

DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

For

**Modernization and Upgradation of Chennai
Fishing Harbour , Kasimedu, Chennai**

By

M/s Chennai Port Authority

No 1, Rajaji Salai, Chennai - 600001

EIA Consultant

HECS

HUBERT ENVIRO CARE SYSTEMS (P) LTD

CHENNAI

November -2023

ACKNOWLEDGEMENT

The following personnel are gratefully acknowledged for their fullest support in collection, compilation of needful data regarding the project and kind co-operation in fulfilling the report on Draft Environmental Impact Assessment (EIA) Report of Modernization and Upgradation of Chennai Fishing Harbour in Kasimedu, Chennai.

For M/s. Chennai Port Authority,



S. DURAIMANICKAM

CHIEF EXECUTIVE OFFICER
Chennai Fishing Harbour
Management Committee

Declaration by the Project Proponent

I,S.Duraimanickam, Chief Execuetive Officer of M/s. Chennai Fishing Harbour Management Committee, declaration/ undertaking that owing the contents (information and data) of draft EIA report preparation has been undertaken for proposed the “Modernization and Upgradation of Chennai Fishing Harbour, Kasimedu,Chennai” and the information and content provided in the report are factually correct.

For M/s. Chennai Port Authority,



S. DURAIMANICKAM

CHIEF EXECUTIVE OFFICER
Chennai Fishing Harbour
Management Committee

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CHAPTER 1

INTRODUCTION

1 Introduction

1.1 Purpose of the Project and Project Background

The proposed project is the Modernization and Upgradation of Chennai Fishing Harbour, Kasimedu, Chennai.

As per EIA Notification 2006, the proposed project site falls under 7(e)-Ports, Harbours, Breakwaters and Dredging. The category of the project is B1.

Chennai Fishing Harbour (CFH) is the largest fishing harbour in Tamil Nadu. It is located to the North of the Chennai Port along the Indian peninsular coastline and is sheltered by Northern and Eastern breakwaters. This fishing harbour is also known as Royapuram Fishing Harbour or Kasimedu Fishing Harbour. Chennai Fishing Harbour is habituated by the fishermen community from Chepauk village. The migration of this community to Chennai dates back to the early 18th century.

At present, the Chennai Fishing Harbour is spread on **31.956 Hectares** of land area and contains **48.56 Hectares** of water spread area within its breakwaters.

The present shape of the fishing harbour is the result of an initial construction work taken up by the neighbouring Chennai Port Trust during 1983-85 with Rs. 13.34 crores funded by the Union Ministry of Agriculture and Rural Development through Grants in Aid and subsequent additional infrastructure which were developed by the State Fisheries Department of GoTN.

Currently, there are 977 Mechanized Fishing Boats (MFBs) and 1370 Fiber Reinforced Plastic (FRP) boats which take shelter at Chennai Fishing Harbor. The harbour witnesses' ingress/egress of 30,000 persons daily for fishing activities or fish-related businesses and handles approximately 300 MT (metric tons) of sea catches daily.

Chennai Fishing Harbour is managed and operated by the Fishing Harbour Management Committee (FHMC). The Chairman of Chennai Port Trust is the Chairman of the FHMC. The Committee has representations from the Ministry of Fisheries, Animal Husbandry and Dairying (GoI), the Department of Fisheries (GoTN), the Marine Product Export Development Authority (MPEDA),

District Administration, the Central Institute of Coastal Engineering, Police and various fisheries unions.

1.2 Identification of the Project and Project Proponent

During the Budget Speech on 01.02.2021, the Honorable Union Finance Minister has proposed substantial investments in the development of Modern Fishing Harbour and Fish landing centers.

Accordingly, the Union Ministry of Fisheries, Animal Husbandry and Dairying (GoI) have informed that the Chennai Fishing Harbour is one among the first five major fishing harbours which will be developed as “Hubs of Economic Activity”.

The development work entails the modernization and upgradation of basic essential requirements, construction of new berthing facilities and strengthening post-harvest infrastructure at a low cost.

Therefore, the proposed project focuses on establishing modern infrastructure and upgrading existing facilities at the Chennai Fishing Harbour, such as:

- Water facilities (drinking and tap water), drainage infrastructure
- Sanitation, Solid and liquid waste management
- Roads and lighting arrangements
- Sheds, fish processing and storage facilities
- Boat repair facility

1.3 Need of the Project

Indian fisheries sector plays a vital role in the National Economy. It contributes to the country’s GDP, exports, food and nutritional security, employment generation and coastal community development. The Indian fisheries sector comprises multiple fisheries clusters along the vast Indian coastline and numerous inland fishing communities. These clusters play a crucial role in the socio-economic development of the region. The fisheries sector provides livelihood to more than 2.8 crores fishermen directly and many more along the fisheries value chain.

The major objectives of the project:

- To manage and maintain the Fishing Harbour for all-weather use for fishing vessels.
- To provide convenient landing facilities to the fishing crafts.
- To facilitate handling of catches, auctioning, fueling, repairing, etc.

- To provide hygienic conditions for the pre-processes, handling of fish to match international standards, and
- To maintain hygienic standards at the international levels in the handling of marine catches.

1.4 Brief Description of nature of the Project

The proposed project is the modernization and upgradation of Chennai Fishing Harbour, Kasimedu, Chennai. The total land area is **31.956 Hectare**. The land document is attached as **Annexure 3**.

Table 1.1: Salient features of the project

S.No	Features	Description																														
1	Name of the project	Modernization and Upgradation of Chennai Fishing Harbour, Kasimedu, Chennai.																														
2	Name of the Company	M/s. Chennai Fishing Harbour																														
3	Project Location	Kasimedu, Chennai.																														
4	Survey Number	The survey where the proposed project site is located are as follows: 3483, 3482, 3514, 3515, 3522, 3524, 4321, 4342, 4343, 3457, 3485, 3464, 3527, 3518. The sub-clause of the above mentioned S.F.Nos are as follows: 3312/2, 3457/1, 3457/2, 3457/3, 3463/3, 3463/4, 3464/1, 3464/2, 3473, 3482/1, 3482/3, 3483/1, 3483/2, 3483/3, 3484/1 part, 3484/3, 3485 part, 3514, 3515, 3518, 3522, 3524 part, 3527/2, 3527/50, 3527/51, 3527/59, 3527/60, 3527/68, 3527/69, 3527/77, 3527/78, 3527/86, 3527/87, 3527/95, 3527/96, 3527/104, 3527/105, 3527/113, 3527/114, 3527/117, 4321, 4342, 4343 part.																														
5	Site Coordinates	<table border="1"> <thead> <tr> <th>S.No</th> <th>Latitude</th> <th>Longitude</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>13° 8'4.22"N</td> <td>80°17'50.67"E</td> </tr> <tr> <td>2</td> <td>13° 7'59.45"N</td> <td>80°18'6.74"E</td> </tr> <tr> <td>3</td> <td>13° 7'48.70"N</td> <td>80°18'12.30"E</td> </tr> <tr> <td>4</td> <td>13° 7'52.97"N</td> <td>80°18'18.16"E</td> </tr> <tr> <td>5</td> <td>13° 7'46.31"N</td> <td>80°18'17.07"E</td> </tr> <tr> <td>6</td> <td>13° 7'24.14"N</td> <td>80°18'2.55"E</td> </tr> <tr> <td>7</td> <td>13° 7'19.19"N</td> <td>80°17'55.60"E</td> </tr> <tr> <td>8</td> <td>13° 7'20.21"N</td> <td>80°17'53.18"E</td> </tr> <tr> <td>9</td> <td>13° 7'29.40"N</td> <td>80°17'44.89"E</td> </tr> </tbody> </table>	S.No	Latitude	Longitude	1	13° 8'4.22"N	80°17'50.67"E	2	13° 7'59.45"N	80°18'6.74"E	3	13° 7'48.70"N	80°18'12.30"E	4	13° 7'52.97"N	80°18'18.16"E	5	13° 7'46.31"N	80°18'17.07"E	6	13° 7'24.14"N	80°18'2.55"E	7	13° 7'19.19"N	80°17'55.60"E	8	13° 7'20.21"N	80°17'53.18"E	9	13° 7'29.40"N	80°17'44.89"E
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6	Land details	The total land area is 31.956 Hectare .																														
7	Elevation	0-3m																														

8	Nearest Village	Description	Dist. (~km)	Dire.
		Royapuram	Site is within the Village	
		Tondiarpet	0.03	W
		Old Washermanpet	0.81	WSW
		Tiruvottiyur	1.02	N
		George Town	2.31	S
9	Nearest major city	Description	Dist. (~km)	Dire.
		Chennai	Site is within the Village	
10	Nearest Railway station	Description	Dist. (~km)	Dire.
		V.O.C.Nagar Railway Station	1.22	WNW
11	Nearest Port	Description	Dist. (~km)	Dire.
		Chennai Port	Adjacent to Site	S
12	Nearest Airport	Description	Dist. (~km)	Dire.
		Chennai International Airport	18.14	SW
13	Highway	Description	Dist. (~km)	Dire.
		SH-114(Chennai-Ennore Rd)	0.01	W
		Chennai-Srikakulam Highway	3.34	SW
14	Nearest Mangroves	Description	Dist. (~km)	Dire.
		Mangroves near Tiruvottiyur	4.87	NNW
		Mangroves near Ennur	11	N
		Mangroves near Adyar	12.48	SSW
15	Reserve Forest	Description	Dist. (~km)	Dire.
		Guindy National Park/Guindy Park RF	14.37	SSW
16	Historical/ Archaeological Place	Monuments	Dist (~km)	Direc
		Old Town Wall Tondiarpet	2.27	SSW
		Tomb of David Yale and Joseph Hymners in the compound of Law College Muthialpet(George Town)	4.09	SSW
		Ramparts gates bastions Ravelins with vaulted chambers and water cisterns underneath moat and defense walls all round with glacis to the extent of the existing barbed wire fence Fort St. George	4.54	SSW
		King's Barracks Block No.XXV Fort St.	4.62	SSW

		George		
		Old British Infantry Officers Mess (Now housing the Fort Museum) Block No.XXXVI/2 Fort St. George	4.7	S
		Guard Room Block No.V Fort St. George	4.89	SSW
		St. Mary's Church with tablets laid on the ground and enclosed by a compound and a buried wall Fort St. George	4.92	S
		Clives House built in 1753 Fort St. George	4.96	SSW
		Nursing Sister's House (Block 1/3) Fort St. George	4.97	S
		Big Warehouse south of the Church Library (in Block No.II/7) Fort St. George	4.98	S
		Garrisons Engineer's Depot Block No.IV Fort St. George	5.03	SSW
		Last house on the left of 'Snobs Allay' (oldest house in theFort with carved staircase) – Block No.I/1 Fort St. George	5.04	S
		Fort St. George "Arsenal" between Wellesley house and Clive's House with shells and cannons piled together near the Gateway Block IV/1-12 and 14-18	5.05	S
		Chaplain's house including portion which the northern side of the Old WallIII/1 Fort St.George	5.06	S
		Wellesley House (Built in 1798) Block No.IV/13 Fort St. George	5.09	SSW
		Victory War Memorial	5.5	S
		Prehistoric settlement site-megalithic period Pulal	11.12	WNW
		Adyar Banyan Tree	12.8	SSW
		Memorial Pillar Anna Salai	12.95	SW
17	Hills & valleys	Nil		
18	Nearest River/ Lakes/Dams	Description	Dist. (~km)	Dire.
		Periyathoppu Lake	6.06	NW
		Kadapakkam Lake	8.37	NW
		Retteri Lake/Madavaram Eri	8.91	W
		Korattur Tank	11.30	W
		Description	Dist (~km)	Dire~

		Bay of Bengal	Site is within Bay of Bengal	
		Buckingham Canal	2.17	WNW
		Kodungaiyur Canal	2.35	W
		Captain Cotton Canal	2.44	W
		Otteri Nala	3.26	SW
		Korttalaiyar/Kosisttalaiyar R	4.75	NNW
		Cooum/Kuvam R	5.07	SSW
		Ennur Creek	10.46	N
		Adyar R	11.16	SSW
		Pulal/Red Hills Lake	11.55	WNW
		Canal near Padiyanallur	14.88	WNW
19	Nearest Mangroves	Description	Dist (~km)	Dire~
		Mangroves near Tiruvottiyur	4.87km	NNW
		Mangroves near Ennur	11km	N
		Mangroves near Adyar	12.48km	SSW
20	Defence Installations	Description	Dist. (~km)	Dire.
		INS Adyar	5.23	S
21	Project cost	INR 89.62 Crore		

1.5 Project Cost

The total investment of the project is **INR 89.62 Crore**.

