collected oil is disposed to SPCB/CPCB authorized agency.
- Oil spill on the barge/vessel loading facility premises should be properly cleaned using absorbents, cotton waste, sand, saw dust, etc., and the materials used for cleaning should be incinerated.
- Major oil spills can be taken to oil separator and the same to be reused depending on the quality.

7.3.1 Oil Spill Contingency Plan

The barge/vessel loading facility will be equipped with minimum equipment to contain and recover oil spills. In addition, HPPL will develop a customised Oil Spill Contingency Plan to cope with any accidental oil spill during bunkering if any. The contingency plan will be prepared by HPPL in consultation with the Department of Ports, GoK.

In case of an oil spill, immediate steps would be taken to contain and control the spill. An Oil Spill Contingency Plan will outline the steps to be taken before, during and after a spill. In the present case, an Oil Spill Contingency Plan covering the following will be prepared:

- Hazard Identification
- Vulnerability Analysis
- Risk Assessment
- Response Actions.

Hazard Identification: All conditions which can lead to an oil spill will be identified and necessary information to react to a spill under different conditions will be studied.

Vulnerability Analysis: Vulnerability analysis will help to identify the resources and communities which could be affected due a spill and accordingly they can be informed or quick measures can be taken so that it results in minimum damage. Information on the following will be collected as a part of vulnerability analysis:

- Public safety officials
- Schools, nursing homes, hospitals and prisons in the area
- Recreational areas
- Special events such as festivals and when they occur
- Ecologically sensitive areas specially areas susceptible to oil or water pollution

Risk Assessment: Based on hazard identification and vulnerability analysis, the extent of risks involved will be assessed.

Response Actions: Response actions will provide information on all the immediate actions that will be taken in the event of a spill. It will have information on the following:

- Measures to prevent further flow of oil
- Measures to prevent ignition
- Agencies responsible for clean-up effort
- Information on the extent of spill
- Measures to contain spill to a limited area
- Measures to remove oil
- Measures to dispose the spilled oil

Mock drills will be carried out to test the effectiveness of the contingency plan.

7.3.2 Liquid Cargo Spillage

HPPL will be handling about 0.08 MTPA of Molasses and 0.07 MTPA Edible oil at the proposed port which would work out to be a small quantity per single vessel handled. The molasses spill in the harbour basin has been analysed by using suitable mathematical models and presented below.

Barge/vessel loading facility proposed in the Sharavathi River experiences both river as well as tidal flow. It is assumed that the accidental spills are expected during loading, storage, grounding and collision during berthing of barges/vessels. As the places such as Mangroves and islands are located inside the river Sharavathi, the spill in the berthing areas are considered to determine the changes in the water quality of river Sharavathi and around the mangroves and islands.

Honnavar Barge/Vessel loading facility is proposed to handle/ export 0.08 MTPA of molasses. Mathematical model studies have been carried out for accidental spill of molasses considering the molasses will be handled by maximum of 10000 DWT vessels. However, the molasses will be handled through various sizes of barges of 1000 DWT to 10000 DWT vessels.

Since the barge loading facility area is experiencing both tidal and river flow, the mathematical model equations developed by O'Connor, 1960,1962,1965 and Thomann, 1972 for the estuaries is used to determine the fate of releases spill in to the environment.

Maximum and minimum flows of Sharavathi river are 50 m^3/sec during dry season and 200-500 m^3/sec during wet season respectively. During wet season mostly the flow will be from river to sea whereas in dry season flood flow will be in reverse direction i.e. from sea to river.

Estimating the time and special behaviour of water quality in estuaries is complicated by the effects of tidal motion. The upstream and downstream currents produce substantial variations of water quality at certain points in the estuary and the calculation of such variation is indeed a complicated problem. Some simplifications can, however, be made which provide some remarkably useful results in estimating the distribution of estuarine water quality. The simplifications can be summarized through the following assumptions:

- Estuary is one-dimensional.
- Water quality is described as a type of average condition over a number of tidal cycles.
- Area, flow, and reaction rate are constant with distance.
- Estuary is in a steady state condition.

A water body is considered to be a one –dimensional estuary when it is subjected to tidal reversals (i.e., reversals in direction of the water velocity) and where only the longitudinal gradient of particular water quality parameters is dominant.

The following are the cases are considered to determine the fate of accidental spill of liquid cargo in the river.

1. Case 1: Dry Season – Lean Flow of 50 m^3/s
2. Case 2: Wet Season – Peak Flow of 300 m^3/s

In the above cases, the credible accidental scenarios expected at the facility are given below:

- 250X5 mm Leak in the Barge/Vessel
- 250X10 mm Leak in the Barge/Vessel
- 250X25 mm Leak in the Barge/Vessel
- 500X5 mm Leak in the Barge/Vessel
- 500X10 mm Leak in the Barge/Vessel
- 500X25 mm Leak in the Barge/Vessel
- 750X5 mm Leak in the Barge/Vessel
- 750X10 mm Leak in the Barge/Vessel
- 750X25 mm Leak in the Barge/Vessel
- 1000X25 mm Leak in the Barge/Vessel

7.3.2.1 Case 1: Dry Season

U, Nontidal Velocity	=0.025 m/s
Q, Net Flow	=50 m^3/s
A, Area	=1996 m^2
E, Longitudinal Dispersion Co-Efficient	=56 m^2/s
Kd, Decay rate Co-efficient	= 0.15 /day
Ka, Re-aeration rate Co-efficient	= 0.18/day
W, Maximum Pollutant load rate	=10.417kg/sec

7.3.2.2 BOD Variations

The BOD variations were studied by considering the following equation:

$$L = L_0 \exp[\frac{ux}{2E}(1 \pm m_1)]$$

BOD, Do Deficit & DO variations are given in the **Figure 7-1, Figure 7-2, Figure 7-3** respectively.

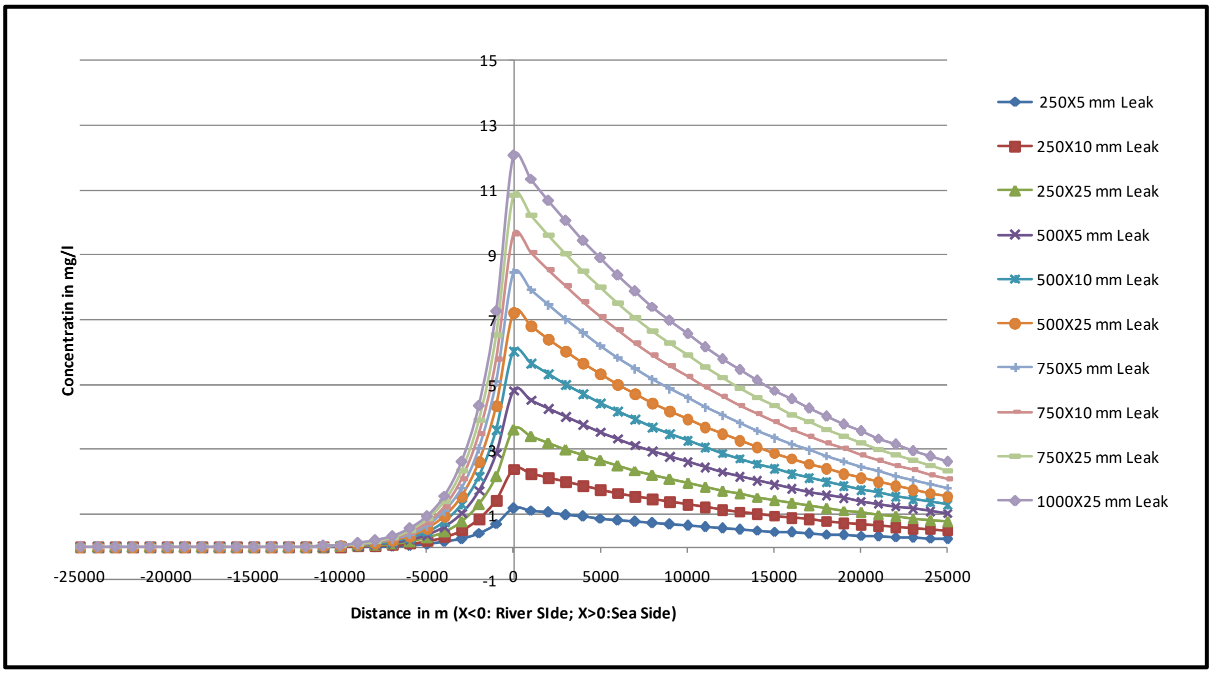


Figure 7-1: BOD Variations during Dry Season

The BOD variations for pollutant loads considering different credible accidental scenarios were studied. From the model studies, it can be inferred the following:

- BOD is varying from 1.13 mg/l to 11.3 mg/l near River Confluence point
- BOD is varying from 1.2 mg/l to 12 mg/l at the Point of Discharge
- BOD is varying from 0.15 mg/l to 1.58 mg/l near Mangrove in the Sharavathi River
- BOD is varying from 0.05 mg/l to 0.57 mg/l near Mavinkurve island

It is observed that the BOD variation for maximum pollutant load is ranging from 12 mg/l to 0.0004 mg/l in the River from point of discharge to 20 km upstream of River.

7.3.2.3 D0 Deficit

The D0 Deficit variations were studied by considering the following equation:

$$D = \frac{k_d W}{(k_a - k_d)Q}\left[\frac{\exp[\frac{ux}{2E}(1 \pm m_1)]}{m_1} - \frac{\exp[\frac{ux}{2E}(1 \pm m_2)]}{m_2}\right]$$

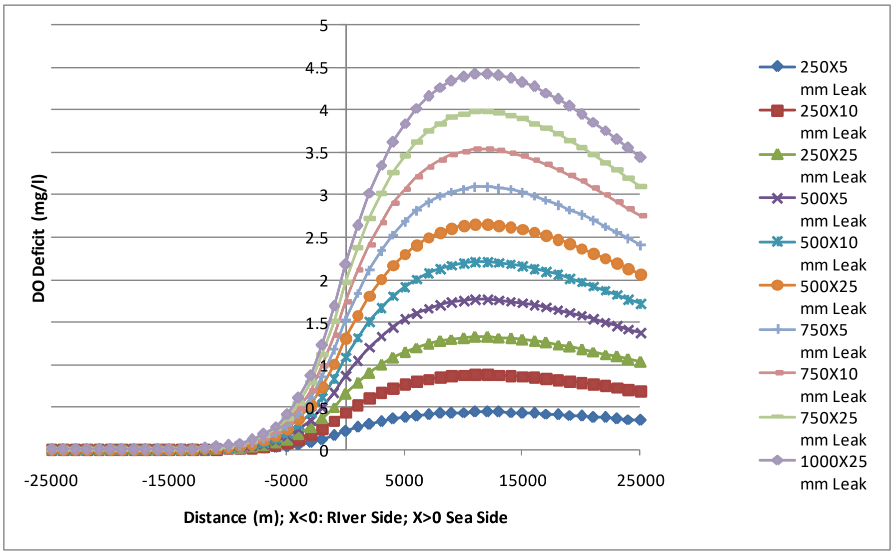


Figure 7-2: DO Deficit during Dry Season

The DO Deficit for pollutant loads considering different credible accidental scenarios were studied. From the model studies, it can be inferred the following:

- DO Deficit is varying from 0.26 mg/l to 2.63 mg/l near River Confluence point
- DO Deficit is varying from 0.218 mg/l to 2.18 mg/l at the Point of Discharge
- DO Deficit is varying from 0.06 mg/l to 0.60 mg/l near Mangrove in the Sharavathi River
- DO Deficit is varying from 0.027 mg/l to 0.27 mg/l near Mavinkurve island

It is observed that the DO Deficit variation for maximum pollutant load is ranging from 2.18 mg/l to 0.0005 mg/l in the River from point of discharge to 20 km upstream of River.

7.3.2.4 DO Variations

Based on the DO deficit results, the DO variations for credible accidental scenarios were arrived by using the following equation:

DO=Cs-C, where Cs is DO saturation and C is DO Deficit of each scenario

Cs= 8.01 mg/l at 5 ppt salinity and 25^0 C

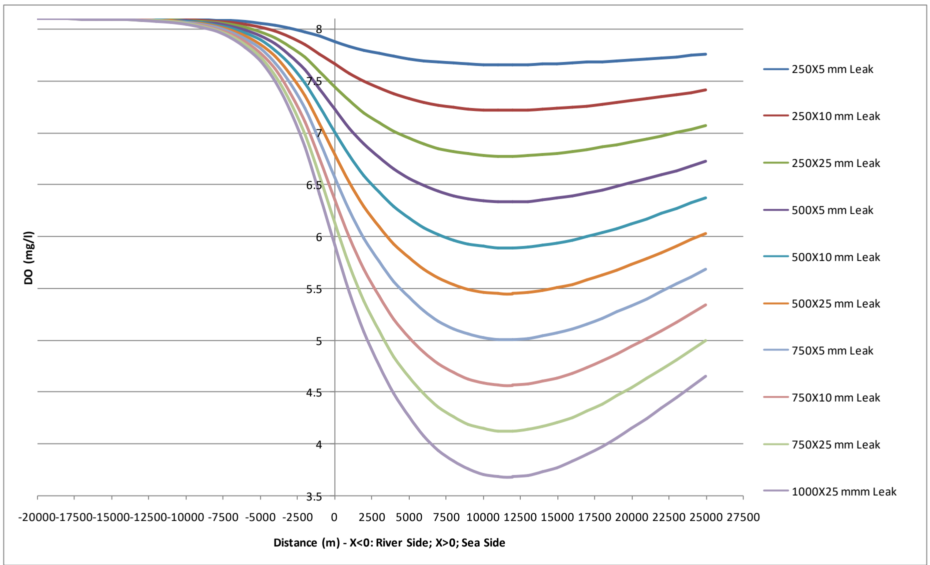


Figure 7-3: DO Variation during Dry Season

The DO variation for pollutant loads considering different credible accidental scenarios were studied. From the model studies, it can be inferred the following:

- DO variation is varying from 7.83 mg/l to 5.46 mg/l near River Confluence point
- DO variation is varying from 7.88 mg/l to 5.91 mg/l at the Point of Discharge
- DO variation is varying from 8.03 mg/l to 7.49 mg/l near Mangrove in the Sharavathi River
- DO variation is varying from 8.07 mg/l to 7.82 mg/l near Mavinkurve island

It is observed that the DO variation for maximum pollutant load is ranging from 5.91 mg/l to 8.09 mg/l in the River from point of discharge to 20 km upstream of River.

Therefore in all scenarios the DO is more than 4 mg/l which meets the Surface water quality standard.

7.3.2.5 Case 2: Wet Season

U, Nontidal Velocity	=0.15 m/s
Q, Net Flow	=300 m^3/s
A, Area	=1996 m^2
E, Longitudinal Dispersion Co-Efficient	=338 m^2/s
Kd, Decay rate Co-Efficient	= 0.15 /day
Ka, Reaeration rate Co-Efficient	= 0.18/day
W, Maximum Pollutant load rate	=10.417kg/sec

7.3.2.6 BOD Variations

The BOD variations were arrived by considering the following equation:

$$L = L_0 \exp[\frac{ux}{2E}(1 \pm m_1)]$$

BOD, Do Deficit & DO variations are given in the **Figure 7-4, Figure 7-5, Figure 7-6** respectively.

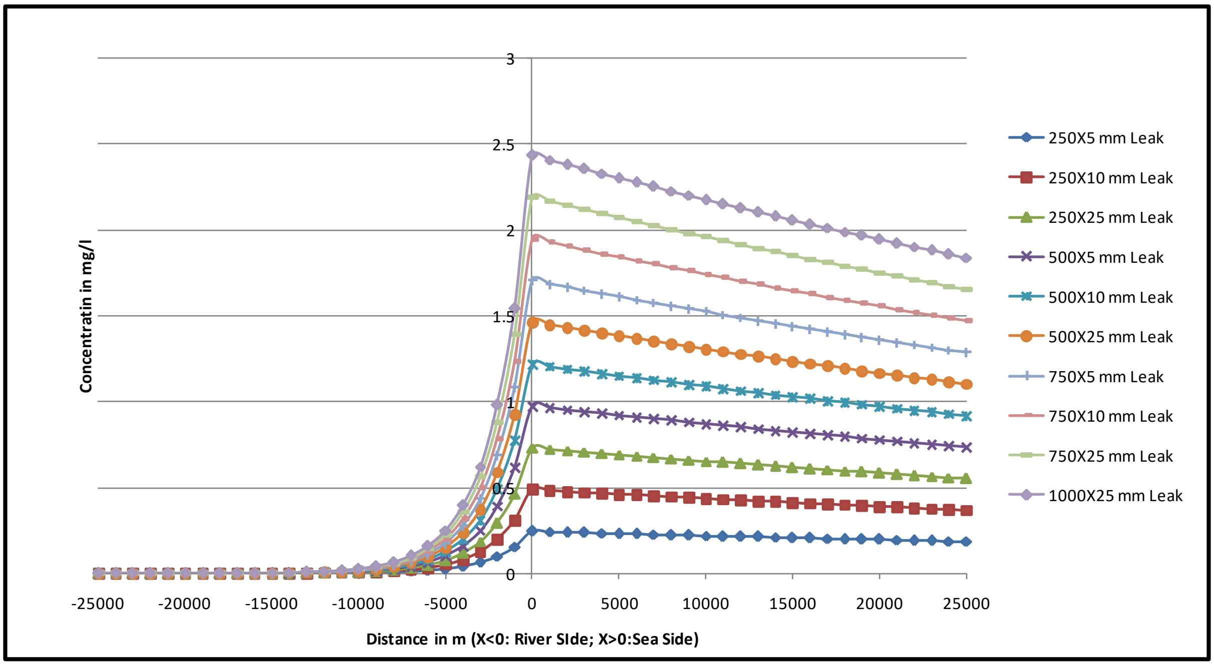


Figure 7-4: BOD Variations during Wet Season

The BOD variations for pollutant loads considering different credible accidental scenarios were studied. From the model studies, it can be inferred the following:

- BOD is varying from 0.24 mg/l to 2.40 mg/l near River Confluence point
- BOD is varying from 0.24 mg/l to 2.43 mg/l at the Point of Discharge
- BOD is varying from 0.03 mg/l to 0.39 mg/l near Mangrove in the Sharavathi River
- BOD is varying from 0.01 mg/l to 0.15 mg/l near Mavinkurve island

It is observed that the BOD variation for maximum pollutant load is ranging from 2.43 mg/l to 0.0002 mg/l in the River from point of discharge to 20 km upstream of River.

7.3.2.7 DO Deficit

The DO Deficit variations were studied by considering the following equation:

$$D=\frac{k_d W}{(k_a-k_d)Q}\left[\frac{\exp[\frac{ux}{2E}(1\pm m_1)]}{m_1}-\frac{\exp[\frac{ux}{2E}(1\pm m_2)]}{m_2}\right]$$

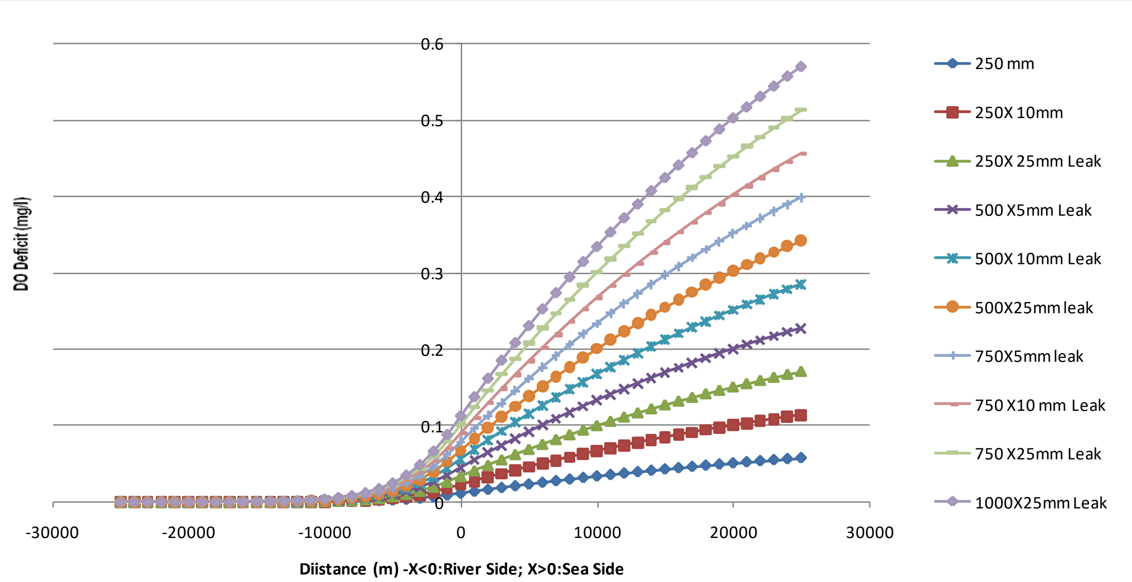


Figure 7-5: DO Deficit during Wet Season

The DO Deficit for pollutant loads considering different credible accidental scenarios were studied. From the model studies, it can be inferred the following:

- DO Deficit is varying from 0.01 mg/l to 0.13 mg/l near River Confluence point
- DO Deficit is varying from 0.01 mg/l to 0.11 mg/l at the Point of Discharge
- DO Deficit is varying from 0.003 mg/l to 0.03 mg/l near Mangrove in the Sharavathi River
- DO Deficit is varying from 0.001 mg/l to 0.01 mg/l near Mavinkurve island

It is observed that the DO Deficit variation for maximum pollutant load is ranging from 0.11 mg/l to 0.000069 mg/l in the river from point of discharge to 20 km upstream of River.

