AM/NS Ports

Ref. No. APHL/ENV/MoEF&CC/EC-2014/2025-26(2)

To
The Inspector General, Forests
Scientist – "C"
Integrated Regional Office, Karmayogi Bhawan, Block -3, F-2 Wing, 5th Floor,
Nr. CH-3 Circle, Sector-10-A, Gandhinagar,
Gujarat – 382 010
E-Mail: eccompliance_guj@gov.in, iro.gandhingr-mefcc@gov.in, ec-rdw.cpcb@gov.in

Date: **29.05.2026**

Subject: Submission of Half Yearly Compliance Report for the EC & CRZ Clearance granted for ***"Expansion of Port Facilities at Hazira, Gujarat"***. Compliance Period – October 2025 to March 2026 for year 2025-26.

Reference: EC & CRZ Clearance Letter issued by the Ministry of Environment, Forests and Climate Change (MoEF&CC) vide F.No. 11-46/2011-IA.III dated 6th May 2014.

Dear Sir,

We are hereby submitting the Half Yearly Compliance Report of the EC & CRZ Clearance granted for ***"Expansion of Port Facilities"*** at Hazira, Gujarat, received vide F.No. 11-46/2011-IA.III dated 6th May 2014. This compliance status is from October 2025 to March 2026. Also, a copy of this report has been marked to the E-Mail ID of your good office. This is for your kind perusal and records.

Thanking You,
Yours' Faithfully
For, **AMNS Ports Hazira Limited**

AMNS Ports Hazira Limited HAZIRA

Rituparn Raghuvanshi
Head of Ports, Hazira, AMNS Ports Hazira Limited

Encl:

1. Half Yearly Compliance Report. Compliance Period – OCT'25 to MAR'26
2. Annexure 1: Mangrove Mapping Report
3. Annexure 2: Compliance Report of GCZMA's Recommendation Letter
4. Annexure 3: Emergency Response Plan
5. Annexure 4: EMP Matrix

CC:

The Additional Principal Chief Conservator of Forests,
Ministry of Environment, Forests and Climate Change,
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The Member Secretary,
Gujarat Pollution Control Board (GPCB),
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Gandhinagar, Gujarat – 382 043
E-mail: ms-gpcb@gujarat.gov.in;

The Regional Officer,
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ro-gpcb-sura@gujarat.gov.in

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SMARTER STEELS BRIGHTER FUTURES

Half Yearly Compliance Report
Period: October 2025 to March 2026
Year 2025-26

File No.: F.No. 11-46/2011-IA.III
EC Details: *Environment and CRZ Clearance for Expansion of Port Facility at Hazira, Surat, Gujarat,*
Date of Issue: 6th May 2014

A	Specific Conditions	
S.No	Condition	Compliance Status
i)	"Consent for establishment" shall be obtained from Gujarat Pollution control Board under Air and water Act and a copy shall be submitted to the Ministry before start of any construction work at the site.	Complied. For this project, first Consent to Establishment (CTE) was granted vide Letter No. GPCB/CCA-SRT 1189(2)/ID_22972/135405, CTE No. 48131 dated 23/01/2013 from the Gujarat Pollution Control Board (GPCB) which was valid till 16/01/2017. A copy of the same has been submitted to the Regional Office (RO), Ministry of Environment, Forests and Climate Change (MoEF&CC), Bhopal, along with the six-monthly compliance report submitted vide Letter No. EBTL/ENV/COMP-MOEF/2015/1st dated 29th June 2015. Amendment to first CTE was received vide Letter No. GPCB/CCA-SRT-1189(3)/ID-22972/422702 dated 12/09/2017 with CTE No. 48131 valid up to 16/01/2020. The same has been submitted to the RO, MoEF&CC, Bhopal along with the six-monthly compliance report submitted for period of April 2017 to September 2017.
ii)	Project proponent shall appoint a consultant to look after and advice on the transportation of dangerous chemicals. Sensors for early detection of leakage of propylene and butadiene shall be provided at berths along with water sprinklers.	Currently not handling any dangerous chemicals. However, during the EIA Study company have had appointed DNV to conduct risk assessment study for handling these liquid cargos. No facilities were developed for handling of liquid cargo, therefore the said sensors and early detectors of leakage systems along with water sprinklers are not in place.
iii)	Project proponent shall ensure proper flushing/free flow of tidal water to the mangroves.	Complied. Although the mangrove area is naturally being flushed by the tidal water, hume pipes have also been provided so that the tidal water can reach the mangroves without any obstruction.

A	Specific Conditions	
S.No	Condition	Compliance Status
		 Hume Pipe
iv)	Project proponent shall submit once in 12 months the latest satellite imagery to MoEF to ensure that mangroves are remains fully intact. Any shrinkage in mangrove area noticed either in satellite imaginary or during site visit, shall be taken as violation.	Noted and being complied on Regular Basis. Mapping report carried out by Gujarat Institute of Desert Ecology (GUIDE) for year 2024-25. The report is attached as Annexure 1 along with this report.
v)	The project Proponent shall get third party inspection carried out once in a year preferably by NEERI to ensure compliance of all the Environmental Clearance (EC) conditions.	Complied. NEERI, is appointed to carry out inspection of environmental conditions and report is submitted with the half yearly EC Compliance report Oct 2024 to Mar 2025. As per the Circular No. GPCB/EA-326/422737 dated 12th September 2017; Schedule-1 Auditor appointed by Gujarat Pollution Control Board (GPCB) conduct annual environment audit, reports of which are submitted to GPCB and uploaded on their web portal.
vi)	There shall be no encroachment of project activities in the mangrove area. The various referral distances / latitudes / longitudes as indicated in the enclosed map (Annexure-II) shall be maintained for the	Complied. The project activities (Deep Water Berth, Back up areas for storage, conveying systems etc.), are well cleared from the mangrove area.

AMNS Ports Hazira Limited HAZIRA

A	Specific Conditions	
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	conservation of this mangrove area within the port limit.	
vii)	Stock yard on northern side (Hazira Village side) shall be provided with bund and wind screen of at least 15m height with well-designed water supply fogging arrangement along with three rows of trees in canopy formation.	Complied. Wind screen with 15-meter height has been provided on the village side. Along with that at the boundary of port, thick 3-rows of trees in canopy formation are provided. Sprinkling has been carried out by means of sprinkling system on the edge of stock yards.  Fully Developed Wind Fence
viii)	The height of coal stack yard shall be at least 2 feet below the height of wind curtain.	Complied. It is ensured that the height of stacks remains 2ft below the wind fence.
ix)	Greenbelt shall be provided all along stack yard and in the premises.	Complied. A 10 m thick greenbelt with 3-rows plantation has been developed all along the boundary of the port and stack yard. Greenbelt development is a continuous process in port.
x)	The existing coal conveyor from berth to stock yard shall be closed with cover since the present water spray appears to be inadequate.	Noted and complied. Bulk material is being handled by means of closed conveyor system only. Transfer junctions are also provided with closed canopy to reduce the fugitive dust generation right from the source.  Canopy provided at the transfer junction

A	Specific Conditions	
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		Also, as per the observation made in Point No. (x), frequency of water sprinkling (by means of mobile water tankers) on internal roads as well as on the stack area has been increased. In addition to this, the sprinkling system has been provided inside the hoppers to reduce the dust generation at the source only.
xi)	The transportation in the proposed facility shall be in closed conveyor only.	**Complied.** Material transportation is only by means of conveyor network only.
xii)	Natural drainage system shall be maintained so that there is free flow to the existing mangroves. Mangrove plantation in 500 ha of land in consultation with GEC/Forest department, Government of Gujarat.	**Noted and complied.** Natural drainage system has been maintained to ensure the free flow to the existing mangrove area. Since year 2008 to 2013, 500 ha of mangrove plantation has been carried out at Dandi village, taluka Olpad, Ankalav village at taluka Hansot and Asarsa, taluka Jambusar in consultation with Gujarat Ecological Commission (GEC) and Saline Area Vitalization Enterprises Limited (SAVE). Against the stipulated 500 ha of this EC & CRZ Clearance, 100 ha of mangrove plantation has been carried out by M/s. SARVA Services and M/s. SAVE between 2020 to 2022. The plantation was carried out in Suva and Nada villages of Vagra and Jambusar talukas, District Bharuch, Gujarat which is now in maintenance phase. In addition to these, a work order has been issued to M/s. SARVA Services in October 2022 for another 50-ha mangrove plantation in intertidal mudflat area of village Nada, taluka Jambusar of Bharuch District. This year we have plan to plant mangroves around 100 Ha.
xiii)	There shall be no disposal of wastes into the coastal areas.	**Noted and Continuously Complying.** Trade effluent is nil. Sewage generated in port is being treated by means of STP inside the port only. The treated water is being used for horticulture whereas the sludge generated is being used as manure for the same purpose. Solid waste is being collected, segregated and sent to common waste collection site in Steel Complex for further disposal. Hazardous waste is being kept in designated hazardous waste storage area from where it has been sent to GPCB approved re-refiner/recycler for final disposal / treatment. Thus, there is no disposal of waste in coastal area.
xiv)	Hazardous chemicals except the permissible Petroleum products shall not be stored with in CRZ area. All the	**Noted and agreed.** No such kind of storage in CRZ area.

A	Specific Conditions	
S.No	Condition	Compliance Status
	construction, storage shall be as per the CRZ Notification'2011.	
xv)	All the conditions/recommendations stipulated by Gujarat Coastal Zone Management Authority vide their letter no ENV-10-2011-877 E dated 01-06-2013 shall be complied with.	**Noted and being complied.** We are complying with the condition mentioned in the letter issued by GCZMA vide Letter No. ENV-10-2011-877 E dated 01-06-2013. • All the activities (construction and operational) were carried out as per the conditions of CRZ Notification and its amendments, • Activities have been carried out in a way so that their will not be any hindrance to the natural drainage and free flushing of mangrove area. Please refer to Specific Condition No. (iii), of this report. Apart from that it is also ensured that there should not be any waste disposal in coastal areas and there should not be any ground water withdrawal from the same. • Since year 2008 to 2013, around 500 ha of mangrove plantation has been carried out at Dandi village, taluka Olpad, Ankalav village at taluka Hansot and Asarsa, taluka Jambusar in consultation with Gujarat Ecological Commission (GEC) and Saline Area Vitalization Enterprises Limited (SAVE). • Against the stipulated 500 ha of this EC & CRZ Clearance, 100 ha of mangrove plantation has been carried out by M/s. SARVA Services and M/s. SAVE between 2020 to 2022. The plantation was carried out in Suva and Nada villages of Vagra and Jambusar talukas, District Bharuch, Gujarat which is now in maintenance phase, • In addition to these, a work order has been issued to M/s. SARVA Services in October 2022 for another 50-ha mangrove plantation in intertidal mudflat area of village Nada, taluka Jambusar of Bharuch District. Report were submitted along with corresponding year EC compliance report. • For remaining 350 Ha, this year we have plan to plant mangrove around 100 Ha. • Conveyor system as well as the transfer points are of closed type only, • We have taken all the necessary permission like construction approval from GMB which was received vide Letter No. GMB/N/PVT-1/836/289 dated 30th September 2015. CTE from GPCB received vide Letter No. GPCB/CCA-SRT 1189(2)/ID_22972/135405, CTE No. 48131 dated 23/01/2013. Approval for Diesel Storage was granted vides Letter No. A/P/HQ/GJ/15/5714(P340804) dated 01/09/2014,

A	Specific Conditions	
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		• Conditions mentioned in the EIA conducted by WAPCOS are complying. Please refer to Specific Point No. (xix), of this report for details. A detailed compliance report of the recommendation letter is attached as **Annexure 2** along with this report.
xvi)	Oil spill contingency plan shall be put in place.	**Complied.** An Oil Spill Contingency Plan (OSCP) last updated in December 2016 is in place. Starting with a brief on port facilities. This plan will provide a view of risks that can be countered. It also details the equipment held by the port facility, the management responses & strategies to be followed during emergencies, communications points, and the procedures to be taken into consideration.
xvii)	Hydrocarbon monitors with provision for alarms set at specific concentrations shall be installed at strategic locations on the berth and around storage tanks as per ISGOTT and OISD.	**Noted.** Currently not applicable. Currently port is handling bulk and break-bulk cargo only and the infrastructure has been developed for this very purpose only. At present there are no storage tanks in port.
xviii)	On site Emergency Management plan shall be put in place.	**Complied.** An emergency response plan in compliance with BS 45001:2018 Occupational Health and Safety Management System Standard Clause 8.2 is in place. Please refer **Annexure no. 3** for the important part of it.
xix)	All the recommendation of the EMP, Risk assessment and DMP shall be complied with letter and spirit.	**Noted and being complied.** Compliance to the Recommendations of EMP is mentioned below: 1. Greenbelt has been developed along the port boundary with 3-rows plantation. Another 6-rows thick greenbelt has been developed covering the stack area, 2. For fugitive dust emissions control, sprinkling system has been provided in hoppers, conveyor belt interchange points within the cranes, 3. Mobile water tankers are deployed for water sprinkling at roads, 4. Mechanical sweeping machines has also been use in port premises, 5. Operational 40 KLD sewage treatment plant, 6. Hazardous waste being disposed by GPCB approved re-refiner/recycler in accordance with the conditions provided in CTO issued by GPCB. 7. Oil spill contingency plan is in place. Equipment for control of oil spill like oil boom, skimmers, shore boom are available to treat any emergency, 8. Fire-fighting equipment are in place. Fire water line with hydrants at appropriate locations has been provided at

A	Specific Conditions	
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	All the mitigation measures submitted in the EIA report shall be prepared in a matrix format and the compliance for each mitigation plan shall be submitted to MoEF along with half yearly compliance report to MoEF – RO.	berth. Fire extinguishers are also provided at appropriate locations, 9. Monitoring of air, water, noise and marine parameters has been conducted as per the environmental monitoring programme, 10. Full time environment engineer working at manager level reporting to the Head-Ports. **Recommendations of Risk Assessment** Risk assessment for the proposed liquid berth has been conducted by DNV and the report has been submitted. Construction of liquid terminal is not yet started; therefore, the recommendation made by DNV will be implemented from the designing phase only. Emergency Response Plan / Disaster Management Plan is in place. It contains the details of team which deals with emergency / disaster, roles and responsibilities of team members and management in case of any emergency / disaster, reporting mechanism within plant and to external agencies, important contact numbers to be called in case of emergency, details of escape plan, etc. In case of any emergency, the Incident Observer (Site In-charge) immediately communicates the incident to the Head Action Team (Fire and Safety, Medical, Designated Employees), Head Security and Incident Controller. Incident Controller (IC) accesses the emergency and will communicate the same to the Site Main Controller on immediate basis. IC at site analyses the situation and takes control to deal with the emergency. The said matrix for the mitigation measures and their implementation status are presented in **Annexure 4** of this report.
xx)	The port shall ensure that the ship under operation follows the MARPOL convention regarding discharge or spillage of any toxic, hazardous or polluting material like ballast water, oily water or sludge, sewage, garbage, etc. The emission of NOx and SOx shall remain within the permissible limits.	**Noted and being complied.** We ensure that the ship under operation follows the MARPOL convention regarding discharge or spillage of any toxic, hazardous or polluting material like ballast water, oily water or sludge, sewage, garbage, etc. Ship's generated waste is discharged directly into approved vendor's trucks, and it is disposed of as per established environment and government norms. Vendors are responsible for disposal of waste as per the norms. Presently the port is not handling any noxious or hazardous cargo. Regarding the air pollution, below practices are followed to ensure that NOx and SOx emissions are well below the permissible limits: 1. Pre-screening of ships is done for physical suitability and validity of statutory certificates prior it arrives our terminal,

A	Specific Conditions	
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		2. International Air Pollution Prevention (IAPP) Certificate of ships is checked for its validity, if not valid ship is rejected by terminal, 3. Once vessel arrives at port, random visual checks are carried out by marine officers for any discolored or black smoke coming from ship's funnel. If observed, physical verification is being carried out by the terminal representative.
xxi)	The hazardous wastes generated shall be collected and disposed as per rules. Disposable wastes shall be sent to authorized TSDF, MoU in this regard shall be submitted to the RO, MOEF along with six monthly monitoring reports.	**Complied.** The hazardous waste is being collected and stored in designated hazardous waste storage area and is taken by Gujarat Pollution Control Board (GPCB) approved re-recycler/ re-processor in accordance with the conditions mentioned in CTO issued by GPCB.
xxii)	The dredging materials shall be utilized for reclamation and excess shall be disposed at the site identified by CWPRS.	**Noted and being Complied.** Reclamation is carried out only by the dredging material and the excess of the same is being disposed on the site specified by CWPRS vide their Technical Report No. 4907 submitted in December 2011, approved by Gujarat Maritime Board (GMB). This report was a part of EIA Study and was submitted to the concerned authorities.
xxiii)	A study to determine the reasons for increase in cancer patient in the vicinity shall be carried out.	**Noted.** Community Medicine Department of Government Medical College, Surat has carried out study on "Status of Cancer Diseases in the Vicinity of Port Facility, Hazira" during March 2016 to May 2016 and submitted the report. It is reported that total prevalence of cancer among surveyed population is 3.63 per 1000 population per 10 years. More than two-third cancer cases were found in the age group of 35-64 years which comprised of only one quarter of the surveyed population. Also, majority of the cancers found were of oral cavity, tongue, oesophagus, oropharynx and pharynx unspecified. It is also reported that among the cancer patients' tobacco smoking was the most common addition. No cases of cancer were observed in the age group 0-14 years which accounts for 15.47 % of surveyed population.
xxiv)	A separate Environment monitoring cell shall be set up especially for this plant and details shall be submitted to the Ministry prior to the commencement of operation.	**Complied.**