1.6 Scope of the study

The baseline environmental study was carried out during **Mid of Jan 2023-Mid of April 2023**.

Chapter 1: Introduction

Introductory information is presented in this Chapter. The introduction chapter provides background of the project, project proponent and describes the objective of this document. The purpose and organization of the report is also presented in this chapter.

Chapter 2: Project Description

This Chapter includes Project Description and Infrastructure Facilities delineating all the industrial and environmental aspect of the Construction and operation phase activities as well as process details of proposed products.

Chapter 3: Description of the Environment

This Chapter provides baseline environmental status of Environmental Components (Primary data) delineating meteorological details of the project site and surrounding area.

Chapter 4: Anticipated Environmental Impacts & Mitigation Measures

This Chapter presents the analysis of impacts on the environmental and social aspects of the project as a result of establishment of plan and thereby suggesting the mitigation measures.

Chapter 5: Analysis of Alternatives (Technology and Sites)

This chapter includes the justification for the selection of the project site from Environmental point of view as well as from economic point of view so that the technology will be affordable to the member units of the industrial area.

Chapter 6: Environmental Monitoring Program

This chapter will include the technical aspects of monitoring, the effectiveness of mitigation measures which will include the measurement methodologies, frequency, location, data analysis, reporting schedules etc.

Chapter 7: Additional Studies

This chapter will deal with identification of the risks due to proposed project in relation to the general public and the surrounding environment during construction and operation phases of the project and thereby presents Disaster Management Plan, Social impact assessment and R&R action plans.

Chapter 8: Project Benefits

This chapter deals with improvement in physical and social infrastructures, employment potential and other tangible benefits.

Chapter 9: Environmental Cost Benefit Analysis

It is not under our scope

Chapter 10: Environmental Management Plan

This is the key Chapter of the report and presents the mitigation plan, covers the institutional and monitoring requirements to implement environmental mitigation measures and to assess their adequacy during project implementation

Chapter 11: Summary and Conclusion

This chapter summarizes the information given in Chapters in this EIA/EMP report and the conclusion based on the environmental study, impact identification, mitigation measures and the environmental management plan.

Chapter 12

Disclosure Of Consultant

1.7 Objectives of the Study

- To ensure environmental considerations are explicitly addressed and incorporated into the development decision-making process.
- To anticipate and avoid, minimize or offset the adverse significant biophysical, social and other relevant effects of the above project proposal.
- To protect the productivity and capacity of natural systems and the ecological processes which maintain their respective functions.
- To promote development that is sustainable and optimizes resource use as well as management opportunities.
- To fully recognize the scope and requirements of the EIA and comply with the same.

1.8 Methodology adopted for the Study

The Environmental Impact Assessment (EIA) is an assessment of the possible impact, whether positive or negative, that a proposed project may have on the environment, together consisting of the natural, social and economic aspects, i.e., aiming at “Sustainable Development” due to the project activities.

Reconnaissance survey and field observations were carried out by the HECS officials and concerned persons. The field observations are used to study the existing status of the environment, to predict the positive and negative impacts of the proposed upgradation on the environment, and identification of mitigation measures (if any) and suggest EMP for the same.

1.9 Terms of Reference (ToR) Compliance

1.9.1 Additional ToR Compliance-SEAC-ToR issued at 07.03.2023

Sr. No	Additional ToR	Compliance															
1	Necessary supporting documents including land documents approval from Competent Authority for supply of fresh water, first and latest valid consents of TNPCB for the existing operation shall be furnished.	<p>The necessary documents supporting documents including land documents approval is attached as Annexure 3.</p> <p>Supply of fresh water from Competent Authority is attached as Annexure 4.</p> <p>The consents from TNPCB is obtained as Annexure 5.</p>															
2	The PP shall furnish project timeline enlisting the proposed activities in	<p>The project timeline enlisting the proposed activities has been enlisted in the below table:</p> <table border="1"> <thead> <tr> <th>Sr.No.</th> <th>Project Components</th> <th>Tentative completion</th> </tr> </thead> <tbody> <tr> <td>1.</td> <td>Administration & Centralized Control Block with Commercial Complex on the ground floor – 25m x 15m (G+2)</td> <td>August 2024</td> </tr> <tr> <td>2.</td> <td>Boat repair spare parts complex - 15m x 15m</td> <td>August 2024</td> </tr> <tr> <td>3.</td> <td>CCTV Surveillance System</td> <td>August 2024</td> </tr> <tr> <td>4.</td> <td>Cleaning, Packaging and Cold Storage Facility – 20m x 10m</td> <td>August 2024</td> </tr> </tbody> </table>	Sr.No.	Project Components	Tentative completion	1.	Administration & Centralized Control Block with Commercial Complex on the ground floor – 25m x 15m (G+2)	August 2024	2.	Boat repair spare parts complex - 15m x 15m	August 2024	3.	CCTV Surveillance System	August 2024	4.	Cleaning, Packaging and Cold Storage Facility – 20m x 10m	August 2024
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chronological order	5.	Controlled Entry and Exit Arrangements, Elevated Compound wall and 2Nos. of Arched Entrances	August 2024
	6.	Dredging	August 2024
	7.	Drinking water arrangements by RO – 5Nos. of 25LPH capacity + 2Nos. of 500LPH capacity + 2Nos. of 1000L Storage Tanks	August 2024
	8.	Electrical High Mast Lights and Street Light arrangements	August 2024
	9.	Fish Handling Shed at the Trawler Wharf – 100m x 27m	August 2024
	10.	Fish Handling Shed at the Trawler Wharf – 100m x 27m	August 2024
	11.	Overhead Tank (100KLD Capacity), Low Level Reservoir (200KLD Capacity) and Water distribution System	August 2024
	12.	Providing Two numbers of solar operated with electrical backup fish drying machine (1 Tonne capacity) including civil structure as Pilot Project	August 2024
	13.	Providing Net Mending shed at southern side	August 2024
	14.	Providing New open shed with Arabian Tent Roofing for fish cutting stalls near retail shops	August 2024
	15.	Providing rooms for stacking unsold items in the rear side of fish cutting stall	August 2024
	16.	Providing Eurocon tile flooring for retail shop portion	August 2024
	17.	Providing New open sheds with Arabian Tent roofing for prawn sale point	August 2024
	18.	Provision for improvement of internal roads and drains	August 2024
	19.	Sanitary Complex – 10m x 5m	August 2024
	20.	Solid and Liquid Waste Management (ETP & STP)	August 2024
	21.	Ship lift facility and Boat repair yard	August 2024
	22.	Truck Paved parking area facility near proposed two & four wheeler parking no 1	August 2024
	23.	Two-lane peripheral road with stormwater drain, cable truss and pedestrian path + widening/ repair of existing internal road network	August 2024
	24.	Two-wheeler/ Four-wheeler Parking Area – 16m x 45m + 44m x 35m	August 2024
	25.	Two nos. of shed over Northern Wharf, supporting with existing structure	August 2024
	26.	Two wheeler and Car Parking for administrative and commercial complex and two wheeler parking shed in the Eastern side of the Administrative and commercial complex building	August 2024
	27.	Vessel Monitoring and Control System	August 2024

3	The PP shall explore the alternate potable water resources and shall furnish feasibility study report for in-situ desalination plant	<ul style="list-style-type: none"> ➤ The fresh water requirement is 200 KLD. The source of water will be met from dedicated pipeline from CMWSSB; which is permitted for 300 KLD. ➤ Moreover, the RO Plants of capacity 25LPH & 500 LPH are to be proposed as Potable drinking water is a necessity for the users of the fishing harbour. ➤ The potable water at the harbour is primarily used in large quantities by the fishing boats (MFBs) before sailing out. On-shore fishermen, labourers, vendors, retailers and buyers also require potable water. ➤ For the storage of water, Ground Level Reservoir (GLR) and Over Head Tank (OHT) will be proposed. Therefore, In-situ desalination plant will not be feasible and required.
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4	The proposed modernisation of fishing harbour by the PP shall conform to the state-of-the-art facilities to the sellers and buyers	<table border="1"> <thead> <tr> <th>Sr.No.</th> <th>Proposed Facilities</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Ship lift facility and boat repair yard</td> <td> <p>Problems faced: Since the existing slipway complex is non-operational, there is no proper boat repair facility for Mechanized Fishing Boats as well FRP boats within the Harbour.</p> <p>State of the Art proposed:</p> <p>A state-of-the-art MFB and FRP boat repair/ boat building complex with a vessel-lifting mechanism is a must to cater to the soaring demand in this region.</p> <p>This facility is expected to reduce the maintenance downtime of the vessels thereby increasing prospects of revenue generation for fishers.</p> </td> </tr> <tr> <td>2</td> <td>Boat repair spare parts complex</td> <td> <p>State of the Art proposed:</p> <ul style="list-style-type: none"> ➤ This facility will enable fishing-boat owners and repair service providers to carry out their maintenance and repair work faster. ➤ The spare part complex will facilitate storage and selling of fishing equipment, consumables and spares for fishing crafts. </td> </tr> </tbody> </table>	Sr.No.	Proposed Facilities	Description	1	Ship lift facility and boat repair yard	<p>Problems faced: Since the existing slipway complex is non-operational, there is no proper boat repair facility for Mechanized Fishing Boats as well FRP boats within the Harbour.</p> <p>State of the Art proposed:</p> <p>A state-of-the-art MFB and FRP boat repair/ boat building complex with a vessel-lifting mechanism is a must to cater to the soaring demand in this region.</p> <p>This facility is expected to reduce the maintenance downtime of the vessels thereby increasing prospects of revenue generation for fishers.</p>	2	Boat repair spare parts complex	<p>State of the Art proposed:</p> <ul style="list-style-type: none"> ➤ This facility will enable fishing-boat owners and repair service providers to carry out their maintenance and repair work faster. ➤ The spare part complex will facilitate storage and selling of fishing equipment, consumables and spares for fishing crafts. 	
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		3	Controlled Entry and Exit Arrangements, Elevated Compound wall and 2Nos. of Arched Entrances	<p>State of the Art proposed:</p> <p>In order to maintain the safety and security of the harbour, public as well as personal properties, it is proposed to construct a compound wall 3 meters high and 1700m long all along the periphery of the Chennai Fishing Harbour.</p>	
		4	Two-lane peripheral road with stormwater drains, cable truff and a pedestrian path including widening and repair of existing road network	<p>State of the Art proposed:</p> <ul style="list-style-type: none"> ➤ It is proposed to construct a two-lane road all along the harbour compound wall inwards to facilitate seamless movement through the road. ➤ This arterial road will be interconnected with all the existing road network and provide easier access to new flagship modernization projects. ➤ The proposed peripheral road is running South – North orientation for a length of 1600m and width of 7.5m. Catering for two lanes for hassle free movement of traffic of Two wheelers, Three wheelers, and Four wheelers trucks. 	
		5	Fish Handling Shed at Trawler Wharf	<p>State of the Art proposed:</p> <ul style="list-style-type: none"> ➤ Based on the primary demand of the stakeholders, it is proposed to construct a fish handling shed with sufficient focus lighting arrangements for illumination during pre-dawn hours and CCTV cameras to ensure secure and safe operation at the trawler wharf. ➤ The shed is planned to have a prefabricated roofing with intermittent translucent roofing sheets to allow natural light during the day. ➤ Since the trawler wharf is an old structure and not designed to take the load of such shed, marine pilings with an RCC fender beam will be installed to take the load of the structure. ➤ The covered shed will shield fishermen, vendors, and labourers from the weather. 	
		6	Cleaning, Packaging and Cold Storage Facility	<p>Problems faced: During the stakeholder consultations, it was understood that there is a lack of a unified and dedicated facility for processing, packaging and storing fish catches in the fishing harbour</p>	