7.3.2.8 DO Variations

Based on the DO deficit results, the DO variations for credible accidental scenarios were arrived by using the following equation:

DO=Cs-C, where Cs is DO saturation and C is DO Deficit of each scenario

Cs= 8.01 mg/l at 5 ppt salinity and 25^0 C

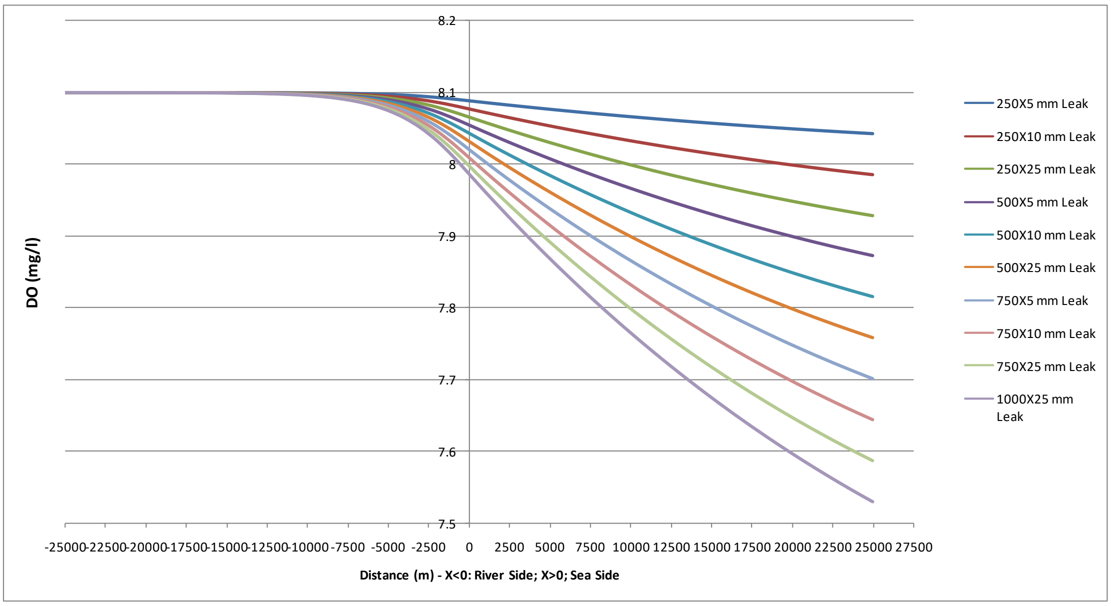


Figure 7-6: DO Variation during Wet Season

The DO variation for pollutant loads considering different credible accidental scenarios were studied. From the model studies, it can be inferred the following:

- DO variation is varying from 8.08 mg/l to 7.96 mg/l near River Confluence point
- DO variation is varying from 8.08 mg/l to 7.98 mg/l at the Point of Discharge
- DO variation is varying from 8.09 mg/l to 8.06 mg/l near Mangrove in the Sharavathi River
- DO variation is varying from 8.09 mg/l to 8.08 mg/l near Mavinkurve island

It is observed that the DO variation for maximum pollutant load is ranging from 7.98 mg/l to 8.09 mg/l in the river from point of discharge to 20 km upstream of River.

Therefore, in all scenarios the DO is more than 4 mg/l which meets the Surface water quality standard.

Hence, it is pertinent to mention that the credible accidental scenarios result insignificant variations of BOD and DO of the Estuary/River. Therefore, the impact on sensitive areas such as Mangroves, Island and Estuary is insignificant.

7.4 Preliminary Risk Analysis

7.4.1 Hazard Identification

A classical definition of hazard states “hazard is in fact the characteristic of a system/plant/process that presents potential for an accident.” Hence, all the components of a system such as process, storage of chemicals, etc., need to be thoroughly examined to assess their potential for initiating or propagating an unplanned event/sequence of events, which can be termed as an accident.

Hazards in the proposed facility were identified in this section in terms of:

a. Hazards during Construction Phase
    - Mechanical Hazards
    - Transportation Hazards
    - Physical Hazards
    - Storage and Handling of Hazardous Materials

b. Hazards during Operation Phase
   - Material Hazards
   - Handling Hazards
c. Hazards due to Natural Calamities
   - Earthquake
   - Tsunami
   - Cyclone

The summary of potential hazards and the probable impacts are given in **Table 7-3.**

Table 7-3: Summary of Potential Hazards

S. No	Potential Hazard	Probable Impacts
	Man Made	
1	Berthing Accidents	Impact on berth (mooring, structure)
2	Carrier Running Aground	Oil Spills, Wreckage
3	Fuel/ Oil Spills, Leaks	Impact on aquatic (marine) environment
4	Break/leak	Asphyxiation/ breathing problems due to fine dust in the air, shutting down of operation
5	Cargo loading/Unloading	Failure of loaders/unloaders may result in cargo deposition in sea and settling on seabed
	Natural	
1	Tropical Storms, Cyclones, Heavy Rain	Rough seas during particular seasons during which carrier berthing is not possible; accidents due to collision with jetty
2	Earth Quake/Tsunami	Damage buildings and equipment, inundation of jetty
	Others	
1	Fire	Fire outbreaks can vary in size and location can cause extensive damage
2	Accident	Can occur at any time especially due to falling debris during construction; operation procedure

7.4.2 Hazards during Construction Phase

Potential hazards during the construction phase of the project could be due to the mechanical hazards, navigation/ transportation hazards, physical hazards and storage and handling of hazardous materials.

Mechanical Hazards: Mechanical hazards during the construction phase arise due to the moving parts in the machinery, especially the belts and bolts of the construction equipment, which are heavy and pose a threat to the work personnel. Other hazards include falling (during working at heights), falling objects like hand held tools, etc; failure of slips and traps created for scaffolding; and due to faulting of electrical equipment.

Navigation/ transportation Hazards: The planning of access/egress to the construction site also plays a significant role in minimizing the associated hazards such as vehicles/vessel collision.

Physical Hazards: The noise and vibrations generated during the construction phase may affect the workers' health, hinder effective communication and may jeopardise sensitive organs. In addition to noise and vibration, hot works also pose a considerable hazard to the workers.

Storage and handling of hazardous materials: During the construction period, storage of hazardous materials like fuel for the engines, lubricants, paints and other flammable materials is likely to pose a fire and explosion risk. Due care shall be taken in locating these materials away from the workplace, free of any influence of temperature or sparks or fire. Proper wiring of the electrical appliances like lights, exhausts, etc., would be made to ensure that there are no live wires causing short circuits to ignite these materials.

7.4.3 Hazards during Operational Phase

7.4.3.1 Material Hazards

The proposed Barge/ vessel loading facility handles coal, iron ore, molasses, fertilizer and other general cargo which can be classified as non-hazardous.

Hazard Intensity Classification

The hazard ratings of various cargoes proposed to be stored in the port area w.r.t National Fire Protection Agency (NFPA) rating is provided in **Table 7-4.**

Table 7-4: NFPA Ratings of Various Materials

S. No.	Material	Properties	NFPA Hazard Intensity			Hazards due to Human Exposure
			H	F	R	
1	Coal	• Melting Point: 750oF • Flash Point: >260oF • Auto Ignition Temperature: 260-365oF	1	1	0	The chronic stage involves massive pulmonary fibrosis that does impair pulmonary function and shorten life. Chronic Bronchitis (lung inflammation, coughing attacks, difficult breathing, etc.) and emphysema can result from excessive coal dust inhalation. Rheumatoid arthritis can be exacerbated by pneumonias leading to rapidly developing lung damage (Caplan's Syndrome).
2	Iron Ore	-	1	0	0	Inhalation may cause irritation to mucous membranes Skin & eye contact may cause irritation

Table 7-5: NFPA Hazard Rating

NFPA Hazard Intensity			
Intensity	**H: Health**	**F: Flammability (Susceptibility of material to burning)**	**R: Reactivity (Susceptibility of Material to release Energy either by themselves or in combination with other materials)**
0	Material that on exposure under fire conditions would offer no hazard beyond that of ordinary combustible material.	Will not burn.	Normally stable; even under fire exposure conditions
1	Material that on exposure would cause irritation but only minor residual injury.	Must be preheated before ignition can occur	Normally stable except in combination with certain other materials or at elevated temperatures and pressures
2	Material that on intense or continued but not chronic exposure could cause temporary incapacitation or possible residual injury.	Must be moderately heated or exposed to relatively high temperature environment before ignition can occur	Normally unstable; readily undergoes violent chemical change at elevated temperature and pressures.
3	Material that on short exposure could cause serious temporary or residual injury	Can be ignited at almost all temperatures	Can detonate or explode under a strong initiating force or after heating under confinement

NFPA Hazard Intensity			
Intensity	**H: Health**	**F: Flammability (Susceptibility of material to burning)**	**R: Reactivity (Susceptibility of Material to release Energy either by themselves or in combination with other materials)**
4	Material that on very short exposure could cause death or major residual injury	Will rapidly or completely vaporize at atmospheric pressure and normal temperature or will rapidly disperse in air and burn easily.	Readily detonates or explodes at normal temperatures and pressure

Coal:

a. **Fire hazard:** Coal is susceptible to spontaneous combustion, most commonly due to oxidation of pyrite or other sulphidic contaminants in coal.

Coal reacts with atmospheric oxygen even at ambient temperatures and this reaction is exothermic. If the heat liberated during the process is allowed to accumulate, the rate of the above reaction increases exponentially and there is a further rise in temperature. When this temperature reaches the ignition temperature of coal, the coal starts to burn and the phenomena is described as spontaneous combustion.

Initiation of spontaneous combustion is through development of hot spots in the coal stockpiles. The significant factors to be considered for prevention of this development are as follows:

- Ventilation
- Coal Quality: low carbon content and large amounts of volatile components support combustion
- Particle Size: the smaller the particles, the larger the surface, the higher the risk
- Stockpile Design
- Humidity

b. **Dust explosion:** Coal dust is prone to ignition depending on its concentration in air and presence of ignition sources. Coal dust therefore represents a significant explosion hazard in coal storage and handling facilities where coal dust clouds may be generated in enclosed spaces. The significant factors which contribute to the dust explosion are:

- Concentration of dust in suspension
- Sufficient oxygen to enable combustion
- Source of energy for ignition
- A certain degree of confinement of the suspended dust mixed with oxygen

c. **Health hazards:** Coal dust poses a possibility of reduced lung function. Workers exposed to coal dust may develop lung damage and pulmonary fibrosis. The occupational exposure standard (OES) for coal dust is 2 mg/m^3 of respirable dust (Exposure limit eight-hour TWA). OES is the level of dust at which there is no evidence of injury to people exposed day after day.

7.4.3.2 Handling Hazards

a. **Cargo handling:** The major components of proposed Barge/ vessel cargo handling system are Barge loaders, Mobile Harbour Cranes and pay loaders etc.,

b. **Barge/ vessel movements:** The possible hazards during Barge/ vessel movements at the barge/ vessel loading facility are collision, grounding, etc.

c. **Barge/ vessel unloading:** During Barge/ vessel unloading operations, the possible hazard may arise due to collision by other Barge/ vessels and others.

d. **Transfer operation:** The transfer operation involves transfer of cargo from mother ship to Barge/ vessel and Barge/ vessels to stock yard or others. During this operation there is a possibility of mal operation/non-synchronisation/misalignment leading to cargo spillage.

7.4.3.3 Hazards due to Natural Calamities

a. **Earthquake:** As per Seismic Zoning Map of India, the project area falls under Zone-III (moderate to low-risk zone) as per the IS: 1893, Part-I, 2002. The design of the facilities should incorporate this factor which would give the required structural integrity.

b. **Cyclone/Tsunami:** Karnataka is one of the cyclone prone areas in west coast of India. In general, west coast experienced less inundation during December 2004 Tsunami. However, necessary mitigation steps shall be taken during cyclone as per Cyclone Contingency Plan and during Tsunami as per “Ship Action Policy against Tsunami”.

7.4.4 Enumeration of Potential Accidents

The possible accidents from the proposed barge/vessel loading facility are envisaged from the spontaneous ignition of coal.

Fire due to spontaneous combustion of coal dust: Coal dust when dispersed in air and ignited would explode. Stock yards are most susceptible to this hazard. To be explosive, the dust mixture should have:

- Particles dispersed in the air with minimum size
- Dust concentrations must be reasonably uniform
- Minimum explosive concentration for coal dust (33% volatile) is 50 g/m^3.

Failure of dust extraction and suppression systems may lead to abnormal conditions and increasing the concentration of coal dust to the explosive limits. Sources of ignition present are incandescent bulbs with the glasses of bulkhead fittings missing, electric equipment and cables, friction, spontaneous combustion in accumulated dust.

Dust explosions may occur without any warnings with maximum explosion pressure up to 6.4 bar. Another dangerous characteristic of dust explosion is that it sets off secondary explosions after the occurrence of the initial dust explosion. Many a time, the secondary explosions are more damaging than primary ones.

7.4.5 Safety Features

The built in safety features in the proposed facility are given in this section.

Firefighting facilities shall be provided with fire hydrant systems and jockey pump. Based upon the type of fire, additional combustible material onsite fire extinguishers of Class A, B, and C will be planted to suppress/prevent the spreading of the fire. The firefighting facilities (hydrant system etc.) to be provided in the barge/vessel loading facility are discussed below:

The fire fighting in the port shall consist of the following:

- Fire protection
- Fire alarms
- Fire-fighting equipment
- Means of escape in case of fire

All sources of ignition (especially in the warehouses) shall be highly controlled. Appropriate use of firefighting equipment shall be provided throughout the barge/vessel loading facility area. All portable fire-fighting equipment shall be grouped at clearly marked fire points, which are marked with conspicuous signs and markings. The choice of firefighting equipment depends on the nature of the cargo stored. The entire barge/vessel loading facility area shall be provided with firefighting system, which must include portable first-aid fire extinguishers and fixed system (Hoses and hydrant) and the same shall be tested at regular intervals and renewed periodically.

In accordance with the International & National guidelines and codal requirement, the type, location and number of firefighting equipment shall be determined:

- Fire points shall not be more than 80 m apart and they shall be marked clearly with signs and shall be visible at all times, it shall be located in such a way that firefighting system is brought into action quickly (Hydrants at warehouses shall be close to doors).
- Depending upon the type of fire, which may likely to occur and nature of material involved, the firefighting agents shall be selected. Catastrophe may occur if an improper fire-fighting agent will be selected.
- Commonly used fire-fighting agents are water, foam, carbon dioxide and powder. In most of the cases when water shall be used as the fire-fighting agent, the intake mains should be below water at any point of time and protected from damages.

7.4.5.1 Fire Hydrant System

The system comprises of a main working pump set, a stand-by main pump set, Jockey Pump Set and a network of hydrant main's with Single Headed Hydrants, double heated hydrants, Fire Escape Hydrants for staircases & all accessories.

Jockey pump set, min. 1 no. shall be provided to:

  - Maintain the water pressure in the Hydrant line.
  - Provide a means of pumping pressurised water to the system in case of small system demands.
  - Jockey pump shall start automatically upon receipt of a signal from pressure switches installed at the downstream of NRV provided for the Jockey Pump.

The main pumping system comprises of two numbers of Centrifugal pumps with end suction and top discharge nozzle pumps (one working and one standby). Working Pump shall be of Electric motor driven and Standby Pump Diesel Engine driven. These pump sets shall satisfy Tariff Advisory Committee (TAC) conditions of performance as a minimum.

The main pump set shall start at lower pressure level sensed by pressure switch installed downstream of the non-return valve for the main pump.

A master panel shall be provided in the pump house. This panel shall receive all the signals from the various pressure switches etc. and then relay the signals onwards to the respective local panels to initiate action to start/stop, etc. the respective pump. The selector switch housing for the selection of main working or stand-by pump set shall be in this master control panel.

Accessories:

The fire and Jockey pumps shall be complete with the following accessories:

- Suction and discharge eccentric reducers.
- Pump coupling guard.

- Common base frame
- Suction & Discharge Piping with all necessary piping & valves.
- Each pump shall have independent set of pressure switches.

Master Control Panel

The composite power cum control panel is proposed to be located in the Firewater Pump House. Incoming power supply for the control panel shall be 415V, 3 phase, 50 Hz.

The motor starters shall consist of electrically actuated contactors. The starter shall be complete with ON - OFF push buttons, timers & auxiliary contacts & shall be fully automatic. There shall be an indicating lamp with each of the pumps & an ammeter & selector switch with the fire pumps. In addition, provision shall be made for starting the motor manually to check the performance after maintenance.

The Master Control panel must be fulfilling the requirement of TAC and Visual alarm would be in the form of annunciation with the following inscriptions:

- Fire water pump(s) fail to start.
- Jockey pump fail to start.
- Low header pressure.

One hooter shall be provided to alert in fire condition & the event of any of the above fault conditions. Fire pump starting shall be annunciated through an electric siren.

One common alarm contact shall be provided to indicate a fire alarm in any of the areas. This signal shall be brought up to a terminal block in vendor's panel for further cabling to clients control system (overall).

The Fire Hydrant System installation shall conform to and meet with the requirements set out by the latest editions of:

IS:1648, 1961	Code of Practice for Fire Safety of Buildings (General) Fire Fighting Equipment and its maintenance.
IS: 3844, 1989	Code of Practice for Installation of Internal Fire Hydrants in Multi-Storied Buildings.
TAC 1998	Fire Hydrant System, sprinkler system & spray system
IS: 778: 1984	Gun metal gate, globe and check valves
IS: 1239 / 3589: 2001	Mild Steel Pipes
IS :12469 :1988	Specification of pumps
IS :5290: 1993	Specification for Landing Valves
IS: 10001: 1981 & 10002: 1981	Specification of Diesel Engine
IS: 5312 :1984	Specification for Non-Return Valve
BS: 5150 (Latest Edition)	Specification for Sluice Valve (Rising stem), PN 16.
IS: 10221:2008	Specification for Wrapping and Coating materials.
IS: 636: 1988	Non-Percolating Flexible Fire Fighting Delivery Hose
IS: 903: 1993	Specification for Hose Coupling

7.4.5.2 Fire Hydrant Posts

The height of the hydrant post shall be minimum 1200 mm overall from the ground level at readily accessible and visible locations.

7.4.5.3 Hydrant Valves

Design manufacture and construction of hydrant valves shall be conforming to IS: 5290 - 1993. Requirements regarding material, types, dimensions, construction, finish painting shall conform to IS: 5290 - 1993 type A in general.

The following tests shall be carried out by the contractor strictly as per IS: 5290 – 1993:

- Hydrostatic pressure test
- Flow test
- Water tightness test for valves
- Marking on the Hydrant valves shall be done as per IS: 5290 - 1993

7.4.6 Risk Reducing Measures

7.4.6.1 General

- Monitoring System for process parameters including manual checking should be established.
- Automation of the preliminary firefighting/system cooling initiation based on temperature and smoke detectors should be ensured to prevent a small incident from escalating. This would also give adequate time for effective personnel response and intervention.
- All sources of ignition should be removed from the storage and process areas. De-matching and removal of spark generating electronic equipment such as cellular phones should be strictly followed.
- Procedures for ensuring use of relevant Personal Protective Equipment (PPE) should be delineated and strictly enforced to prevent exposure to personnel.
- Periodic Inspection/Corrosion Monitoring
- Periodic Training to Personnel

Above all, consistent and total quality assurance for engineering design, hardware selection, through construction to commissioning and subsequent operation and maintenance has to be adopted.