<table>
<tr><td>A</td><td colspan="2">Specific Conditions</td></tr>
<tr><td>S.No</td><td>Condition</td><td>Compliance Status</td></tr>
<tr><td>xxv)</td><td>Controlled cutter suction dredging shall be used along with the enclosure to contain the turbidity.</td><td>Noted and being complied.
Controlled cutter suction dredger is being used for the dredging activities.</td></tr>
<tr><td>xxvi)</td><td>The responses/commitments made during public hearing shall be complied with letter and spirit.</td><td>Being complied.
<table>
<tr><th>Condition</th><th>Compliance Status</th></tr>
<tr><td>Preference to Locals in employment.</td><td>In terms of employment, locals (based on their skills) from Hazira and other nearby villages are given priority.</td></tr>
<tr><td>Essar should contribute to the growth of Hazira Village through CSR.</td><td>Emphasizing Socio-Economic Development, CSR activities are mainly focused on Infrastructure Development, Education, Health and Sanitation, Vocational Trainings in study area.</td></tr>
<tr><td>Trucks and Trailers of Hazira people should be used in Essar while awarding contracts</td><td>For any contractual work, first preference will always be given to the villagers in the nearby area. At present, around 60% of the transportation contacts are given to locals.</td></tr>
<tr><td>EBTL project effect Fishermen. What plans for them?</td><td>There is no restriction to anyone for fishing in the area. Moreover, this area declared as No Fishing Zone by Gujarat Maritime Board (GMB).</td></tr>
<tr><td>Essar should inform the pros and cons of the project to the people of Hazira</td><td>Public Hearing was conducted during the EIA Study of the project.</td></tr>
<tr><td>There should be a disaster management plan, fire station, hospital and escape route</td><td>Disaster Management Plan / Emergency Response Plan is in place. We have a dedicated department to firefighting. An operational Occupation Health Center (OHC) is present in port premises.
Apart from that, a full-fledged Hospital is present in the township close to the port.</td></tr>
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A	Specific Conditions		
S.No	Condition	Compliance Status	
		The industry should be established at few km away from village. Hazira village is surrounded by industries.	This is a port facility that needs waterfront area. Moreover, the project site is around 1 km from the nearest village.
		When ports like Adani, Essar would be implemented, pressure on the roads would increase which is dangerous for the local people.	Port is connected to NH-6, constructed by NHAI and is prepared by considering the existing traffic road.
		State & Central Laws should be strictly followed at Essar Bulk Terminal Hazira.	Noted and being followed.
		Diseases like cancer are increasing day by day in nearby villages. The future of Hazira would be handicapped like that of Hiroshima and Nagasaki	Community Medicine Department of Government Medical College, Surat has carried out study on "Status of Cancer Diseases in the Vicinity of Port Facility, Hazira" during March 2016 to May 2016 and submitted the report. Majority of the cancers found were of oral cavity, tongue, oesophagus, oropharynx and pharynx unspecified. It is also reported that among the cancer patients' tobacco smoking was the most common addiction.

<table>
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<tr><td>S.No</td><td>Condition</td><td>Compliance Status</td></tr>
<tr><td></td><td></td><td><table><tr><td>Due to developments along Tapi estuary and reclamation the flooding of Surat during monsoon would increase</td><td>Before the start of port activities, CWPRS conducted number of mathematical model studies and concludes that there would not be any adverse impact on flushing of rainwater through mouth of Tapi as the mouth is 10 km wide and that significant deepening of the channel would assist in draining flood water to the sea more efficiently.
Besides the expansion is parallel to the flow of Tapi River which will not obstruct the flow.</td></tr></table></td></tr>
<tr><td>xxvii)</td><td>CSR activities shall cover the villages within 10 km radius. CSR for fisherman shall be carried out as committed.</td><td>Complying
Expenditure details on CSR activities for year October 2025 to March 2026 is as follows:<table><tr><th>Particular</th><th>Expenditure</th></tr><tr><td>Cultural Development Support to Hazira</td><td>9,35,228</td></tr><tr><td>Rural development in Environment front for Rajagari & Damka village</td><td>16,43,328</td></tr><tr><td>Rural development support to Rajagari village</td><td>7,54,484</td></tr><tr><td>Teaching Support to Hazira</td><td>1,91,38,262</td></tr><tr><td>TOTAL</td><td>2,24,71,302</td></tr></table></td></tr>
<tr><td>xxviii)</td><td>There shall be no ground water drawl within CRZ area.</td><td>Noted and complied.
There is no ground water withdrawal in CRZ area.</td></tr>
<tr><td>xxix)</td><td>Sewage shall be treated, and the Treatment facility shall be provided in accordance with the Coastal Regulation Zone Notification 2011. The disposal of treated water shall confirm the regulation of State Pollution Control Board.</td><td>Complied.
Sewage is being treated by inhouse STP. Treated sewage is being used in for horticulture purpose whereas the sludge generated is being used as manure. Monitoring report of treated sewage (carried out By NABL approved Lab) are being submitted to GPCB on monthly basis.</td></tr>
<tr><td>xxx)</td><td>Solid waste management shall be as per Municipal Solid (Management and Handling) Rules'2000.</td><td>Noted and complied.
Solid waste generated in port is segregated, stored and then sent to common waste collection site in steel Complex for further disposal.
Construction and demolition (C&D) waste as and when generated is stored in our own premises and disposed as per the Construction and Demolition Waste Management Rules, 2016. No disposal of C&D waste in coastal areas.
At any point of operations throwing, burying or burning of solid waste will not be envisaged.</td></tr>
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<tr><td>A</td><td colspan="2">Specific Conditions</td></tr>
<tr><td>S.No</td><td>Condition</td><td>Compliance Status</td></tr>
<tr><td>xxxi)</td><td>The Project shall be executed in such a manner that there shall not be any disturbance to the fishing activity.</td><td>Agreed.
The navigation channel of Tapi estuary has been declared as no fishing zone by Gujarat Maritime Board (GMB).
However, artisanal fishermen are never obstructed to do fishing.</td></tr>
<tr><td>xxxii)</td><td>It shall be ensured that there is no displacement of people, houses or fishing activity as a result of the project</td><td>Not applicable.
The project is on reclaimed land.</td></tr>
<tr><td>xxxiii)</td><td>No construction work other than those permitted in Coastal Regulation Zone Notification shall be carried out in Coastal Regulation Zone area.</td><td>Noted and agreed.
All the construction works were carried out as per the provisions of CRZ Notification and in accordance with the condition provided in EC & CRZ Clearance issued for the project.</td></tr>
<tr><td>xxxiv)</td><td>The project proponent shall set up separate environmental management cell for effective implementation of the stipulated environmental safeguards under the supervision of senior executive.</td><td>Complied.
Company is having a separate environment cell. Team of qualified environment engineers in collaboration with other teams in port, is working and looking for the effective implementation of environmental safeguards, mitigation measures, timely and effective implementation of management programs, monitoring of environmental parameters, timely submission of reports and returns to concerned authorities. Environment team directly reports to Head of Ports.</td></tr>
<tr><td>xxxv)</td><td>The funds earmarked for environment management plan shall be included in the budget and this shall not be diverted for any other purposes.</td><td>Noted and agreed.
Expenditure details on environmental parameters for year October 2025 to March 2026 is as follows:
<table>
<tr><th>Particular</th><th>Expenditure</th></tr>
<tr><td>Dust Control and Horticulture (Water Taker)</td><td>1161002</td></tr>
<tr><td>Greenbelt Development</td><td>1995063</td></tr>
<tr><td>Monitoring of Environmental Parameters</td><td>285377</td></tr>
<tr><td>Mangrove Mapping</td><td>137500</td></tr>
<tr><td>STP & Waste Management</td><td>384721</td></tr>
<tr><td>TOTAL</td><td>3963663</td></tr>
</table></td></tr>
<tr><td>B</td><td colspan="2">General Conditions</td></tr>
<tr><td>1</td><td>Appropriate measures must be taken while undertaking digging activities to avoid any likely degradation of water quality.</td><td>Being complied.
To eliminate / minimize dispersion of sediment during piling activities, "Bored cast in-situ" piling technique is being used in the project.</td></tr>
<tr><td>2</td><td>Full support should be extended to the officers of this Ministry's Regional</td><td>Complied.</td></tr>
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A	Specific Conditions	
S.No	Condition	Compliance Status
	Office at Bhopal and the officers of the Central and State Pollution Control Boards by the project proponents during their inspection for monitoring purposes, by furnishing full details and action plans including the action taken reports in respect of mitigative measures and other environmental protection activities.	
3	The six-monthly reports shall need to be submitted by the project proponents to the Regional Office of this Ministry at Bhopal regarding the implementation of the stipulated conditions.	Complied regularly.
4	Ministry of Environment or any other competent authority may stipulate any additional conditions or modify the existing ones, if necessary in the interest of environmental and the same shall be complied with.	Noted and Agreed.
5	The Ministry reserves the right to revoke this clearance, if any of the conditions stipulated are not complied with to the satisfaction of the Ministry.	Noted and Agreed.
6	In the event of a change in project profile or change in the implementation agency, a fresh reference shall be made to the Ministry of Environment and Forests.	Noted and Agreed.
7	The project proponents should inform the Regional Office at Bhopal as well as the Ministry the date of financial closure and final approval of the project by the concerned authorities	Noted Till date 1100 m multipurpose berth, part of 4800 m of water front has been completed. The project expenditure is done through the internal accruals of the company and no fresh loan is taken. Consent to Establish for the same has been granted on 23.01.2013 vide CTE No. 48131 which was amended and received vide Letter No. GPCB/CCA-SRT-1189(3)/ID-22972/422702 dated 12/0/2017. Land

A	Specific Conditions	
S.No	Condition	Compliance Status
	and the date of start of Land Development Work	Development work started on 30.09.2015 and is in progress. Combined Consent and Authorization (CCA), for the said project was received vide Letter No. GPCB/CCA-SRT-1189(3)/ID_22972/349978 dated 23.03.2016 which was valid till 29.07.2020, which is further extended till year 2025 vide consent order No. AWH-109664 dated 09.10.2020. Pursuant to the takeover by AMNS Ports Hazira Limited, revised CCA with name change has been received vide letter No. GPCB/CCA-SRT-1189(3)/ID_22972/747314 dated 12.07.2023. which is further renewed with CCA Order No. AWH-142698 issued on dated 05.06.2025 and valid upto 31.03.2030. Regular update of the progress has been informed to the Ministry by submission of our Half yearly Compliance Reports.
8	A copy of the clearance letter will be marked to the concerned panchayat/local NGO, if any, from whom any suggestion/representation has been received while processing the proposal.	Complied. Letter along with a copy of Clearance Letter was submitted to the Gram Panchayat, Hazira on 16/05/2014.
9	The Gujarat Pollution Control Board should display a copy of the clearance letter at the Regional Office, District Industries Centre and Collector's office/Tehsildar's office for 30 days.	Complied by GPCB.
10	These stipulations would be enforced among others under the provisions of Water (Prevention and Control of Pollution) Act 1974, the Air (Prevention and Control of Pollution) Act 1981, the Environment (Protection) Act, 1986, the Public Liability (Insurance) Act, 1991 and EIA Notification 2006, including the amendments and rules made thereafter.	Noted & Agreed.
11	All other statutory clearances such as the approvals for storage of diesel from Chief Controller	Complied.

<table>
<tr><td>A</td><td colspan="2">Specific Conditions</td></tr>
<tr><td>S.No</td><td>Condition</td><td>Compliance Status</td></tr>
<tr><td></td><td>of Explosives, Fire Department, Civil Aviation Department, Forest Conservation Act, 1980 and Wildlife (Protection) Act, 1972 etc. shall be obtained, as applicable by project proponents from the respective competent authorities.</td><td></td></tr>
<tr><td>12</td><td>The project proponent should advertise at least in two local newspapers widely circulated in the region around the project, one of which shall be in the vernacular language of the locality concerned informing that the project has been accorded environmental clearance and copies of clearance letters are available with GPCB and may also seen at Website of the Ministry of Environment and Forests at http://www.envfor.nic.in.
The advertisement should be made within 7 days from the date of issue of the clearance letter and a copy of the same should be forwarded to the Regional Office of this Ministry at Bhopal.</td><td>Complied.
Advertisement has been given in two newspapers on 13/05/2014. The same has been communicated to the MoEF&CC, Bhopal on 22/07/2014 and the copy of the same submitted vide our EC compliance report dated 29/06/2015.
English – Western Express | Gujarati – Gujarat Samachar
 
ESSAR PORTS
PUBLIC NOTICE
This is bring to the Public Notice that under the provisions of Ministry of Environment and Forest (MoEF) Environmental Impact Assessment (EIA) notifications dated: 14-08-2006, M/s ESSAR Bulk Terminal Limited, Hazira has been accorded Environmental & CRZ by MoEF vide their letter F.No. 11-46/2011.1A.III dated: 06-05-2014 for the proposed Port facility Expansion Project at Hazira, Surat District. Copy of the Env. & CRZ clearance letter is available with GPCB and may also been seen at the website of Ministry of Environment and Forest (MoEF at http://www.envfor.nic.in)
Captain S.Das
Cheif Executive Officer
Essar Bulk Terminal Limited, Hazira
ESSAR PORTS
જાહેર નોટીસ</td></tr>
<tr><td>13</td><td>This clearance is subject to final order of the Hon'ble Supreme Court of India in the matter of Goa Foundation Vs. Union of India in Writ Petition (Civil) No.460 of 2004 as may be applicable to this project.</td><td>Noted and agreed.</td></tr>
</table>

A	Specific Conditions	
S.No	Condition	Compliance Status
14	Any appeal against this Environmental Clearance shall lie with the National Environment Appellate Authority, if preferred, within a period of 30 days as prescribed under Section 11 of the National Environment Appellate Act, 1997	Noted. There was no complaint for this Environment Clearance within the stipulated time.
15	Status of compliance to the various stipulated environmental conditions and environmental safeguards will be uploaded by the project proponent in its website.	Complying. Status in terms of half yearly EC Compliance report is being submitted to the concerned authorities and uploaded on website.
16	A copy of the clearance letter shall be sent by the proponent to concerned Panchayat, Zilla Parisad/Municipal Corporation, Urban Local Body and the Local NGO, if any, from whom suggestions/ representations, if any, were received while processing the proposal. The clearance letter shall also be put on the website of the company by the proponent.	Copy of clearance letter was submitted to Gram Panchyat Office. Also, the issues raised during PH were addressed in the final EIA report and was submitted to the MoEF&CC. Copy of EC and CRZ Clearance has been uploaded in company's website.
17	The proponent shall upload the status of compliance of the stipulated EC conditions, including results of monitored data on their website and shall update the same periodically. It shall simultaneously be sent to the Regional Office of MoEF, the respective Zonal Office of CPCB and the SPCB.	Complying on regular basis. Status of compliance for the stipulated EC Conditions in terms of six-monthly compliance reports are being uploaded in the company's website of regular basis. As per the OM dated 14th June 2022, issued by the MoEF&CC, we are now uploading the status of the compliance of the stipulated EC Conditions on the module available on PARIVESH. In addition to these, we are also intimate and submit the said reports to the good offices of IRO-MoEF&CC, Gandhinagar, GPCB-HO Gandhinagar and GPCB-RO Surat and forwarding the physical copies as well.

A	Specific Conditions	
S.No	Condition	Compliance Status
18	The project proponent shall also submit six monthly reports on the status of compliance of the stipulated EC conditions including results of monitored data (both in hard copies as well as by e-mail) to the respective Regional Office of MoEF, the respective Zonal Office of CPCB and the SPCB.	Complying on regular basis. As per the OM dated 14th June 2022, issued by the MoEF&CC, we are now uploading the status of the compliance of the stipulated EC Conditions on the module available on PARIVESH. In addition to these, we are also intimate and submit the said reports to the good offices of IRO-MoEF&CC, Gandhinagar, GPCB-HO Gandhinagar and GPCB-RO Surat and forwarding the physical copies as well.
19	The environmental statement for each financial year ending 31st March in Form-V as is mandated to be submitted by the project proponent to the concerned State Pollution Control Board as prescribed under the Environment (Protection) Rules, 1986, as amended subsequently, shall also be put on the website of the company along with the status of compliance of EC conditions and shall also be sent to the respective Regional Offices of MoEF by e-mail.	Complied. Environment Statement (Form-V) is being regularly submitted to the good office of Gujarat Pollution Control Board (GPCB). For the year 2024-25 the Statement has been submitted vide Letter No. EBTL/ENV/GPCB/Form-V/2024-25 dated 23rd September 2025.