			<p>State of the Art proposed:</p> <ul style="list-style-type: none"> ➤ It is proposed to construct a cleaning, packaging and cold storage facility near Northern Lower Wharf with five segregated units. Similar facility with 5 additional units is planned in the Southern Fish Handling Complex. ➤ Based on the recommendations of GoTN, the proposal for 30 segregated units is reduced to 10 segregated units. ➤ This integrated facility will help local fishermen to quickly pack and freeze their catches for selling it to distant vendors or even export immediately by using chillers. ➤ This facility will help local fishermen to become global and earn a better price for their products. 	
		7	<p>Administration & Centralized control Block with Commercial Complex on the Ground Floor</p> <p>Problems faced: In order to ensure better governance and operation of the harbour, it is highly important that an administration and control block building is planned at a conspicuous place to encompass all the governing bodies.</p> <p>State of the Art proposed:</p> <ul style="list-style-type: none"> ➤ The ground floor is planned to be developed as a Commercial Complex to facilitate visitors and fishermen with diverse facilities. ➤ The commercial complex will have varied facilities, such as restaurants, shops, ATMs, groceries, fishing equipment shops, etc. to serve the basic needs of the fishing harbour. 	
		8	<p>Vessel Monitoring and Control System at the Harbour Entrance</p> <p>State of the Art proposed:</p> <ul style="list-style-type: none"> ➤ In order to monitor the movement of fishing vessels, provide a safe access channel and aid in rescue operations, it is proposed to implement a vessel monitoring and control system. ➤ The vessel monitoring system is used to provide advance warning to the fishermen and fishing boats at the harbour in the event of natural calamities, such as cyclones, Tsunamis, etc. ➤ This mechanism will also help in regulating the movement of boats during unfavourable weather conditions. The facility will help in tracking the 	

			<p>movement of fishing boats at the harbour entrance area.</p> <ul style="list-style-type: none"> ➤ An operational mechanism may be put in place to dissuade fishing boats from leaving the harbour in rough weather conditions.
		9	<p>Two-wheeler/ four-wheeler Parking Area</p> <p>State of the Art proposed:</p> <p>Two different locations will ensure organized parking of vehicles at these dedicated areas and help alleviate traffic congestions on the internal roads of the harbour.</p>
		10	<p>Electrical High Mast Lights and Street Lights arrangements</p> <p>State of the Art proposed:</p> <p>In order to facilitate safe berthing of fishing boats, ensure safe fish landing and transport operations, especially during the peak time of pre-dawn hours, it is proposed to install 6 highmast towerlights and 300 street light poles with LED fittings inside the Fishing Harbour (actually proposed area and in addition all Finger Jetty, Eastern and Northern breakwater).</p>
		11	<p>Sanitary Complex</p> <p>State of the Art proposed:</p> <ul style="list-style-type: none"> ➤ This facility will have separate arrangements for males and females. It can be accessed by a ramp as well as a staircase. ➤ Sanitary water supply will be through an overhead tank and a fixed piping arrangement. ➤ Lighting arrangements shall allow using the facility during dark hours.
		12	<p>Overhead Tank, Low-level Reservoir and Internal water distribution</p> <p>State of the Art proposed:</p> <p>A fixed supply and distribution for tap water is proposed which will be used for RO plants, supply to MFBs, sanitation, cleaning of fish catches, repair and maintenance activities, etc. it is proposed to develop an Overhead Tank (OHT) and Low-level reservoir (LLR) with a fixed piping arrangement to provide water inside the Chennai Fishing Harbour.</p>
		13	<p>Drinking water arrangements by RO</p> <p>State of the Art proposed:</p> <ul style="list-style-type: none"> ➤ The RO Plants of capacity 25LPH & 500 LPH are to be proposed as Potable drinking water is a necessity for the users of the fishing harbour.

		<ul style="list-style-type: none"> ➤ The potable water at the harbour is primarily used in large quantities by the fishing boats (MFBs) before sailing out. ➤ On-shore fishermen, labourers, vendors, retailers and buyers also require potable water. ➤ For the storage of water, Ground Level Reservoir (GLR) and Over Head Tank (OHT) will be proposed.
14	Solid and Liquid Waste Management	<p>State of the Art proposed:</p> <ul style="list-style-type: none"> ➤ All the domestic sewage facilities will be equipped by proposing STP with SBR technology of capacity 40KLD and the STP specification is attached as Annexure 6. ➤ Effluent generation from washing will be treated by proposing ETP of 80 KLD capacity and the ETP specification is attached as Annexure 7.
15	CCTV Surveillance System	<p>State of the Art proposed:</p> <ul style="list-style-type: none"> ➤ The centralized surveillance and monitoring of CCTV feed will ensure a secure environment inside the harbour. ➤ The proposed locations for CCTV cameras are harbour gates, proposed southern fish-handling complex and peripheral road, Northern and Southern breakwaters and fish-handling shed at the trawler wharf.
16	Solar Operated with Electrical Backup Fish Drying Machine	<p>State of the Art proposed:</p> <ul style="list-style-type: none"> ➤ It usually takes 3-5 days to dry the fish depending on the type of fish and weather conditions. In the process, the fish is exposed and attracts a lot of insects & flies and accumulates a lot of dust and sand while drying. ➤ The solar fish dryers are standalone structures which do not require electricity and providing electrical backup also, and which could provide high quality dried fish with no contamination.
17	Two-wheeler/ four-wheeler Parking Area – 2 Nos (22m x 16m and 22m x 4m)	<p>State of the Art proposed:</p> <ul style="list-style-type: none"> ➤ Many two-wheelers and cars belonging to the fishermen, vendors and buyers are parked at various places inside the Fishing Harbour in an unorganized

			<p>manner.</p> <ul style="list-style-type: none"> ➤ 2 nos. of proposed parking facilities viz. 22m x 16m and 22m x 4m in two locations will ensure organized parking of vehicles at these dedicated areas and help alleviate traffic congestions on the internal roads of the harbour.
		18	<p>Net Mending Shed at Southern Side</p> <p>State of the Art proposed:</p> <ul style="list-style-type: none"> ➤ The existing net mending sheds that are being utilized by the fishermen community. However, these sheds are operating at max capacity during peak days. ➤ During peak days, some fishermen mend nets directly under the Sun and at times under rain. ➤ The southern side new net mending shed construct with RCC structure with covered shed will shield fishermen, vendors, and labourers from the weather.
		19	<p>Truck Paved Two-wheeler/ four-wheeler Parking Area – 2 Nos (27m x 35m and 28m x 35m)</p> <p>State of the Art proposed:</p> <ul style="list-style-type: none"> ➤ Many two-wheelers and cars belonging to the fishermen, vendors and buyers are parked at various places inside the Fishing Harbour in an unorganized manner. ➤ 2 nos. of proposed parking facilities viz. 22m x 16m and 22m x 4m in two locations will ensure organized parking of vehicles at these dedicated areas and help alleviate traffic congestions on the internal roads of the harbour.
		20	<p>Fish Handling Shed at Trawler Wharf – 100m x 27m</p> <p>State of the Art proposed:</p> <p>Based on the primary demand of the stakeholders, it is proposed to construct a additional fish handling shed with sufficient focus lighting arrangements for illumination during pre-dawn hours and CCTV cameras to ensure secure and safe operation at the trawler wharf.</p>
		21	<p>Shed over Northern Wharf – 2 Nos</p> <p>State of the Art proposed:</p> <ul style="list-style-type: none"> ➤ In order to inspect and repair the fishing nets, fishermen use net mending sheds at different places inside the CFH to protect themselves from scorching Sunlight or rains.

			<ul style="list-style-type: none"> ➤ Fuel, ice blocks and drinking water are carried on trucks and driven to the boats for loading. ➤ The ice blocks are crushed at berth using mobile crushers which run on diesel. The crushed ice is then transferred to the boats using a chute.
		22	<p>Additional Fish Handling Shed at Trawler Wharf– 100mx 27m</p> <p>State of the Art proposed:</p> <ul style="list-style-type: none"> ➤ The Commissioner, State Fisheries GoTN, highlighted this in one of the meeting. ➤ Hence, based on the primary demand of the stakeholders, it is proposed to construct a additional fish handling shed of size 100 m X 27 m in the southern side of the already proposed shed of size 100 m X 27m with sufficient focus lighting arrangements for illumination during pre-dawn hours and CCTV cameras to ensure secure and safe operation at the trawler wharf.
		23	<p>Rooms for stacking unsold items (72m x 5m)</p> <p>State of the Art proposed:</p> <ul style="list-style-type: none"> ➤ Presently the unsold catches from retail shops are stored in temporary sheds. These temporary sheds are covered with tints sheets, AC sheet sheets with sides and roof. ➤ Presently there is no such facilities available in Chennai Fishing Harbour near retail shops. Hence, it is proposed to provide 15 to 20 rooms made of RCC roof and side covering with brick work in an area of 72 m X 5m.
		24	<p>Net Mending shed over Northern Wharf of size 80m x 5.60M</p> <p>State of the Art proposed:</p> <ul style="list-style-type: none"> ➤ It is proposed to provide Net mending shed of size 80 m X 5.6 m on Eastern side of the Eastern net mending shed matching in width with existing net mending shed such that without affecting ice loading operation. ➤ The proposed net mending shed has to be developed over the existing wharf constructed recently by state Fisheries after checking load carrying capacity of the existing Piles and beams.
5	Lead-free paints shall be used for painting	When discussed with the boat builders and the owners, regarding the type of paints being used for fishing boats, it is stated that since other paints are higher in price value, only normal lead free paints are only used of around 15-20 litres for a MFB once a year.	