7.4.6.2 Coal Handling – Prevention of Coal Dust Generation

Recommendations to prevent and control fugitive coal emissions and generation of coal dust include the following:

- Design of the facility layout to facilitate emissions management and to reduce the number of transfer points
- Use of loading and unloading equipment to minimize the height of coal drop to the stockpile
- Suppression of dust during coal transfer using spraying systems
- Providing access for fire fighting
- Eliminating the presence of potential sources of ignition, providing appropriate equipment grounding to minimize static electricity hazards
- Installing dust collector systems to capture fugitive emissions from coal handling equipment or machinery
- Loaded vehicles will be covered with tarpaulin

7.4.6.3 Control of Exposure of Coal Dust

- Keeping away people who do not need to be in dusty areas

- Using totally enclosed, continuous handling systems - these usually provide the best control and should be used whenever reasonably practicable
- Enclosing the bottoms of discharge chutes and spouts
- Suppressing dusts with sprays of water or other binding agents
- Use appropriate PPEs.

It is proposed to use loader with chutes during iron ore loading considering the following advantages.

- Minimises dust emission
- Prevention of spillage into marine environment
- Improves work safety
- Improves employee working conditions
- Reduces maintenance and clean-up cost

7.4.6.4 Navigation and Barge/ vessel/ Ship Movements

Construction Phase: Good communications and exchange of information when planning boats/Barge/ vessel movements are essential. The master and pilot should exchange information and agree on a berthing plan which should include the above information taking into account the position of obstructions such as the cranes, piles, dredgers etc. The master should inform the Barge/ vessel operator, the characteristics such as the bow flare, cranes etc.

The authorities should ensure that the construction area is well lit and that the Barge/ vessel operators and Barge/ vessel are fully informed of the berthing requirements and position of obstructions. All obstructions such as gantries and cranes should be moved out of the way or to a position where it is clear of danger from an overhanging part of the ship’s bow or stern.

If necessary, movement of boats/ Barge/ vessels/ berthing should be delayed until the gantry unloaders and cranes have been moved to a less vulnerable position.

Operation Phase: Charts, tidal information and other information about the prevailing conditions at the port should be checked prior to berthing and cargo operations. If there is any doubt about the conditions at the berth, including the available depth of water, clarification should be obtained before berthing or cargo operations start.

Even apparently minor contacts with piers and jetties should be taken very seriously and experts called in immediately to assess the extent of damage.

7.4.6.5 Safety

Construction Phase: All workers, technicians and supervisors should make use of all safety equipment such as masks, goggles, helmets, safety belts, ear muffs safety shoes, etc., as required, during the construction phase. Danger areas will be marked in order to restrict unauthorized entry into the Project area. Proper security arrangements will be made during nights to avoid any accidents due to unauthorised entry of workers or civilians. Adequate and proper fire-fighting facilities will be provided by the management in all areas so as to take care of all unexpected fire accidents.

Operational Phase: The following safety measures in addition to those outlined in previous subsections are recommended:

- Preparation of detailed operational procedures including instructions for emergency situations

- Preparation of strict working procedures in connection with repair and maintenance of the various equipment and systems.

7.4.6.6 Hazardous Material Storage

The hazardous materials anticipated to be stored at the site during construction are gas for welding, fuel for operating construction equipment, paint, etc. All these and other materials of a dangerous or hazardous nature will be stored as per the norms of industrial safety.

7.5 Disaster Management Plan

The disaster management plan mainly deals with:

- Prevention of loss of life
- Damage limitation
- Preparedness to deal with any disaster
- Return of normal working after the crisis
- The plan also delegates specific assignments to available manpower with a view to avoid over-lapping of activities between various groups.

7.5.1 Causes of Disaster

- Natural: Flood, Earthquakes, cyclones, Tsunami and Lightning
- System failure, design deficiency, bad operating practice, sabotage resulting in
    - Fire
    - Explosion
    - Release of toxic/ inflammable gases

7.5.2 Categorization of Emergency

Any emergency situation has to be first categorised as an onsite emergency or an offsite emergency, the difference being that the effects of the onsite emergency are confined within the premises while those of an offsite emergency spill over beyond the Barge/ vessel loading facility premises or even beyond the project site premises. Thus, the onsite and offsite emergency plans are detailed below:

7.5.3 Onsite Emergency Plan

The plan would have the following components:

- Formulation of Disaster Management Plan and Emergency Services
- Organisation Structure
- Roles and Responsibilities of Emergency Teams
- Communication
- Emergency Control Centre
- Alarm Systems & Assembly Points
- Mutual Aid Scheme
- Onsite Emergency Plan and Rehearsals
- Spillage & Contingency Plan
- Formulation of Disaster Management Plan for Cyclones

7.5.3.1 Formulation of Disaster Management Plan and Emergency Services

The assessment of the risks and hazards leads either to improvements being made at the installation in the form, for example, of additional safeguards or better procedures, or the decision being taken that the risk is sufficiently small to be accepted.

The Disaster Management Plan must be related to the final assessment, and it is the responsibility of the HPPL management to formulate it. The plan will include the following elements.

- Assessment of the magnitude and nature of the events foreseen and the probability of their occurrence
- Formulation of the plan and liaison with outside authorities, including the emergency services
- Procedures for raising the alarm and communication both within and outside the barge/vessel loading facility
- Appointment of key personnel and their duties and responsibilities (organizational structure)
- Emergency Control Centre and Action on site/Action off site

7.5.3.2 Organization Structure

The first few minutes after the incident/accident are invariably the most critical period in prevention of escalation. Therefore, the personnel available at or near the incident site (and often responsible for or carrying out that particular activity) and on around the clock basis play a vital role in an emergency. This concept is made use of in nominating the Key Persons.

In each hazardous location it is necessary to nominate a functionary as the "Incident Controller" who is invariably a shift-in-charge of the facility. The Incident Controller tackling the emergency in real terms requires support from various other services e.g. fire & safety, medical services, security, engineering, administration, technical services covering communication, transport and personnel functions, etc. A Key Person for each one of these services, therefore, should be nominated.

The "Site Main Controller" (SMC) will be the Unit In-charge. The various controllers selected to carry out the work will co-ordinate with the SMC through the functional Key Persons at the incident site. The Key Persons will generally be at the site of incident and the Controllers will report at the Emergency Control Centre.

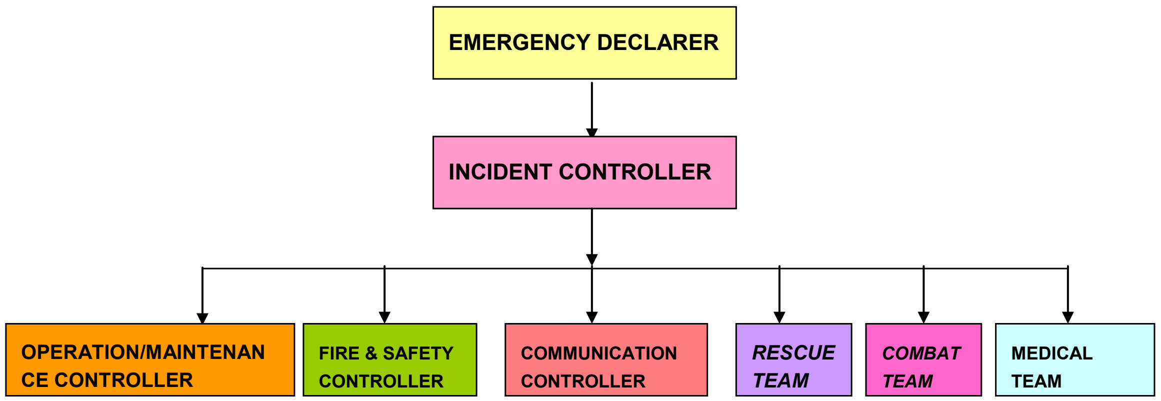
The duties and responsibilities of various Key Persons and Controllers will be written down ensuring no grey areas or overlapping responsibilities.

Various Controllers will be drawn from the organisation and clear-cut responsibilities will be spelt out for the following controllers:

- Operation Controller
- Maintenance Controller
- Fire and Safety Controller
- Communication Controller
- Environment Controller

A Succession chart will be developed as above nominating second-line controller who would act as controller in the absence of any of the above officials.

An emergency organisation chart is as follows:



7.5.3.3 Roles and Responsibilities of Emergency Team

i) Site Main Controller (In-charge)

- To access the extent and magnitude of the damage and by maintaining communication with the Site Incident Controller (SIC).
- To determine how far the emergency control plan can be extended
- Prepare action for monitoring and controlling the emergencies
- To decide whether any section/process/area to be shut down/isolated in the event of any accident
- To finalise the means of evaluation and explore the possibilities of taking help from offsite sources
- Review the firefighting operations in consultation with Safety Coordinator
- Co-ordination with the safety officer regarding evacuation and shelter rehabilitation aspects
- Arrange for restoration and normalcy in consultation with Incident Controller
- Announcement of conclusion of emergency
- Issuance of authorised statements and ensures that all evidences of the incident are preserved.

(ii) Site Incident Controller (Shift in-charge)

- Establish Emergency Control Centre and inform SMC
- Ensure availability of Controllers/Team members
- Priority decisions for strategy for development of resources for incident control
- Periodic assessment of actual disaster zone and resource deployment (own / external)
- Periodic status report of SMC
- Seek help for:
    - Fire Fighting
    - Medical Aid
    - Rescue
    - Transport
    - Traffic Arrangement
    - Law and Order
- Inform the following authorities about the incident through zonal/sector authorities:
    - District Collector
    - Superintendent of Police
    - District Environmental Engineer
    - District Health Officer
    - Inspector of Factories
    - Neighbouring Installations
- Establish contacts with the following, through controllers:

- Superintendents of nearby hospitals
- Chief Fire Officer of nearby fire services
- Insurance Company
- Establish First Aid Centre through Safety Coordinator
- Establish Information Centres

7.5.3.4 Emergency Co-ordinators

Logistics Coordinator: The duties and responsibilities in the event of any emergency include:

- Report at the affected area to the SMC & SIC
- Arrange to attend all maintenance jobs as instructed by SIC
- Ensure that all essential services like power, water etc are maintained without interruption
- Ensure adequate manpower availability at the affected area
- Reporting all the incidents to SIC
- Arrange for all the tools, materials at the site of emergency

Communication Coordinator: Responsibilities include:

- Report to SMC & SIC
- Removal of non-essential personnel from the emergency area in consultation with SIC
- Contact with SIC and arrange for necessary facilities
- Control over entry and maintain law & order and arrange for police help in consultation with SMC
- Liaison with external agencies in consultation with SMC
- Co-ordination of transportation requirements for moving personnel for first aid, evacuation, rehabilitation etc.
- Maintenance of inventory systems in the Emergency Control Centre

Safety Coordinator: Responsibilities include:

- Immediate Reporting to SIC
- Co-ordination with Security officer and security personnel
- Ensure availability of all safety equipment at site
- Co-ordination of all rescue operations
- Co-ordination of availability of first aid to all injured personnel
- Advice to SIC on firefighting operations
- Ensure availability of necessary antidotes/medicines in case of toxic release

7.5.3.5 Communication

An essential component of any emergency preparedness programme is the communication links for gathering information needed for overall co-ordination e.g. emergency control centre with in-house as well as outside emergency services. Too much reliance on the telephone system Fixed lines/Mobile phones is risky as it can soon be overloaded in an emergency situation. A computer with internet and printer facility and photocopying machine, wireless networks, fax, intercom units are recommended for higher reliability.

Help line numbers will be setup for emergency related queries

The description of the tasks and responsibilities, reporting place, etc. for each key functionary will be, as far as possible, so drafted as to reduce the communication needs between the interacting groups and permit good mutual understanding and well co-ordinated independent actions to tackle emergency situations.

7.5.3.6 Emergency Control Centre

The emergency control centre should be established separately for Barge/ vessel loading facility and should be equipped with the following:

- An adequate number of external telephones. If possible, one should accept outgoing calls only, in order to bypass jammed switchboards during an emergency.
- An adequate number of internal telephones, Radio equipment/pager system.
- A layout plan of the facility showing.
- Location of possible spillage/fire points.
- Sources of safety equipment and other fire-fighting system elements.
- Escape Routes.
- A nominal roll of employees at the facility.
- A list of Key Personnel with addresses, telephone numbers, etc.
- An adequate number of personnel protective/safety equipment available on site/back up in warehouse or with other member groups of mutual aid programme.
- Locations of various firefighting arrangements at the facility.

7.5.3.7 Alarm Systems

The emergency (due to fires or spillages) should be initiated by the first person noticing it by activating the fire alarm from the nearest call-point or by contacting the fire control room immediately on the internal telephone in case of any emergency.

If in the opinion of the shift in-charge in consultation with the fire safety officer, the severity of the emergency is such that it can primarily be coped with by HPPL's own resources (aided by firefighting appliances from the fire brigade, if required) the siren code for Onsite Crisis will be sounded through the hooter. The siren codes for distinguishing between an Onsite & Offsite Crisis will be clearly established.

The onsite/offsite siren codes should be informed to the neighbouring population of the facility.

7.5.3.8 Mutual Aid Scheme

Assistance in terms of equipment and manpower will be taken from the neighbouring installations under a Mutual Aid Scheme/Zonal Disaster Management Plan.

7.5.3.9 Assembly Points

Shifting or evacuating facility personnel during an onsite crisis will be done to a predetermined assembly point in a safe part of the facility. The assembly point will be identified at safe locations (Barge/ vessel loading facility administrative building).

7.5.3.10 Onsite Emergency Plan and Rehearsals

Once the emergency programme is finalised, it should be made known to all personnel so that each one knows his or her role in the event of an emergency. The plan will be regularly tested through the rehearsals, at a regular frequency and updated accordingly.

7.5.3.11 Coal Dust Suppression System

The stack height of the coal stack yard would be limited to 10-12 m from the point of view of safety against fires. During coal handling and storage activities there may be fugitive dust emission which might cause occupational health hazards. Hence, dust suppression will be provided.

Dust control equipment system consisting of suitable pump, storage tank for water and sprinklers & nozzles for dust suppression will be provided. In addition to the above, suitable spray system shall also be provided at ship unloader & coal stockyard.

The water sprinkling system with nozzles shall be installed to cover the entire stockpile. The nozzles shall be installed on pipes at about 2 to 3 meters elevation from ground. The nozzles shall be installed along the stockpile which can cover the stockpile height and proposed width.

7.5.3.12 District Disaster Management Authority

The District Level Disaster Management Authority[20] is set up for major off-site emergencies along with Port Officers for Uttara Kanada. This committee would comprise of the following members:

Table 7-6: District Disaster Management Authority (As per DM Act, 2005, Sec-25(2))

Members	Designation
Deputy Commissioner of the District	Chairperson
President, Zilla Panchayat	Co-Chairperson
Chief Executive Officer of Zilla Panchayath	Member
Superintendent of Police	Member
District Health & Family Welfare Office	Member
Joint Director, Agriculture	Member
Additional Dy. Commissioner of the District	Chief Executive Officer
Executive Engineer, PRED – Permanent Invite	

7.5.3.13 Disaster Management Plan for Cyclones/Floods

In line with the Disaster Management Plan of Uttara Kannada District, HPPL will develop a customised DMP to cope during disasters from natural calamities such as rough weather conditions, cyclones, Tsunami and floods, etc. Proper planning can reduce the potential damage from disasters in terms of losses to human lives, port assets, and environmental damage and rehabilitation costs. The DMP for Cyclones and Tsunami will be prepared by HPPL in consultation with the Department of Ports, Government of Karnataka.

The rough weather operations will be controlled in three stages:
- Green Status – The operations of loading/unloading will be carried out as planned.
- Yellow Status – This is an alert stage indicating possibility of rough weather. Still operations can be continued with all emergency precautions
- Red Status – Emergency situations or rough weather; operation will be suspended.

Activities controlled by in-charge of emergency operations. The vessel/tanker is to be moved to safe anchorage or will be advised to proceed to sea.

The main components of the DMP for cyclones will include the following:

- Pre-Disaster (or Pre-Cyclone/Flood) Plan
- On (or During Cyclone/Flood) Disaster Plan
- Post (or After Cyclone/Flood) Disaster Plan

Cyclone/Flood Plan

Pre-Cyclone Measures: Barge/ vessel loading facility will maintain and exchange information continuously with the local IMD authorities at Honnavar, Uttar Kanada district for continuous updates of meteorological conditions in general and emerging/predicted weather

[20] Source: Uttara Kannada District Disaster Management Plan 2022-23

phenomenon such as cyclones and prolonged or intensive rainfall in particular. Upon issue of a cyclone/flood warning by the IMD, the management would immediately initiate the Pre-Cyclone/flood Measures. The Department of Ports and District Collector of Uttar Kanada would be informed of the imminent cyclone. All barge/vessel loading facility officials dealing with operations and disaster management will be informed.

Pre-Cyclone/flood Exercise: On signalling of a cyclone alert, the Control Room will be manned 24 hours a day for disaster management. The 'Weather Signals' depending on the data available about the cyclone/intensive rainfall and flow details Sharavati/Badgani and its threat perception will be informed to all personnel. The marine side operations will be regulated as per the rough-weather classification and will be continued with all emergency precautions. The different personnel of Barge/ vessel loading facility would assume their roles and responsibilities as previously identified for disaster management. The standby arrangement for power supply will be checked. Pre-identified 'Rescue Centres' will be kept ready. A pre-alert will be issued regarding suspension of all operations in case of emergency and to await instructions regarding the same. All Port Crafts and barges/vessels will be fully secured inside the harbour area. Communication system including standby arrangement will be tested for working condition. Vehicles involved in rescue operations will be checked for working condition. Port crafts to be engaged in rescue will be kept in readiness. The safety in the project area will be ensured.

The following Flood warning messages will also be given:

- Flood Alert – Flooding is possible
- Flood Warning – Flooding of homes, businesses and main roads is expected
- Severe Flood Warning – Severe flooding may cause Imminent danger
- All Clear – No Flood Alerts or Warnings are in force

When a flood warning message is received, an Emergency team In-charge shall alert relevant agencies. The following advice shall be given to the Public:

- Flood warning: 'GO IN, STAY IN, TUNE IN'
- Stay calm
- Ensure that neighbours know of the warning, and be prepared to help them
- Monitor local radio
- Make a flood kit: medications, warm clothing, sealed food, blankets, matches, candles, flashlights, portable radio, spare batteries, rubber gloves, personal documents

During Cyclone/Flood Plan: The emergency alarm siren will be raised as per the 'Alarm System'. All personnel will be evacuated except essential operational personnel and personnel dealing with disaster management. The cargo handling operations will be suspended. The vessel will be moved to safe anchorage or will be advised to proceed to sea. Power supply will be disconnected and alternative power supply will be restored in essential operational areas. Port Crafts and Tugs will continue to be in readiness for rescue.

Depending upon the scale of potential flooding, the following steps shall be taken:

- Care of evacuated, hurt or homeless people
- Protecting of utilities
- Availability of transport
- Flood alleviation e.g. clearing blocked culverts and drains
- Providing emergency health advice
- Providing road barriers and signs
- Coordinating emergency support

Post Cyclone/Flood Plan: This would be the rescue and rehabilitation stage after passing of the cyclone/flood. The damages would be assessed, and rehabilitation work initiated to restore operations at the earliest. The records of the events during the cyclone/flood will be maintained and reviewed for possible enhancements to the DMP.

7.5.4 Offsite Emergency Plan

The components of an offsite emergency plan would include:

- Identification of locations of hazardous or dangerous substances, personnel and emergency control rooms.
- Technical information such as chemical and physical properties, dangers, etc. Background information, past accidents, control techniques and effects of hazardous materials of relevance.
- Identification of facilities and transport routes for toxic materials.
- Contact for further advice such as meteorological information, transport, temporary food and accommodation, first aid and hospital services, water etc.
- Establishing communication links including firefighting materials, damage control and repair items.
- Detailing emergency response procedures.
- Notification to public at large.
- Evacuation arrangements.
- Press/media handling.
- Addressing long term environmental clean-up.