Authorized Signatory
For, AMNS Ports Hazira Limited

Ritupárn Raghuvanshi
Head of Ports, Hazira,
AMNS Ports Hazira Limited
27th KM, Surat-Hazira Road,
Village Hazira, Choryasi taluka,
Surat – 394 270
Gujarat.

Annexure 1: Mangrove Mapping Report

Final Report
for
Mangrove Mapping Using Satellite Imagery

Environment Clearance Details:
F. No. 11-46/2011-IA.III
Issued date: 6th May 2014
Condition No. (iv)

Submitted to:
AMNS Ports Hazira Limited
27th KM Surat-Hazira Road, Village Hazira, Tal. Choryasi, Dist. Surat, Gujarat – 394 270

Submitted by:

Gujarat Institute of Desert Ecology
P.O. Box No. 83, Mundra Road,
Bhuj, Kachchh-370001, Gujarat
www.gujaratdesertecology.com

Year 2024-25

Project Personnel

Project Coordinator

Dr. V. Vijay Kumar
Director

Principal Investigator

Mr. Dayesh Parmar
Senior Scientific Officer

Co-Principal Investigators

Dr. Kapil kumar Ingle

Project Scientist

Team Members

Mr. Ketan Yogi

TABLE OF CONTENTS

Contents

LIST OF FIGURES

LIST OF TABLES

1. INTRODUCTION

Introduction

The coastal environment encompasses diverse habitats such as mangroves, mudflats, sandy and rocky beaches, and coral ecosystems in select regions all of which support a rich array of flora and fauna tailored to their habitat preferences. Among these, mangroves in India span across nine maritime states and three Union Territories. Of these, Gujarat stands out with the longest coastline (2,340.62 km) and harbours two of the country's three major gulfs; Gulf of Kachchh and Gulf of Khambhat. Importantly, Gujarat also accounts for the second-largest share of the nation's mangrove cover, 1,164.06 km^2 which represents 23.32 % of the mangrove cover of the country.

These coastal ecosystems are vital for local communities, offering resources like firewood, fodder, tannin-rich bark, edible young shoots and fruits, timber, and medicinal plants. Ecologically, mangroves furnish essential ecosystem services—including enhancing marine productivity and providing defence against natural disasters such as tsunamis and cyclones. They also serve as critical habitats for coastal biodiversity. In Gujarat, the mangrove cover is divided into 179.09 km^2 of moderately dense and 984.97 km^2 of open/sparse mangroves.

Gujarat's coastal regions faces various environmental challenges; high tidal amplitudes, low and erratic rainfall, climate change, land degradation, scarce freshwater input, and elevated salinity. Despite these stresses, the state sustains 15 recorded mangrove species, including *Acanthus illicifolius, Aegiceras corniculatum, Avicennia alba, Avicennia marina, Avicennia officinalis, Bruguiera cylindrica, Bruguiera gymnorrhiza, Ceriops decandra, Ceriops tagal, Excoecaria agallocha, Kandeliacandel, Lumnitzera racemosa, Rhizophora apiculata, Rhizophora mucronata* and *Sonneratia apetala* (https://forests.gujarat.gov.in/mangrove-conserv.htm).

1.1.1. Gulf of Khambhat

The Gulf of Khambhat is in the northern part of the Arabian sea has a width of 80 km at the mouth and funnels down to 25 km over the longitudinal reach of 140 km. Entire banks surrounding the Gulf are bordered by large tidal flats nested into numerous tidal creeks and creek lets. The major rivers/rivulets such as; Ambika, Purna, Kim, Tapti, Narmada, Mahi and Dhadhar discharge into the Gulf. Mal Bank is a prominent sand shoal present in the northern part of the Gulf while the middle part of the Gulf is deeper with depths ranging up to 30 m. The seabed in most of the Gulf remains in a quasi-steady state and it moves as sand bars with tides. Many offshore oil, gas, and chemical terminals exist and new installations are planned between Hazira and Dahej on the eastern part of the Gulf. On the other hand, the tidal amplitude in the Gulf remains the largest along the Indian coast with spring tidal ranges around 9 m and resulting in strong currents. Due to strong flood and ebb tidal currents, the water remains always turbid with high bed and suspended sediment loads. Studies on the sand waves in the Gulf of Khambhat suggest the formation under high-energy hydrodynamic conditions associated with the large tidal waves (Vora *et al.,* 1980), with the finer sediments concentrated at the crests, are derived from the coarse sediments supplied by the Narmada and Tapti rivers.

Located in the northern Arabian Sea, the Gulf of Khambhat spans about 80 km at its mouth, narrowing to 25 km over a 140 km longitudinal stretch. It is characterized by broad tidal flats, pronounced tidal creeks, and high-energy hydrodynamics driven by rivers like the Narmada, Tapti, Mahi, Purna, Kim, Dhadhar, and Ambika. The region features prominent sand shoals (e.g., Mal Bank), fluctuating seabed conditions, strong tidal ranges (~9 m spring tides), and turbid waters loaded with suspended sediments. These features foster dynamic sand wave movement, with fine sediments often congregated at their crests

Mangrove distribution around the Gulf of Khambhat covers approximately 134 km^2, which constitutes around 11.4 % of Gujarat's total mangrove area. Major concentrations are found in Bharuch (56.84 km^2) and Surat (35.63 km^2), particularly near river mouths and along the creek networks. In total, Surat's mangroves are mainly distributed in Hazira, which is 1.6 % of Gujarat's mangrove cover.

Table 1.1: District wise Mangrove cover in Gujarat State

S. No	District	Very Dense Mangroves	Moderately Dense Mangrove	Open Mangrove	Total	Change w.r.t. 2021 Assessment
1	Ahmadabad	0	1.46	38.8	40.26	10.79
2	Amreli	0	0	1.78	1.78	0.11
3	Anand	0	0	8.39	8.39	-0.28
4	Bharuch	0	14.33	42.51	56.84	7.22
5	Bhavnagar	0	4.63	25.99	30.62	2.21
6	Devbhumi	0	6.96	71.04	78	3.25
7	Dwarka					
8	Gir Somnath	0	0	9.87	9.87	2.7
9	Jamnagar	0	43.96	118.57	162.53	-9.97
10	Junagadh	0	0	0	0	0
11	Kachchh/ Kutch	0	102.86	605.56	708.42	-61.14
12	Morbi	0	0.58	4.36	4.94	-1.04
13	Navsari	0	0.05	17.39	17.44	1.48
14	Porbandar	0	0.28	1.07	1.35	0.09
15	Rajkot	0	0	0	0	0
16	Surat	0	3.7	31.93	35.63	7.97
17	Vadodara	0	0	1.7	1.7	0
18	Valsad	0	0.28	6.01	6.29	0.22
	Total	0	179.09	984.97	1,164.06	-36.39

Areas are in Sq. km. **Source: India State of Forest Report, 2023**

AMNS Ports Hazira Limited (APHL)

AMNS Ports Hazira Limited (APHL), a captive facility operates under the Magdalla Group of Ports, Gujarat Maritime Board (GMB) located at 27th KM Surat-Hazira Road, Village Hazira, Tal. Choryasi, Dist. Surat, Gujarat – 394 270. The port facility operates 1650 m deep water berth for handling of bulk and break-bulk cargo through the mechanized network of gantry ship unloaders, conveyor belts and stacker-cum-reclaimers.

Location

APHL is located on the West Coast of India located at 21°05'48" N and 72°39'27" E near the Gulf of Khambhat. The terminal is in the Tapi River Estuary, connected to the high seas of the Gulf of Khambhat by a navigation channel well marked by buoys and beacons.

Navigation Channel & Turning Circle:

Navigational Channel is ~8.8 km long with turning circle of 600 m diameter.

Connectivity:

Road: AMNS Ports Hazira Limited is connected to NH8 at Navi Pardi junction by a north corridor. Of the 46 km long road, 26 km is being developed by the Government of Gujarat as an escape corridor to the Hazira peninsula while the remaining 20 km is the existing State Highway. A south corridor which is the NH6 connects the port to NH8 the at Palsana junction.

Rail: There is no direct rail connectivity to APHL. KRIBHCO has a private siding from the Mumbai-Delhi railway line which is located 20 km away from the port. Surat is an important railway station 40 km from the port and is on the broad-gauge route that connects Mumbai to Delhi. This route is double-tracked, and completely electrified and the tracks are designed to handle faster trains.

Marine Infrastructure

APHL has total 1650 m deep draft berth to handle bulk and break-bulk vessels. The navigation channel, clearly marked with beacons and buoys, has a channel width of

~300 m with a turning circle of 600m diameter. The terminal can accommodate partially loaded capsize vessels and fully loaded minicape vessels (105,000 DWT) along with Supramax and Panamax vessels.

1.2. Origin of the Study

To ensure the health of natural mangrove patch located on the southern side of the APHL, the MoEF & CC while granting the EC & CRZ Clearance vide File No. 11-46/2011-IA.III dated 6th May 2014, directed APHL (erstwhile, Essar Bulk Terminal Limited) to study the mangrove cover through satellite imagery on yearly basis (Specific Condition No. iv). APHL, to comply the condition, annually engages Gujarat Institute of Desert Ecology (GUIDE) for the same and providing the report to the MOEF&CC along with their half yearly EC compliance reports. However, in year 2020, a passenger ferry terminal was developed by Deendayal Port Authority on the southern end of APHL and is now fully operational. This passenger ferry terminal is well between the APHL boundary and mangrove patch. Considering the bifurcation order (EC) issued by MOEF&CC, vide File No. 11-46/2011-IA.III dated 4th April 2022, APHL continued to engage agencies to have the study done and submit the report to the MoEF & CC. APHL directed to study the mangrove patch through satellite imagery and to formulate a management plan for conservation of mangrove ecosystem through scientific investigation. Therefore, APHL Limited has approached M/s. Gujarat Institute of Desert Ecology (GUIDE) to study the long-term temporal mangrove cover changes in the surroundings of APHL through satellite imagery (LISS-IV). The present report mainly emphasizes the status and changes in mangrove cover and its ecological significance.

1.3. Objectives of the Study

1. The specific objective of this study is to map the current extent of mangroves in the specified southern side of AMNS Ports Hazira Ltd. facilities at Hazira and its time series (yearly) changes, if any, through GIS and RS.
2. Mapping of the mangrove areas by using LISS-IV (MSS) ortho rectified imagery of pre-monsoon season.
3. Monitoring of mangroves in the surroundings of the APHL area at Hazira through periodic (annual) assessment of the vegetation structure like density, growth, regeneration, and recruitment capacity.
4. Formulating an appropriate management plan based on the results for the sustained well being and conservation of mangroves in southern side of APHL, Hazira.

2. STUDY AREA

2.1. Location

The study area is situated on the bank of the Tapi estuary, at Kadiya Bet, within the Gulf of Khambhat. The Gulf of Khambhat lies on the western coast of India, along the Arabian Sea, adjacent to the Saurashtra Peninsula. The Gujarat coast experiences some of the highest tidal amplitudes in India, with the maximum tidal range is found in Gulf of Khambhat with an average tidal range of 10 m near to Bhavnagar. Owing to its funnel-shaped, semi-enclosed configuration, the tidal height increases significantly upstream. This exceptionally high tidal range, particularly in the upper Gulf, results in vast intertidal zones extending between 1.5 km and 5 km—the widest along the Indian coastline. While the open Arabian Sea coast is dominated by longshore currents and low wave energy, the Gulf experiences powerful tidal currents generated by strong flood and ebb tides, typically ranging between 3–4 knots. During mid-tide, the currents may reach maximum velocities of up to 6 knots, often accompanied by high wave energy.

The study site falls under the extent of co-ordinates; (1) 21° 04’ 11” N, 72° 39’ 11” E; (2) 21° 04’ 11” N, 72° 39’ 18 ”E;(3) 21° 04’ 13 ”N, 72° 39’ 17 ”E; (4) 21° 04’ 11” N, 72° 39’ 16” E; (5) 21° 04’14” N, 72° 39’ 15” E; (6) 21° 04’ 17” N, 72° 39’ 0.9” E; (7) 21° 04’ 17” N, 72° 39’ 06” E; (8) 21° 04’ 11” N, 72° 39’ 16” E; (9) 21° 04’ 17” N, 72° 39’ 09” E; (10) 21° 04’ 15” N, 72° 39’ 07” E; (11) 21° 04’ 05” N, 72° 39’ 01” E; (12) 21° 04’ 18” N, 72° 39’ 03” E and (13) 21° 04’ 22” N, 72° 39’ 02” E.

The site, encompassing an area of approximately 110.1 ha, is located in the Southern side of AM/NS Ports Hazira Ltd., Hazira (Figure 2.1). Within this area, three prominent mangrove patches were observed.

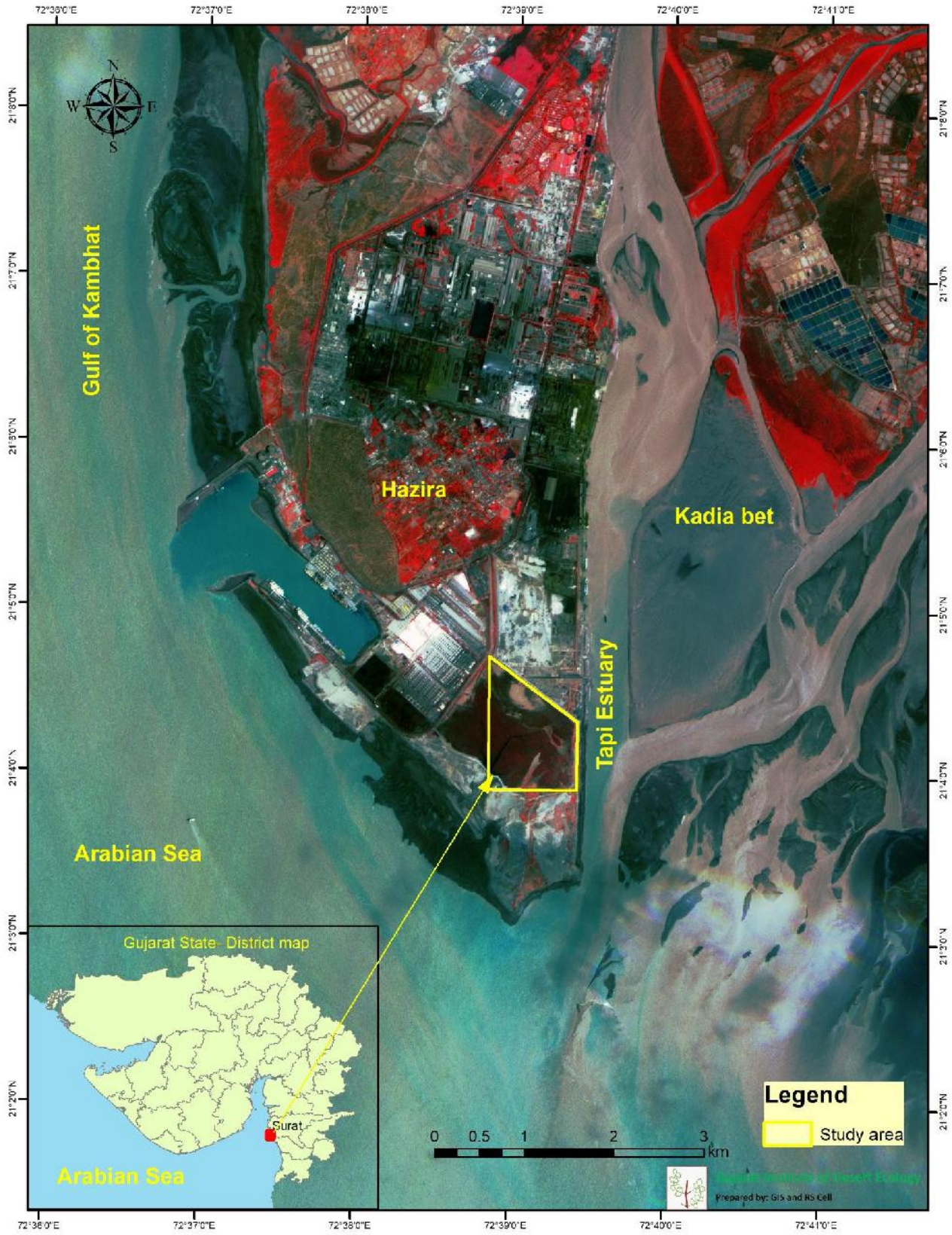


Figure 2.1: Location Map of the Study Area

2.2. Climate

Summer begins in early March and lasts until June. April and May are the hottest months, with the average maximum temperature reaching around 37 °C. The monsoon season starts in late June. Surat receives approximately 1,200 mm of rainfall between late June and mid-October. By November, the monsoon retreats, and temperatures rise again until late November. Winter sets in by December and continues until late February, with an average mean temperature of around 23 °C.