	boats/docks	Moreover, all the boatowners will be instructed to use lead-free paints.												
6	Implications of construction activities on the local ecology shall be detailed	<table border="1"> <thead> <tr> <th>Impacts of proposed construction</th> <th>Mitigation Measures</th> </tr> </thead> <tbody> <tr> <td>During construction, waste will be generated which is an inert and non-biodegradable material such as concrete, plastic, metal, wood etc.</td> <td> <ul style="list-style-type: none"> ➤ All the construction waste should be sorted and stored within the site itself. ➤ The proper screen should be provided so that the waste will not scatter and pollute the sea shore and sea water. </td> </tr> <tr> <td> <ul style="list-style-type: none"> ➤ The machinery used in the construction may exceed the level and may cause vibration also. ➤ Due to excessive exposure of more noise can lead to loss of hearing and also affect the marine life. </td> <td> <ul style="list-style-type: none"> ➤ The machinery used for the construction work will be well maintained and well lubricated. ➤ Providing noise barrier or acoustic enclosures which will block the direct path of sound wave. It will reduce the level of noise. ➤ Noise shield will be used around the noise producing equipment. The noise shield will be any physical barrier which can reduce the noise level. </td> </tr> <tr> <td> <ul style="list-style-type: none"> ➤ The waste generated in the process of the construction waste thrown in the sea causing water contamination. ➤ The concrete may spill into the sea during the construction may cause the water pollution. </td> <td> <ul style="list-style-type: none"> ➤ Built erosion control blankets, sedimentation ponds and silt fences to avoid erosion of construction material to the sea. ➤ Laying debris trap close to the location will stop the debris from leaving the site. To avoid tourist disruption, the debris trap should be placed away from the shore. ➤ Ensure ground water is not contaminated by the penetration of leaches from the stockpile or waste dump. Geo textile can be used in the waste dumping area to prevent the penetration of leaches. </td> </tr> <tr> <td> <ul style="list-style-type: none"> ➤ During Construction, the transport of the fine materials like, sand, cement may cause air pollution. ➤ The smog from the vehicle can pollute the air. </td> <td> <ul style="list-style-type: none"> ➤ The vehicle and equipment used for construction should be maintained and pollution emission should check frequently and equipment should be switched off when it is not in the use. ➤ The speed of the vehicles can be restricted to 20 kmph to reduce dust emission due to movement of the vehicle. ➤ Sprinkling of water near the construction area while running the equipment may reduce the dust production </td> </tr> <tr> <td> <ul style="list-style-type: none"> ➤ The seismic operation like drilling, Pile driving, can cause noise and vibration which can temporarily affect the fish and marine ecology. ➤ Due to construction, the disturbance may cause temporary displacement of fishery resources and affect other aquatic fauna and flora. ➤ The waste from the construction can affect the </td> <td> <ul style="list-style-type: none"> ➤ Identify the sensitive area for marine life such as feeding, breeding, calving and spawning area and plan the seismic activity like pile driving, according to that to avoid the damage of the marine life and ecosystem. ➤ To avoid underwater noise generated by pile driving will be reduced by providing air bubble curtains, temporary noise attenuation piles, air filled fabric barriers. </td> </tr> </tbody> </table>	Impacts of proposed construction	Mitigation Measures	During construction, waste will be generated which is an inert and non-biodegradable material such as concrete, plastic, metal, wood etc.	<ul style="list-style-type: none"> ➤ All the construction waste should be sorted and stored within the site itself. ➤ The proper screen should be provided so that the waste will not scatter and pollute the sea shore and sea water. 	<ul style="list-style-type: none"> ➤ The machinery used in the construction may exceed the level and may cause vibration also. ➤ Due to excessive exposure of more noise can lead to loss of hearing and also affect the marine life. 	<ul style="list-style-type: none"> ➤ The machinery used for the construction work will be well maintained and well lubricated. ➤ Providing noise barrier or acoustic enclosures which will block the direct path of sound wave. 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During construction, waste will be generated which is an inert and non-biodegradable material such as concrete, plastic, metal, wood etc.	<ul style="list-style-type: none"> ➤ All the construction waste should be sorted and stored within the site itself. ➤ The proper screen should be provided so that the waste will not scatter and pollute the sea shore and sea water. 													
<ul style="list-style-type: none"> ➤ The machinery used in the construction may exceed the level and may cause vibration also. ➤ Due to excessive exposure of more noise can lead to loss of hearing and also affect the marine life. 	<ul style="list-style-type: none"> ➤ The machinery used for the construction work will be well maintained and well lubricated. ➤ Providing noise barrier or acoustic enclosures which will block the direct path of sound wave. It will reduce the level of noise. ➤ Noise shield will be used around the noise producing equipment. The noise shield will be any physical barrier which can reduce the noise level. 													
<ul style="list-style-type: none"> ➤ The waste generated in the process of the construction waste thrown in the sea causing water contamination. ➤ The concrete may spill into the sea during the construction may cause the water pollution. 	<ul style="list-style-type: none"> ➤ Built erosion control blankets, sedimentation ponds and silt fences to avoid erosion of construction material to the sea. ➤ Laying debris trap close to the location will stop the debris from leaving the site. To avoid tourist disruption, the debris trap should be placed away from the shore. ➤ Ensure ground water is not contaminated by the penetration of leaches from the stockpile or waste dump. Geo textile can be used in the waste dumping area to prevent the penetration of leaches. 													
<ul style="list-style-type: none"> ➤ During Construction, the transport of the fine materials like, sand, cement may cause air pollution. ➤ The smog from the vehicle can pollute the air. 	<ul style="list-style-type: none"> ➤ The vehicle and equipment used for construction should be maintained and pollution emission should check frequently and equipment should be switched off when it is not in the use. ➤ The speed of the vehicles can be restricted to 20 kmph to reduce dust emission due to movement of the vehicle. ➤ Sprinkling of water near the construction area while running the equipment may reduce the dust production 													
<ul style="list-style-type: none"> ➤ The seismic operation like drilling, Pile driving, can cause noise and vibration which can temporarily affect the fish and marine ecology. ➤ Due to construction, the disturbance may cause temporary displacement of fishery resources and affect other aquatic fauna and flora. ➤ The waste from the construction can affect the 	<ul style="list-style-type: none"> ➤ Identify the sensitive area for marine life such as feeding, breeding, calving and spawning area and plan the seismic activity like pile driving, according to that to avoid the damage of the marine life and ecosystem. ➤ To avoid underwater noise generated by pile driving will be reduced by providing air bubble curtains, temporary noise attenuation piles, air filled fabric barriers. 													

			<p>marine water</p> <ul style="list-style-type: none"> ➤ If a marine life mammals are sighted within 500m of the proposed construction site, the work will be stopped until it move away. ➤ The disposal to the marine will be maintained as per the standards 													
			<ul style="list-style-type: none"> ➤ When the structure is opened to tourism, a proper solid waste management should be maintained by providing Dust bins in required distance. ➤ A proper screening system can be done for avoiding plastic in to the bridge covering the sea area. ➤ The waste collected is disposed as per the municipal solid waste management 	<p>Solid waste shall be segregated as hazardous waste, municipal waste and disposed as per the municipal solid waste criteria.</p>												
7	The PP shall furnish detailed plan for providing solar Panels as alternate source of energy	<p>All the lights and other decorative luminaries can utilise the solar energy. Solar panel will be installed at the roof of the shades with proper cleaning system.</p> <p>The alternative energy will be equipped from Solar panels which will be installed on the roof of the Adminstrative Complex for all the lightings around the project site.</p>	<table border="1"> <thead> <tr> <th>Description</th> <th>Quantity</th> </tr> </thead> <tbody> <tr> <td>Total Roof Area of the Adminstrative Complex (Sq.m)</td> <td>187 Sq.m</td> </tr> <tr> <td>Sq.m/ 1KW</td> <td>10</td> </tr> <tr> <td>KW</td> <td>18.70</td> </tr> <tr> <td>Sun hour/day</td> <td>5</td> </tr> <tr> <td>Average units/day</td> <td>93.5</td> </tr> </tbody> </table>	Description	Quantity	Total Roof Area of the Adminstrative Complex (Sq.m)	187 Sq.m	Sq.m/ 1KW	10	KW	18.70	Sun hour/day	5	Average units/day	93.5	
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8	PP shall detail environment priorities of fishing port, environment policy of the port, environment management cell available at the port and eco-friendly port assessment model.	<p>The environmental priorities of fishing port are given below:</p> <ul style="list-style-type: none"> ➤ Enhance and maintain the Environmental Management System (EMS), consistent with its activities, services and environment impacts that include planning and setting EMS objectives and targets. ➤ Risk Assessment techniques will be implemented and followed. ➤ All the preventive and mitigation measures will be taken to control the pollution created by the Port activities. ➤ Environmental Management System will be implemented in the proper disposal and treated waste materials. ➤ Continuous improvement of environment management system and its performance.
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சென்னை துறைமுகம்
PORT OF CHENNAI
पोर्ट अन्ना चेन्नई

CHENNAI PORT AUTHORITY

ENVIRONMENTAL POLICY

Chennai Port Authority (ChPA) recognizes the environmental, social and economic importance for operating all port activities in an environmentally sustainable and responsible manner. Chennai Port Authority is committed to achieve a high-level environmental performance ensuring continual improvement.

To achieve environmental performance consistent with this policy, ChPA will

- Develop and maintain an Environmental Management System (EMS), consistent with its activities, services and environmental impacts, that includes planning and setting EMS objectives and targets, implementation and operation, monitoring performance, review and continual improvement.
- Implement risk management techniques (including environmental risk and opportunities methods) to assess impacts of ChPA's activities, introducing appropriate mitigation measures.
- Comply with all applicable environmental laws, regulation, policies and standards which relate to its activities and services in a transparent manner.
- Seek to prevent: Minimize the pollution resulting from port activities and services.
- Communicate this policy and ChPA's progress in meeting the objectives and targets defined in its Environmental Management System, to concerned interested parties, including employees and stakeholders.
- Implement the Environmental Management System for reduction in generation of waste, consumption of natural resources like water, energy, etc., safe disposal of waste, waste usage wherever possible, usage of treated water and to rely on renewable sources of energy.
- Continually improve its Environmental Management and Environmental Performance through providing sufficient resources and training to achieve the targets defined in its Environmental Management System.

For the effective implementation of this policy all the interested parties the officers, employees, lessees, licensees, service providers, other persons and those otherwise engaged at the workplace are responsible and expected to reasonably comply with requirements of this policy.