7.5.5 Recommendations for Implementation of Off-site Emergency Plan

- Emergency control centre will be the focal point to co-ordinate emergency activities. Emergency control centre would be equipped with adequate number of equipment mentioned under heading “Emergency Control Centre”.
- Succession or second-line controllers would be named for assuming responsibilities in case disaster occurs in absence of principal co-ordinators.
- Hot line would be provided between Barge/ vessel loading facility and Fire Brigade at Honnavar/Karwar
- HPPL would make arrangement for coded siren system or through some other suitable means to alert people in surrounding areas in case of off-site crisis.

A summarised version of action procedures detailing the “Role of Essential Staff in Major Emergency” would be issued in a flip chart like booklet form to all concerned persons (officers and supervisors) at workplaces and also to senior officers of the civic administration.

7.5.6 Conclusion

The broad Disaster Management Plan is prepared in conjunction with and taking into consideration all technical reviews and suggestions as per acceptable norms. These details shall be considered as guidelines to Disaster Management Plan based on detailed risk analysis which will be prepared by project proponent.

7.6 Dredge Material Utilization and Disposal Plan

The capital dredging quantity will be ~3.9 mcm. Reclamation will be carried out in the back up area for providing landside facilities. Suitable dredge spoil material is proposed to be utilised for reclamation and remaining will be dumped into sea at the designated at 2km to the north of port entrance channel. The total maintenance dredging quantity is estimated to be around 10,300m^3/year, which will be disposed at the designated disposal site. Mathematical model studies for identification of suitable disposal grounds are discussed in **Chapter 4.**

7.7 SWOT Analysis

The identified strengths, opportunities, weaknesses and threats for the proposed facility is discussed below.

STRENGTHS	OPPORTUNITIES
The Port understands its business model; operates in a good business environment; and is willing to pursue opportunities.	Movement of cargo from Hinterland
Established trading partners	Investment in transport chain
Value- added logistics services	Rail and Road connectivity
Congestion free port environment	Environment and pollution management
	Major cargo handled at the port are coal, Iron ore and general cargo
	Improves relation with local governments
	Promote the Port's overall impact on the local economy.
	Funding for the community development
	Supporting industrial activities will be developed and economy of the region will be developed
WEAKNESSES	**THREATS**
Limited Port capacity	Private ports
Land Lease	Competition from the other Major & Minor Ports
Involvement of forest land for the road connectivity	Bureaucracy
Perceived need for improvement in service levels to retain the clients, avoid them being lost to other ports and for developing new ones	Four lane road was under litigation. After hearing the proceedings, the judgment has been delivered by court in favour of HPPL
If any local issues	If any natural disasters and need resiliency planning

Chapter 8
Project Benefits

Chapter 8 Project Benefits

8.1 Introduction

In Karnataka, there exists a significant disparity between demand and supply especially for port infrastructure asset. Presently, the state relies heavily on New Mangalore Port, its sole major port, which efficiently manages approximately 40 MTPA of cargo. Additionally, among the 12 minor ports, only Karwar Port operates, albeit handling a relatively small volume of EXIM cargo.

Given this scenario, there arises a pressing need for a suitable port to cater to the user industries in the Bellary-Hospet-Hubli-Gulbarga region. Such a port would effectively bridge the existing demand and supply gap, ensuring smoother logistics and bolstering economic activities in the area. The proposed port of Honnavar will mainly cater to the hinterland spread over northern and central parts of the Karnataka. The various project benefits are discussed in this chapter

8.2 Infrastructure Facilities

The following infrastructure facilities will be developed; Good road and rail connectivity is an essential requirement for the efficient functioning of any port. As far as Honnavar Barge/ Vessel facility is concerned, the main commodities being handled are coal, iron ore and other general cargo. Hence good road and rail connectivity plays a vital role in the successful functioning of Honnavar Barge/ Vessel loading facility.

8.2.1 Rail Connectivity

The nearest railway station is Honnavar Railway station which is on the Konkan stretch connecting Kerala to Mumbai. The railway station is at about 2.25 km (aerial distance) from the Honnavar barge/vessel loading facility.

The site can be easily accessed through Konkan railway (Connecting Kerala with Mumbai). The barge/vessel loading facility proposed at Honnavar is at a distance of 5.0 km from Honnavar railway station and 14 km from Manki railway station.

The rail connectivity to the Port site is proposed to be provided with Broad gauge Single line from a new railway station proposed at Hosapattana under section of Konkan Railway broad gauge line, which is 8.5 km from the Port site.

8.2.2 Road Connectivity

The site has good road connectivity. NH 66 passes through Honnavar towards East of project site at a distance of about 1 km. connectivity road from km 0.00 (Kasarkod side of Honnavar port) to Km 2.580 (towards NH – 66) connecting Honnavar Port with NH - 66 at Km 195.986 and to improve NH – 66 from Km 195.00 to Km 197.00 as part of Bharatmala Pariyojana Phase I programme by NHA. The proposed road will consists of 3 under passes and 1 box culvert as part of the development.

Presently the site can be approached from a single lane black topped road that runs in continuation to NH 66 and then lies parallel to shoreline. The site can also be accessed from a Kachha road that was formed by the Minor Irrigation/Port department for construction of coastal protection works along the seashore of Kasarkod village.

8.3 Induced development

Apart from the surrounding region, the adjoining states would also benefit a lot because of the proposed development of Honnavar Barge/ Vessel loading facility. The benefits may be realised with the upcoming of industries such as steel plants, thermal power plants and their allied ancillary units. Other benefits would be generation/providing of either direct or indirect employment to the local people. With the new connectivity through rail and road, there will be a facility to improve the trading, marketing and as well as value addition of local products. The proposed connectivity will also serve to the tourist places nearby thereby improving employment to the local people. The development of Honnavar Barge/ Vessel loading facility will be a boon for the development of the region.

8.4 Improved Socio-economic Conditions

The proposed project is likely to have a positive impact on the socio-economic conditions of the region. The social infrastructure in the region is likely to change due to the creation of more job opportunities and avenues for income generation. People will have higher income due to direct employment as well as indirect employment and will have higher earning and buying capacities.

8.4.1 Quality of Life

The quality of life in the region is likely to improve due to the creation of jobs for the local people so that the dependency changes and there will be more than one earning member in the family, which will provide economic freedom.

8.4.2 Health

As part of the CSR, it will also be proposed to conduct periodic health camps and carry out health campaigns which will lead to better health conditions of the local people. As a part of CSR, procurement of essential medical equipment has been proposed.

8.4.3 Educational Facilities

HPPL is planning to undertake the following activities in the project region as part of Corporate Social Responsibility (CSR):

Basic education facilities for the children of the employees will be provided
Strengthen the primary schools with teaching aids and student education material
Strengthen the upper primary and high schools with teaching aids, mobile laboratory and computer education
Initiatives for reducing school dropouts Funds for setting up of Libraries

8.5 Corporate Social Responsibility (CSR)

As a part of Corporate Social Responsibility (CSR), HPPL proposed to take up following activities for improving the way of living of people in the nearby villages:

Providing better health services
Providing better educational facilities for children of employees and students studying in schools in Kasarkod & around project area and nearby villages
Creating job opportunities
Facilitate self-employment through training and credit linkage
Outsourcing opportunities to Self Help Groups (SHG)
Providing protected water supply system to Kasarkod Tonka and Apsarkonda villages.

Strengthening area Government hospitals by assisting them in procurement of essential medical equipment.
Providing quality health care through regular medical camps.

8.5.1 Education Facilities

Basic education facilities for the children of the employees children of employees and students studying in schools in Kasarkod & around project area and nearby villages will be provided.

8.5.2 CSR Activities carried out from 2019 to 2024

- In Tonka village, road repair work was carried out inside the village fisheries harbour
- Ex-gratia compensation for 30 fishermen was done in Kasarakod Tonka
- Road protection work at Tonka village housing area was carried out.
- Donation was given for Ganesothsawa Samithi, Veera Hanuman Jayanti and Vardanti Utsava
- A total of 6.5 Million INR was spent for CSR activities

8.5.3 Budgetary Allocation for CSR Activities

The budget allocated for CSR is given **in Table 8-1.**

Table 8-1: CSR – Activity/ Budget / Time Frame

S. No	Activity	Budget Allocation (Lakhs)	Time frame
1	Health Camps	25.00	5 Years
2	Educational Facilities	25.00	5 years
3	Training to Self Help Group & Labour	15.00	5 years
4	Protected water supply to Kasarkod and Apsarkonda Village	40.00	5 years
5	Procurement of equipment and strengthening of Government Hospital	45.00	5 years
Total		150.00	

8.5.3.1 Treated Drinking Water

Kasarkod Tonka and Apsarkonda are the villages identified for regular treated drinking water provision. The cost for implementing the same is estimated as below.

S. No.	Particulars	Amount (Lakhs)
1	Reverse Osmosis plant (2 units)	40
	Total	**40**

8.5.3.2 Budgetary Provision for Educational Facilities

There are two (2) Schools nearby barge/ vessel loading facility area.

S. No.	Particulars	Amount (Lakhs)
1	Adoption of two Schools	12
2	Building & Furniture	6
3	Library Facility	5
4	Science Library Facility (2 Schools)	5
5	Sanitary & Water Supply	2
6	Electricity Facility	2
7	Sports Equipment Facility	2
8	Miscellaneous & Contingency	1
	Total	**35**

8.6 Employment Opportunities

The proposed project will provide direct as well as indirect employment to the locals.

There will be a huge demand for skilled, semi-skilled and unskilled work force during the construction and operational phase of the port and it is imperative that mostly local people would be employed based on their skills and educational qualifications. The employment potential from the construction phase of the proposed Barge/ Vessel loading facility is estimated as 500 persons (approximately). The expected direct employment during operation phase will be 50 people. The proposed project is likely to have positive impact on socio-economic condition of the region overall. Indirect employment will be generated due to overall improvement of socio-economic growth of the project region.

Chapter 9
Environmental Cost Benefit Analysis

Chapter 9 Environmental Cost Benefit Analysis

SEIAA has issued Standard Terms of Reference (ToR) along with Additional ToR on 12th August, 2024 stating to incorporate Environmental Cost Benefit Analysis in EIA and EMP report.

The proposed Honnavar port intends to handle dry bulk cargo and there is a significant demand from the immediate hinterland. Following are the benefits of the project

- The development of proposed port at Honnavar is envisaged to play a significant role in strengthening connectivity along the Karnataka coastline.
- Enhancement in economy of Karnataka
- Substantial positive impact on socio-economic profile of Honnavar, both in terms of overall employment and skill development of local workforce.
- Direct as well as indirect employment potential is envisaged
- Augmentation in infrastructure resources such as transport, Communication, health facilities & other basic facilities

Table 9-1: Estimation of cost for Environmental Cost Benefits

S. No	Parameters	Remarks
1	Ecosystem services due to proposed forest diversion	No forest land is involved in the proposed port activity. Forest diversion is required for Road corridor for connectivity.
2	Loss of animal husbandry productivity, including loss of fodder	Only 0.76 ha of forest land shall be diverted for the Road connectivity. This will not cause any significant loss to animal husbandry or fodder or productivity. Port does not cause any pollution as it does not manufacture any product.
3	Cost of human resettlement	There is no displacement of any house and therefore there is no cost of human settlement.
4	Loss of public facilities and administrative infrastructure (Roads, buildings, school, dispensaries, electric lines, railways, etc.) land if these facilities were diverted due to the project	None of these facilities are affected by the port project nor is any road or rail closed or diverted. Hence there is no loss.
4	Possession value of land to be diverted	An amount of Rs. 1.1 Crores has been allocated for the compensatory afforestation
5	Cost of Sufferings to oustees	There is no oustees in the project as no house is affected or acquired. Hence no cost
6	Habitate Fragmentation Cost	No Habitate fragmentation

Table 9-2: Guidelines for estimating benefits

S. No	Parameters	Remarks
1	Increase in productivity attribute to the specific project	• The development is envisaged to play a significant role in strengthening connectivity along the Karnataka coastline. • Enhancement in economy of Karnataka • Direct as well as indirect employment potential is envisaged. • Probable augmentation in infrastructure resources such as transport, Communication, health facilities & other

S. No	Parameters	Remarks
		basic facilities. • Overall enhancement of socio- economic condition of the area along the project. • Though overall mission to increase the GDP of the said region and make it comparable the nation GDP
2	Benefits to economy due to the specific project	Increase in employment opportunities both direct and indirect. Boost to entrepreneurship and local business. Facility of import and export benefits the economy at large
3	No. of population benefited due to specific project	Population of 1,56,000 within 15 kms radius.
4	Economic benefits due to specific project	Employment opportunities, better health and educational facilities, improvement in living standards in local population.

9.1.1 Dredging and Disposal

The mathematical model studies for the dredging and disposal of dredge spoil have been conducted in order to understand the fate of dredged spoil and change in morphodynamic of the river mouth/inlet respectively. The study reveals that there is no movement of dredged spoil towards the river mouth from where it can reach mangrove and island area during dredging. Change in morphodynamic of the river mouth/inlet due to the proposed breakwater is also not observed.

9.1.2 Land Acquisition

HPPL has been allotted the government land of 44 hectares by Government of Karnataka near Sharavati river mouth in Kasarkod Tonka village to develop a barge/vessel loading facility. The land allotted is not habituated and hence no land acquisition. Proposed project site more than 6.0 km towards NW of habituated island.

9.1.3 Impact on Nearby Settlements

The impact on nearby settlements during construction phase will be due to air pollution and the noise generating activities. Proposed project site more than 6.0 km towards NW from the habituated island. However, the activities are limited to the construction phase and will cease upon completion of the construction. Hence, this impact is considered to be negligible and therefore can be classified as insignificant.

The dust suppression measures such as sprinkling of water and suitable enclosures around the high noise generating areas within construction area will be provided. The noise generating equipments will be provided with suitable enclosures such that cumulative noise will be within permissible limits.

9.1.4 Fishing Activity

The construction activities involve dredging, construction of cargo berths which may likely impact the fishing activity at nearby fishing villages. The fish landing centres in the study area are Honnavar, 1.0 km SE and Manki, 11 km S.

Necessary marker buoys shall be installed and interactions shall be initiated with the fishing community about marker buoys indicating the areas of construction so that they may avoid those areas during construction period. Hence, minimal hindrance to fishing activity is anticipated during construction phase of the proposed barge/vessel loading facility which will be in temporary nature.

9.1.5 Employment Potential

The employment potential from the construction phase of the proposed facility is estimated as 500 persons & operation 50 persons.

9.1.6 Environmental Management Cost

As part of Environmental Management Plan for the proposed project an amount of Rs. 25.73 Crores has been allotted as an Environment Management Capital cost for carrying out the various Mitigative measures during the operations of the project.

In addition to the EMP capital funds an amount of Rs. 3.7 crores will also be spent towards EMP recurring cost for monitoring and management of all the environment parameters due to operations. Further, an amount of Rs.70 lakhs was spent to improve the environment in the surrounding villages. An amount of Rs. 150 lakhs shall be spent towards the CSR activities in the surrounding villages. Additionally, an amount of Rs.1.1 crores towards forest diversion of 0.76 ha for the connectivity to port (NPV & afforestation cost) has also been spent. Rs. 4.00 lakhs is allocated towards turtle conservation plan.

It can be concluded that due to the implementation of the various environmental measures and welfare activities for the development of the surrounding communities the project will have overall positive benefit.

Chapter 10
Environmental Management Plan (EMP)

Chapter 10 Environment Management Plan

The Environment Management Plan (EMP) is a project specific Environmental Protection Plan (EPP) which is developed to outline the proposed environmental protection and mitigation measures and commitments to be undertaken by Project Proponent, its contractors, and subcontractors, during construction and operation phase to avoid or reduce potential adverse environmental effects. The main objectives of Environmental Management Plan are to:

a) Identify key environmental issues envisaged to be encountered during construction and operation phases of the project

b) Provide guidelines for appropriate mitigation measures

c) Establish systems and procedures for implementing mitigation measures

d) Ensure the mitigation measures are being implemented

e) Monitor the effectiveness of mitigation measures

f) Take necessary prompt action when unforeseen impacts occur

The anticipated environmental impacts and mitigation measures for each likely impact on the prevailing environment have been discussed in detail at the respective sections in **Chapter 4.** The Environmental Monitoring Programme during construction and operation phase has been discussed in **Chapter 6**.

Following specific environmental management plan/measures are discussed in this chapter:

i. Summary of project activities, associated impacts and mitigation measures

ii. Administrative and Technical Setup for Environment Management

iii. Institutional arrangements/framework for Environment management

iv. Occupational health and safety

v. Budgetary estimates for Environment Management during construction and operation phases

10.1 Components of EMP

10.1.1 Summary of Impacts and Mitigation Measures

Various project activities its associated impacts and mitigation measures are summarised in **Table 10-1.**

Table 10-1: Project Activities, Associated Impacts and Mitigation Measures

S. No.	Activity	Relevant Environmental components likely to be impacted	Likely Impacts and their significance in the absence of Mitigation Measures	Proposed Mitigation Measures	Responsible Agency for Implementation
Construction Phase					
1.	Capital dredging	Marine water quality	– Increase in turbidity – Change in marine water quality due to aqueous discharges (oily waste, sanitary wastes) from dredgers, barges and workboats	– Dredging Management Programme – Regular monitoring of turbidity levels – Checking turbidity levels with baseline levels as reference during entire monitoring programme – Providing silt screens around the sensitive areas if required – A well-planned implementation programme based on contractors dredge management plan – The dredging activities will ideally be avoided during the notified fish breeding season and turtle nesting season. – During dredging, spotting of marine faunal species would form part of the project work while at sea. If these species are observed in the vicinity of the work area, the vessels would execute measures to avoid disturbance – Discharge of waste into sea will be prohibited – Oil Spill control measures will be adopted – Marine environmental monitoring as per environmental monitoring programme	Construction Contractor and HPPL
		Marine ecology	– Decrease in DO levels – Increase in noise levels – Removal of benthic communities – Increase in species diversity and density in areas adjoining dredging site – Smothering or blanketing of sub-tidal communities		
		Changes in Seabed Profile	– Littoral drift – Alteration in seabed	– Provision of rip-rap structures, side screens while laying piles – Post construction/ implementation survey of pile positioning is suggested	
		Mangrove area	– Impact on nearby mangrove	– Mangroves are located at ~0.3 km inside the river Sharavati River near to the site of the proposed barge/vessel loading facility port and no significant impacts are expected. – Dredge spoil should not be entered into mangrove area. – Awareness will be imparted to workers in the port about the importance of mangroves and their conservation	
		Impact on turtle/Other	– Accidental take during dredging	– The channel area is well away from the turtle congregation	

S. No.	Activity	Relevant Environmental components likely to be impacted	Likely Impacts and their significance in the absence of Mitigation Measures	Proposed Mitigation Measures	Responsible Agency for Implementation
		Macro Fauna	– Light Glare on Nesting	area and hence there is no regular movement of turtle into the channel area. – HPPL to take appropriate measures to avoid accidental take of turtle during dredging. – Install specialised illumination system in line with "International Dark Sky Association (IDA)" to avoid glare to the sky or focusing light towards sea. – Mercury vapour and metal halides will not be used. Sodium vapour lamps will be used	
2	Land Reclamation	Marine water quality Marine ecology	– Land reclamation is likely to impact the reclamation area/site with the turbid water.	– Reclamation bunds and setting ponds will be constructed. – Dredged material will be pumped into reclamation area enclosed by reclamation bunds. – Return water will be directed into sea through appropriate return channel/pipelines. – Minimum required retention time of return water in reclamation area as well as in return channel will be ensured. – Reclamation fill will be strengthened by suitable ground improvement technique. – To study variations in groundwater quality of nearby villages due to reclamation, regular water quality monitoring will be carried out.	Construction Contractor and HPPL
3	Project material transport and construction activities	Air Quality	– Exhaust emissions from vehicles – Windblown dust during material movement – Fugitive dust during material unloading – Dust suspension during site preparation, construction and trenching – Emissions from DG set	– To reduce impacts from exhausts, emission control norms will be enforced / adhered. – All the vehicles and construction machinery will be periodically checked to ensure compliance to the emission standards – Construction equipment and transport vehicles will be periodically washed to remove accumulated dirt – Providing adequately sized construction yard for storage of construction materials, equipment tools, earthmoving equipment, etc – Provide suitable enclosures on all sides of construction site – Movement of material will be mostly during non-peak	Construction Contractor/HPPL