2.2.1. Tidal Regime

The tide in the Gulf is a mixed semi-diurnal type, with large diurnal inequality and varying amplitude, which decrease from north to south. While, the unique position of the Gulf of Khambhat, the coasts experience very high tidal amplitude; probably the highest anywhere along the Indian coast. The funnel shape and the semi-enclosed nature of the Gulf lead to a tremendous increase in tidal height upstream (Gupta, 2002). The maximum spring tide recorded is 8.1m (Mitra, *et al.,* 2020c). As a result, the inter-tidal expanse is vast to the extent of 1.5 to 8 km, perhaps the widest along the Indian coast. The Hazira mangrove cover has a bi-diurnal tidal regime (i.e., two ebb and flow tides per day). This was mainly due to the funnel shape of the Gulf of Khambhat coupled with the resonance effect of exceptionally high tides. Along its eastern shore, the mean spring high water range is maximum 5.7 m. The Tapi estuary experiences fairly high tidal ranges in the mouth segment due to its proximity to the Gulf of Khambhat and hence marked changes in the durations of flood and ebb phases occur as the tide progresses along the length of the estuary. During neap tide, the water level decreases from 2.3 m to 1.7 m at Hazira.

2.2.2. Currents

Long-shore currents with low waves dominate the open coasts of the Arabian Sea. In the Gulf, due to exceptionally high flood and ebb tides, powerful tidal currents with maximum velocities of 6 knots associated with high wave energy occur during mid-tide. Currents were predominantly tide induced with speeds up to 3.3 m/s and were north-northwest during flood tide and south-southeast during ebb tide (Kumar and Ashok Kumar, 2010). The flow adjusts its orientation with the changing direction of wind and affected by the changing seasons of the year. The turnover residence times are quite

short because of its shallow nature, large tidal amplitude, and strong tidal currents (Gupta, 2002).

The wave-current interaction process is studied by (Osuna and Monbaliu, 2004) using a coupling scheme that allows the synchronous data transfer between a wave and a tide/surge model. In most of the earlier studies, currents were up to 2 m/s (Masson, 1996) whereas in the Gulf of Khambhat, currents were more than 2 m/s and it was reported that this could be associated with the interaction between high currents and the waves (Kumar and Kumar, 2010).

2.2.3. Salinity

Salinity is an indicator of the rate of freshwater inflow in the coastal waters and estuaries in particular. Normally, seawater salinity is 35–36 ppt, which may vary depending on the rate of evaporation and precipitation. Flora and fauna inhabiting the inshore and coastal waters are generally acclimatized to a certain range of salinity where they thrive. Wide changes in salinity during the monsoon can result in adaptation with modification and dominance of selected species in the lower order while higher-order biota may migrate.

The estuarine salinity varies over a wide range of the annual cycle (George *et al.,* 2012). The salinity at a given location varies depending on the state and stage of the tide even during monsoons except in the inner estuary, which is fully freshwater-dominated. Due to the proximity to the river flow, the salinity variations were over a wider range in the inner estuary in the dry season.

3. METHODOLOGY

3.1. GIS and Remote Sensing

LISS 4 Satellite imagery of pre-monsoon season procured from NRSC, Hyderabad was used for the present study. The procured imagery has a resolution of 5.8 m with UTM projection with spheroid and datum named WGS 84 in UTM zone 43 north, which will meet the requirement of estimating the areal extent of mangroves within the earmarked co-ordinates and its present status. The supervised classification method has been applied to determine the present scenario of mangrove cover. The accuracy of Supervised Classification was ascertained by ground-truthing the delineated area. The details of the satellite imagery used for the study are given below.

Satellite Imagery	Year	Month	Sensor	Bands	Pixel Resolution
IRS-R2	2024	28, April	**LISS IV**	3	5.8 m

3.1.1. Pre-processing

Pre-processing of satellite data including geometric correction, atmospheric correction and radiometric correction, and clipping of the area has been carried out. The rectification operation aims to correct distorted images to create a more faithful representation of the original scene. It typically involves the initial processing of raw image data to correct for geometric distortions.

Radiometric Correction: Radiometric correction addresses variations in the pixel intensities (DNs) that have not been caused by the object or scene scanned. These variations include differing sensitivities or malfunctioning of the detectors, topographic effects, and atmospheric effects

Geometric Correction: Geometric correction addresses errors in the relative positions of pixels. These errors are induced by sensor viewing geometry or terrain variations. A geometric correction was done based on Ground Control Points (GCPs) and the image was re-sampled using nearest neighbourhood interpolation method.

3.2. Supervised Classification

Supervised classification can be defined normally as the process of a sample of known identity to classify pixels of unknown identity. Samples of known identity are those pixels located within training areas. Pixels located within these areas term the training samples used to guide the classification algorithm to assigning specific spectral values to appropriate information classes.

Preliminary surveys were conducted on the ground to collect training samples for different Land covers using Garmin GPS with the help of the training sample; a classification map was generated based on the maximum likelihood Supervised Classification model and NDVI (Normalized Difference Vegetation Index) using ERDAS software.

3.2.1. Land Cover Classification for 2024

Land cover classifications for April, 2024 were undertaken through satellite imageries, which includes a classification of five classes; such as mangrove, water, saline soil, mudflat, and other vegetation.

3.3. Fieldwork Work

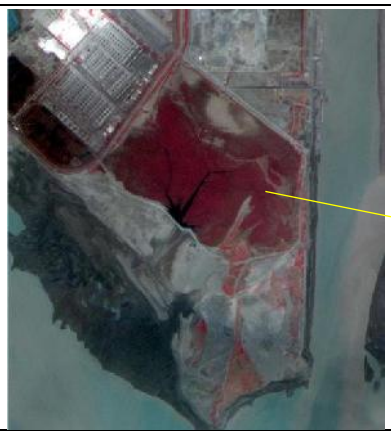
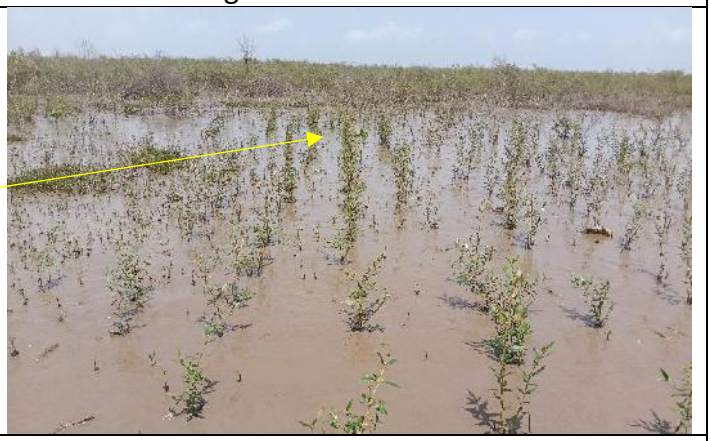
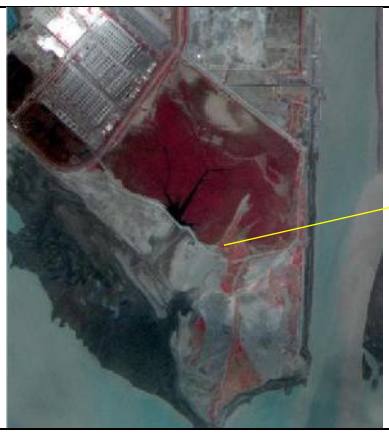
A reconnaissance field survey was undertaken to gain an understanding of the overall land cover patterns of the study area. Such preliminary field investigations, together with ground-truthing, are an indispensable part of the project, as they provide accurate baseline information for fine-tuning and validating the interpretation of satellite imagery. Fieldwork not only helps in confirming the features visible in the imagery but also enables the collection of supplementary details that cannot be easily detected through remote sensing alone.

During the survey, different patches of mangrove cover were examined, and their structural characteristics and health conditions were assessed and recorded. Particular attention was given to variations in tone, texture, and density observed during ground-truthing, which were simultaneously marked and annotated on the corresponding satellite images (Figure 3.1). Traverses were systematically carried out across the area, covering major roads, mangrove patches, saline stretches, mudflats, and other

vegetation types. These traverses facilitated the verification of land cover features and provided a clearer understanding of spatial distribution patterns.

The features identified in the field were then correlated with image elements, allowing for accurate interpretation and classification. Furthermore, GPS observations collected from different quadrats across the site were documented, and these spatial data points were later superimposed on the satellite imagery to strengthen the mapping accuracy (Figure 3.2). This integrated approach of field survey, ground-truthing, and geospatial analysis ensured a reliable representation of the land cover and mangrove distribution within the study area.

Figure 3.1: Ground Truthing Data Collection in the Field by GPS.

Dense Mangrove	
	
Mangrove Recruitment and Regeneration	
	
Other Vegetation	
	

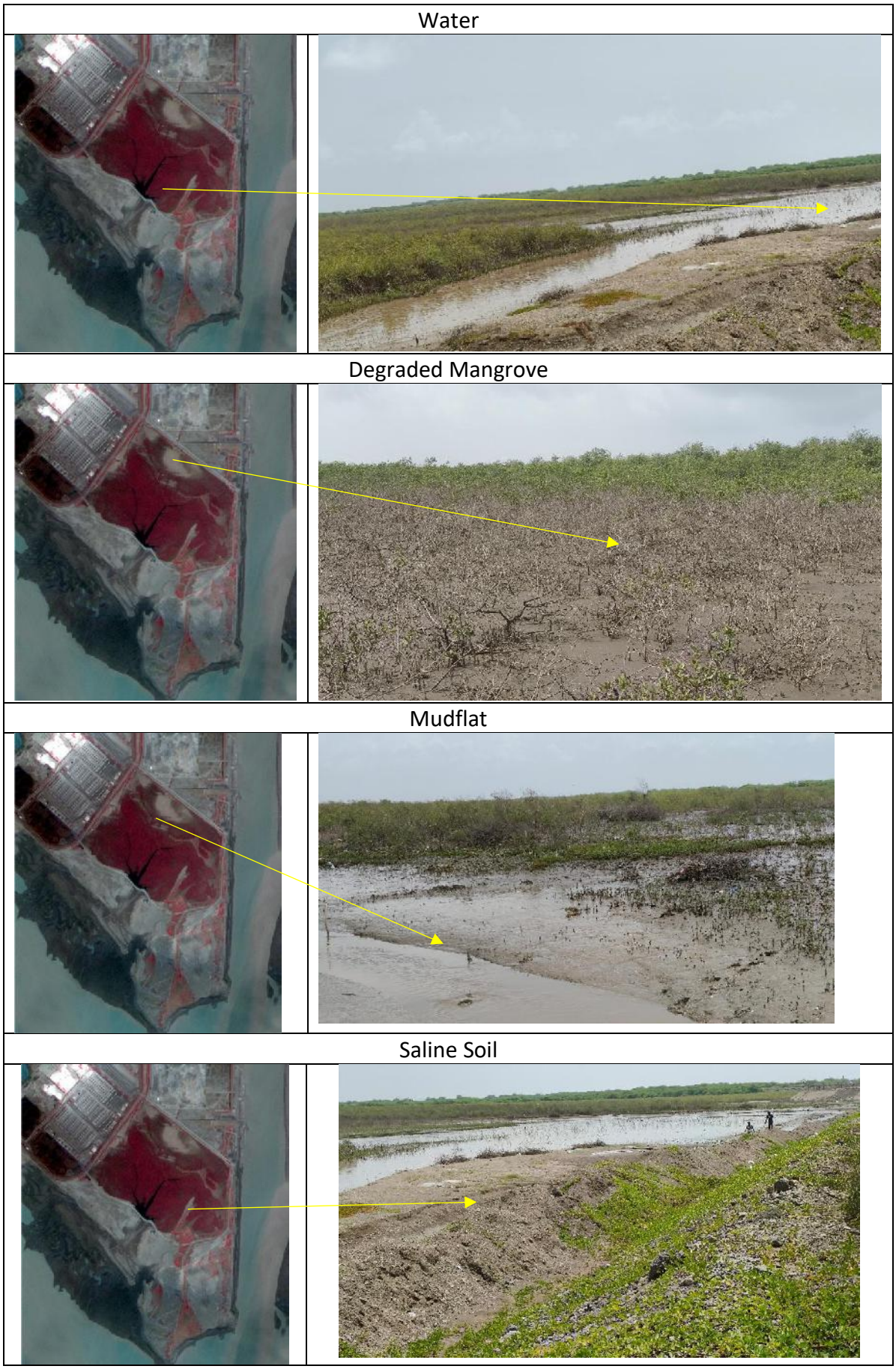


Figure 3.2: Various Land-Cover Classes in The Study Area.

3.4. Mangrove Data Collection

The vegetation structure of the present investigation was carried out at diverse representative sites of mangrove formations (near to Tapi estuary) southern side of APHL, Hazira. The characteristics of mangrove vegetation spread over the southern side of APHL Hazira were studied by the quadrate method (Kershaw and Wright, 1973). For the measurements of mangrove tree density, height variations, and basal area, the methodology and measurement accuracy applied was adapted by using standard methodologies (Cintron and Novelli, 1984). In this study, APHL mangrove formations are classified as trees and younger classes (Recruitment and Regeneration classes).

1. Plant height up to 50 cm: Regeneration class

2. Plant height from 50 to 100 cm: Recruitment class

3. Plant height from 100 cm and above: Tree class

In total, 10 random samplings were carried out in the mangrove formations of the APHL Hazira at different landscapes like mangrove and regeneration and recruitment patches (Figure 3.3).

Figure 3.3: Mangrove Data Collection

In each quadrate laid in the mangrove patches, Tree Height, Girth at Breast Height (GBH), Canopy Length, and Canopy Width (Figure 3.4) were measured. Only GBH of all mature trees taller than 1 m was considered. To enumerate regeneration and recruitment classes, sub plots of 1×1 m and 2×2 m respectively were randomly laid in all the quadrates of 10 × 10m selected. The regeneration class includes saplings less than 50 cm in height and the recruitment class that includes well-established saplings above 50cm but less than 1m of height. The density of mature trees, regeneration, and recruitment class for each station was expressed as number per hectare (No/ha).

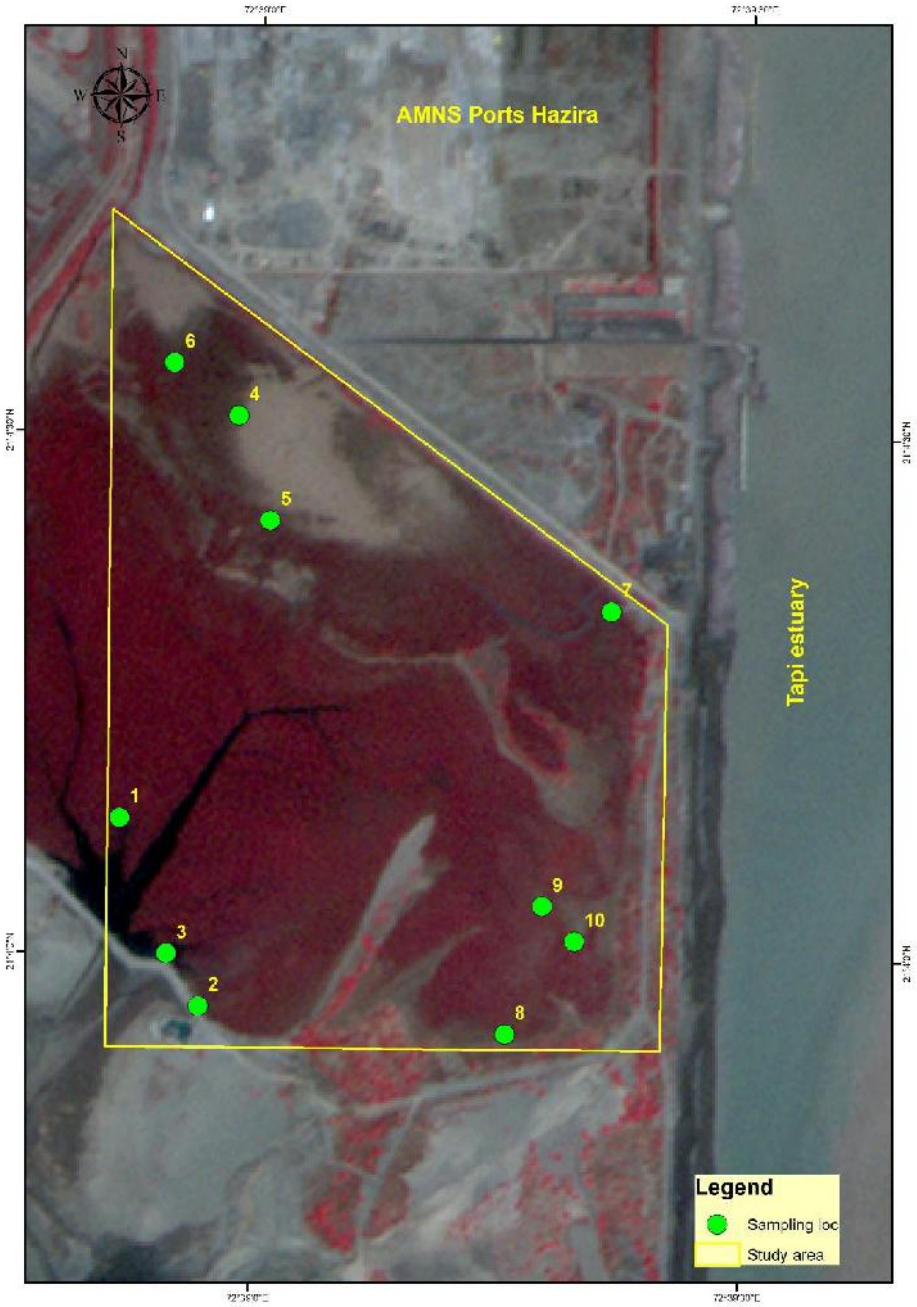


Figure 3.4: Sampling Locations in the Study Area

4. RESULTS

4.1. Land Cover Mapping

Land cover maps of the study area were prepared by using the satellite imagery (LISS-IV of April, 2024), by applying NDVI, and supervised classification methods.