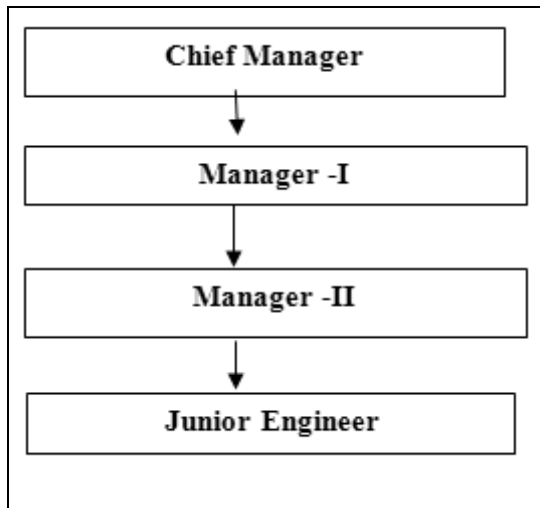
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CHAIRMAN

DATE: 07.02.2023

Environmental Policy of ChPA

Environmental Management Cell of ChPA:



1. Chief Manager

- The chief manager has to lead the whole team and totally responsible for the Environment and safety of the port.
- He will provide strategic vision and plan in the implementation of various environmental and security initiatives of the port.
- Responsible for improving the ports environmental compliance including implementation management of various environmental and security plans.
- Environmental project permitting sustainability and environmental policy development and implementation.
- He is responsible for developing environmental management and monitoring plans.
- Encourage the integration of appropriate environmental management considerations into decision making processes there by preventing or minimizing the potential for environmental harm.
- Provide framework for continually improving environmental performance of the organization and communicate the same to TCPCB/CPCB and MoEF.
- He has to represent the port in local state and federal agency meetings.
- Implementation of IOS 14001-2004 standards in Chennai port co-ordination with external surveillance authors. Incorporation of suggestions in the manual and implementation of the same.

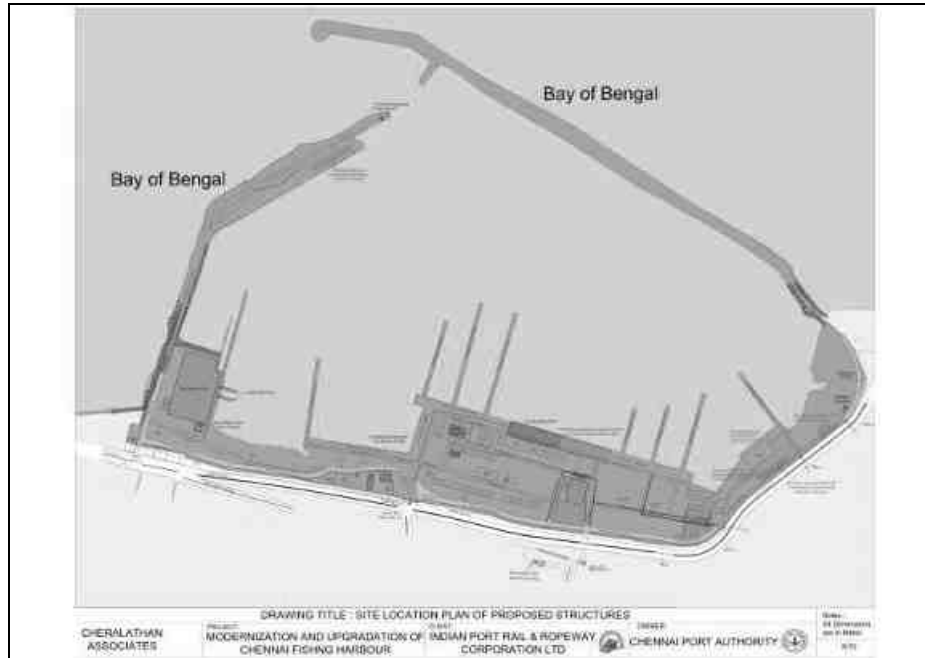
- To comply with all legal social and community obligations etc.
- Monitoring of periodical returns and consent every month.
- 2. Manager - I**
- The manager is responsible for safety, operations and industrial health in all parts of the port.
- He has to take all safety measures to prevent accidents on the road, wharf and anywhere inside the port and to minimize the occupational risk.
- To ensure all port workers adhere to the safety norms and wear personal equipment while working in the operational area.
- He has taken care of marine oil pollution, workshop waste etc. and take all remedial measures for the safe disposal of the above pollutants as directed by TNPCB/MoEF.
- To implement the Disaster management plan for the entire port.
- Conducting awareness training programme on environmental, safety and industrial health in Chennai port.
- submission of periodical reports to TNPCB and Administration every month.
- 3. Manager - II**
- The manager is responsible for getting project clearances under EIA/CRZ notification.
- Preparation of EIA/EMP report as per standard TOR.
- Conducting public hearings whenever required.
- Represent the port in local state and federal agency meetings.
- He has to get consent approval for establishment under Air and Water Act.
- Compliance of clearance conditions during construction stage.
- Development of green belt, dust suppression system etc. to reduce the adverse pollutant parameters in consultation with SE(Plantation Cell).
- Wastewater management and disposal plan.
- Distribution of pamphlets and display of message boards on Environmental Management.
- Conducting awareness training programme on control of pollution in port.

		<ul style="list-style-type: none"> ➤ To comply with all legal social and community obligations etc. <p>4. Junior Engineer</p> <ul style="list-style-type: none"> ➤ Marine oil spill response and disposal. ➤ Project clearance under EIA/CRZ notifications ➤ Preparing EIA/EMP as per ToR. ➤ Development of green belt, dust suppression system etc. to reduce the adverse pollutant parameters. ➤ To comply with all legal, social and community obligations etc. ➤ Prepare the periodical reports and sent to the Administration every month. ➤ Keep the records up to date
9	<p>The proponent shall submit the feasibility report by involving the reputed research institutions such as Ocean Mining & Deep sea Mining Technology Division ,NIOT/Chennai, Dept of Ocean Engineerin</p>	<p>In the proposed project activity , there is no removal of of the longstanding and existing breakwater mound; It is not the part of the project proposal ; therefore the studies are not applicable.</p>

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materials,
Cost-
Benefit
analysis
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environme
nt impacts
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excavation
and
checking
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bility
studied by
reputed
institutions
like the
Central

	Water and Power Research Station (CWPRS), Pune	
10	The proponent should ensure that the boats are properly maintained and there is no oil spillage. Used oil disposal details shall be furnished.	<p>The proponent will ensure that the boats are properly maintained and there is no oil spillage.</p> <p>The used Engine oils will be reused in their boats for other purposes like spraying on the engines and other machinery parts to avoid rust and the remaining oil has been sold out by the boat owners, which are being taken out by the purchaser from Chennai Fishing Harbour for secondary purposes.</p> <p>Oil Spill Management Plan is attached as Annexure 8.</p>

11 The proponent should prepare a comprehensive line diagram in which all the facilities to be created should be marked. Then for each facility the probable effluent generation and waste generation should be indicated with quantity and quality. Finally, methodology for collection, treatment, and reuse/disposal of the liquid and solid waste should be indicated.



Comprehensive Line Diagram with all the facilities

The methodology of ETP has been detailed in its specification and it is attached as **Annexure 7**. There will not be any sort of marine discharges from the proposed activity.

	Specific attention should be paid to the marine discharges.																																																																																																																																																																		
12	Within 10km radius all the parameters like air, sediment and biology including coastal ecology should be studied in detail.	<p>The parameters like air, sediment and biology which includes coastal ecology are studied within the 10km radius.</p> <p>Air Environment :</p> <table border="1"> <thead> <tr> <th rowspan="3">Parameters</th> <th rowspan="3">Conc.</th> <th rowspan="3">NAAQ Standards</th> <th colspan="8">Locations</th> </tr> <tr> <th>Project Site</th> <th>Tiruvottiyur</th> <th>Royapuram</th> <th>George Town</th> <th>Veysarpadi</th> <th>Tondiarpet</th> <th>Kodangiyur</th> <th>Chinna Sekkadu</th> </tr> <tr> <th>AAQ1</th> <th>AAQ2</th> <th>AAQ3</th> <th>AAQ4</th> <th>AAQ5</th> <th>AAQ6</th> <th>AAQ7</th> <th>AAQ8</th> </tr> </thead> <tbody> <tr> <td rowspan="4">PM10 Conc. (µg/m³)</td> <td>Min.</td> <td rowspan="4">100 (24 Hours)</td> <td>44.98</td> <td>35.55</td> <td>38.04</td> <td>39.09</td> <td>40.28</td> <td>39.73</td> <td>40.57</td> <td>39.69</td> </tr> <tr> <td>Max.</td> <td>64.11</td> <td>50.66</td> <td>54.22</td> <td>55.72</td> <td>57.41</td> <td>56.62</td> <td>57.82</td> <td>56.56</td> </tr> <tr> <td>Avg.</td> <td>53.94</td> <td>42.63</td> <td>45.62</td> <td>46.88</td> <td>48.31</td> <td>47.64</td> <td>48.66</td> <td>47.59</td> </tr> <tr> <td>98th 'tile</td> <td>63.73</td> <td>50.36</td> <td>53.90</td> <td>55.39</td> <td>57.07</td> <td>56.29</td> <td>57.49</td> <td>56.23</td> </tr> <tr> <td rowspan="4">PM2.5 Conc. (µg/m³)</td> <td>Min.</td> <td rowspan="4">60 (24 Hours)</td> <td>26.99</td> <td>21.33</td> <td>22.83</td> <td>23.46</td> <td>24.17</td> <td>23.84</td> <td>24.34</td> <td>23.81</td> </tr> <tr> <td>Max.</td> <td>38.46</td> <td>30.39</td> <td>32.53</td> <td>33.43</td> <td>34.44</td> <td>33.97</td> <td>34.69</td> <td>33.94</td> </tr> <tr> <td>Avg.</td> <td>32.37</td> <td>25.58</td> <td>27.38</td> <td>28.13</td> <td>28.99</td> <td>28.59</td> <td>29.20</td> <td>28.56</td> </tr> <tr> <td>98th 'tile</td> <td>38.24</td> <td>30.22</td> <td>32.34</td> <td>33.24</td> <td>34.24</td> <td>33.78</td> <td>34.49</td> <td>33.74</td> </tr> <tr> <td rowspan="4">SO2 Conc. (µg/m³)</td> <td>Min.</td> <td rowspan="4">80 (24 Hours)</td> <td>6.91</td> <td>6.86</td> <td>6.88</td> <td>6.53</td> <td>6.42</td> <td>6.40</td> <td>6.88</td> <td>6.82</td> </tr> <tr> <td>Max.</td> <td>9.85</td> <td>9.77</td> <td>9.81</td> <td>9.31</td> <td>9.15</td> <td>9.13</td> <td>9.81</td> <td>9.72</td> </tr> <tr> <td>Avg.</td> <td>8.30</td> <td>8.23</td> <td>8.26</td> <td>7.84</td> <td>7.71</td> <td>7.69</td> <td>8.26</td> <td>8.19</td> </tr> <tr> <td>98th 'tile</td> <td>9.80</td> <td>9.71</td> <td>9.75</td> <td>9.25</td> <td>9.10</td> <td>9.07</td> <td>9.75</td> <td>9.67</td> </tr> <tr> <td rowspan="2">NO2 Conc.</td> <td>Min.</td> <td rowspan="2">80 (24 Hours)</td> <td>13.83</td> <td>13.70</td> <td>13.68</td> <td>12.96</td> <td>12.76</td> <td>12.71</td> <td>13.68</td> <td>13.57</td> </tr> <tr> <td>Max.</td> <td>19.71</td> <td>19.53</td> <td>19.81</td> <td>18.47</td> <td>18.19</td> <td>18.11</td> <td>19.50</td> <td>19.33</td> </tr> </tbody> </table>	Parameters	Conc.	NAAQ Standards	Locations								Project Site	Tiruvottiyur	Royapuram	George Town	Veysarpadi	Tondiarpet	Kodangiyur	Chinna Sekkadu	AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7	AAQ8	PM10 Conc. (µg/m ³)	Min.	100 (24 Hours)	44.98	35.55	38.04	39.09	40.28	39.73	40.57	39.69	Max.	64.11	50.66	54.22	55.72	57.41	56.62	57.82	56.56	Avg.	53.94	42.63	45.62	46.88	48.31	47.64	48.66	47.59	98th 'tile	63.73	50.36	53.90	55.39	57.07	56.29	57.49	56.23	PM2.5 Conc. (µg/m ³)	Min.	60 (24 Hours)	26.99	21.33	22.83	23.46	24.17	23.84	24.34	23.81	Max.	38.46	30.39	32.53	33.43	34.44	33.97	34.69	33.94	Avg.	32.37	25.58	27.38	28.13	28.99	28.59	29.20	28.56	98th 'tile	38.24	30.22	32.34	33.24	34.24	33.78	34.49	33.74	SO2 Conc. (µg/m ³)	Min.	80 (24 Hours)	6.91	6.86	6.88	6.53	6.42	6.40	6.88	6.82	Max.	9.85	9.77	9.81	9.31	9.15	9.13	9.81	9.72	Avg.	8.30	8.23	8.26	7.84	7.71	7.69	8.26	8.19	98th 'tile	9.80	9.71	9.75	9.25	9.10	9.07	9.75	9.67	NO2 Conc.	Min.	80 (24 Hours)	13.83	13.70	13.68	12.96	12.76	12.71	13.68	13.57	Max.	19.71	19.53	19.81	18.47	18.19	18.11	19.50	19.33
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Pb (µg/m³)	Avg.	1 (24 hour)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)
CO (mg/m³)	Avg.	4 (1hour)	0.54	0.43	0.46	0.47	0.48	0.48	0.49	0.48
Ozone(O₃), µg/m³	Avg.	180 (1hour)	10.4	10.60	10.30	10.80	10.20	10.11	10.23	10.40
Benzene, µg/m³	Avg.	5	BLQ (LOQ 1)	BLQ (LOQ 1)	BLQ (LOQ 1)	BLQ (LOQ 1)	BLQ (LOQ 1)	BLQ (LOQ 1)	BLQ (LOQ 1)	BLQ (LOQ 1)
Benzo (a) pyrene, ng/m³	Avg.	1 (Annual)	BLQ (LOQ 1)	BLQ (LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ (LOQ 1)	BLQ(LOQ 1)
As (ng/ m³)	Avg.	6(Annual)	BLQ (LOQ 2)	BLQ (LOQ 2)	BLQ (LOQ 2)	BLQ (LOQ 2)	BLQ (LOQ 2)	BLQ (LOQ 2)	BLQ (LOQ 2)	BLQ (LOQ 2)
Ni (ng/m³)	Avg.	20(Annua l)	BLQ (LOQ 10)	BLQ (LOQ 10)	BLQ (LOQ 10)	BLQ (LOQ 10)	BLQ (LOQ 10)	BLQ (LOQ 10)	BLQ (LOQ 10)	BLQ (LOQ 10)
NH₃ (µg/m³)	Avg.	400 (24hours)	BLQ(LOQ5)	BLQ(LOQ5)	BLQ(LOQ5)	BLQ(LOQ5)	BLQ(LOQ5)	BLQ(LOQ5)	BLQ(LOQ5)	BLQ(LOQ5)