S. No.	Activity	Relevant Environmental components likely to be impacted	Likely Impacts and their significance in the absence of Mitigation Measures	Proposed Mitigation Measures	Responsible Agency for Implementation
				hours. – On-site vehicle speeds will be controlled to reduce excessive dust suspension in air and dispersion by traffic – Water sprinkling will be carried out to suppress fugitive dust – Environmental awareness program will be provided to the personnel involved in developmental works – Use of specialised equipment – Scientific and regulated stacking of project material – Periodic cleaning of spilled materials – Use of tarpaulin covers and speed regulations for vehicles engaged in transportation – Ambient Air Quality Monitoring at regular intervals	
		Noise	Noise from following activities – Vehicles transporting construction material – Diesel run engines of construction machinery, dredgers, tug and other flotillas. – Pile driving activities during construction of cargo berths and BMHS foundation – Cargo Transport through trucks, dumpers, trailers and barges during construction.	– Noise levels will be maintained below threshold levels stipulated by Central/State Pollution Control Board (CPCB)/KSPCB – Procurement of machinery / construction equipment will be done in accordance with specifications conforming to source noise levels less than 75 dB (A) – Well-maintained construction equipment, which meets the regulatory standards for source noise levels, will be used – Any equipment emitting high noise, wherever possible, will be oriented so that the noise is directed away from sensitive receptors – Noise attenuation will be practised for noisy equipment by employing suitable techniques such as acoustic controls, insulation and vibration dampers – High noise generating activities such as piling and drilling will be scheduled to daytime to minimise noise impacts during night. – Personnel exposed to noise levels beyond threshold limits will be provided with protective gear like earplugs, muffs, etc. – Ambient noise levels will be monitored at regular intervals	Construction Contractor/HPPL
		Disturbance to Natural	– Impact to natural flow of runoff due	– Adequate storm water drainage system will be provided. if	Construction

S. No.	Activity	Relevant Environmental components likely to be impacted	Likely Impacts and their significance in the absence of Mitigation Measures	Proposed Mitigation Measures	Responsible Agency for Implementation
		Drainage pattern	to blockage and change of drainage course	natural drainage is disturbed, the same will be reinstated	contractor/HPPL
		Vegetation and Strain on existing infrastructure	– Loss of vegetation and strain on existing infrastructure.	– Retaining of vegetation in undeveloped areas within the port site – Adequate greenbelt will be developed – Temporary workers camp with self-sufficient infrastructure facilities.	Construction contractor/HPPL
		Existing Traffic	– Traffic addition	– New road link will be developed to connect the NH 66 with proposed barge/vessel loading facility site – New rail way link will be developed to connect the Konkan rail way link with the barge / vessel loading facility site.	Construction Contractor/HPPL
3.	Land Reclamation	Existing Water Resources like Groundwater and surface water	– The land which is to be reclaimed falls mostly in intertidal zone and will be separated from adjoining land by creating bund.	– Protective bunds will prevent inundation of sea water to the adjoining land. – Return sea water will be sent back to sea through appropriate channels.	Construction Contractor/HPPL
4.	Solid Waste Management	Soil quality	– Impacts due to disposal of solid waste on ground without treatment	– Adequate measures for Solid Waste collection, segregation, reuse and disposal during construction will be in place. – Proper sanitation bins will be installed in the port area for collection of sewage/solid waste/construction wastes on site. – Construction waste will be used within port site for filling of low-lying areas. – Composted bio-degradable waste will be used as manure in greenbelt. Other recyclable wastes will be sold. – Excavated soil will be stockpiled in a corner of the site in bunded area to avoid run off with storm water. – General refuse generated on-site will be collected in waste skips and separated from construction waste. – Burning of refuse at construction sites will be prohibited.	Construction Contractor/HPPL
5.	Handling of hazardous wastes	Human safety and property loss	– Fire accidents due to hazardous material handling	– Hazardous materials such as lubricants, paints, compressed gases, and varnishes etc., will be stored as per the prescribed/approved safety norms. – Construction site will be secured by fencing with	Construction Contractor/HPPL

S. No.	Activity	Relevant Environmental components likely to be impacted	Likely Impacts and their significance in the absence of Mitigation Measures	Proposed Mitigation Measures	Responsible Agency for Implementation
				controlled/limited entry points. – Hazardous wastes will be disposed through approved KSPCB/CPCB vendors. – Medical facilities including first aid will be available for attending to injured workers – Handling and storage as per MoEF&CC guidelines Fire protection system. – Installation of fire protection system – Adequate safety measures as per OSHA standards will be adopted.	
6.	Fishing	Fishermen and fishing villages	– Impact on fishing due to Construction works	– Signboards will be placed at the construction site in order to make fishermen aware of the on-going activities – Necessary marker buoys will be installed to avoid loss of fishing nets/gears due to dredging activities. – Interactions with the fishing community will be carried out before/during commencement of construction works to create awareness and taking feedback.	Construction Contractor/HPPL
7.	Water Resources	Water scarcity /Pollution	– Impacts to the surface water body/groundwater	– Water Requirement during the construction and operation phase will be met from Karnataka rural water supply and groundwater/surface water will not be utilized. – Care should be taken to prevent the runoff from the construction site to the nearby natural streams, if any.	Construction Contractor/HPPL
Operational Phase					
1.	Cargo handling and Inland Cargo movement and storage areas	Air Quality	– Emissions from loading equipment, DG sets, vehicular dust emissions from storage areas, spillage of cargo	– Use of specialised ship loaders/ Barge /Vessel loaders and Unloaders, mobile harbour cranes and payloaders – Dust suppression measures at loading and unloading points – Water sprinkling at berths & internal roads – Scientific and regulated stacking of cargo – Periodic cleaning of cargo spills, – Use of tarpaulin/HDPE covers and speed regulations for vehicles engaged in transportation – Greenbelt Development	HPPL

S. No.	Activity	Relevant Environmental components likely to be impacted	Likely Impacts and their significance in the absence of Mitigation Measures	Proposed Mitigation Measures	Responsible Agency for Implementation
		Noise	– Due to equipment handling and vehicular movement	– Acoustic Barriers and Enclosures – Personal Protecting Equipment (PPE) – Greenbelt Development – Counselling and traffic regulation	HPPL
2.	Aqueous discharges in harbour basin	Marine water quality and ecology	– Change in marine water quality/ecology due to discharge barge/vessel wastes (silage), sewage, bilge water, solid waste etc.	– Barges/vessels are prohibited from discharging wastewater, bilge, oil wastes, etc. into the near-shore and harbour waters. – Barges/vessel will comply with the MARPOL convention. – As a mitigation measure for spillages an Oil spill contingency plan will be prepared and implemented. – Provision of waste reception facility by Port Authorities	HPPL to provide regulations to Vessel operators
3.	Cargo and Oil spills	Marine water quality and ecology	– Change in marine water quality	– In case of any cargo spillage during transfer from/to mother ships, Barges/vessel, the spills will be recovered. – Oil spill control equipment such as booms / barriers will be deployed for containment and skimmers will be provided for recovery. – Response time for shutting down the fuelling, containment/recovery will be quicker.	HPPL
4.	Maintenance dredging	Marine water quality	– Increase in turbidity	– The dredged spoil arising out of maintenance dredging will be dumped at the designated offshore dumping areas – Additional Environmental Monitoring Programme comprising monitoring of marine water quality, marine sediment quality and marine ecology will be initiated one week prior to commencement of dredging and will be carried out during the dredging period.	Dredging Contractor/ HPPL
		Marine Ecology	– Due to decrease in DO levels which effect marine ecology and disturbance to benthic communities.		
5.	Water Supply	Water resources	– Impact on existing water resources	– The water requirement will be met from Karnataka Rural water supply and sanitation agency which includes supply to Barge/vessels, staff and users. In addition to that water required for dust suppression system and fire fighting will be sourced from Sharavati River after obtaining necessary approvals.	HPPL
6.	Wastewater Discharge	Water Quality	– Impact due to discharge of runoff from stockpiles and disposal of untreated sewage	– Collection of runoffs from stockpiles and directing into settling ponds – Neutralization using lime to ensure settlement of heavy	HPPL

S. No.	Activity	Relevant Environmental components likely to be impacted	Likely Impacts and their significance in the absence of Mitigation Measures	Proposed Mitigation Measures	Responsible Agency for Implementation
				metals if any – Sewage treatment plant will be constructed within port area – Treated wastewater from STP will be used for greenbelt.	
7.	Solid Waste Management	Groundwater and Soil quality	– Impact due to disposal of solid waste on ground without treatment	– Segregation of solid waste into bio-degradable and non-degradable waste – Proper disposal non-biodegradable solid waste – Bio-degradable waste will be composted which will be used as manure in greenbelt. – Other recyclable wastes will handed over to approved/authorized vendors.	HPPL
8.	Handling of hazardous wastes	Fire accidents due to products handling	– Human life and loss of property	– Hazardous materials will be stored as per the prescribed/approved safety norms. – The hazardous material will be secured by fencing with controlled/limited entry points. – Hazardous wastes (used oil & used battery) will be sent to KSPCB/CPCB approved recyclers. – Medical facilities including first aid will be available for attending to injured workers – Provision of emergency alarms, fire hydrant system and fire station. – Effective Disaster Management Plan (DMP) which covers onsite and offsite emergency plans will be deployed. – The spills will be recovered to the extent possible.	HPPL
9.	Fishing activity	Fishermen livelihood	– Impact on fishing due to vessel movement	– Educating the fishermen about the orientation of approach channel – Regular Interactions will be initiated with the fishing community – Conflicts if any with fishing community will be amicably resolved in all cases	HPPL
10.	Operation of port	Socio-economic conditions of the region	During construction phase, the employment potential is estimated at about 500 people. During operational phase, the Barge/ Vessel loading facility is likely to generate employment for 50 people. Local people will be given preference based on their qualification and skill set. Together with this employment potential, project will help to enhance the socio-economic conditions of the area with better schooling, communication and transport facilities that will be developed/triggered as a part of overall economic development of the region.		

S. No.	Activity	Relevant Environmental components likely to be impacted	Likely Impacts and their significance in the absence of Mitigation Measures	Proposed Mitigation Measures	Responsible Agency for Implementation
		Natural Hazards	Disaster Management Plan (DMP) will be prepared; Manager (EHS) will act as the overall in-charge of the control of educative, protective and rehabilitation activities to ensure least damage to life and property.		
		Induced Development	Offers an efficient and cost-effective supply chain/ value proposition to the local importers and exporters in states of Maharashtra, Goa, Telangana, Andhra Pradesh and Kerala.		

10.1.2 Administrative and Technical Setup for Environmental Management

Highly qualified and experienced personnel in the field of Environmental Management of barge/vessel loading facility shall be considered for the position of Senior Manager for Environmental management along with adequate supervisory staff.

Well qualified personnel with minimum qualification of graduation in the respective discipline and with requisite experience in relevant field will be considered at different levels as mentioned in the organisation setup who will look after the following:

a. Ensuring that an Environmental Management System is established implemented and maintained in accordance with the requirements of ISO 14001.
b. Reporting to top management on the performance of the Environmental Management System for review, including recommendations for improvement.

10.1.3 Institutional Framework of EMP

The proposed organization of all personnel involved in the EMP process is depicted in **Figure 10-1**. The roles and responsibilities of the various parties involved in the EMP process are summarized below.

Project Proponent: Honnavar Port Private Limited, Environmental Management Cell.

Project Design, Construction and Operation: Contractor employed by the Project Proponent will carry out design, construction and operation of the barge/vessel loading facility.

Environmental Management Team (EMT): The EMT will be responsible for implementing all environmental measures and EMP requirements recommended in the EIA Report throughout the construction, operation, restoration, aftercare of the barge/vessel loading facility and report to the barge/vessel loading facility Contractor on all environmental aspects of the Project. The EMT can be a separate consultant employed by the barge/vessel loading facility Contractor or the Contractor's in house environmental specialists.

Independent Consultant (IC): The IC will be appointed by the Project Proponent to provide an independent review and certification of the design, construction, operation, restoration and aftercare of the port.

Independent Environmental Checker (IEC): The IEC will be appointed by the Project Proponent as part of the IC to provide independent monitoring and audit to verify the overall environmental performance of the project and to assess the effectiveness of the Environment Team in their duties. An IEC will be responsible to certify all environmental submissions to the Environmental Protection Division (EPD).

Environmental Protection Division (EPD): The Project EPD will be the authority to approve all submissions under The Environmental Impact Assessment Ordinance (EIAO) Authority.

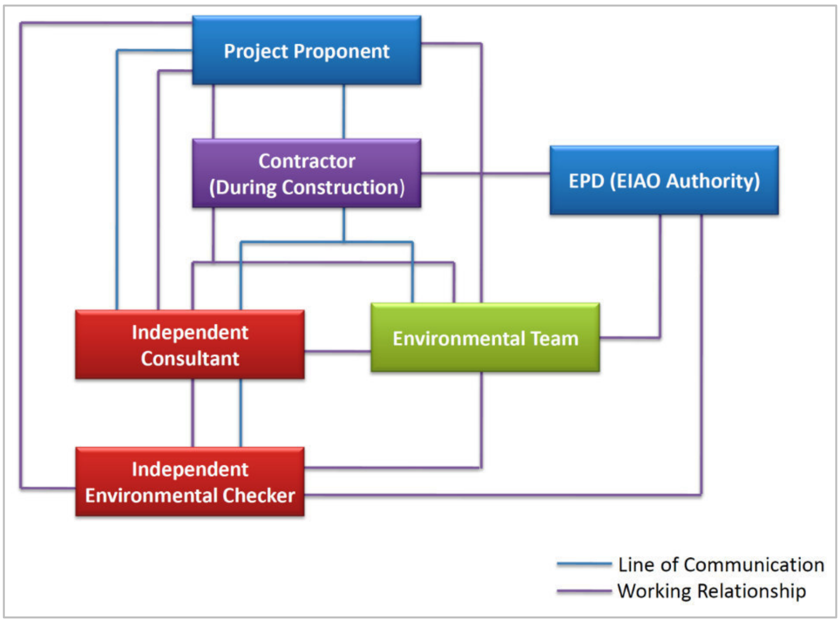


Figure 10-1: Proposed Institutional Mechanism for Environmental Management

10.1.4 Institutional Mechanism for Implementation of Mitigation Measures

The effective implementation and close supervision of the environmental management to mitigate the environmental impacts, which are likely to arise due to the construction and operational phases of the project could be achieved through a suitable institutional mechanism. The proposed institutional mechanism recommended for the implementation of the mitigation measures is presented in **Figure 10-2.**

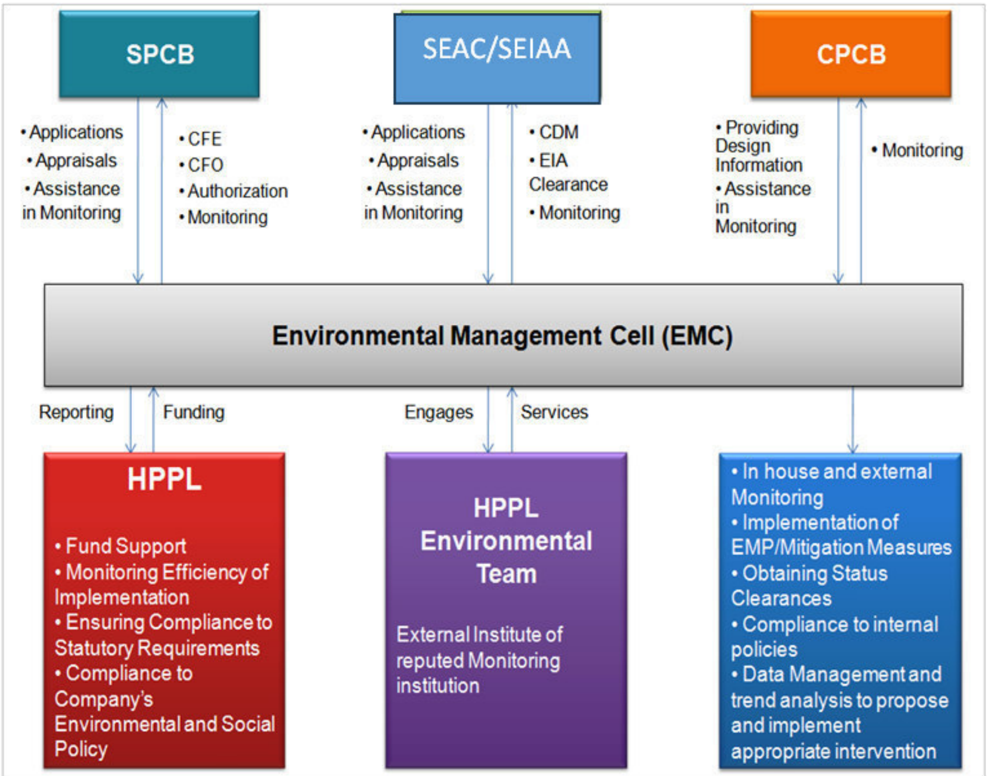


Figure 10-2: Institutional Mechanism for Implementing Mitigation Measures

A proper institutional mechanism to understand and implement appropriate environmental management measures during various stages of the project is a prerequisite and has a strong bearing for the overall success of the project management. Implementation of the Environmental Management measures will become easy once a good project management team is in place.

10.1.5 Approach towards Voluntary Compliance

During operational phase, HPPL may adopt an Environmental Management System (EMS) which can be proposed to be certified under ISO 14000. The objective of ISO 14000 is to establish a system to assess, monitor and manage environmental performances, which can be used to promote continual environmental improvement and prevention of pollution.

a) Identify and list out environmental aspects due to the operation of the proposed project
b) Determine the key operations that have significant environmental impacts
c) Identify and track environmental legislations, policies, codes and other relevant requirements
d) Establish objectives and targets (Environmental Management Plan)
e) Formulate an Environmental Management System

For successful implementation of the formulated Environmental Management System, HPPL will ensure that the essential resources (with defined roles and responsibilities) are made available to implement, maintain and improve the Environmental Management System.

10.2 Environment Management Cell (EMC)

Apart from having an Environmental Management Plan, it is also necessary to have a permanent organizational set up charged with the task of ensuring its effective implementation of mitigation measures and to conduct environmental monitoring. The major duties and responsibilities of Environment Management Cell are:

(i) To implement the environmental management plan

(ii) To assure regulatory compliance with all relevant rules and regulations

(iii) To ensure regular operation and maintenance of pollution control devices

(iv) To minimize environmental impacts of operations as by strict adherence to the EMP

(v) To initiate environmental monitoring as per approved schedule

(vi) Review and interpretation of monitoring as per approved schedule

(vii) Review and interpretation of monitoring results and corrective measures in case monitored results are above the specified limit

(viii) Maintain documentation of good environmental practices and applicable environmental laws as ready reference

(ix) Maintain environmental related records

(x) Coordination with regulatory agencies, external consultant, monitoring laboratories

(xi) Maintain log of public complain and the action taken

The proposed environmental management cell should have all basic record keeping facilities such as hardware/software facilities, adequate space, vehicle (transport) and basic furniture and all simple instruments such as GPS, Digital camera, Handheld noise metre etc. The cell should have all basic environmental management data of the project that includes but not limited to the following:

(i) Environmental Impact Assessment Reports (both well preserved soft and hard copy)

(ii) A stand-alone Comprehensive Environmental Management Plan (CEMP)

(iii) All valid and up to date environmental clearances papers

(iv) All latest Environmental legislations, policies, codes and manuals for ready references

(v) A list of consultants on environmental management need to be kept with yearly revision of the list. This will help to receive proper advice in case of an emergency or a requirement and also to implement day to day environmental management activities.

Over a period of time a system to understand and absorb the new revisions and changes in the environmental requirements and practices are to be established. This can only be achieved by regular training and genuine capacity building initiatives. All this require a sound positive attitude of top-level management towards environmental management.