4.1.1. Land Cover Map in 2024

The land cover map based on supervised classification of LISS-IV of April, 2024 is given in the Table 4.1. The area under different land-cover classifications is listed in Table 4.1 The mangrove covers an area of 73.83 ha in the year 2024 (Table 4.1. and Figure 4.2).

As per this April, 2024 classification (Table 1.1 & Figure 4.1), different land cover categories have been estimated. In the Southern direction of APHL, mangrove, constitutes 67.05 %, followed by mudflats (21.37 %), saline soil (6.24%) and other vegetation (2.81%) the rest of 2.53% is comprised of the water spread area.

Table 4.1 : Land-cover Classification at Southern Direction of APHL April 2024

No.	LULC Class Name	Area (ha)	Percentage
1	Mangrove	73.83	67.05
2	Mud flat	23.54	21.37
3	Other vegetation	3.09	2.81
4	Saline soil	6.87	6.24
5	Water	2.79	2.53
Total		110.11	100.00

Figure 4.1: Land Cover Classification Map of the Study Area –April 2024

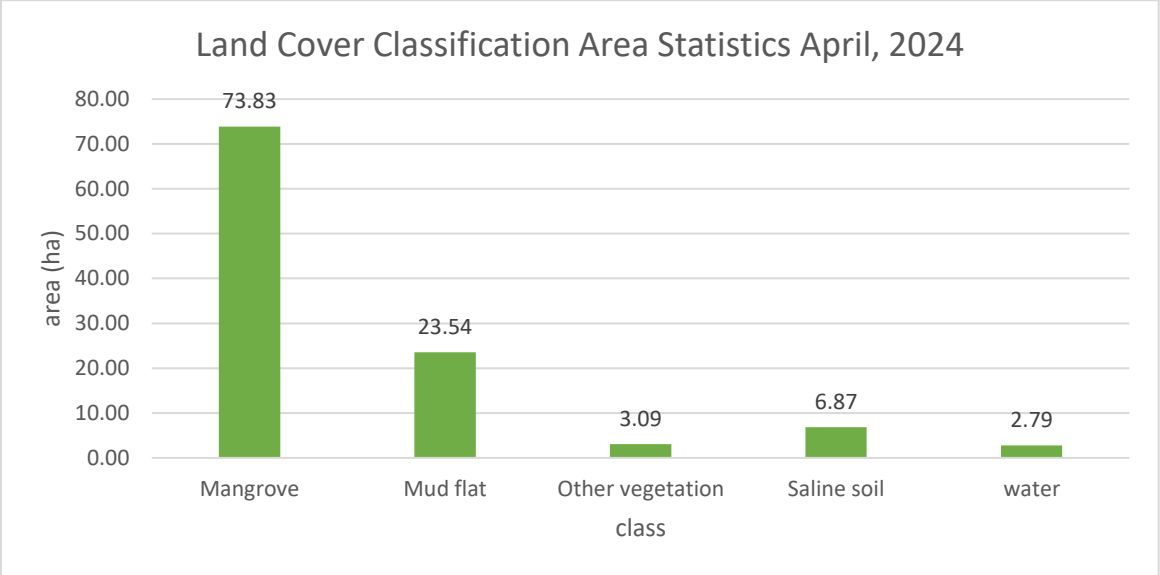


Figure 4.2 : Area Classification Statistics During April, 2024

4.1.2. Details of Mangrove Cover (Year Wise)

The area occupied by mangroves has been measured by Remote Sensing and GIS techniques using the satellite imagery during the pre-monsoon period. The satellite imagery coupled with field surveys showed that the present mangrove cover has increased from 13.89 ha during the year 2014 to 73.83 ha in the year 2024, showing an overall increase of 59.94 ha during the period between 2014 and 2024 (Table 4.2 & Figure 4.3), with an annual average increase of 6.91ha/year, between 2014 and 2023. However, Table 4.2 also highlights a slight reduction in the total mangrove cover of about 2.25 ha area in 2024, when compared with the previous year 2023 (Figure 4.3). A road traversing the study area has been observed, which appears to be impacting the natural hydrological flow and thereby contributing to the decline of mangroves in both the zones. It is learned that AMNS Ports Hazira Limited has not undertaken any construction activity in the said area and the present study is based on field investigation, and ground-truthing observations by using satellite imageries. The overall year wise land use/land cover classification changes are shown in Figure 4.5.

Overall Mangrove cover showed a minimal decrease in the study area, which is due to the degraded patch of regeneration and the recruitment category of plants. A decrease was observed predominantly along the northern sector, while the southwest sector exhibited mixed trends along the mouth of the inlet creek (Figure 4.4), with a decrease

of mangroves along the left side of the creek while an increase in the right side of the creek. The decrease was due to inundation of water for longer period due to obstruction of the road and the increase was due to some plantation efforts undertaken in the area.

Table 4.2 : Year-Wise Mangrove Cover at APHL

S. No	Year	Mangrove Cover (ha)	Yearly Increase in Mangrove cover (ha)	% Increase (Compared to Previous Year)
1	2014	13.89	0	0
2	2015	20.45	6.56	47.2
3	2017	25.18	4.73	23.1
4	2018	37.26	12.08	47.9
5	2019	46.86	11.6	31.1
6	2020	57.73	8.87	18.9
7	2021	63.30	5.57	9.6
8	2022	68.50	5.2	8.2
9	2023	76.08	7.58	6.7
10	2024	73.83	-2.25	-2.0

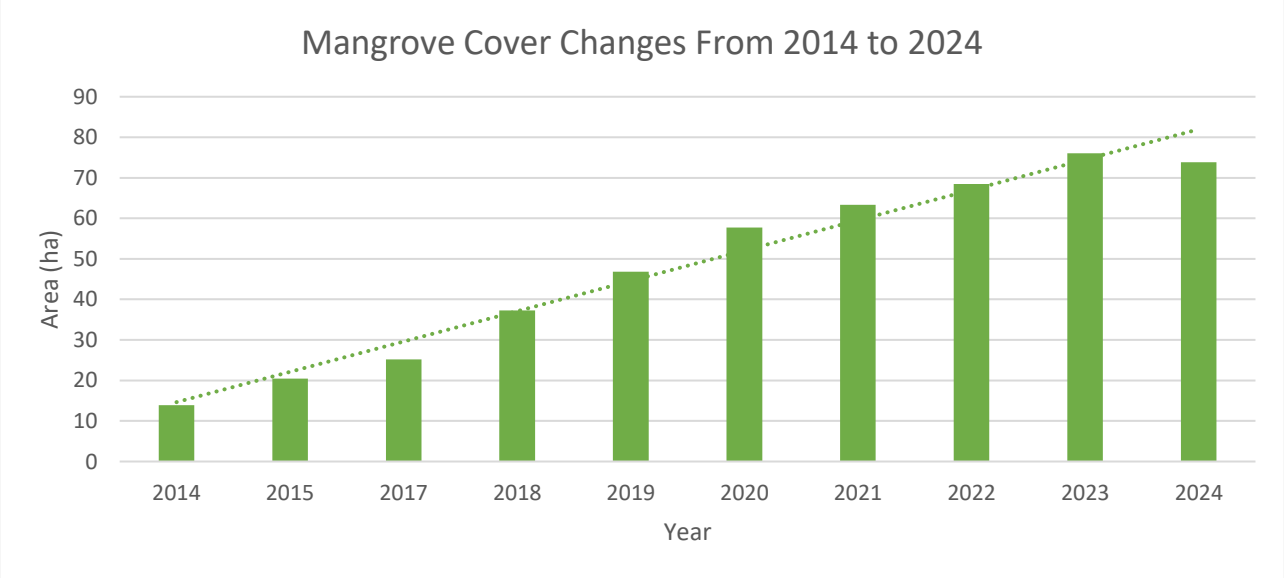


Figure 4.3: Mangrove Cover at APHL, Surat from 2014-2024

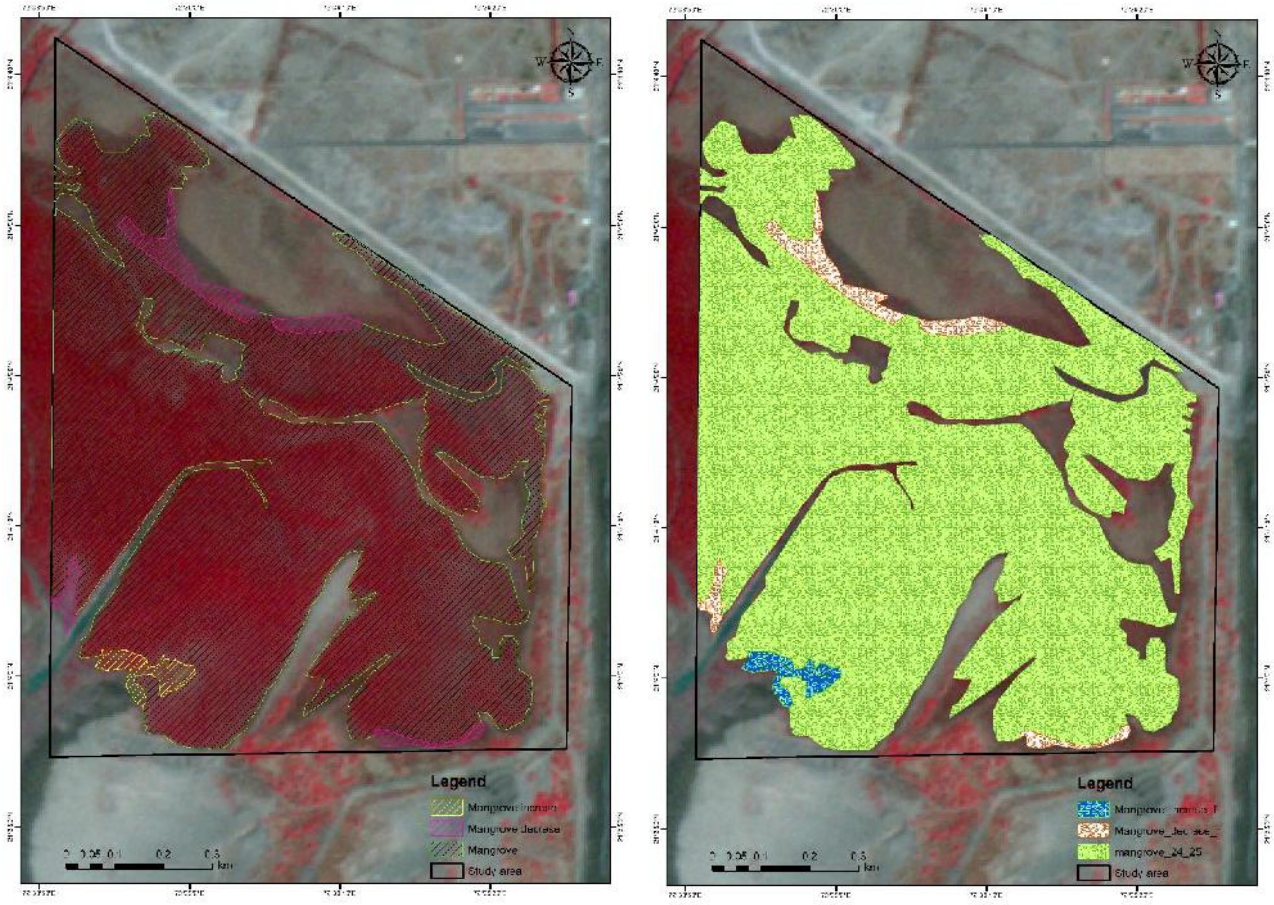


Figure 4.4: Changes in the Mangrove Cover from April, 2023 to April, 2024

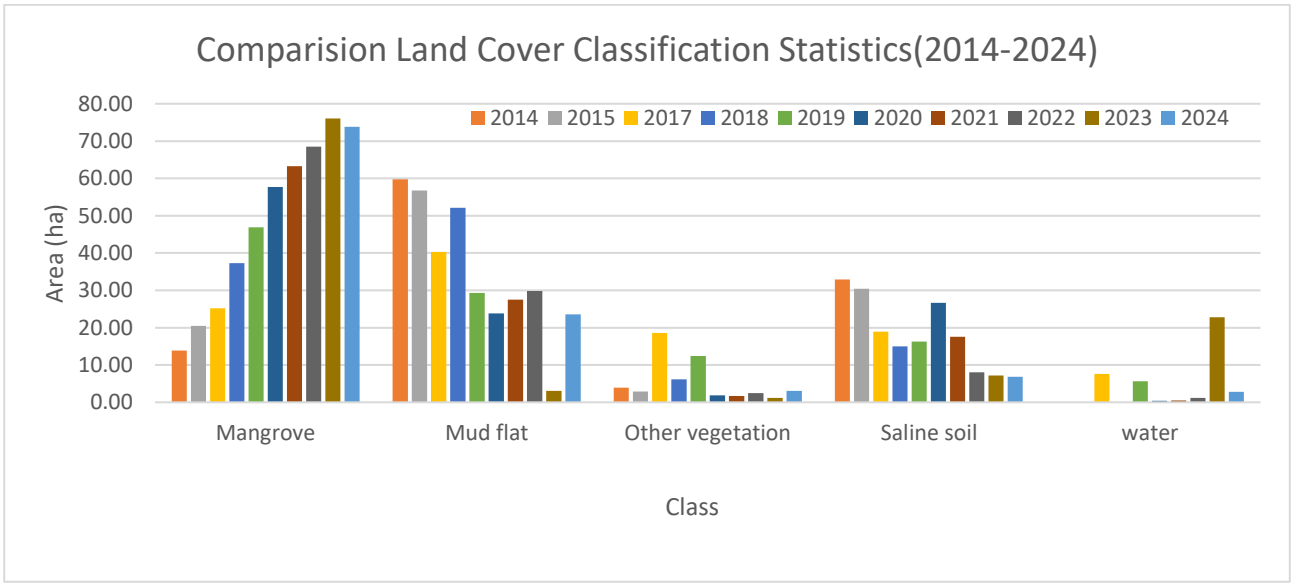


Figure 4.5: Comparison Classification of Area Statistics

4.2. Vegetation Structure of Mangrove

Mangroves are salt-tolerant plants found in the intertidal areas in tropics and sub-tropics throughout the globe. They role as one of the most productive, biodiverse ecosystems. As these ecosystems flourish where land meets the water, offering vital habitats for a variety of terrestrial and marine flora and fauna. For young fish, crabs, and other marine life, they serve as nurseries. By storing a lot of carbon dioxide, these ecosystems aid in slowing down global warming. Coastal towns are less affected by storms, tsunamis, and cyclones thanks to mangroves' natural barriers. Water quality is enhanced by their complex root systems, which filter contaminants out of the water. Their protective role benefits thirty nations that border the Indian Ocean. There are 55 mangrove species in 22 genera and 18 families in India. They are the source of tannin extraction, wood, fuel, and fodder. Both food and medication are made from their fruits and young shoots. In addition to being visually appealing, they are crucial for preserving coastal habitats, promoting biodiversity, and protecting local populations. They grow poorly in stagnant water, but thrive in alluvial soil that contains silt or fine-textured muck. Stunted growth and sparse distribution are frequently the results of the diversity and heterogeneity of mangroves within inundated zones, such as creeks, mudflats, salt marshes, and partially wooded areas. A number of variables, such as the relative densities of various species and the physical and chemical characteristics of the water and sediment, affect the vegetation structure of mangroves. Because of its tremendous potential for sequestering carbon, this structure is essential in defining the functional capacity of mangroves, which in turn affects forestry, fisheries, and the global climate. The overall vegetation structure of the mangrove forest near AMNS Hazira was evaluated using GUIDE. The density of both the younger and mature mangrove classes including recruitment and regeneration was taken into account in this assessment. These discoveries advance our knowledge of the ecological significance of mangrove ecosystems.