Note: BLQ (Below Limit of Quantification); LOQ (Limit of Quantification)

Noise Environment

S. No	Location	Location Code	Distance (~km) from Project boundary	Direction	Noise level in dB(A) Leq		CPCB Standard		Environmental Setting
					Day	Night	Lday (Ld)	LNight (Ln)	
1.	Project Site	N1	Within the Site		50.5	43.4	75	70	Industrial
2.	Tiruvottiyur	N2	3.16	N	52.3	44.7	55	45	Residential
3.	Royapuram	N3	0.37	S	51.7	43.3	55	45	Residential

4.	George Town	N4	3.16	SSW	52.3	42.8	55	45	Residential
5.	Veysarpadi	N5	3.96	WSW	54.8	44.3	55	45	Residential
6.	Tondiarpet	N6	0.44	W	53.2	42.2	55	45	Residential
7.	Kodangiur	N7	4.16	W	54.6	41.5	55	45	Residential
8.	Chinna Sekkadu	N8	4.88	NW	53.6	40.2	55	45	Residential

Surface Water Environment:

Para meter	Unit	Surface water standards (IS 2296 Class-A)	Marine sample near project site	Adyar River d/s	Adyar River u/s	Buckingham Canal d/s	Cooum River u/s	Buckingham Canal u/s	Otteri Nala	Cooum River d/s
			SW1	SW 2	SW 3	SW 4	SW 5	SW 6	SW 7	SW 8
pH (at 25°C)	--	6.5-8.5	8.17	6.78	7.23	6.69	7.42	7.47	7.58	6.90
Electri cal Condu ctivity	µS/cm	-	52008	14797	4305	40314	39369	33087	2817	43350
Total Dissol ved Solids	mg/l	500	30233	8729	2336	23670	23135	19635	1576	26450
Total Suspe nded Solids	mg/l	-	19	48	41	38	46	29	25	52
Total Alkali nity as CaCO 3	mg/l	-	436.9	327.4	278.9	367.5	334.5	307.8	231.9	389.5
Total Hardn ess as CaCO 3	mg/l	300	5503.8	1563.8	574.7	4306.0	4209.3	3569.7	297.0	4813.0
Sodiu m as Na	mg/l	-	8924	2535	618	6982	6825	5788	481	7804
Potass	mg/l	-	398	113	27	311	304	258	21	348

ium as K										
Calcium as Ca	mg/l	-	1249.4	355.0	130.5	977.5	955.5	810.3	67.4	1092.6
Magnesium as Mg	mg/l	-	578.4	164.3	60.4	452.5	442.4	375.2	31.2	505.8
Chloride as Cl	mg/l	250	13280.0	3773.3	920.0	10390.0	10156.7	8613.3	574.1	11613.3
Sulphate as SO ₄	mg/l	400	5511.2	1565.9	381.8	4311.9	4215.0	3574.5	238.2	4819.5
Nitrate as NO ₃	mg/l	20	2.8	5.1	4.0	3.8	6.0	3.7	3.4	4.4
Fluorides as F	mg/l	1.5	0.87	0.52	0.45	0.63	0.71	0.64	0.41	0.69
Cyanide	mg/l	0.05	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)
Arsenic	mg/l	0.05	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)
Boron as B	mg/l	-	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)
Cadmium as Cd	mg/l	0.01	BLQ(LOQ 0.001)	BLQ(LOQ 0.001)	BLQ(LOQ 0.001)	BLQ(LOQ 0.001)	BLQ(LOQ 0.001)	BLQ(LOQ 0.001)	BLQ(LOQ 0.001)	BLQ(LOQ 0.001)
Chromium, Total	mg/l	0.05	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)
Copper as Cu	mg/l	1.5	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)
Lead as Pb	mg/l	0.1	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)
Manganese as Mn	mg/l	0.5	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)
Mercury	mg/l	0.001	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)
Nickel as Ni	mg/l	-	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)

Selenium as Se	mg/l	0.01	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)
Dissolved Oxygen	mg/l	6	6.5	5.7	5.9	5.5	5.2	5.9	5.7	5.1
Chemical Oxygen Demand as O ₂	mg/l	-	16.0	68.0	50.0	80.0	98.0	62.0	54.0	112.0
BOD, 3 days @ 27°C as O ₂	mg/l	2	2.0	12.0	8.0	12.0	16.0	10.0	8.0	17.0

Ground water Environment

Sl. No	Parameters	Unit	Drinking water Standard (IS 10500 : 2012) Permissible Limit	Drinking water Standard (IS 10500 : 2012) Acceptable Limit	Near Project Site	Tiruvottiyur	Royapuram	George Town	Veysarpadi	Tondi arpet	Kodangiyur	Chinna Sekkadu
					GW1	GW2	GW3	GW4	GW5	GW6	GW7	GW8
1.	Colour	Hazen	15	5	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)
2.	Turbidity	NTU	5	1	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)
3.	pH	--	NR	6.5-	7.98	7.6	7.37	7.96	7.8	7.75	7.41	7.83

				8.5								
4.	Conductivity	µS/cm	-	-	2098	1887	1675	1732	1427	1526	1843	1478
5.	Total Dissolve Solids	mg/l	2000	500	1166	1040	911	934	802	835	1018	812
6.	Total Suspended Solids		-	-	BLQ(LO Q 1)	BLQ(LOQ 1)	BLQ(LO Q 1)	BLQ(LO Q 1)	BLQ(LO Q 1)	BLQ(LOQ 1)	BLQ(LO Q 1)	BLQ(LOQ 1)
7.	Alkalinity as CaCO ₃	mg/l	600	200	301	269	234	241	198	215	261	209
8.	Total Hardness as CaCO ₃	mg/l	600	200	478	427	372	390	315	348	415	338
9.	Sodium as Na	mg/l	-	-	221	197	172	177	178	157	191	153
10.	Potassium as K	mg/l	-	-	15	14	12	10	7	8	13	7
11.	Calcium as Ca	mg/l	200	75	108.6	96.9	84.5	88.5	71.5	79.0	94.1	76.7
12.	Magnesium as Mg	mg/l	100	30	50.3	44.9	39.1	41.0	33.1	36.6	43.6	35.5
13.	Chloride as Cl	mg/l	1000	250	395.0	352.5	307.5	316.0	260.0	282.0	342.5	274.0
14.	Sulphate SO ₄	mg/l	400	200	163.9	146.3	127.6	131.1	107.9	117.0	142.1	113.7
15.	Nitrate as NO ₃	mg/l	NR	45	4.3	6.5	7.8	4.8	5.5	6.2	7.1	5.4
16.	Fluorides as F		1.5	1	0.48	0.46	0.44	0.43	0.41	0.40	0.45	0.42
17.	Cyanide	mg/l	NR	0.05	BLQ(LO Q 0.01)	BLQ(LOQ 0.01)	BLQ(LO Q 0.01)	BLQ(LO Q 0.01)	BLQ(LO Q 0.01)	BLQ(LOQ 0.01)	BLQ(LO Q 0.01)	BLQ(LOQ 0.01)
18.	Arsenic as As	mg/l	0.05	0.01	BLQ(LO Q 0.005)	BLQ(LOQ 0.005)	BLQ(LO Q 0.005)	BLQ(LO Q 0.005)	BLQ(LO Q 0.005)	BLQ(LOQ 0.005)	BLQ(LO Q 0.005)	BLQ(LOQ 0.005)
19.	Boron as B	mg/l	1.0	0.5	BQL(LO Q 0.1)	BQL(LOQ 0.1)	BQL(LO Q 0.1)	BQL(LO Q 0.1)	BQL(LO Q 0.1)	BQL(LOQ 0.1)	BQL(LO Q 0.1)	BQL(LOQ 0.1)
20.	Cadmium as Cd	mg/l	NR	0.003	BQL(LO Q 0.001)	BQL(LOQ 0.001)	BQL(LO Q 0.001)	BQL(LO Q 0.001)	BQL(LO Q 0.001)	BQL(LOQ 0.001)	BQL(LO Q 0.001)	BQL(LOQ 0.001)