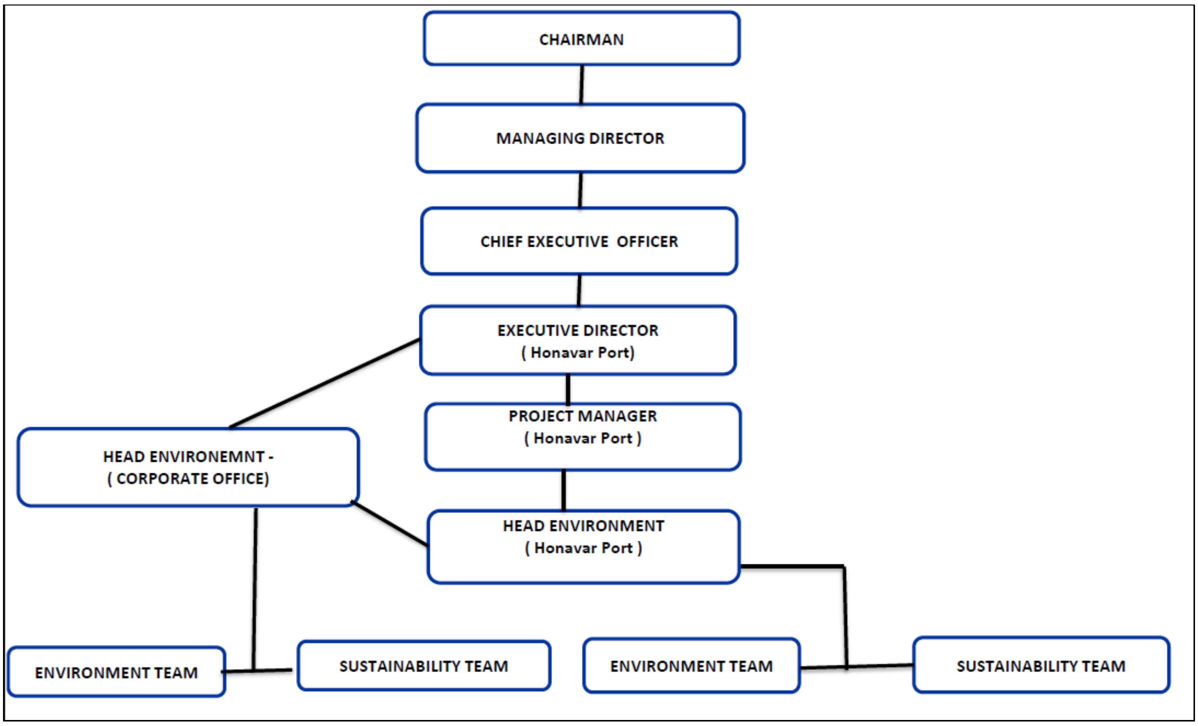


Figure 10-3: Organizational Setup for Environmental Management Cell

10.3 Greenbelt Development Plan

With rapid industrialization and consequent deleterious impact of pollutants on environment, values of environmental protection offered by trees are becoming clear. Trees are very suitable for detecting, recognizing and reducing air pollution effects. Monitoring of biological effects of air pollutant by the use of plants as indicators has been applied on local, regional and National scale. Trees function as sinks of air pollutants, besides their bio-aesthetical values, owing to its large surface area.

The greenbelt development not only functions as foreground and background landscape features resulting in harmonizing and amalgamating the physical structures of the plant with surrounding environment, but also acts as pollution sink. Thus, implementation of afforestation program is of paramount importance. It will also check soil erosion, make the ecosystem more complex and functionally more stable and make the climate more conducive. With a view to attenuate noise propagation and mitigate fugitive air pollution impacts, it is planned to develop a greenbelt all along the periphery of project site. Compatible species will be identified by HPPL for greenbelt. Saplings will be suitably nurtured. Regular watering will be undertaken. Soil conditioning and fertiliser application will be undertaken. If required, suitable soil treatment will be provided to ensure good growth of tree cover. Greenbelt development will be carried out in and around the proposed port along the roadside and on the vacant areas to reduce pollution as well as to improve aesthetic value within port premises. Species recommended by horticulturists will be selected on the basis of air pollution tolerance index of tree. Selection of the plant species will be based on their adaptability to the existing geographical conditions and the vegetation composition of the forest type of the region. During the development of the green belt within the project area, it has to be emphasized that those native plant species should be planted which are good ornamental values and are fast growing with excellent canopy cover.

The selection of plant species for the development depends on various factors such as climate, elevation and soil. The plant species should exhibit the following desirable characteristic in order to be selected for plantation:

(i) Should be fast growing and providing optimum penetrability.

(ii) Should be wind-firm and deep-rooted.

(iii) should form a dense canopy

(iv) As far as possible, the species should be indigenous and locally available.

(v) Species tolerant to air pollutants like PM, SOX and NOX should be preferred

(vi) Should be permeable to help create air turbulence and mixing within the belt

(vii) Plants will be preferably indigenous and would be native of the area.

(viii) Introduction of monocultures and alien plant species would be avoided to the maximum possible extent

Further Plants will:

(i) Be fast growing and attaining a height of 5 m or more in 3 to 4 years.

(ii) Have thick canopy cover.

(iii) Be preferably evergreen.

(iv) Have large leaf area index.

(v) Be resistant to specific air pollutants.

(vi) Maintain species diversity,

(vii) Be able to attenuate noise generated within the area.

(viii) Be well adapted to the existing soil conditions

As per the stipulations of MoEF&CC, greenbelt will be provided all around the project site boundary. Wherever feasible, greenbelt will be developed all along the port boundary, near administration buildings and cargo storage areas. The total greenbelt/ green area proposed in the port site is 3.1 Ha.

In the proposed greenbelt, about 7750 trees will be planted (2500 trees/Ha) with a capital cost of about INR 1 Million will be earmarked for this purpose.

10.3.1 Species for Plantation

The species proposed will have broad leaves. Trees will be selected based on the type of pollutants, their intensity, location, easy availability and suitability to the local climate like coastal adoptability. They have different morphological, physiological and bio-chemical mechanism/ characters like branching habits, leaf arrangement, size, shape, surface (smooth/hairy), presence or absence of trichomes, stomatal conductivity proline content, ascorbic acid content, cationic peroxides and sulphite oxidize activities etc to trap or reduce the pollutants. Species to be selected will fulfil the following specific requirements of the area:

Tolerance to specific conditions or alternatively wide adaptability to eco-physiological conditions
Rapid growth
Capacity to endure water stress and climate extremes after initial establishment
Differences in height and growth habits
Pleasing appearances; and
Providing shade

The pollutants namely dust/fugitive emissions, sulphur dioxide, smoke and carbon dioxide along with the noise pollution can be effectively curbed by planting the below mentioned specific floral species. Based on the above, the recommended species for greenbelt and plantation are given in **Table 10-2.**

Table 10-2: Recommended Plants for Greenbelt

S. No.	Botanical name	Importance
1	*Acacia auriculiformis*	Tall Evergreen drought resistant Avenue tree
2	*Ailanthus excelsa*	Tall branched semievergreen tree
3	*Albizia lebbeck*	Branced evergreen leguminous tree
4	*Alstonia scholaris*	Beautiful medicinal tree
5	*Neolamarckia cadamba*	Beautiful tree with large leaves
6	*Azadirachta indica*	Neem oil & neem products
7	*Bauhinia racemosa*	Ornamental tree
8	*Cassia fistula*	Ornamental and bark is a source of tannin
9	*Cassia siamea*	Ornamental avenue tree
10	*Cocos nucifera*	Coconut palm
11	*Dalbergia sissoo*	Avnue and timber tree
12	*Dendrocalamus strictus*	Bamboo products
13	*Casuarina equisetifolia*	Pulp and construction material
14	*Delonix regia*	Ornamental avenue tree
15	*Eucalyptus sp*	Grown in high density along the boundary
16	*Ficus benghalensis*	Shade and a source of food for birds
17	*Ficus racemosa*	Edible fruits
18	*Ficus religiosa*	Shade and a source of food for birds
19	*Gmelina arborea*	Timber
20	*Grewilia robusta*	Avenue tree
21	*Holoptelia integrifolia*	Fibre and timber
22	*Leucaena leucocephala*	Fodder and pulp wood
23	*Mangifera indica*	Edible fruit
24	*Michelia champaca*	Scented flowers
25	*Mimosops elengi*	Shade and edible fruit
26	*Muntingia calabura*	Shade and edible fruit
27	*Phoenix sylvestris*	Palm and the grown-up palms can be easily transplanted. Good soil binder
28	*Pongamia pinnata*	Source of biodiesel
29	*Polyalthia pendula*	Majestic tree with drooping branches
30	*Polyalthia longifolia*	Avenue tree
31	*Samania saman*	Shade, timber and fruits are a good livestock feed

S. No.	Botanical name	Importance
32	*Shorea robusta*	Tall and locally adapted Timber tree.
33	*Spathodea companulata*	Ornamental avenue tree
34	*Terminalia bellerica*	A common local tree of timber vlue.
35	*Syzygium cumini*	Edible fruits
36	*Tamarindus indica*	Tamarind fruit and leaf
37	*Tectona grandis*	Timber
38	*Terminalia arjuna*	Timber and shade tree
39	*Terminalia catappa*	Edible almond nuts

10.4 Biodiversity Conservation and Management Plan

At the core of the biodiversity study lies the objective of furnishing a comprehensive understanding of how the proposed development may influence the marine and terrestrial ecosystems and biodiversity. This necessitates a multifaceted approach encompassing various components, each meticulously examined to gauge potential impacts. From the detailed description of project activities to the analysis of physio-chemical parameters and biological dynamics, the assessment will provide valuable insights into the potential environmental ramifications of the project.

The Uttara Kannada district falls in Western Ghats of Karnataka state. The Western Ghats have stretched between Tapi river valley in the north and the Nilgiris in the south along the western coast of India. The Western Ghats is one among the 34 global hotspots of biodiversity are nearly 1600 kilometers in length with an average elevation of 1067 to 1219 meters. The Honavar is situated on the northern bank of the river Sharavathi to the north of Bhatkal and to the south of Karwar. The river Sharavathi is navigable up to Gersoppa in the up Ghat.

Honnavar is adorned with lush greenery, owing to its location within the Western Ghats biodiversity hotspot. Dense forests, consisting of both evergreen and deciduous vegetation, cloak the hillsides, supporting a rich variety of plant species. The costal belt includes sandy beaches with casuarina trees. Plantation of Coconut and Areca nut can be seen on bank of Estuary of Sharavti river along with mangrove ecosystem.

Honnavar port area doesn’t have any ecosensitive areas or forest lands. Mangroves in Sharavati river are at ~0.3 km and reserve and mixed reforest areas in the study area near Kumta (12.2 km).

Effective conservation and management plans should be in place to mitigate the impacts of project activities. Monitoring of biological parameters in and around the project site is warranted for any developmental activity. Such monitoring carried out before, during and after the developmental activity would help to better manage and minimize the impacts as well as to take appropriate remedial measures through effective mitigation actions.

HPPL approached CSIR-NIO, Goa for Marine biodiversity assessment studies and Building Environment (India) Pvt. Ltd. (BEIPL) for Terrestrial biodiversity assessment studies and preparation of Marine and Terrestrial Biodiversity Management plans. Biodiversity Assessment reports were given as **Appendix P.**

Marine Biodiversity study at Honnavar Port was undertaken by National Institute of Oceanography (NIO), during April 2024. As per the study, out of 34 genera observed, 15 were dominated by abundance (>5% contributed). Only 7 genera (Coscinodiscus spp., Pleurosigma spp., Ornithocercus spp., Trichodesmium spp., Leptocylindrus spp., Staurastrum spp., Skeletonema spp.) had >20% of cell abundance. The dominant zooplankton groups observed were copepods, appendicularia, chaetognatha, gastropods.

The benthic macrofauna a total of 30 taxa were recorded belonging to a wide range of taxonomic groups viz., Polychaeta, Amphipoda, Cumacea, Bivalvia, Gastropoda, Ophiuroidea, and Chaetognatha. Polychaeta, with 19 taxa (63%), was the most dominant group, followed by Crustacea 5 taxa (16.6%) and Gastropoda, 4 taxa (13%). Meiobenthos recorded belonged to a wide range of taxonomic groups viz., Nematoda, Oligochaeta, Copepoda, Amphipoda, Cumacea, and Polychaeta. Nematoda, was the most dominant group, followed by Oligochaeta. The abundance of meiobenthic fauna varied between 1 ind/10 cm^2 to 151 ind/10 cm^2.

In the present study species of conservation importance were not recorded or reported in the Port area. Floral species of conservation importance such as Madhuca bourdillonii, Hopea ponga, Myristica fatua and Mangrove species such as Avicennia alba ,Avicennia marina, Avicennia officinalis, Bruguiera cylindrica, Bruguiera gymnorrhiza, Bruguiera parviflora, Bruguiera sexangular, Ceriops decandra, Excoecaria agallocha, Kandelia candel, Rhizophora apiculate, Rhizophora mucronata, Sonneratia alba and Sonneratia caseolaris and faunal species of conservation importance such as Indo-Pacific Bottlenose Dolphin, Lion-tailed Macaque, Brahminy Kite, Common Indian Krait, Draco/ Flying lizard, Olive Ridley Turtle, Indian Cobra, Indian Python and Common Indian Monitor, Jungle striped squirrel, Brown Palm Civet, Common Indian Mangoose and Schneider's leaf-nosed bat are reported in the forest patches near to Westren Ghat Biodiversity spot located at above 10km from the port location.

Based on the baseline information, the Marine Biodiversity Management Plan is prepared, and the measures suggested may help in minimizing or nullifying the impact of development and extension of the port to the nearby environment. The impacts on the marine diversity should be studied at regular interval to understand the development and its impact on the biodiversity. The detailed impacts and mitigation measures along with various studies carried out to arrive at the conclusion associated with the marine environment is given in **Section 4.3** of **Chapter 4**.

10.4.1 Impacts on the environment and biodiversity due to the proposed activities during construction phase

The major activities undertaken during the construction and operation phases that could potentially impact the marine environment include

10.4.1.1 Anticipated Construction Phase Impacts

1. Dredging Activity

Impact on Benthic Organisms

- Benthic organisms will suffer the maximum damage as they are directly affected.
- Sedimentation in the dredged channel would likely be heavy and would also affect all the benthic organisms.
- Sedimentation caused by dredging could potentially bury the benthic organisms in the nearby region.
- Dumping of dredged soil is also likely to affect all the benthic organisms in the dumping site apart from causing excessive sedimentation.

Impact on Plankton and Productivity

- Increasing the suspended sediment concentrations, sediment deposition and turbidity

- Reduced light penetration, decrease in photosynthetic efficiency and primary productivity in the water column
- Changes in circulation pattern and littoral sediment transport
- Project activities would affect the nutrient movement and plankton density

Impact on Fishery Resources

- The impact on plankton community and benthic organisms would directly affect the fishery resources
- Increased turbidity may cause significant changes in fish behaviour, which include avoidance, disorientation, decreased reaction time, increased or decreased predation, increased or decreased feeding activity, and physical injury and even mortality.
- Noise generated during dredging would force the fishes in the area to move away.
- Suspended sediment concentration in the dredging sites influences the fish availability in the area.
- Benthic fishery resources such as shrimps and crabs will be disturbed and dislocated and hence their population is likely to be affected during dredging operations.

Impact on Plankton and Productivity

- Likely to affect the nutrient circulation due to dredging
- Current circulation will affect the flushing of sea water inside the proposed port
- Wave energy transformation near the construction sites will also have its impact on plankton and productivity

Impact on Fishery Resources

- Impacts on benthic and pelagic organisms due to dredging activities would also indirectly affect the fishery resources of the area during construction phase
- Any impact on fishery resources would possibly affect livelihood of fishermen of nearby villages

Impact on Avifauna and Other Animals

The increase in the volume of traffics is likely to have an adverse effect on the environment and lead to air pollution, noise pollution and water pollution

Construction and maintenance/operation may lead to short and long term impacts on aquatic and shoreline habitats. Direct impacts may include the physical removal or covering of sea floor, shore, or land side habitat, in addition to changes to water flow patterns and related sedimentation rates and patterns, while indirect impacts may result from changes of water quality by sediment suspension or discharges of storm water and wastewater. The following mitigations shall be followed to minimize the impact of stress factors on the biodiversity and for their management.

- Data must be collected at regular intervals to evaluate the potential impacts of port construction and operation to shoreline vegetation, wetlands, fisheries, bird life, and other sensitive aquatic and near-shore habitat/habitats (with special consideration for areas of high biodiversity value or those required for the survival of critically endangered or endangered fauna) including nearby mangrove patches.

- The plants selected for plantation must be indigenous, preferably perennial and evergreen and fast-growing trees. Trees should also be planted along the roadside in such a way that they act as sink for air pollution.

Mangroves: The following measures shall be adopted to conserve mangroves:

- Awareness will be given to workers in the port about the importance of mangroves and their conservation
- Discharge of waste/wastewater during the construction and operation without treatment in mangrove areas would not be allowed
- Illegal cutting of mangroves for firewood by workers during the construction and operation phases of port would be strictly prevented
- Fuelling stations, petroleum products and hazardous material storage units must be located at minimum 50m distance away from the northern mangrove areas
- Necessary steps should be taken in case of any oil spill or leakage of any hazardous substances in the port area to minimize its impact as per contingency plan.

10.4.2 Mangrove Plantation

The port authorities could contemplate taking up mangrove plantation or rehabilitation activities in appropriate areas with assistance of forest department or reputed institutes. The following fish bone model can be suggested for the restoration of mangroves.

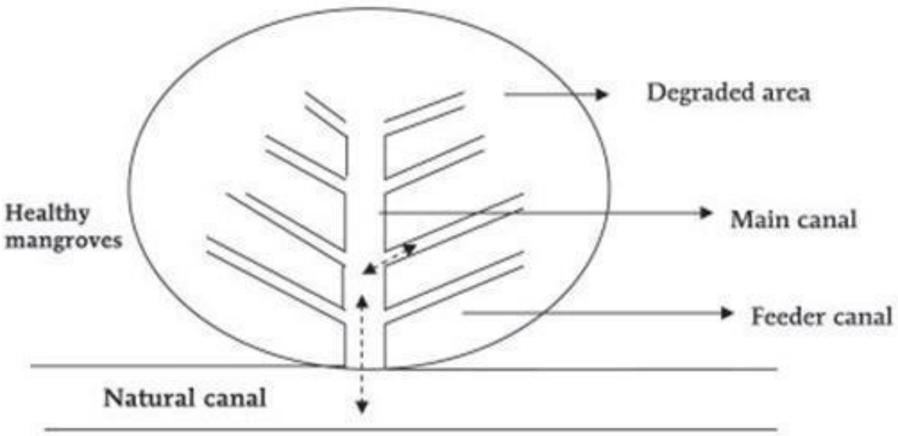


Figure 10-4: Fish Bone diagram of Mangrove plantation

Protected Faunal Species (species in IUCN and Wildlife Protection Act): The following measures shall be adopted for the protected species.

- Monitoring of occurrence of protected species and their habitat
- Habitat protection
- Awareness among common people
- Conservation of mangrove patches existing near the project are in support with forest department

The respective government department will take care of the protected faunal species and HPPL will provide the necessary support for the conservation.

10.4.3 Sea Turtle Conservation

The olive ridley sea turtle is the only species of sea turtle known to nest along the coast of Karnataka (Kar and Bhaskar 1982). Uttara Kannada has a coastline of about 170 km between Karwar to the north and Bhatkal to the south. All along this coast, the beach is divided by hillocks that reach the sea. The main nesting season is from October to January.

It should be noted that manmade protected turtle hatcheries recorded from the study area during field visit. The following measures are provided based on the secondary data information:

- Significant habitats of turtles lying outside the protected areas should not be disturbed.
- Low sound producing equipment may be used for the purpose of dredging and other such activities.
- Care should be taken in ship movements with regard to turtle conservation.

10.4.3.1 Nesting Site Protection

The beaches that serve as important nesting places in the port vicinity for female sea turtles should be identified and protected. Take steps to ensure that no port activity poses a concern during nesting seasons in order to avoid disruptions and guarantee successful nesting.

10.4.3.2 Dredging Management

The channel area is well away from the turtle congregation area and hence there is no regular movement of turtle into the channel area to avoid accidental take, HPPL followed the dredging protocol which may be continued.

10.4.3.3 Protection of Eggs

Ensure that the turtle nesting grounds are protected and free from predators, poaching, and natural threats. Especially, stray dogs in the turtle nesting beaches pose major threats to nesting sites.

10.4.3.4 Lighting Management

The glare of the port complex lighting system is likely to cause adverse impacts on the Nocturnal fauna and marine creatures. During the hatching of eggs laid by Olive Ridely turtle, the glare of light may destruct their movement to landward side causing desiccations and death. Considering these ecological issues, HPPL shall adopt DARK SKY LIGHTING SYSTEM an exemplary activity for the coastal eco system.