4.2.1. Mangrove Status

The Mangroves patches were located near an operational passenger ferry terminal which is on the southern side of APHL, is mono-species, showed dominance of *Avicenna marina*, which is widespread in the Gujarat state. Nevertheless, mangrove diversity in Gujarat can majorly be found in South Gujarat region. In the study area, a few trees of other species of mangrove such as; *Sonneratia apetala* and *Acanthus ilicifolius* are found with full grown status, together with their recruitment and regeneration classes.

4.2.2. Tree Height

The overall average tree height ranged from 120 cm to 183 cm, with a mean height of approximately 153 cm across all quadrants. Among the quadrants, the tallest average tree height was recorded in Quadrant Q-10, reaching 183 cm. The shortest average height was observed in Quadrant Q-4, where trees measured around 120 cm. It is important to note that this study was conducted primarily in peripheral zones of the mangrove habitat, focusing on areas that were accessible for field observation. As such, the data may not fully represent the total mangrove extent; however, the assessed mangrove patch lies on an operational passenger ferry terminal which is along the southern side of APHL.

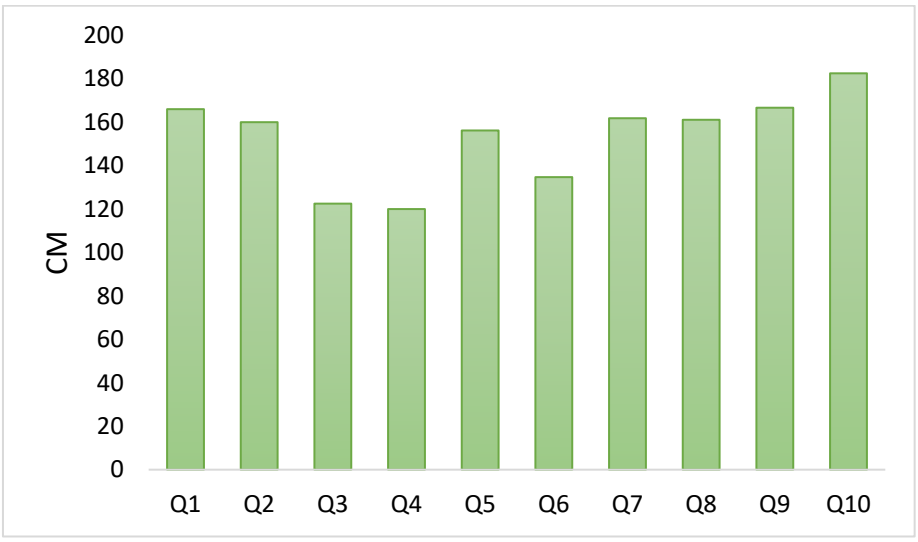


Figure 4.6 : Tree Height Measurement at APHL

4.2.3. Basal Girth

The basal girth, ranged from 7 cm to 14 cm, with an overall average of 9 cm. The maximum basal girth was recorded in Quadrant Q-10, followed by Q-7, suggesting the

presence of mature mangrove individuals that have undergone significant growth over time. The lower girths observed in other quadrants point to the dominance of younger mangrove plants, which are still in the early stages of development.

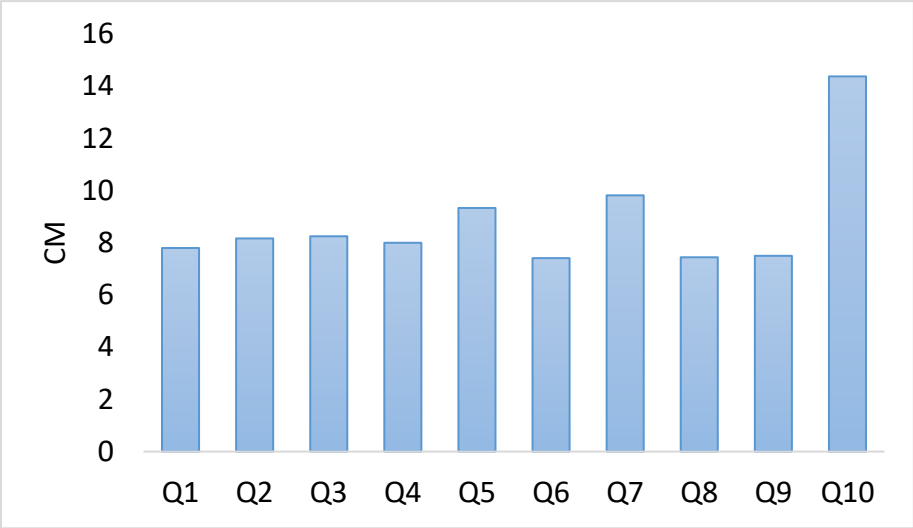


Figure 4.7 : Tree Girth in Different Quadrates at APHL

4.2.4. Canopy of Trees

The canopy cover of mangroves within the study area exhibited notable variation across the sampled quadrants. The average canopy cover ranged from 1.2 m^2 to 4.2 m^2, with the overall average canopy cover across all sampling locations calculated at 1.6 m^2. The highest canopy cover was recorded in Quadrant Q-10, suggesting the presence of mature mangrove individuals with well-developed crowns. In contrast, the lowest canopy cover was observed in Quadrant Q-6. Canopy structure serves as a key indicator of forest maturity, ecological succession, and habitat quality.

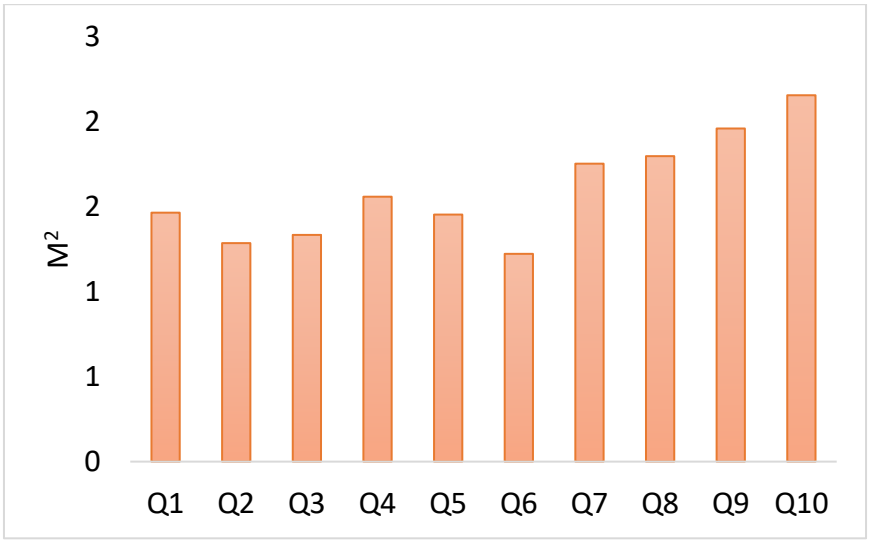


Figure 4.8 : Canopy of Mangrove Trees in the Hazira Study Area

4.2.5. Regeneration and Recruitment Class:

The present study investigated the regeneration and recruitment classes of mangrove species across various quadrants within the designated sampling site. The average density of the regeneration class was recorded at approximately 30,000 plants per hectare, with observed values ranging from a minimum of 10,000 plants/ha to a maximum of 100,000 plants/ha. Notably, the highest density of regenerative mangrove plants was documented in Quadrant Q-5. This suggests that Q-5 may possess favourable ecological conditions that support the successful establishment and growth of younger mangrove cohorts.

The recruitment class, average density across the site was recorded at 6,000 plants per hectare, with ranging from 2,500 to 10,000 plants/ha. The highest recruitment density was observed in Quadrant Q-2. These findings highlight the importance of spatially explicit ecological assessments in understanding mangrove population dynamics and underscore the need for targeted conservation strategies that enhance both regeneration and recruitment success across heterogeneous coastal landscapes.

4.2.6. Mangrove Density

The overall average density of mature trees was recorded at 880 trees per hectare. The quadrant-wise assessment shows, Q-5 exhibited the highest mature tree density, with 2,100 trees per hectare, followed by Q-6, which recorded 1,700 trees per hectare. The lowest mature tree density was observed in Quadrant Q-4, with only 100 trees per hectare. This quadrant was characterized by widespread desiccation of mangrove trees, indicating a zone of ecological stress that leads to the degradation. The presence of dead and dried mangroves in Q-4 may be attributed to factors such as lack of tidal water flow and it is not reaching in this area, which subsequently impacting mangrove vitality and regeneration potential.

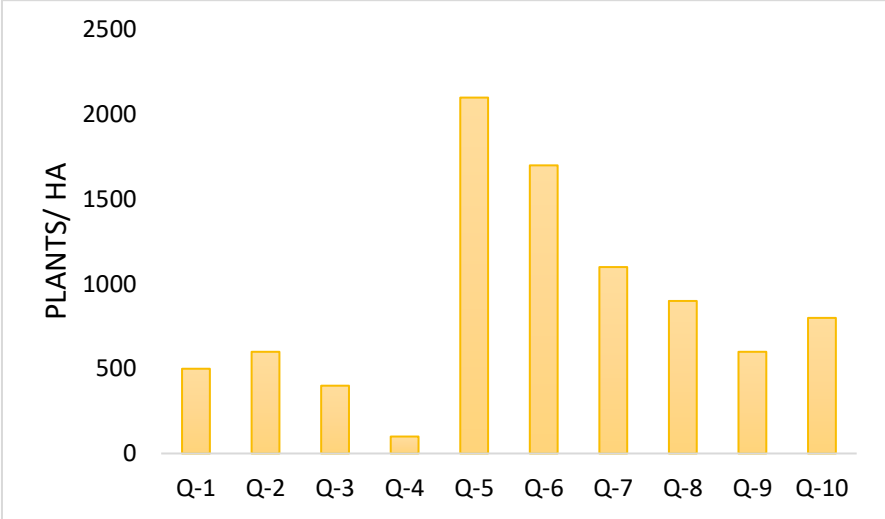


Figure 4.9 : Density of Mangrove Trees in the Hazira Study Area

Figure 4.10 : Mangroves in the Study Area

4.3. *Potential Threats to Mangroves*

The rapid growth in the human population, industrial development and urbanization are the most important stresses on mangroves. Along with these, natural processes such as soil erosion, natural disasters, sedimentation, and poor tidal flushing due to creeks and channel blockages also exerts pressures on the mangrove ecosystems. However, alarming pressure on the mangrove ecosystem can be the anthropogenic activities such as over exploitation, encroachment, and reclamation of mangrove cover for industrial, commercial, or residential development tend to alter the nature of mangrove ecosystems and its functions. Although being a very important ecosystem, mangroves were treated as unwanted plants by many people due to unawareness and utilized as a source of fuel wood and fodder that led to depletion of mangroves during the last two decades. It is reported that deforestation is responsible for the destruction of about 44% and 26% of mangroves along the west and east coast of India, respectively (Upadhyay, et al., 2002). In this background, it is crucial to create awareness among the local population about the mangrove ecosystems, its biodiversity and services to human and environment. As this ecosystem is a nursery for juvenile of various economically important fish and crustacean species, conservation of mangroves can be an essential task. Mangrove ecosystems support a great amount of detritus food for a variety of young fish and shrimps (Ingole, 2005). However, in private areas, mangroves are facing several threats due to the land conversion for various activities such as aquaculture, agriculture, and various industrial developmental activities. And importantly, the reclamation of the near mangrove ecosystem is responsible for the damage to saplings and young mangrove plants.

I. Non-biodegradable Debris

Non-biodegradable Materials: As mangroves play a critical role in maintaining coastal ecosystems, and understanding the impact of non-biodegradable waste on these habitats is essential for conservation efforts. Many plastic and other non-biodegradable materials were recorded in the debris found in the mangroves located southern side of the study area (Fig. 4.18). The possible sources for such debris are probably nearby

anthropogenic activities in this area. During the high tide, these materials may reach inside the mangroves and get trapped in this area.

Figure 4.11: Non-Biodegradable Debris at the Mangrove Areas

5. CONCLUSION

5.1. Mangrove Cover

The present study in 2024 has assessed the status of the Mangroves during the period between 2014 and 2024. The data highlighted a steep yearly average increase of approximately 6.91 ha/Year during the period between 2014 and 2023. However, a minimal annual decline in mangrove area of 2.25ha was recorded within the study area during the period between 2023 and 2024. A road traversing the mangrove area has been observed, which appears to be instrumental in the decline of mangroves in both zones, primarily due to disruption of the natural hydrological flow. This has led to limited water supply and inundation in the mangrove areas, while the same road restricted outflow of water which again made long duration inundation of mangroves. The AMNS Ports Hazira Limited is not involved in any construction activity in the said area, and other facilities exist between the observed location and the boundary of AMNS Ports Hazira Limited. The present assessment is based on field assessment and using satellite imageries. This reduction was more pronounced along the northern and north-western sectors compared to the southwestern region, where only minor changes in mangrove extent were observed. The spatial variability in mangrove dynamics can be attributed to a combination of geomorphological and hydrological factors, as well as biological regeneration processes along with anthropogenic interventions. The following factors provide scientific justification for the observed patterns:

5.1.1. Habitat Instability:

The northern and north-western sectors towards the landward side of the study area have experienced significant changes in soil characteristics due to erosion and sediment displacement that subsequently increased the salinity of the area. Such geomorphological changes adversely affect mangrove seed retention and seedling establishment. The loss of cohesive mudflats reduces the substrate stability required for mangrove rooting, ultimately leading to degradation of the stand.

5.1.2. Reduced Tidal Flushing:

Weakening of the tidal water flow has resulted inundation along the southern part and reduced water circulation in certain pockets along the northern part of the mangroves which have resulted in increased salinity, sediment compaction, and poor nutrient exchange. Limited tidal flushing reduces oxygen availability in the root zone, affecting physiological functions such as respiration and nutrient uptake, thereby contributing to mangrove stress and mortality.

5.1.3. Poor Regeneration and Recruitment:

Field observations indicate low seedling density and poor natural regeneration in the degraded areas. This can be attributed to altered hydrological conditions, excessive sedimentation, or disturbance from anthropogenic activities. As a result, older stands are not being replaced by younger cohorts, leading to gradual thinning and canopy loss over time.

5.1.4. Sediment Erosion and Altered Accretion Patterns:

Changes in sediment dynamics-such as increased erosion or reduced sediment deposition-have resulted in unfavourable conditions for mangrove establishment in certain areas. Field observations indicate that localized scouring by tidal currents and wave action has exposed root systems, leading to mechanical stress and leading mangrove mortality, while in other patches, excessive sediment accumulation may have buried pneumatophores, thereby restricting gaseous exchange and subsequent seedling survival.

5.1.5. Anthropogenic Interference:

The developmental and maritime activities in the nearby coastal region, have made some impacts on local hydrology and turbidity levels. A decrease was observed predominantly along the northern sector, while the southwest sector exhibited mixed trends along the mouth of the inlet creek (Figure 4.4), with a decrease of mangroves along the left side of the creek while an increase in the right side of the creek.

In the present study, signs of dieback and drying of mangroves especially in the recruitment and regeneration classes were observed in few patches of the mangrove habitat, indicating ecological stress and instability. Notably, two distinct zones of degradation were identified, *i.e.,* one toward the seaward side (southwest direction) and another toward the landward side (northern direction) due to a road traversing the study area.

Figure 5.1: Mangrove Degradation Due to New Constructed Road

The obstruction caused by the road and its allied conduit or culvert for tidal water flow has likely to be impeded the free tidal flushing, a vital process for maintaining the health of mangroves. On the seaward side (southwest direction), it aids waterlogging due to poor outward drainage and prolonged inundation beyond the tolerance limits of mangrove species results in reduced soil aeration, limiting oxygen availability for root respiration and nutrient uptake. These conditions degraded the root systems and alter microbial activity, compounding the stress and increasing mortality risk. While, along the landward side (northern direction), mangroves exhibit signs of desiccation and salinity build-up, due to restricted tidal flushing caused by the same road which led to deprived water flow and reduction in maintaining the essential soil moisture and subsequent nutrient replenishment. This has impacted the regeneration and recruitment classes of mangroves and enhance the growth and proliferation of saline tolerant halophytic species such as *Sesuvium* sp. and *Salicornia* sp. Their increased presence in the affected zones further suggests a shift from mudflats to salt marsh vegetation, driven by altered tidal dynamics. Thus, the cause of mangrove degradation

at both the locations is directly linked to hydrological changes, induced by the establishment of a road network.