21.	Chromium as Cr	mg /l	NR	0.05	BQL(LO Q 0.01)	BQL(LOQ 0.01)	BQL(LO Q 0.01)	BQL(LO Q 0.01)	BQL(LO Q 0.01)	BQL(LOQ 0.01)	BQL(LO Q 0.01)	BQL(LOQ 0.01)
22.	Copper as Cu	mg /l	1.5	0.05	BLQ(LO Q 0.01)	BLQ(LOQ 0.01)	BLQ(LO Q 0.01)	BLQ(LO Q 0.01)	BLQ(LO Q 0.01)	BLQ(LOQ 0.01)	BLQ(LO Q 0.01)	BLQ(LOQ 0.01)
23.	Lead as Pb	mg /l	NR	0.01	BLQ(LO Q 0.005)	BLQ(LOQ 0.005)	BLQ(LO Q 0.005)	BLQ(LO Q 0.005)	BLQ(LO Q 0.005)	BLQ(LOQ 0.005)	BLQ(LO Q 0.005)	BLQ(LOQ 0.005)
24.	Manganese as Mn	mg /l	0.3	0.1	BLQ(LO Q 0.05)	BLQ(LOQ 0.05)	BLQ(LO Q 0.05)	BLQ(LO Q 0.05)	BLQ(LO Q 0.05)	BLQ(LOQ 0.05)	BLQ(LO Q 0.05)	BLQ(LOQ 0.05)
25.	Mercury	mg /l	NR	0.001	BLQ(LO Q 0.0005)	BLQ(LOQ 0.0005)	BLQ(LO Q 0.0005)	BLQ(LO Q 0.0005)	BLQ(LO Q 0.0005)	BLQ(LOQ 0.0005)	BLQ(LO Q 0.0005)	BLQ(LOQ 0.0005)
26.	Nickel as Ni	mg /l	NR	0.02	BLQ(LO Q 0.01)	BLQ(LOQ 0.01)	BLQ(LO Q 0.01)	BLQ(LO Q 0.01)	BLQ(LO Q 0.01)	BLQ(LOQ 0.01)	BLQ(LO Q 0.01)	BLQ(LOQ 0.01)
27.	Selenium as Se	mg /l	NR	0.01	BLQ(LO Q 0.005)	BLQ(LOQ 0.005)	BLQ(LO Q 0.005)	BLQ(LO Q 0.005)	BLQ(LO Q 0.005)	BLQ(LOQ 0.005)	BLQ(LO Q 0.005)	BLQ(LOQ 0.005)
28.	Zinc as Zn	mg /l	15	5	BLQ(LO Q 0.1)	BLQ(LOQ 0.1)	BLQ(LO Q 0.1)	BLQ(LO Q 0.1)	BLQ(LO Q 0.1)	BLQ(LOQ 0.1)	BLQ(LO Q 0.1)	BLQ(LOQ 0.1)

Soil Environment

S.No	Parameters	Units	Project Site	Tiruvottiyu r	Royapuram	George Town	Veysarpadi	Tondiarpet	Kodangiyur	Chinna Sekkadu
			S1	S2	S3	S4	S5	S6	S7	S8
1.	Soil Texture	-	Sandy Clay	Clay loam	Sandy Clay	Clay loam	Sandy Clay	Clay loam	Sandy Clay loam	Clay loam
2.	Sand	%	45.2	35.4	46.2	33.1	46.5	32.7	45.6	33.4
3.	Silt	%	19.4	26.6	17.4	29.9	18.3	30.8	20.2	31.2
4.	Clay	%	35.4	38.0	36.4	37.0	35.2	36.5	34.2	35.4
5.	pH	-	7.52	7.32	7.54	7.10	7.12	7.12	7.43	6.12
6.	Electrical conductivity	µS/cm	175	157	143	168	136	129	186	182
7.	Nitrogen as N	mg/kg	120.2	115.3	110.6	115.8	120.7	95.4	98.6	105.2

8.	Phosphorus	mg/kg	5.83	5.16	4.93	5.16	5.38	4.26	4.39	4.71
9.	Potassium	mg/kg	75.25	69.82	66.79	69.82	72.86	57.68	59.50	63.75
10.	Boron	mg/kg	BLQ(LOQ0.1)	BLQ(LOQ0.1)	BLQ(LOQ0.1)	BLQ(LOQ0.1)	BLQ(LOQ0.1)	BLQ(LOQ0.1)	BLQ(LOQ0.1)	BLQ(LOQ0.1)
11.	Cadmium	mg/kg	BLQ(LOQ0.1)	BLQ(LOQ0.1)	BLQ(LOQ0.1)	BLQ(LOQ0.1)	BLQ(LOQ0.1)	BLQ(LOQ0.1)	BLQ(LOQ0.1)	BLQ(LOQ0.1)
12.	Chromium	mg/kg	BLQ(LOQ0.1)	BLQ(LOQ0.1)	BLQ(LOQ0.1)	BLQ(LOQ0.1)	BLQ(LOQ0.1)	BLQ(LOQ0.1)	BLQ(LOQ0.1)	BLQ(LOQ0.1)
13.	Porosity	-	0.42	0.75	0.42	0.73	0.42	0.74	0.42	0.71
14.	Water holding Capacity	%	15.80	17.80	15.80	17.60	16.20	17.70	19.80	18.00

Biological Environment:

Flora Study

The assessment of the flora of the study area is done by extensive secondary source information of the area of 10 km radius.

Plants species were documented based on their habit characters of family, genus and species using available floral, other related literature.

Besides the identification of plant species, information was collected on the vernacular names and uses of plants made by local inhabitants.

Floristic Composition within the study area

The ecology and diversity assessed within the 10 km radius in the study area. It is observed that human settlements present in and surround the project site and within the study area of 10 km radius and many of construction building area/ colonies have very low level of plantations.

There were total 53 species and 25 genera under 25 family found in the study area. The study area does not have any forest land or permanent natural vegetation and the main land use feature of the study area is comprised habitation and cultivating lands. From the primary observation, the tree species recorded in the plantation area were *Cocos nucifera*, *Azadirachta indica*, *Ficus benghalensis*, *Mangifera indica*, *Musa paradise* were found.

Rare and endangered Floral species

During the vegetation documentation for the study area recorded any such species which are endangered or threatened under IUCN (International Union for Conservation of Nature and Natural resources) guidelines found in the Indian Biodiversity Portal.

S.No	Scientific name	Family	Habit	Venacular Name	IUCN status
1	<i>Abutilon indicum</i>	Malvaceae	Shrub	Thuthi	NA
2	<i>Acalypha indica</i>	Euphorbiaceae	Herb	Kuppaimeni	NA
3	<i>Acanthospermum hispidum</i>	Asteraceae	Herb	Kombu mull	NA

4	<i>Aerva persica</i>	Amaranthaceae	Shrub	Perumpulai	NA
5	<i>Aristida setacea</i>	Poaceae	Herb	—	NA
6	<i>Atriplex repens</i>	Chenopodiaceae	Herb	—	NA
7	<i>Azadirachta indica</i>	Meliaceae	Tree	Veppamaram	NA
8	<i>Boerhavia diffusa</i>	Nyctaginaceae	Herb	Mukurattai	NA
9	<i>Borassus flabellifer</i>	Arecaceae	Tree	Panaimaram	NA
10	<i>Bulbostylis barbata</i>	Cyperaceae	Herb	—	NA
11	<i>Calotropis gigantea</i>	Asclepiadaceae	Shrub	Erukku	NA
12	<i>Canavalia cathartica</i>	Fabaceae	Climber	—	NA
13	<i>Canavalia rosea</i>	Fabaceae	Climber	—	NA
14	<i>Cassia italica</i>	Caesalpiniaceae	Herb	Nilavahai	NA
15	<i>Casuarina litorea</i>	Casuarinaceae	Tree	Chavuku	NA
16	<i>Catharanthus roseus</i>	Apocynaceae	Herb	Nithyakalyani	NA
17	<i>Cenchrus ciliaris</i>	Poaceae	Herb	Kolukattai	NA
18	<i>Citrullus colocynthis</i>	Cucurbitaceae	Herb	Peykkumatti	NA
19	<i>Cocos nucifera</i>	Arecaceae	Tree	Thennaiaram	NA
20	<i>Croton bonplandianus</i>	Euphorbiaceae	Herb	Mannannaichedi	NA
21	<i>Datura metel</i>	Solanaceae	Herb	Oomathai	NA
22	<i>Euphorbia hirta</i>	Euphorbiaceae	Herb	Amampatchaiarisi	NA
23	<i>Euphorbia tortilis</i>	Euphorbiaceae	Shrub	Tirukukalli	NA
24	<i>Fimbristylis cymosa</i>	Cyperaceae	Herb	—	NA
25	<i>Gisekia pharnaceoides</i>	Aizoaceae	Herb	Manalkeerai	NA
26	<i>Gomphrena serrata</i>	Amaranthaceae	Herb	—	NA
27	<i>Hibiscus tiliaceus</i>	Malvaceae	Tree	Neerparuthi	LC
28	<i>Launaea intybacea</i>	Asteraceae	Herb	—	NA
29	<i>Launaea sarmentosa</i>	Asteraceae	Herb	—	NA
30	<i>Leucas aspera</i>	Lamiaceae	Herb	Thumbai	NA
31	<i>Lopholepisoritho cephalo</i>	Poaceae	Herb	—	NA
32	<i>Opuntia stricta</i>	Cactaceae	Shrub	Sappathikalli	LC
33	<i>Panicum repens</i>	Poaceae	Herb	—	NA

34	<i>Passiflora foetida</i>	Passifloraceae	Climber	Sirupunaikali	NA
35	<i>Pedaliium murex</i>	Pedaliaceae	Herb	Perunerunji	NA
36	<i>Percularia daemia</i>	Asclepiadaceae	Climber	—	NA
37	<i>Phyla nodiflora</i>	Verbenaceae	Herb	Koduppai	LC
38	<i>Prosopis juliflora</i>	Mimosaceae	Tree	Veelikkaruvai	NA
39	<i>Pycnus polystachyos</i>	Poaceae	Herb	—	LC
40	<i>Sida cordifolia</i>	Malvaceae	Herb	Nilathuthi	NA
41	<i>Spinifex littoreus</i>	Poaceae	Herb	Ravananmeesai	NA
42	<i>Tephrosia purpurea</i>	Fabaceae	Under Shrub	Kolungi	NA
43	<i>Thespesia populnea</i>	Malvaceae	Tree	Poovarasu	LC
44	<i>Tribulus terrestris</i>	Zygophyllaceae	Herb	Nerinji	NA
45	<i>Vernonia cinerea</i>	Asteraceae	Herb	Mukuttipundu	NA
46	<i>Zoysia matrella</i>	Poaceae	Grass	—	NA
47	<i>Canavalia cathartica</i>	Fabaceae	Climber	Maunaloa	LC
48	<i>Ipomoea pes-caprae</i>	Convolvulaceae	Creeper	Bayhops	LC
49	<i>Pupalia lappacea var. orbiculata</i>	Amaranthaceae	Herb	—	LC
50	<i>Turnera subulata</i>	Passifloraceae	Herb	White buttercup	LC
Aquatic Plants					
51	<i>Avicennia marina</i>	Acanthaceae	Tree	Mangrove	LC
52	<i>Calophyllum inophyllum</i>	Calophyllaceae	Tree	Mangrove	LC
53	<i>Pontederia crassipes</i>	Pontederiaceae	hydrophyte	Water hyacinth	LC