Lighting Mitigation Efforts

- All outdoor lighting, roadway lighting, wharf lighting, and lighting mounted on masts or other elevated structures will be of the minimum lamp wattage to achieve required safety within the lighted area.
- No area lighting or any lighting mounted on masts or other elevated structures will include fluorescent lamps, mercury vapour (MV) lamps, metal halide (MH) lamps, or other broad-spectrum high-intensity discharge lamp types.
- No lighting of grounds, building walls, signs, cranes, or other elevated structures will employ flood lighting, up-lighting, or other forms of directional lighting aimed above the horizon.
- Wherever possible, use low-pressure sodium vapour lamps or other light sources that exclude wavelengths less than 520 nm.

10.4.3.5 Bycatch Reduction

- Work with forest and fisheries department to enforce the use of Turtle Excluder Devices (TEDs) in fishing gear to prevent accidental capture of sea turtles.
- Organize awareness programs and educate fishermen about responsible fishing practices.

- Research and Monitoring
- Support studies on sea turtle behaviour, migration patterns, and population dynamics. This research study should mainly focus on nesting site monitoring, tracking sea turtle migration and threats posed to them particularly in the port vicinity.

10.4.3.6 Marine Debris Reduction

Organize to conduct coastal clean-ups to remove plastic and other debris that can entangle or harm sea turtles. Raise awareness about reducing plastic use to keep beaches and oceans clean.

10.4.3.7 Wildlife Including Turtle Conservation Awareness Programme

The HPPL will implement the project in a manner that will not have significant adverse impact on the wildlife exists within the study area. The company strives for ecologically sustainable development and has adopted the improved practices to ensure continual improvement of its environmental preferences. It is required to create awareness among the employees of HPPL and the local community regarding importance of wildlife in sustenance of life on earth and to be responsible for conservation of nature.

10.4.3.8 Budgetary Provisions

HPPL has submitted the turtle conservation plan in consultation with Deputy Conservator of Forests. Honnavar Division and same has been recommended and submitted through the Chief Conservator of Forests, Canara Circle, Sirsi.

An amount Rs. 4.00 lakhs on annual basis were allocated towards protection of turtle nesting associating with forest department, Honnavar division proposed conservation activities includes build barricades around the nesting area during breeding season, watch and ward during breeding season and conservation awareness programmes. Approval from forest department for Turtle conservation was given as **Appendix Q**.

10.5 Conservation Strategies for Terrestrial Biodiversity

10.5.1 Conservation Plan for IUCN & IWPA Scheduled I Fauna recorded in the 15 km buffer area

Wildlife management is the application of scientific knowledge and technical skills to protect, conserve, limit, enhance, or conserve the existing wildlife habitat. Wildlife management also includes implementing laws regulating wildlife management tools to the area of interest.

Conservation strategies for the species of importance

- General distribution studies
- Habit and habitat assessment
- Population status assessment
- Identification of major threats
- Identification of Stress Factors
- Mitigation and management planning
- Implementation of conservation strategies
    - Habitat improvement programme
    - Water availability
    - Awareness programmes (community and school level)

Birds: The following measures shall be adopted for birds.

- Avoid using of high sound producing equipment's for longer duration
- Minimise using of light in locations near to mangrove habitats
- Locate dumping sites away from bird residing habitats such as mangrove areas.

The green belt area proposed by HPPL is about 3 Ha as a part of development. The plants which have to be selected for plantation must be indigenous, preferably perennial and evergreen and fast-growing trees. Trees should also be planted along the roadside in such a way that they act as a sink for air pollution.

The Government of India, MoEF&CC has accorded approval "in-principle" Stage -I for diversion of 0.76 Ha of forest land in Sy.No. 233 and 237 of Kasarkod village, Honnavar Taluk, Uttara Kannada District approach road from NH-66 to Kasarkod side of Honnavar port. An amount Rs. 4.00 lakhs were allocated towards protection of turtle nesting i.e to build barricades around the nesting area during breeding season and watch and ward during breeding season.

10.6 Solar Power Harnessing

10.6.1 Solar Power Harnessing Potential

Solar Power Harnessing has been proposed within the Honnavar port built up areas particularly at available roof tops. The available technologies for generating solar power are mainly Solar Photo Voltaic (PV) Cells and Solar Thermal. Technology of Solar PV Cells is suitable for solar power generation with proper utilization of the roof top areas available on the roofs of buildings/structures within the port premises. The off grid solar PV system will be used for the solar power harnessing in the proposed power plants.

Basic components that are used to build a solar PV system are as follows:

Flat Roof Solar PV Panel mounting systems	Off-Grid Solar PV Power Inverters
Solar PV Panels and solar modules	Solar PV Cables & Connectors
Solar PV Charge Controllers	Solar PV Generation Meters
Solar Batteries	AC & DC Isolators
PV Junction Boxes/PV Combiner Boxes	Solar PV System monitoring

Based on our initial assessment, it is predicted that up to 0.01 MW of Solar energy can be harnessed in this area. Precise capacity will be worked out during detailed engineering of various structures and will be implemented accordingly. Depending on availability of suitable area, solar power harnessing potential will also be considered during overall implementation of Honnavar port.

10.7 Storm Water Management Plan

Storm water runoff will be directed into open concrete lined channels alongside the roads and paved areas in the cargo storage areas and other areas of the barge/vessel loading facility. The polluted runoff from berths and stockpiles of cargo storage areas will be intercepted and directed to septic tank .The runoff from uncontaminated areas will be discharged into the greenbelt area. Contaminated storm water will be collected and conveyed to settling tank for removing grit.

The oil contaminated water will be sent to oil water separator, separated oil will be sent to KSPCB approved vendors and water will be sent to soak pits.

10.7.1 Rainwater Harvesting

Rainwater collected from roof of buildings will be channelized through rain water down comers and routed to garland drain around the buildings. These garland drains are connected to the plant storm water drainage network system all around the proposed barge/ vessel loading facility area. Recharge wells will be located at strategic locations within the site and will be interconnected to the storm water drain network system.

The amount of water harvested depends on the frequency and intensity of rainfall, catchment characteristics, water demands and how much runoff occurs & how quickly or how easy it is for the water to infiltrate through the subsoil and percolate down to recharge the aquifers.

As per IMD data of Honnavar station (1991-2020), the total annual rainfall is 3732.4 mm and number of rainy days is 110.4 per year. Based on these data, the rainwater harvesting potential of the project area is estimated as 0.208 MCM per year.

Table 10-3: Rainwater Harvesting Potential

S. No	Land Use	Total Area (m^2)	Coefficient	Area after coeff	Rainfall (mm)	Volume (m^3/year)
1.	Roof top area	350.0	0.75	262.5	3732.4	980
2.	Road Area	61298.2	0.825	50571.0	3732.4	188751
3.	Green area	32981.6	0.15	4949.9	3732.4	18475
	Total	**61648.2**		**55783.4**		**208206**

10.8 Budgetary Estimates

The budgetary estimate (Capital Cost) for Environmental Management is INR (25.73 Crores) and the annual recurring cost is INR (3.7 Crores). The breakup of cost is given in **Table 10-4 & Table 10-5.**

Table 10-4: Environmental Management – Capital Cost.

S. No.	Purpose	Cost items	Amount (Million)
1.	Air Pollution and Noise Abatement	Tree (Greenbelt) Plantation	1.1
2.	Solid Waste Management	Waste dustbin	0.03
3.	Capacity building	Training workshop	0.3
4.	Marine life protection out of oil spill	One tugboat with booms and skimmer and dust exhausting equipment	100.2
5.	Dust Sweeper		7.5
6.	Air Pollution Control	Installation of AP Control System	120
7.	Environmental Monitoring Construction Phase	Marine & Terrestrial Environment	28.2
8.	Sewage Treatment Plant	STP	0.1
Total Capital Cost			**257.4**

Table 10-5: Environmental Management- Annual Recurring Cost

S. No.	Purpose	Cost items	Amount (Million)
1.	EMC Running expenditure	Environment Manager	0.9
		Site Officer (Legal & Compliance)	0.35
		Asst. Manger	0.45
		Environment Observer	0.2
		Office Expenses	3.6
		House Keeping	0.6
		Watering for GB and Road by Tankers	0.8
2.	Green Belt Maintenance	-	0.10
3.	Maintenance of Dust bins	-	0.003

S. No.	Purpose	Cost items	Amount (Million)
4.	Awareness campaigns-Training	-	0.3
5.	Maintenance of tugboat, booms and skimmer etc	-	5.01
6.	Maintenance of Dust sweepers	-	1.5
7.	Maintenance of AP Control System	-	6
8.	Wetting of Roads	-	6
9.	STP Maintenance	Environmental Monitoring	0.005
10.	Statutory compliance for environmental protection	Marine & Terrestrial Environment	11.53
Total Annual Recurring Cost			**37**

Chapter 11
Summary and Conclusion

Chapter 11 Summary and Conclusion

11.1 Introduction

As per the EC&CRZ clearance M/S. Honnavar Port Pvt. Ltd., have proposed for development of a barge / vessel loading facility at Coastal Sand Spit, Kasarkod Tonka Village, Honnavar Taluk, Uttara Kannda District. Total land requirement for the proposed facility is 44 Ha.

Total capacity of cargo handling is 4.9 MTPA for Coal, Iron Ore and General Cargos. Two break waters are proposed (Southern Break Water: 865 m and northern break water: 820 m). Berth of 440m long and 30m wide with backup areas, approach channel, Turning circle, dredging quantity 3.9 million cum and reclamation 1 million cum.

HPPL obtained the Environmental & CRZ Clearance through File No. SEIAA: 22: IND:2011 dated September 21, 2012. EC & CRZ clearance validity extension for three years was obtained through File No. SEIAA: 22: IND: 2011 dated July 01, 2019 and further EC & CRZ clearance validity extension for further one year was obtained through File No. SEIAA: 22: IND: 2011 dated September 20, 2023.

SEIAA through vide letter no. SEIAA0 03 MISC 2024 dated May 18, 2024 clarified that Construction of four lane road of 2.58km length from Honnavar Port to NH-66 is integral part of the EC and CRZ clearance granted. Part of the proposed road is passing through the Forest lands and 'in-principle' (Stage-I) clearance for the diversion of 0.76 ha. of forest land was obtained.

Consent for Establishment (CFE) was obtained from Karnataka State Pollution Control Board (KSPCB), Bengaluru through vide Order No. KSPCB/SEO (Non-EIA)/Honnavar Port/EIA/2012-13/1381 dated February 06, 2013. CFE extension was obtained through vide Order No. PCB 185/infra 2020/4003 dated October 25, 2023.

Table 11-1: Cargo Handling Capacities at HPPL

Company	Cargo	Approved Handling Capacity (MTPA)
Honnavar Ports Private Limited (HPPL)	Coal	2.70
	Iron ore	1.00
	General Cargo • Granite (0.16 MTPA) • Fertilizer (0.2 MTPA) • Molasses with Agro Products (0.15 MTPA) • Steel Products (0.40 MTPA) • Sugar (0.29 MTPA)	1.20
	Total Handling Capacity at Port (MTPA)	4.9

It is proposed to construct a jetty of 440 x 30 m with two approach trestles of 67.5 x 15 m each and construction of two parallel breakwaters at the estuary of River Sharavthi and Badagani in the Northern and Southern side respectively.

11.1.1 Project Location

The proposed site for development of Barge/ Vessel loading facility is located near mouth of Sharavati River in Honnavar Taluk of Uttara Kannada district in Karnataka. It is at a distance of about 90 km from Karwar, the district headquarter and about 400 km from Bengaluru.

Port limits of Honnavar Port as per notification by Public Works, Ports and Inland Water Transport Department of Government of Karnataka (GoK) through notification no. PWD 142 PSP 2011 dated August 13, 2013 is as follows:

Point A: 14°18' N, 74°25' E	Point B: 14°18' N, 74°22' E
Point C: 14°13' N, 74°24' E	Point D: 14°13' N, 74°26' E

11.1.2 Project Status/Existing Development

HPPL initiated the construction work after completing the financial closure formalities and after getting the clearances from Honourable courts. Mobilization and material procurement activities were initiated and following activities are fully/partially completed

- Approach Trestle No. 1 (Completed)
- Approach Trestle No.2 (Partially completed 5 out of 17 piles)
- Internal earthen road work for construction materials transportation (Completed)
- Black topping of existing Kachha road for a length of 2.10 Km along the seashore of Kasarkod village (Partially Completed)
- Initial work was carried out till the year 2022. Due to Covid-19 and other issues the construction work was halted.

11.1.2.1 Court Cases Details

Various Writ Appeal (WA) / Want of Prosecution or Writ Petition (WP) / Public Interest Litigation (PIL) / Appeals / Applications were filed from the year 2016 to 2022 against the accorded approvals related to GO's issued by the Port Officer, Honnavar, Appeal against the court order, Appeal against ownership of the land, Challenged the Environment Clearance granted on September 21, 2012 and the extension granted on July 01, 2019, on turtle nesting grounds in project area, on the dedicated road corridor to provide road connectivity from the Honnavar Port Project to the National Highway – 66.

All the court cases pertaining to turtle nesting grounds in project area, connectivity corridor and land ownership with Honourable Karnataka State High Court, Dharwad branch, Karnataka; Honourable Court of Deputy Commissioner, Uttara Kannada, Karwar, Karnataka; Honourable Karnataka State High Court, Bengaluru; Honourable Court of the PRL. District & Sessions Judge, Uttara Kannada, Karwar, Karnataka; Honourable the National Green Tribunal, Southern Zone, Chennai; were Dismissed/ Disposed in favour of Govt. of Karnataka and Project Proponent HPPL. Details of court cases are given in **Table 1-3.**

11.1.3 Need for the project

Based on the growing demand/export potential in the state, the Government of Karnataka has estimated that Karnataka coast would need more seaports/barge/vessel loading facility along Coast. Out of the ports of the state, NMPT, the major port currently caters to only ~4.5% of Indian port cargo. Cargos such as granite, fertilizer, molasses, iron ore, coal with other agro products and steel products also has the potential to grow in demand and supply which will increase the traffic. This will increase the traffic across the proposed Barge/ Vessel loading facility.

11.2 Project Description

The salient features of barge/ vessel loading facility Layout are presented in **Table 11-2.**

Table 11-2: Salient Features of Barge/ Vessel Loading Facility

S. No	Parameter	Description
1.	Land Area	44 Ha (108 acres)
2.	Cargo handling capacity	4.9 MTPA
3.	Total Project Cost	INR 607.03 Crores
4.	Cargo handling equipment	Barge/Vessel loader, mobile harbor cranes, pay loaders
5.	Berthing facilities	Berth of length 440 m and width 30 m
6.	Length of Northern Breakwater	820 m
7.	Length of Southern Breakwater	865 m
8.	Navigation Facilities	Approach Channel (Inner/ Outer): Length: 1395/2280 m; Width: 100/100 m; Depth:(-) 10/10 m Turning Circle: Diameter: 250 m; depth: (-)10.0 m
9.	Dredging and Reclamation	• Capital dredge material: 3.9 MCM • Reclamation: 1 MCM of dredged material will be used • Remaining dredge material will be disposed at the identified disposal location, recommended through mathematical modelling studies at a distance of about 2.0 km to the north of port entrance channel. During periods of strong near shore currents (during peak wet season), it is suggested to dispose the sediment offshore at greater depths (>30 m).
10.	Navigational Aids	• Channel marker buoys; Fairway marker Buoy; Breakwater marker lights; Berth Corner Lights
11.	Connectivity	• Proposed Rail Corridor Connecting project site to Manki Railway station of about 8.5 km • New railway station in between Hosapattana between existing Honnavar RS and Manki RS is being proposed • Road Corridor connecting project site to NH 66 is proposed under Bharatmala Pariyojana.

A layout showing the planned barge/vessel loading facilities is given as **Figures FD0201.**

11.2.1 Present status of onshore and offshore facilities

The proposed development comprises of the facilities like Berth & Approach trestle, and other onshore and offshore infrastructure and utilities. Two approach trestles at northern and southern side were proposed.

Mobilization and material procurement activities were initiated and following activities are fully/partially completed

- Approach Trestle on the southern side of 67.5m length and 15m width is completed. (Completed)
- For the approach trestle on the northern side concreting of 5 pilers out of 17 have been completed
- Internal earthen road work for construction materials transportation (Completed)
- Black topping of existing Kachha road for a length of 2.10 Km along the seashore of Kasarkod village (Partially Completed)
- Casting of tetrapod’s (Partially completed)

11.3 Description of Environment

The EIA Report is prepared with one season primary data for terrestrial during October-December 2023 and marine environmental parameters during April 2024. The Environmental monitoring and analysis of terrestrial parameters with respect to ambient air, noise, water (groundwater and surface water), soil has been carried out by Ms Vision laboratories, a NABL accredited laboratory and the marine monitoring (water, sediment, plankton, and chlorophyll) has been carried out by CSIR-NIO.

The current State of the environment was studied (primarily for bench marking) in the project area and within a radius of 15 km from the project site (further referred to as the study area). The baseline environmental studies have been carried out for marine and terrestrial environments by covering land, air, noise, water and biological environment.

11.3.1 Terrestrial Environment

- Existing terrestrial environmental conditions in the study area were established through collection and analysis of air, noise, groundwater, surface water, soil and ecology (flora and fauna) samples at selected locations for October-December 2023.
- The slope in the project site and surrounding areas are nearly 0-1 % and the slopes show increasing trend in the East starting from 1-3%
- The total area considered for land use study is 314 sq.km (~10 km radius). Majority of land use is occupied by water bodies (58.3%) and forest land (15.3%).
- Predominant wind directions observed are from West followed by West North-West. The average wind speed is 2.79m/s.
- As per the Climatological data for Honnavar region published by the IMD, based on daily observations at 08:30 and 17:30 hour IST for the period 1991-2020:
    - Daily maximum temperature of 33.6°C and daily minimum temperature of 20.1°C were recorded in the months of December and January respectively
    - Maximum and minimum relative humidity of 94% in the months of July & August and 63% in the month of December was recorded at 08:30 hours
    - Maximum relative humidity of 89% in the month of July and minimum of 54% was recorded in the month of December at 17:30 hours
    - Maximum and minimum mean monthly rainfall of 1161.0 mm and 0.0 mm were recorded in the months of July and February, respectively
    - Total annual mean rainfall recorded is 3732.4 mm spread over 110.4 total rainfall days.
    - Maximum and minimum mean wind speed is 6.3 kmph (1.75 m/s) and 4.3 kmph (1.19 m/s).
- The concentrations of PM_{10}, $PM_{2.5}$, SO_2, NO_2, O_3, CO, NH_3, Pb, BaP, As, Ni, PAH, HCl, HBr, H_2S, VOC, Chlorine and C_6H_6 are observed to be well within the NAAQ standards prescribed by Central Pollution Control Board (CPCB) for residential zone.
- It is observed that day and night-time equivalent noise levels at all locations are within CPCB standards for residential zone.
- It is observed that all ground water sample collected within the study area are well within the permissible drinking water standards IS 10500:2012 (as amended).
- None of the plant species recorded either from the core area belongs to the Rare/Endangered/Endemic/Threatened category.
- No declared eco-sensitive zones like National Park, Wildlife Sanctuary or Wetlands are present within a 15 km radius of the project site.