The above emphasizes that there is an urgent need for a comprehensive, site-specific assessment of hydrological alterations and the health assessment of the mangroves for the implementation of long-term conservation and management of the mangroves.

5.2. Conservation and Management Plan

The Figure 5.2: Annexure-II Provided by MoEF & CC depicts the referral distances as indicated in the Annexure-II provided by MoEF & CC is maintained for the conservation of this mangrove cover.

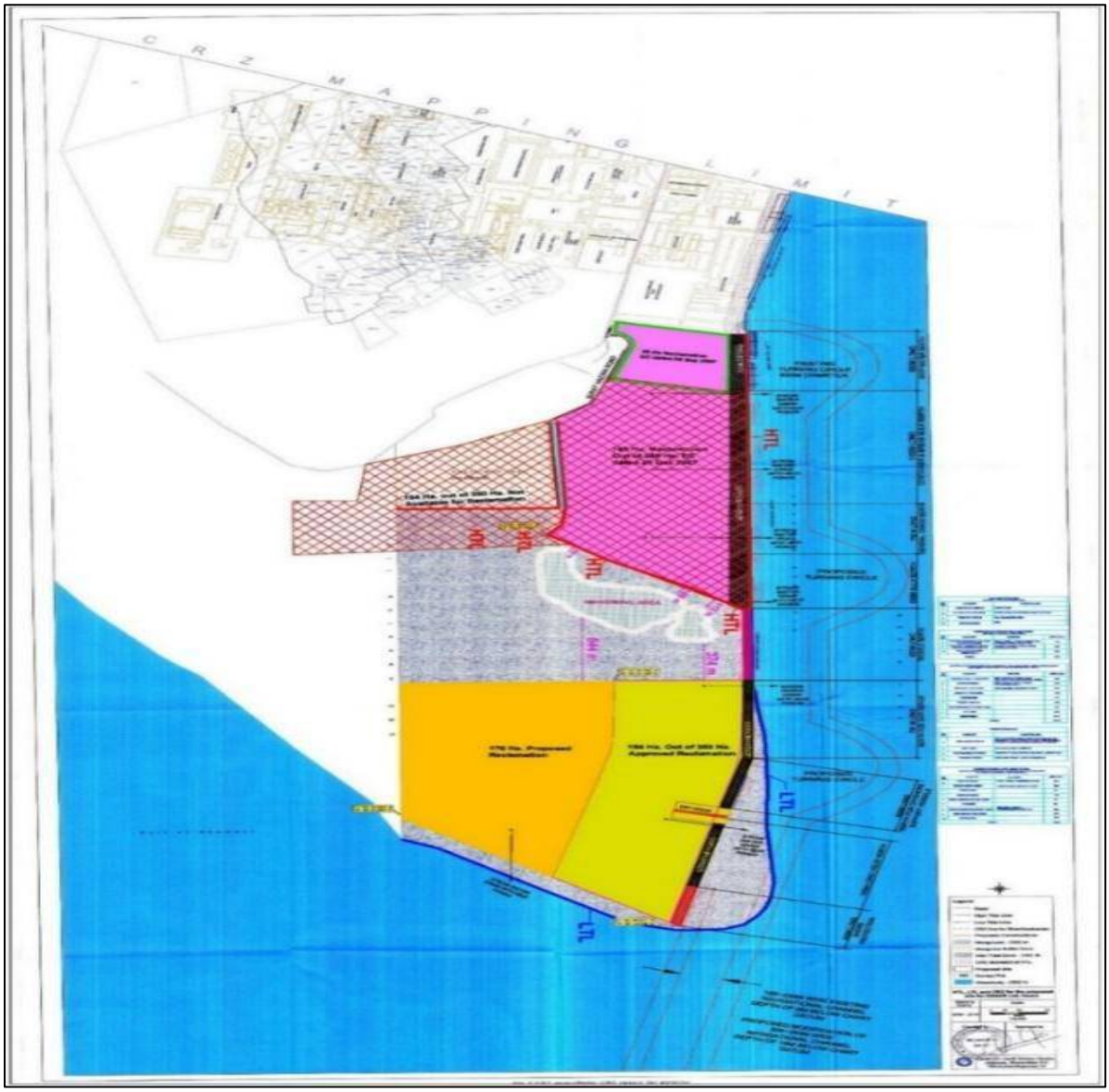


Figure 5.2: Annexure-II Provided by MoEF & CC

5.2.1. Monitoring and Assessment

- **Regular Monitoring of Identified Mangrove Patches:**

  Implement systematic annual monitoring of the identified environmental pressures within the AMNS Port Hazira Ltd. (APHL) area. Special attention should be given to degraded or stressed mangrove patches to detect the changes, and formulate early as well as timely corrective actions.

- **Periodic Monitoring and Data Consolidation:**

  Conduct rapid monitoring programs at annual intervals to assess mangroves and its extent, especially in the affected zones due to industrial and other developmental activities. APHL has already generated valuable baseline data on mangrove structure, including canopy cover, density, and diameter classes for more than a decade. Consolidation of these datasets will provide a strong foundation for long-term, time-series data for continuous monitoring by using ground truthing and high-resolution satellite imageries (e.g., LISS-IV).

5.2.2. Conservation and Protection

- **Maintenance of Natural Environmental Conditions:**

The stability and sustainability of the mangrove ecosystem purely depends on restoring and maintaining the natural hydrological regimes, regular tidal flex, elevation gradients, soil and water salinity and pH levels. Appropriate maintenances and preventing any alteration of these parameters is essential to preserve healthy ecological balance which will helps in preventing any further degradation.

- **Promotion of Natural Regeneration:**

Plantation activities should be avoided in areas that showing healthy natural regenerations. Instead, the management efforts should aim to maintain favourable natural conditions such as adequate tidal flushing, sediment stability and nutrient

cycling, etc. that support spontaneous regeneration/ recruitment as well as lateral expansion of mangroves in the area.

5.2.3. Shoreline and Hydrological Management

- **Shoreline Erosion Control:**

Erosion along the seaward edges of mangrove stands should be managed using eco-engineering methods such as bio-shields, natural barriers, or specially designed coastal protection structures. These should be designed to permit natural tidal flushing, ensuring hydrological connectivity between the mangrove area and the sea. Periodic satellite-based monitoring of shoreline dynamics is recommended to assess erosion rates and effectiveness of interventions.

- **Hydrological Improvement and Biophysical Amendments:**

In degraded or stunted mangrove areas suffering from poor tidal water exchange, it is crucial to make minor biophysical interventions to restore the free tidal water movements. Further, eco-engineering techniques (such as creek modification or tidal channel deepening) will enhance mangrove establishment in degraded zones. These interventions should prioritize natural processes and focus on restoring hydrological connectivity. This includes the creation or widening of small creeks and deepening of existing channels to improve tidal flushing and enhance water circulation. Such measures will improve soil aeration, nutrient availability, and hydroperiod conditions necessary for mangrove recovery.

5.2.4. Restoration and Future Expansion

The extensive natural mudflat areas adjacent to mangrove zones needs to be systematically evaluated for their suitability for future mangrove plantation. Parameters such as tidal inundation frequency, sediment composition, and salinity levels should be assessed before any intervention.

5.2.5. Long-Term Sustainability

- **Integrated Management Approach:**

All mangrove conservation efforts should be integrated with the port's environmental management framework. Collaboration among ecologists, hydrologists, and coastal engineers is essential to ensure that development and conservation objectives are balanced. Regular monitoring, adaptive management, and incorporation of scientific feedback into future planning will ensure the long-term sustainability of the mangrove ecosystem at APHL Hazira.

5.3. General Mangrove Conservation Plan:

Apart from the above-discussed site-specific and area-specific measures, the following are some of the conservation measures which can be implemented for proper conservation and management of mangroves at Hazira:

- Proper documentation of Hazira mangroves with reference to potential regeneration sites, areas facing natural and anthropogenic threats, and areas suitable for restoration needs to be delineated. These areas should be monitored for effective conservation and management.

- Potential Regeneration Areas (PRAs) should be allowed to grow naturally by enhancing protection from human interference such as cutting, grazing by domestic animals, and solid waste dumping, especially plastic pollution.

- In addition to mangrove plantations, simplified restoration or rejuvenation of mangroves will promote a healthier and ecologically viable ecosystem. In many instances, restoration will yield better results than creating new plantations.

- Developmental activities or civil works should be avoided near the mangrove ecosystem. In particular, alteration of the natural habitat should not be undertaken along the buffer zone of the mangrove ecosystem. Further, saline

tolerant mangrove associates could be raised towards to landward side to enhance the green belt of the areas.

- In the study site, Avicennia marina is the dominant mangrove species, however, few trees of other species of mangrove such as; Sonneratia apetala and Acanthus ilicifolius are found with full grown status, together with their recruitment and regeneration classes. Therefore, efforts should be taken to protect and encourage the natural regeneration of these species through habitat protection, minimal disturbance, and hydrological restoration. Increasing species diversity will enhance ecological resilience and overall health of the mangrove ecosystem.

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Annexure 2: *Compliance Report of the Conditions mentioned in the GCZMA's recommendation letter issued dated 01/06/2013 for "Expansion of Port Facility at Hazira, Surat".*

S.No.	Condition	Compliance Status
1	The provisions of the CRZ Notification of 2011 shall be strictly adhered to by M/s. EBTL. No activity in contradiction to the provisions of the CRZ notification shall be carried out by M/s EBTL.	Noted and Complying.
2	Natural drainage system shall be designed in such a way that there shall be no damage to the existing mangrove patches nearby site.	Complied. The existing mangrove patch is undisturbed. Natural flushing takes place and Hume Pipes are additionally provided. *Mangrove Area* 
3	The Essar Bulk Terminal Limited shall take up mangrove plantation in 500 ha of land in consultation with GEC/Forest department.	Complied. Since year 2008 to 2013, around 500 ha of mangrove plantation has been carried out at Dandi village, taluka Olpad, Ankalav village at taluka Hansot and Asarsa, taluka Jambusar in consultation with Gujarat Ecological Commission (GEC) and Saline Area Vitalization Enterprises Limited (SAVE). Against the stipulated 500 ha of this EC & CRZ Clearance, 100 ha of mangrove plantation has been carried out by M/s. SARVA Services and M/s. SAVE between 2020 to 2022. The plantation was carried out in Suva and Nada villages of Vagra and Jambusar

S.No.	Condition	Compliance Status
		talukas, District Bharuch, Gujarat which is now in maintenance phase. In addition to these, Plantation work carried out by M/s. SARVA Services in October 2022 for 50-ha mangrove plantation in intertidal mudflat area of village Nada, taluka Jambusar of Bharuch District. Reports are being submitted along with the EC compliance reports of the corresponding years. Currently, we have plan to plant mangroves about 100 Ha.
4	Coal, ore and other material handling shall be done through totally closed system.	Complied. The existing coal conveyor system is full covered. Water sprinkling system has been provided in hoppers and all the transfer points to control the fugitive dust emissions during the operations. *Picture of Sprinkling System working in Unloading Point* 
5	All necessary permissions from different Government Departments / agencies, including GMB, shall be obtained by M/S EBTL, before commencing the activities.	Complied.
6	All the recommendations and suggestions given by WAPCOS in their	Agreed.

S.No.	Condition	Compliance Status
	Environment Impact Assessment reports for conservation / protection and betterment of environment shall be implemented strictly by M/S EBTL.	
7	The construction and operational activities shall be carried out in such a way that there is no negative impact on mangroves, if any, and other important coastal / marine habitats. The construction activity shall be carried out only under the guidance / supervision of the reputed institute / organisation.	Complied.
8	M/s EBTL shall strictly ensure that no rivers are blocked due to any activity at the proposed site.	Noted.
9	The construction debris and / or any other type of waste shall not be disposed of in to the sea, creek or in the CRZ area. The debris shall be removed from the construction site immediately after construction is over.	Noted and complied.
10	The construction camps shall be located outside the CRZ area and the construction labour shall be provided with the necessary amenities, including sanitation, water supply and fuel and it shall be ensured that the environmental conditions are not deteriorated by the construction labours.	Complied.
11	M/s EBTL shall bear the cost of the external agency that may be appointed by this Department for supervision / monitoring of proposed activities and the environmental impacts of the proposed activities.	Noted and agreed.
12	The groundwater shall not be tapped within the CRZ areas by the EBTL to meet with the water requirements in any case.	Noted and Complied.
13	M/s EBTL shall take up massive greenbelt development activities in consultation with Forest department / GEER Foundation / Gujarat Ecology Commission.	Complied.

S.No.	Condition	Compliance Status
	A comprehensive plan for this purpose has to be submitted to the Forest and Environment Department.	
14	The EBTL shall have to take up bio-shielding development programme as part of CSR in consultation with Forest Department/PCCF and an action plan in this regard shall have to be submitted to the MoEF-GOI and this Department.	**Complied.** Mangrove plantation has been carried out.
15	The EBTL shall have to contribute financially for taking up the socio-economic upliftment activities in this region in consultation with the Forest and Environment Department and the District Collector / District Development Officer.	**Complied.** The CSR team is continuously working for the socio-economic upliftment of study area. Various projects have been carried out in the villages of study area in the field of medical, education, infrastructure. Apart from that, projects like this generates employment (direct & indirect) and various business opportunities for the people in study area.
16	A separate budget shall be earmarked for environmental management and socio-economic activities including the greenbelt / mangrove plantation and details thereof shall be furnished to this Department as well as the MoEF, GOI. The details with respect to the expenditure from this budget head shall also be furnished along with the compliance report.	**Noted and being complied.** Details of expenditure regarding the environment management are being provided along with the half yearly compliance report of environment clearance.
17	A separate Environmental Management cell with qualified personnel shall be created for environmental monitoring and management during construction and operational phases of the project.	**Complied.** Company is having a separate environment cell. Team of qualified environment engineers in collaboration with other teams in port, is working and looking for the effective implementation of environmental safeguards, mitigation measures, timely and effective implementation of management programs, monitoring of environmental parameters, timely submission of reports and returns to concerned authorities. Environment team directly reports to Head of Ports.
18	Environmental Audit report indicating the changes, if any, with respect to the baseline environmental quality in the coastal and marine environment shall be submitted every year by M/s EBTL to this department as well as to the MoEF, GOI.	**Complied.** Every year, Environment Audit Report carried out by one of the Schedule-I auditors of GPCB has been submitted along with compliance report. NEERI, is appointed to carry out inspection of environmental condition and report is submitted with the half yearly EC Compliance report Oct 2024 to Mar 2025.
19	A six monthly report on compliance of the conditions mentioned in this letter shall have to be furnished by	**Complied.**

S.No.	Condition	Compliance Status
	M/s EBTL on a regular basis to this Department as well as to the Ministry of Environment and Forest, Government of India.	
20	Any other condition that may be stipulated by this Department / Ministry of Environment and Forest, Government of India from time to time for Environmental Protection / management purpose shall also have to be complied with by M/s EBTL.	Agreed.

Authorized Signatory
For, AMNS Ports Hazira Limited

Rituparn Raghuvanshi
Head of Ports, Hazira,
AMNS Ports Hazira Limited
27th KM, Surat-Hazira Road,
Village Hazira, Choryasi taluka,
Surat – 394 270
Gujarat.

AM/NS INDIA A joint venture between ArcelorMittal and Nippon Steel Corporation ArcelorMittal NIPPON STEEL	ArcelorMittal Nippon Steel India Limited (AMNSIL)		REF. No: AMNSIL/Port/ERP
			REV. No: 00
			EFF. DATE: 01 April 2022
	Prepared by- Alok Tyagi	Approved by- Capt. Rituparn Raghuvanshi	REV. DATE: 15th Mar 2023

EMERGENCY RESPONSE PLAN

IN COMPLIANCE WITH BS 45001:2018 OCCUPATIONAL HEALTH AND SAFETY MANAGEMENT SYSTEM STANDARD CLAUSE 8.2

AMNS PORTS HAZIRA LIMITED

Address	:	**AM/NS INDIA CAPTIVE JETTY, 27TH KM, SURAT HAZIRA ROAD, HAZIRA – 394270, GUJRAT**
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DOCUMENT CONTROL	
Manual Number:	**ERP-01**
Title of Holder:	**HSE**
Issue Date:	**01 April 2022**
Authorized By:	**Chief of Ports**

CONTENTS

PREFACE

This is our First emergency plan, after that it will be regularly updated as & when required based on learning from various Mock drills and on account of expansion in the facility. Mock drills will be conducted to test the plan and improve our emergency preparedness. The goals and objectives will be to improve quality of work and working life through dedicated concentrated efforts consistent with the requirement of safety, health and environment at workplace. The results of these exercises, identification and assessment of all credible scenarios, survey of various Rules, Regulations and standards will be taken as basis for modifying the ON-SITE Emergency Plan.

As emergencies arise suddenly the necessity to remain always alert and ready with supporting facilities to face them is of paramount importance. This document cannot be said to be the complete as it only sets the broad guidelines. It is only by periodically conducting regular table top exercise and mock drills our preparedness will improve which will help us to minimize the consequences of emergencies as and when they arise.

All the key personnel are requested to study the document and become familiar with the contents and disseminate information to those working with them.

Capt. Rituparn Raghuvanshi

Occupier

PURPOSE

Major accidents may cause emergency and it may lead to disaster, which may cause heavy damage to plant, property, and harm to persons and create adverse effects on production.

Many disasters like Bhopal gas tragedy, Chernobyl Nuclear Disaster etc. have occurred at many places in the world causing heavy loss of life and property.

Emergency situation arises all of a sudden and creates havoc and damage to property, production and environment and harm to human beings.

Therefore, such situations and risks should be thought, visualized and assessed in advance and it should be planned beforehand to tackle them immediately and control them within the shortest time.

We handle various raw materials & finished goods cargo. Despite precautions and safety measures we take, an incidence of potential damage may arise occasionally. Such incidents if effectively handled by the Department Heads / Shift-in-Charges / Shift Engineers would cease to be a potential hazard thereafter. However, in case the situation demands for greater assistance, the mitigation measures are not enough to control or when the Shift-in-Charge / Shift Engineer is in doubt of combating and controlling the situations with resources at his command, he will initiate the emergency procedure. "The purpose of this plan is to lay down guidelines to handle such emergencies."

Under the provision of Sec 41B (4) of the Factories Act 1948 every occupier shall draw up an On-site Emergency Plan and detailed disaster control measures for his Port Facility and make known to the workers employed therein and to the general public living in the vicinity of the Port Facility the safety measures required to be taken in the event of an accident taking place.

Similarly, Schedule 8-A of Sub rule 68-J-(12) (1) of Gujarat Port Facility Rule 1963 requires that every occupier of a hazardous Port Facility shall prepare an ON-SITE emergency plan and detailed disaster control measures including linkage with off Site Emergency Management for the Port Facility. Accordingly, the ON-SITE and OFF-SITE emergency plan with details of disaster control measures has been prepared for the employees and general public living in the vicinity of the Port Facility. This plan gives the safety measures to be taken in the event of any accident or disaster happening at the plant.

The provisions of the following guidelines are kept in mind while preparing this plan.

- Status relating to risk assessment and environment impact in case of Fire, Explosion and the measures taken for prevention of such accident.

- Provisions for all facilities and procedures for immediate control to minimize the effect of such probabilities.
- Arrangement with mutual aid agencies.
- Arrangement for informing workers through emergency alarm and public in vicinity and surrounding factories through telephone
- Arrangement for evacuation of persons likely to be affected due to emergency.
- Arrangement for transporting affected persons to the hospital and medical center through Car/Ambulance.
- Arrangement for necessary treatment and availability of antidotes at hospitals and at medical center.
- Organization Chart for fixation of responsibilities of managers, officers, workers at different stages for handling emergency due to fire, explosion etc.
- Details regarding alert system like emergency detection and alarm.
- Notification of place of gathering of workers and staff at the time of emergency.
- Information in detail, regarding any disaster, which might have occurred in Port Facility.
- Provisions of main control for 24 hours to use at the time of emergency.
- Arrangement regarding maintenance of different equipment's, control measures and safe procedure of work so that they shall work effectively.
- A statement of all possible source of accidents involving fire, explosion, and plan of showing the place of above accidents with the facilities to control the emergency near the place and at the control place.
- OFF-SITE emergency services that is a link between ON-SITE and OFF-SITE Emergency Plan. While preparing this plan, the following documents have been referred and thankful to those for their contribution.
- As per Gujarat Disaster Management Act, as requested shall assist the State Government, the Commissioner and the Collector in all disaster management activities and should prepare a disaster management plan in conformity with the other disaster management plans of local authorities, departments of Government having regard to the guidelines laid down in this behalf by the Authority.
- Each Port Facility shall be responsible for effective implementation of the plan drawn up by it in this behalf. Each private and public sector entity shall provide assistance to the Authority, the Commissioner, the Collector and take such other steps as may be necessary for disaster management.

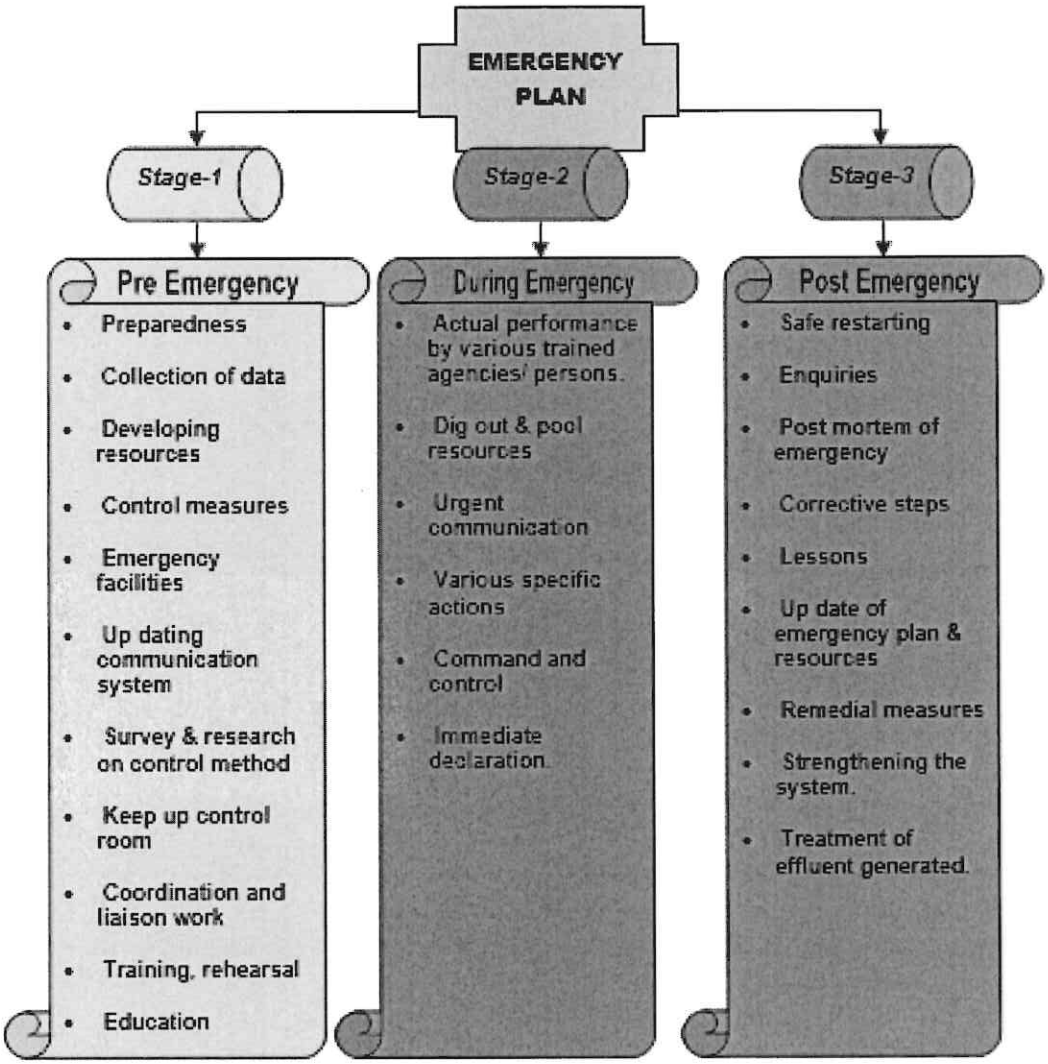
DEFINITIONS

Some definitions used in on-site emergency plan are given below:

Hazard	source, situation, or act with a potential for harm in terms of human injury or ill health, or a combination of these
Hazard identification	process of recognizing that a hazard as defined above exists and defining its characteristics
Incident	work-related event(s) in which an injury or ill health (3.8)(regardless of severity) or fatality occurred, or could have occurred **NOTE 1** An accident is an incident which has given rise to injury, ill health or fatality. **NOTE 2** An incident where no injury, ill health, or fatality occurs may also be referred to as a "near-miss", "near-hit", "close call" or "dangerous occurrence". **NOTE 3** An emergency situation is a particular type of incident.
Occupational Health and Safety (OH&S)	Conditions and factors that affect, or could affect the health and safety of employees or other workers (including temporary workers and contractor personnel), visitors, or any other person in the workplace.
Workplace	Any physical location in which work related activities are performed under the control of the Organization. NOTE When giving consideration to what constitutes a workplace, the Organization should take into account the OH&S effects on personnel who are, for example, traveling or in transit (e.g. driving flying, on boats or trains), working at the premises of a client or customer, or working at home.
Accident	An accident is an unplanned and undesired event, which results into unacceptable and undesired consequences. It does not necessarily involve human injury. The consequences might be injuries and / or damage to equipment, machinery and raw material or finished products, etc. or damage to environment. It is undesired circumstances which give rise to ill health or injury, damage to property, plant, products or the environment, production losses or increase liabilities.
Major Accident	Major accidents means an incident involving loss of life inside or outside the site or ten or more injuries and /or one or more injuries outside or release of toxic chemical or explosion or fire or spillage of hazardous chemical resulting in "on-site" or "off site" emergencies or damage to equipment leading to stoppages of process or adverse effects to the environment.
Emergency	"Emergency" means a situation leading to a circumstance or set of circumstances in which there is danger to the life or health of persons or which could result in big fire or explosion or pollution to the work and outside environment, affecting the workers or neighbourhood in serious manner, demanding immediate action.
Disaster	'Disaster' means an actual or imminent event, whether natural or otherwise occurring in any part which causes or threatens to cause all or any of the followings widespread loss or damage to property, both immovable & movable; or widespread loss of human life or injury or illness to human beings; or damage or degradation of environment and any of the effects specified in sub clause (i) to (iii) is such as to be beyond the capacity of the affected community to cope up with using its own resources and which disrupt the normal functioning of the community.

Earthquake	Earthquakes are caused by the sudden release of slowly accumulated strain energy along a fault in the earth's crust.
Risk	A chance or Possibility of danger, loss, injury or other adverse consequences.
Tsunami	Tsunamis are water waves or seismic sea waves caused by large-scale sudden movement of the sea floor, usually due to earthquakes and on rare occasions to landslides, volcanic eruptions, or man-made explosions.
Cyclone	Cyclones cannot be irradiated from the western coast of India. There is excessive length of coastline across the western coast of India and moreover the topographical features of the Indian coast and existent of Ghats in the southern part, there is a strong possibility of a Low being Built in the northern and south western region of the Hazira Port .This could get in a cyclone from low to heavy strength. There has been History of Cyclones on the Gujarat coast
Epidemic	An Epidemic cannot be precluded when we have considered Floods to be one of the contingencies. Epidemics follow Flood. Earthquakes are caused by the sudden release of slowly accumulated strain energy along a fault in the earth's crust.
Lightening	Lightening striking is also a common phenomenon when there is monsoon season and specially when the monsoon onsets there is a process of cloud formation and in the initial stages the static is very heavy due to which the Lightening takes place and it may strike anytime

CLASSIFICATION OF EMERGENCY:



Annexure 4: *Action plan for compliance of Environmental Management Plan recommended in the EIA Report*

S. No.	Impact identified	Environment Management Plan	Action Plan / Compliance status
		Construction phase	
1	During dredging and reclamation sedimentation could occur locally if the suspended sediment associated with the drained water settles in the channel feeding mangroves restricting the water flow in an extreme case.	• Cutter Suction Dredgers (CSD) and Trailing Suction Hopper Dredgers (TSHD) will be deployed. CSD would be used mainly within the estuary and just outside the estuary mouth for utilizing dredged material for reclamation. TSHD would be used in the sea segment of the channel. • The dredged material will be primarily utilised for reclamation and balance disposed at the sites approved by the Gujarat Maritime Board. Based on the modelling studies CWPRS has confirmed the suitability of this site for the disposal of the dredged material. • The water draining from the reclamation site will be diverted away from the channel feeding the mangroves via 3 No. mud ponds to remove excess suspended solids. • Prior to dredging the mangrove area will be surveyed and marked on a drawing in 1:4000 scale. The monitoring of the mangrove patch will be done through satellite imageries once a year.	• **Complied:** Cutter Suction Dredgers (CSD) and Trailing Suction Hopper Dredgers (TSHD) were engaged for dredging operations as identified in EIA report. • **Complied:** The material dredged by CSD was being utilised for reclamation as per the plan submitted to MoEF&CC whereas, the TSHD dredged material is disposed in GMB approved sites. • **Complied:** The water draining from the reclamation site was diverted away from the channel feeding the mangroves via mud ponds to remove excess suspended solids. • **Complied:** The mapping of the mangrove area through Satellite is already carried out by GUIDE the report are being submitted along with respective EC Compliance Report.
2	Reclamation and construction of quay can potentially modify the aquatic dynamics resulting in changes in erosion / accretion pattern in the mouth estuarine zone.	• Numerical modelling by CWPRS indicates absence of significant changes in the shoreline due to proposed constructions. Nevertheless, shoreline changes if any will be studied through satellite imageries once a year from the commencement of construction of berths. • If changes are found, reference will be made to CWPRS for their suggestion for mitigation measures. The recommended	We have not observed any shoreline changes due to our existing operations as well expansion activities. Changes if any, will be detected through satellite imagery.

S. No.	Impact identified	Environment Management Plan	Action Plan / Compliance status
		mitigation measures will be implemented.	
3	There could be increase in fugitive dust emission from reclaimed area particularly during summer due to wind and movement of vehicles and machinery. Other impacts could be due to misuse of nearby area by workers, vehicular exhaust, discarded materials etc.	• Frequent water sprinkling in the dried reclaimed sites will be undertaken. • Vehicles and construction machinery will be properly maintained to comply with the exhaust emission requirements. Frequent PUC monitoring will be done. • The areas earmarked for greenbelt will be developed and plantation will be undertaken. • On completion of construction, surplus materials, debris, discarded boxes, containers, drums etc will be removed from the site and disposed as per the procedure of Gujarat-Pollution Control Board.	• As suggested, we have arranged water sprinkling through mobile water tankers in the dried reclaimed sites. • All construction vehicles complied with the exhaust emission requirements. • Greenbelt development has been initiated and is a continuous process. • Complied.
4	The construction labour could mess-up the intertidal area and may even cut vegetation for firewood thereby causing local habitat degradation if proper facilities are not provided to them.	• The workforce will be accommodated in the existing labour colony. The colony has drinking water and sanitation facilities. • The workers will be provided with fuel. • Facilities for collection and conveyance of garbage are already in place. The waste is stored segregated and then transported for disposal by authorised vendors only. • Potable water and 10 Nos of toilets with soak pits will be made available to them at the project site as per relevant norms.	• Construction camps kept well cleared of CRZ areas. • Facilities like drinking water, sanitation provided inside the camps. • Waste is being disposed as per the waste management plans specified by pollution control board. • Operational 40 KLD sewage treatment plant is provided.
5	Noise from impact hammers, vibratory hammers, trucks, generators, compressors,	• Noise from air compressors will be reduced by fitting exhaust mufflers and intake mufflers. • Chassis and engine structural vibration will be dealt by isolating the engine from the chassis and by covering various	• Noise control measures suggested in the EIA report are followed.

S. No.	Impact identified	Environment Management Plan	Action Plan / Compliance status
	pumps etc would be a source of nuisance for workers.	sections of the engines. • Noise levels from the drillers will be reduced by fitting exhaust mufflers and provision of damping on the steel tool. • Exposure of workers near the high noise levels will be minimized by job rotation / automation, use of ear plugs, etc. • The noise prone activities will be restricted to the day time.	
Operation Phase			
1	Marine water: Monitoring in dry season at 3-4 locations.	• Physico-chemical parameters (pH, salinity, turbidity, DO). • Biological parameters (Mangroves, light penetration, coliform, *E coli*).	• Marine monitoring is being carried out on six monthly basis by one of the MoEF&CC accredited laboratory and reports are being submitted to GPCB.
2		• Physico-chemical parameters (Texture, pH).	
3	Ambient air quality: Monitoring in summer, post-monsoon and winter seasons. (Twice a week for four consecutive weeks per season)	• Parameters: SPM, RPM, SO_2 and NOx.	• Monitoring of environmental parameters is being carried out by one of the MoEF&CC accredited Laboratory and reports are being submitted to GPCB.
4	Noise: Monitoring during peak construction activities at construction sites	• Equivalent noise level.	