11.3.2 Marine Environment

Marine Water:

- **Temperature:** The water temperature was recorded from 30.16°C to 31.88°C,
- **Salinity:** The salinity varied from 4.52 PSU to 35.39 PSU
- T**urbidity:** The turbidity ranged from 0.84 NTU to 8.97 NTU
- **Dissolved Oxygen:** The dissolved oxygen varied from 4.43 to 8.34 mg/l
- **Biochemical oxygen demand:** The BOD varied from 1.08 mg/l to 2.86 mg/l
- **Nitrate:** Concentration of Nitrate ranged between 0 to 0.32 µmol/l
- **Nitrite:** Concentration of Nitrite ranged between 0.01 to 0.06 µmol/l
- **Total Phosphate:** Concentration of total phosphate ranged between 0.14 to 0.45 µmol/l
- **Silicate:** Concentration of Silicates ranged between 17.96 to 111.72 µmol/
- **Ammonia:** Concentration of Ammonia ranged between 0.71 to 2.07 µmol/l

Sediment:

- The sand fraction ranged from 0.02 to 97.44%, silt fraction ranged from 2.16% to 99.32 and clay fraction ranged from 0.08 to 1.69%
- **Aluminium**: Concentration of Al ranged 7.27 to 14.43 %
- **Calcium**: Concentration of Ca ranged 0.36 to 2.26 %
- **Iron:** Concentration of Fe ranged 0.6 to 6.35 %
- **Magnesium**: Concentration of Mg ranged 0.03 to 2.38
- **Mercury**: Concentration of Hg ranged upto 0.05 µg/g
- **Chromium**: Concentration of Cr ranged 14.55 to 217.65 µg/g
- **Zinc**: Concentration of Zn ranged 21.8 to 115.9 µg/g
- **Nickel**: Concentration of Ni ranged 18.33 to 98.2 µg/g
- **Copper**: Concentration of Cu ranged 9.45 to 53.37 µg/g
- **Cobalt**: Concentration of Co ranged 0.78 to 22.38 µg/g
- **Lead**: Concentration of Pb ranged 3.14 to 19.75 µg/g
- **Arsenic**: Concentration of As ranged 4.18 to 29.52 µg/g
- **Cadmium**: Concentration of As ranged 4.18 to 29.52 µg/g
- **Manganese**: Concentration of As ranged 4.18 to 29.52 µg/

Marine Biology:

- Total viable count of bacteria varied between 3 x 10^3 CFU $100mL^{-1}$ and 4 x 10^4 CFU $100mL^{-1}$
- Total E. coli count of bacteria varied between 1 x 10^1 CFU $100mL^{-1}$ and 2 x 10^1 CFU $100mL^{-1}$.
- Other coliforms count varied between 3 x 10^1 CFU $100mL^{-1}$ and 8.2 x 10^2 CFU $100mL^{-1}$
- Total faecal coliforms count varied between 1 x 10^1 CFU $100mL^{-1}$ and 7 x 10^1 CFU $100mL^{-1}$
- Total Vibrio count varied between $1x10^1$ CFU $100mL^{-1}$ and $5.2x10^3$ CFU100 mL^{-1}
- *Salmonella* growth was observed only at six marine sampling locations.
- Total *Shigella* count varied between 1 x 10^1 CFU $100mL^{-1}$ and 1.36 x 10^3 CFU $100mL^{-1}$.
- The zooplankton abundance varied from 852 Nos./m^3 to 15537 Nos./m^3

11.3.3 Socio-economic Environment

The socio-economic profile of the project influence area was established through compilation of secondary data and 2011 census data for assessing the Study area profile.

- Uttara Kannada with a total population of 1,437,169 holds the 20th position in terms of total population in the State.
- The district with a Sex ratio of 979 holds 18th rank in the State.
- The district has a literacy rate of 84.1 percent and is placed at 4th rank in the State.
- The district has registered a work participation of 42.3 percent and stands at 28th rank in the State.
- Among the total workers in the district 81.9 percent are Main workers and 18.1 percent are Marginal workers
- Agricultural sector constitute 37.4 percent of the total workers i.e., Cultivators (18.3 percent) and Agricultural Labourers (19.1 percent) and 1.6 percent of the total workers are engaged in Household Industry
- The population density for this district is 140 and it is the third least dense district in the State.

11.4 Anticipated Impacts and Mitigation Measures

The port activities and their impacts on the environmental and social attributes during the development and operation phase have been discussed in **Chapter 4**. Mathematical modelling studies have been carried out to evaluate the impacts due to disposal of dredge material, and shoreline changes near the proposed project. The following potential impact categories are taken into account:

- Land Environment
- Water Environment
- Marine Environment
- Air Environment
- Noise Environment
- Flora and Fauna
- Coastal impacts
- Solid Waste Management
- Socio-Economic Impacts

The impacts have been summarised, evaluated and suitable mitigation measures proposed to negate the likely impacts are presented in **Chapter 4**.

11.5 Analysis of Alternatives

EC & CRZ Clearance for Honnavar Port was obtained vide No. SEIAA: 22: IND: 2011 dated 21st Sep 2012. Further, EC & CRZ clearance validity extension for three years was obtained vide File No. SEIAA: 22: IND: 2011 dated July 01, 2019 and further EC & CRZ clearance validity extension for further one year was obtained vide File No. SEIAA: 22: IND: 2011 dated September 20, 2023.

There is no change in the proposal for which EC & CRZ clearance was obtained and regular compliance is being submitted. Certified compliance report from RO, MoEF&CC has been obtained. Present proposal is to fresh EC for completion of the initiated construction activity. HPPL has obtained fresh Terms of Reference (ToR) from SEIAA, Karnataka through vide File No: SEIAA 02 IND 2024 dated August 12, 2024 and accordingly EIA study has been carried out. Hence, analysis of alternative site and construction of port on the west side of the coastal sand pit is not envisaged for the proposed proposal.

11.6 Environmental Monitoring Programme

The environmental attributes to be monitored during construction and operation phase of the project, specific description along with technical details of environmental monitoring including the monitoring parameters, methodology, sampling locations and frequency of monitoring are presented in **Chapter 6**.

11.7 Additional Studies

11.7.1 Public Hearing

As per the requirements of EIA Notification 2006 (as amended) for Category B1 projects, public hearing was conducted as a part of previous EC/CRZ Clearance at Project Site, kasarkod-tonka, Honnavar taluk, Uttara Kannada district. The Public Hearing was conducted on January 27, 2012 by KSPCB in the presence of Dy. Commissioner & District Magistrate, Uttar Kannada District, Karwar Regional State Pollution Control Board Officer.

No changes in pollution load and the CCR from RO, MoEF&CC dated 29.05.2024 obtained which mentions that about five percent of the project has been undertaken. Now, HPPL intends to obtain the valid EC/CRZ clearance for completion of initiated construction activities which are delayed due to various PIL's fielded in various Honourable courts and verdicts were disposed in favour of construction of Port by GoK/HPPL. SEIAA accorded the ToR on August 12, 2024 with exception from public hearing for present proposal.

As per the accorded, ToR dated August 12, 2024 public hearing action plan as a part of the EIA report needed to addressed and the details of previous public hearing queries raised, and the responses are provided in Chapter 7.

11.7.2 Risk Analysis

Risk Assessment study was carried out to assess risks associated with the construction and operation of the Captive Port. A systematic Risk Analysis/Assessment (RA) will help in identification of the hazards and associated risk. The RA thus carried out also provides inputs for formulating the onsite Disaster Management Plan (DMP). The RA can be broadly divided into three basic steps:

a. Hazard Identification
b. Risk Analysis
c. Discussion and Recommendations/Risk Mitigation Measures
d. The necessary measures will be taken during handling, transfer and storage of cargos.

11.7.3 Disaster Management Plan

The Disaster Management Plan (DMP) is aimed to ensure safety of life, protection of environment, protection of installation, restoration of infrastructure and salvage operations in the same order of priorities. For effective implementation of DMP, personnel training will be provided through rehearsals/drills.

The Disaster Management Plan (DMP) for the proposed facility shall be prepared suitably to match the requirements of present proposal. The disaster management plan mainly deals with continuous and integrated process of planning, organising, coordinating and implementing measures. An On-Site Emergency Preparedness Plan and Off-Site Emergency Preparedness Plan including Oil spill contingency plan will be prepared to deal with emergencies and prevent disasters. Liquid cargo spillage (molasses) studies were also carried out and discussed.

The roles and responsibilities will be clearly defined and location of Emergency Control Centre and Assembly Points will be identified. Communication system and alarm systems for effective communication in the event of a disaster will also be identified. DMP for natural hazards such as floods, cyclones, tsunami and earthquake will be prepared.

11.7.4 Social Impact Assessment

No land acquisition and R&R is envisaged as HPPL has been allotted to use government land of 44 hectares by Government of Karnataka. The construction activities involve dredging, construction of cargo berth which may likely impact the fishing activity at nearby fishing villages. There are no major fishing zones in the study area. The fish landing centres in the study area are Kasarkode ~1km, Mavinkurve ~3.4km, Haldipur ~3.8km, Dhareshvar ~7.6km, Manki-Madi ~13.2km and fishing settlements within 5km radius are Karki ~0.97km, Honnavar ~1.2km, Mavinkurve ~2.5km and Haldipur ~4.3km. However, necessary marker buoys shall be installed and interactions shall be initiated with the fishing community about the marker buoys indicating the areas of operation so that they may avoid those areas during construction period. Hence, minimal hindrance to fishing activity is anticipated during construction phase of the proposed barge/vessel loading facility.

The expected direct employment will be 50 persons. The proposed project is likely to have positive impact on socio-economic condition of the region overall.

11.7.5 Traffic and Transportation Study

It is anticipated that total yearly forecast for Honnavar Port is around 4.9 MTPA. The traffic forecast in terms of PCU's is around 4722 PCU's for Cargo Quantity of 4.9 MTPA. Hence considering the above capacity, lane configuration of four lane with Paved Shoulders (4L+PS), has been proposed. The following recommendations have been proposed:

- Due care shall be taken for Protection works for the port road on the sea side at the execution stage.
- Rigid Pavement has been proposed considering the port traffic and coastal weather conditions which are subjected to heavy rainfalls, maintenance etc.
- A toll collection office is proposed at Ch. 0+000 at the entry gate of the Port.
- Since majority of the road alignment for runs along the seashore, provision for bank protection shall be made by providing sheet piles

11.8 Project Benefits

The employment potential from the construction phase of the proposed Barge/ Vessel loading facility is estimated around 500 persons. The expected direct employment during operation phase will be 50 people.

The proposed project is likely to have a positive impact on the socio-economic conditions of the region. The social infrastructure in the region is likely to change due to the creation of more job opportunities and avenues for income generation. People will have higher income due to direct employment as well as indirect employment and will have higher earning and buying capacities.

The quality of life in the region is likely to improve due to the creation of jobs for the local people so that the dependency changes and there will be more than one earning member in the family, which will provide economic freedom.

11.8.1 Corporate Social Responsibility

As part of the CSR, it will also be proposed to conduct periodic health camps and carry out health campaigns which will lead to better health conditions of the local people.

As a part of Corporate Social Responsibility (CSR), HPPL proposed to take up following activities for improving the way of living of people in the nearby villages:

- Providing better health services
- Providing better educational facilities for children of employees
- Creating job opportunities
- Facilitate self-employment through training and credit linkage
- Outsourcing opportunities to Self Help Groups (SHG)
- Providing protected water supply system to Kasarkod Tonka and Apsarkonda villages.
- Strengthening area Government hospitals by assisting them in procurement of essential medical equipment.
- Providing quality health care through regular medical camps.

11.9 Environment Management Plan

The effective implementation and close supervision of the environmental management to mitigate the environmental impacts, which are likely to arise due to the construction and operation phases of the project will be best achieved through a suitable institutional mechanism.

Environmental Management cost for establishment of environmental control equipment, including greenbelt development and annual recurring cost details are provided.

EMP capital cost of INR 25.74 Crores and recurring Cost of INR 3.7 Crores has been estimated.

Environment Management Plan for the proposed port has been prepared keeping commitment towards sound environment management. The environment management plan consists of Greenbelt Development Plan; Marine Biodiversity Management and Conservation Awareness Programme; Occupational health and Safety etc., Apart from these the designed inbuilt components such as Air pollution abatement measures, wastewater treatment measures, Storm water management Plan, Stockyard runoff management plan, Noise abatement measures, solid and hazardous waste management measures which will ensure effective environment management.

The institutional mechanism responsible for the implementation of the mitigation measures is presented in the **Chapter 10.**

11.10Conclusion

The proposed site for development of Barge/ Vessel loading facility is located near mouth of Sharavati River in Honnavar Taluk of Uttara Kannada district in Karnataka. It is planned to handle 4.9 MTPA import/export of non-hazardous cargo.

The operations of the proposed facility are not expected to negatively impact or hinder the movement of boats or fishing activities. No additional private land acquisition is required at port site. Besides, there is no rehabilitation or resettlement is involved.

The project will generate direct and indirect employment in the region and improve socio-economic conditions. Besides, the proposed project will act as a catalyst for industrialization and urbanization in the region.

Chapter 12
Disclosure of Consultants

Chapter 12 Disclosure of Consultants Engaged

Honnavar Port Private Limited, HPPL has engaged Assystem India Limited (Formerly known as L&T- Infra Engineering Limited), to undertake EIA study. The nature of consultancy service rendered covers both terrestrial and marine environmental assessment.

12.1 Brief Profile of M/S Assystem India Limited

Assystem is an independent, international company with one key mission: to accelerate the energy transition throughout the world. Assystem has acquired L&T Infrastructure Engineering Limited (L&T IEL), a wholly owned subsidiary of the Larsen & Toubro group. Assystem is supporting India's switch to low-carbon energy, transport, and infrastructure.

Assystem India Limited (Formerly known as LNTIEL) has made a distinctive mark by creating new standards in providing sustainable solutions. Today, Assystem India Limited is distinguished from others not limited to its lineage but its relentless quest for quality - a unique tradition of placing client's needs above all.

Assystem India Limited offers a diverse array of talents together with practical experience. We assure our clients a professional approach by innovation and evolving optimal solutions. At Assystem India Limited, we recognise that human resources are the key to organisational success. Assystem India Limited expertise ranges across a broad spectrum of sectors with special forte in Infrastructure Projects and Industrial Parks/SEZs. Assystem India Limited has expertise in carrying out Techno-Economic Feasibility Studies, Preparation of Master Plans & Detailed Project Reports and Bid Process Management. Assystem India Limited is rendering the following services for Specialised Industrial Clusters/SEZs/Industrial Parks/Investment Regions:

a. Environmental and Social Impact Assessment including assistance to Client in obtaining necessary clearances/approvals from various statutory authorities: State PCB's, Coastal Zone Management Authorities (CZMA's), MoEF&CC (GoI)
b. Field surveys (Terrestrial & Marine Environments) and investigations
c. Numerical modelling especially for the marine projects
d. Project formulation/conceptualisation & configuration
e. Market study and demand assessment
f. Master planning, Urban planning, Environmental planning and Tourism planning
g. Infrastructure design and engineering
h. Block cost estimation
i. Economic and financial analysis
j. Bid Process Management
k. Assistance in domestic and international marketing including road shows/investors conference (or meet) for marketing the project.
l. Assistance to Client in achieving technical and financial closures

Strengths of Assystem India Limited

Assystem India's staffs is replete with a wide range of professionals – Planners, Engineers, Designers, Environmental and Social Specialists, Financial Analysts, Project Structuring, Marketing and Privatisation Experts, Construction Supervision Managers – covering a wide spectrum of services. The skills of the Experts are continuously aligned to suit the changing Client requirements. Assystem India has strategic tie-ups with Associates for specialized services. Services of an eminent group of Expert Consultants are also available to Assystem India. Our clients value the highly motivated and dedicated team of professionals who assure them international quality service through focused and optimal solutions.

Assystem India provides a stimulating working environment. We have assembled a team of skilled, creative and dynamic professionals who strive to translate the organisational ethos into reality. To enhance the efficiency of the personnel and enable them to be updated with the latest developments in technology, we organise comprehensive technical training programmes and organisational development programmes at regular intervals. A creative work environment, motivated staff, structured training, latest methodologies and tools, continuous adherence to quality, adoption of best ethical standards and a keen client orientation are the factors that spur on Assystem India's journey into the future. Our driving philosophy is 'Client First'. We work towards complete satisfaction of our clients by adopting good work practices and meeting their requirements through timely delivery of appropriate solutions. Further for achieving this objective, we have acquired state-of-the-art IT facilities and software to ensure quality in all spheres of our activity.

Assystem India has modern fully computerized offices with latest computational and communication facilities. A large number of high-end computers are available and are connected by a network. Further, data one Internet connectivity enables fast exchange of information with the clients, as well as within the offices and the parent companies. These facilities help us to provide our clients high quality services within the shortest possible time. Besides several expert consultants hired regularly for various highly skilled expertise requirements, Assystem India has more than 400 regular employees at four offices forming a leading consulting group with extensive operations across India.

<u>QCI-NABET - EIA Accreditation</u>

Assystem India Limited (Formerly known as LNTIEL) is committed to achieve and sustain excellence in consultancy services to customers world-wide through an in-house Quality Management System that conforms to ISO 9001:2015. The commitment stated above will be fulfilled by:

i. Working towards complete satisfaction of AIL's customers by adopting good work practices and meeting their requirements through timely delivery of appropriate solutions.
ii. Striving to achieve continual improvement of quality management system through periodic review of quality policy, processes and quality objectives.
iii. Striving to maintain well-qualified and motivated staff by empowering them and providing a stimulating work environment.
iv. Adhering to the best ethical standards for business behaviour by respecting the rules of law governing AIL's business and presenting a well-audited financial statement every year.
v. Impelling employees at all levels in achieving the objectives of the organisation and ensuring that all employees are aware of and act within the policy framework of LNTIEL.
vi. Propagating our quality policy and procedures to our sub-consultants and associates and ensuring adherence to the relevant components of the quality system.

QCI-NABET - EIA Accreditation

National Accreditation Board for Education & Training (NABET) is a constituent board of the Quality Council of India (QCI). QCI, NABET has accredited Assystem India Limited (Formerly known as L&T Infrastructure Engineering Limited) for carrying out EIA studies in the following Seven (07) sectors: NABET Certificate of Accreditation is enclosed as **Attachment 2.**

S. No.	Sector
1	**Ports, Harbours, Break Waters and Dredging**
2	Industrial Estates/Parks/Complexes/Areas, Export Processing Zone (EPZs), Special Economic Zones (SEZs), Biotech Parks and Leather Complexes
3	Highways
4	Airports
5	Thermal Power Plants
6	Townships and Area Development Projects
7	Mining of Minerals- opencast only.

Further details may be seen on the following URL: www.assystem.com

12.2 Other Consultants Engaged

12.2.1 M/s. Vision Labs, Hyderabad

Nature of Consultancy Services Rendered: Terrestrial Baseline Environmental Surveys

M/s. Vision Labs is a consultancy Recognized by NABL, MoEF&CC that provides environmental monitoring and analytical services. The monitoring and analysis are conducted based on the guidelines and methods provided by Bureau of Indian Standards, Central Pollution control Board, American Public Health Association and US Environment Protection Agency. Further details on the agency may be seen on the following website http://visonlabs.com/ NABL Certificate is enclosed as **Attachment 3.**

12.2.2 CSIR- National Institute of Oceanography (NIO)

Nature of Consultancy Services Rendered: Marine Baseline Environmental Surveys

National Institute of Oceanography is a multi-disciplinary oceanographic research institute of international repute. In addition to basic research, the institute also carries studies like oceanographic data collection, environmental impact assessment and modelling to predict environmental impact. Further details on the agency may be seen on the following website https://www.nio.res.in/.

12.2.3 Building Environment India Private Limited

Nature of Consultancy Services Rendered: Terrestrial Biodiversity Studies

Building Environment (India) Private Limited (BEIPL) works in the field of environment since 2010. The company has NABET Accreditation for category A&B projects. The company has extensive experience of working in areas of environmental impact assessment, environmental management plan, environmental risk assessment, ecology and biodiversity management, sustainability solutions, and statutory compliance management. Major sectors in which BEIPL works are key infrastructure projects, building construction sector, port, jetty, forest and urban development. Further details on the agency may be seen on the following website https://www.beipl.co.in/about.php.

12.2.4 HTL/LTL, CRZ Demarcation Surveys

Nature of Consultancy Services Rendered: Demarcation of HTL\LTL and CRZ Area

The National Centre for Sustainable Coastal Management (NCSCM), under Ministry of Environment, Forest and Climate Change, Government of India promotes integrated and sustainable management of coastal and marine areas in India and advice the Union and States/ Union Territory Governments and other associated stakeholders on policy, and scientific matters relating to Integrated Coastal Management (ICZM).They offer services like Shoreline change assessment & coastal vulnerability assessment, Coastal and marine environmental monitoring, Mapping of coastal land use land cover, Numerical modeling of near-coastal processes, Preparation of Coastal Zone Management Plan (CZMP), Post-project monitoring for specific project sites, Tourism Carrying capacity of islands and coastal areas, Beach carrying capacity, Coastal Regulation Zone maps at state and local levels, Capacity building in Integrated Coastal Zone Management (ICZM), Preparation of Conservation Management Plan, Sale of data Products, Decision Support System for Coastal Management. Further details on the agency may be seen on the following website http://ncscm.res.in/.

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