LC-Least Concern; NA-Not Assessed

Reptiles and Amphibian

S.No	Reptiles & Amphibians	Common name	IUCN Status
1	<i>Hemidactylus sp.</i>	House lizard	Not Assessed
2	<i>Eutropis macularia</i>	Common skink	Not Assessed
3	<i>Bungarus caeruleus</i>	Common Krait	Not Assessed
4	<i>Ophisops leschenault</i>	Snake-eyed lizard	Not Assessed
5	<i>Rana tigrina</i>	Common yellow frog	Least Concern
6.	<i>Lepidochelys olivacea</i>	Olive Ridley Turtle	Vulnerable

Butterfly

S.No	Zoological Name	Family	Common Name	IUCN status
1	<i>Ariadne merione</i>	Nymphalidae	Common Caster	Least Concern
2	<i>Atrophaneura aristolochiae</i>	Papilionidae	Common Rose	Least Concern
3	<i>Catopsilia pomona</i>	Pieridae	Common Emigrant	Least Concern
4	<i>Catopsilia pyranthe</i>	Pieridae	Mottled Emigrant	Least Concern
5	<i>Colotis etrida</i>	Pieridae	Small Orange Tip	Least Concern
6	<i>Danaus chrysippus</i>	Nymphalidae	Plain Tiger	Least Concern
7	<i>Danaus genutia</i>	Nymphalidae	Striped Tiger	Least Concern
8	<i>Delias eucharis</i>	Pieridae	Common Jezebel	Least Concern
9	<i>Euchrysops cnejus</i>	Lycaenidae	Gram Blue	Least Concern
10	<i>Eurema hecabe</i>	Pieridae	Common Grass Yellow	Least Concern
11	<i>Hypolimnas bolina</i>	Nymphalidae	Great Egg Fly	Least Concern
12	<i>Hypolimnas misippus</i>	Nymphalidae	Danaid Egg Fly	Not Assessed
13	<i>Junonia almana</i>	Nymphalidae	Peacock Pansy	Least Concern
14	<i>Junonia hierta</i>	Nymphalidae	Yellow Pansy	Least Concern
15	<i>Junonia iphita</i>	Nymphalidae	Chocolate Pansy	Least Concern
16	<i>Junonia lemonias</i>	Nymphalidae	Lemon Pansy	Least Concern
17	<i>Junonia orithya</i>	Nymphalidae	Blue Pansy	Least Concern
18	<i>Leptosia nina</i>	Pieridae	Psyche	Least Concern
19	<i>Mycalesis perseus</i>	Nymphalidae	Common Bush Brown	Least Concern
20	<i>Phalanta phalantha</i>	Nymphalidae	Common Leopard	Least Concern

Aquatic Ecology

S.No	Phytoplankton
1	<i>Oscillatoria subbrevis</i>
2	<i>Pediastrum duplex</i>
3	<i>Spirogyra sp.</i>
4	<i>Navicula rhynchocephala</i>
5	<i>Microcystis aeruginosa</i>

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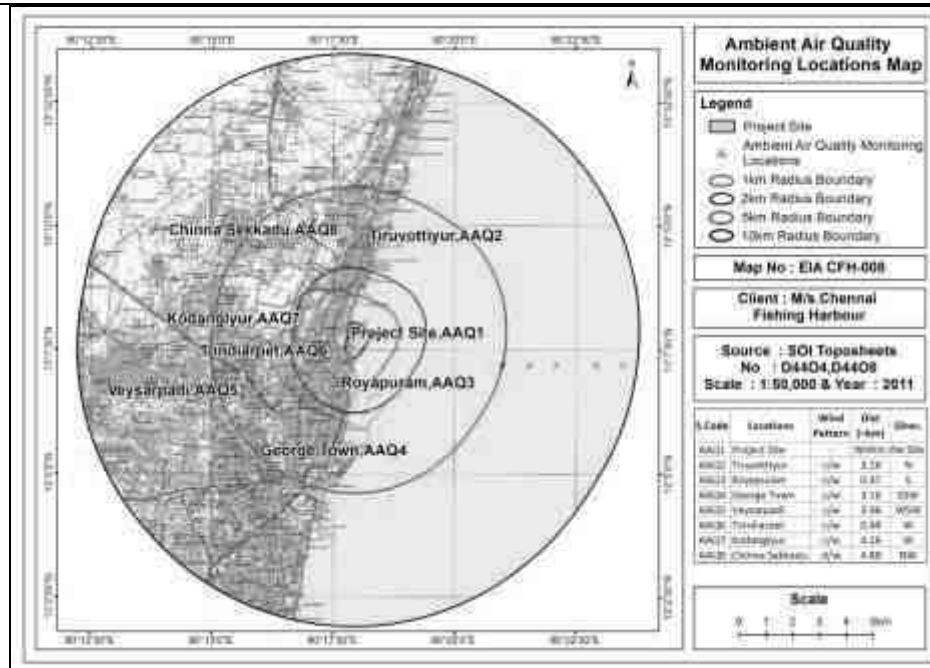
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Reptiles:

Aengals, R., Sathish Kumar, V.M., Palot, M.J. & Ganesh, S.R. (2018). A Checklist of Reptiles of India. 35 pp

13	The sampling should be done in grid pattern and every one kilometre the samples (air, water, sediment and biological samples) within 10km radius.	<p>The sampling of Air, Noise, Water , Soil and Biological Environment has been taken for a period of 3 months from Jan 2023-April 2023. Each sampling study has been conducted at 8 different location along the 10km radius of the proposed project site.</p> <table border="1"> <thead> <tr> <th>Station Code</th> <th>Location</th> <th>Wind Pattern</th> <th>Distance (~km) from Project boundary</th> <th>Directions</th> </tr> </thead> <tbody> <tr> <td>AAQ1</td> <td>Project Site</td> <td>-</td> <td colspan="2">Within the Site</td> </tr> <tr> <td>AAQ2</td> <td>Tiruvottiyur</td> <td>c/w</td> <td>3.16</td> <td>N</td> </tr> <tr> <td>AAQ3</td> <td>Royapuram</td> <td>c/w</td> <td>0.37</td> <td>S</td> </tr> <tr> <td>AAQ4</td> <td>George Town</td> <td>c/w</td> <td>3.16</td> <td>SSW</td> </tr> <tr> <td>AAQ5</td> <td>Veysarpadi</td> <td>c/w</td> <td>3.96</td> <td>WSW</td> </tr> <tr> <td>AAQ6</td> <td>Tondiarpet</td> <td>c/w</td> <td>0.44</td> <td>W</td> </tr> <tr> <td>AAQ7</td> <td>Kodangiyur</td> <td>c/w</td> <td>4.16</td> <td>W</td> </tr> <tr> <td>AAQ8</td> <td>Chinna Sekkadu</td> <td>d/w</td> <td>4.88</td> <td>NW</td> </tr> </tbody> </table> <p>Ambient Air Quality</p>	Station Code	Location	Wind Pattern	Distance (~km) from Project boundary	Directions	AAQ1	Project Site	-	Within the Site		AAQ2	Tiruvottiyur	c/w	3.16	N	AAQ3	Royapuram	c/w	0.37	S	AAQ4	George Town	c/w	3.16	SSW	AAQ5	Veysarpadi	c/w	3.96	WSW	AAQ6	Tondiarpet	c/w	0.44	W	AAQ7	Kodangiyur	c/w	4.16	W	AAQ8	Chinna Sekkadu	d/w	4.88	NW
Station Code	Location	Wind Pattern	Distance (~km) from Project boundary	Directions																																											
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Parameters	Conc.	NAAQ Standards	Locations							
			Project Site AAQ1	Tiruvottiyur AAQ2	Royapuram AAQ3	George Town AAQ4	Veysarpadi AAQ5	Tondiarpet AAQ6	Kodangiyur AAQ7	Chinna Sekkadu AAQ8
PM10 Conc. ($\mu\text{g}/\text{m}^3$)	Min.	100 (24 Hours)	44.98	35.55	38.04	39.09	40.28	39.73	40.57	39.69
	Max.		64.11	50.66	54.22	55.72	57.41	56.62	57.82	56.56
	Avg.		53.94	42.63	45.62	46.88	48.31	47.64	48.66	47.59
	98th 'tile		63.73	50.36	53.90	55.39	57.07	56.29	57.49	56.23
PM2.5 Conc. ($\mu\text{g}/\text{m}^3$)	Min.	60 (24 Hours)	26.99	21.33	22.83	23.46	24.17	23.84	24.34	23.81
	Max.		38.46	30.39	32.53	33.43	34.44	33.97	34.69	33.94
	Avg.		32.37	25.58	27.38	28.13	28.99	28.59	29.20	28.56
	98th 'tile		38.24	30.22	32.34	33.24	34.24	33.78	34.49	33.74

SO2 Conc. (µg/m3)	Min.	80 (24 Hou rs)	6.91	6.86	6.88	6.53	6.42	6.40	6.88	6.82
	Max.		9.85	9.77	9.81	9.31	9.15	9.13	9.81	9.72
	Avg.		8.30	8.23	8.26	7.84	7.71	7.69	8.26	8.19
	98th 'tile		9.80	9.71	9.75	9.25	9.10	9.07	9.75	9.67
NO2Conc. (µg/m3)	Min.	80 (24 Hou rs)	13.83	13.70	13.68	12.96	12.76	12.71	13.68	13.57
	Max.		19.71	19.53	19.81	18.47	18.19	18.11	19.50	19.33
	Avg.,		16.59	16.44	16.42	15.54	15.31	15.25	16.41	16.27
	98th 'tile		19.59	19.42	19.55	18.36	18.08	18.01	19.39	19.22
Pb (µg/m3)	Avg.	1 (24 hour)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)
CO (mg/m3)	Avg.	4 (1hour)	0.54	0.43	0.46	0.47	0.48	0.48	0.49	0.48
Ozone(O3), µg/m3	Avg.	180 (1hour)	10.4	10.60	10.30	10.80	10.20	10.11	10.23	10.40
Benzene, µg/m3	Avg.	5	BLQ (LOQ 1)	BLQ (LOQ 1)	BLQ (LOQ 1)	BLQ (LOQ 1)	BLQ (LOQ 1)	BLQ (LOQ 1)	BLQ (LOQ 1)	BLQ (LOQ 1)
Benzo (a) pyrene, ng/m3	Avg.	1 (Annual)	BLQ (LOQ 1)	BLQ (LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ (LOQ 1)	BLQ(LOQ 1)
As (ng/ m3)	Avg.	6(Annual)	BLQ (LOQ 2)	BLQ (LOQ 2)	BLQ (LOQ 2)	BLQ (LOQ 2)	BLQ (LOQ 2)	BLQ (LOQ 2)	BLQ (LOQ 2)	BLQ (LOQ 2)
Ni (ng/m3)	Avg.	20(Annua l)	BLQ (LOQ 10)	BLQ (LOQ 10)	BLQ (LOQ 10)	BLQ (LOQ 10)	BLQ (LOQ 10)	BLQ (LOQ 10)	BLQ (LOQ 10)	BLQ (LOQ 10)
NH3 (µg/m3)	Avg.	400 (24hours)	BLQ(LOQ5)	BLQ(LOQ5)	BLQ(LOQ5)	BLQ(LOQ5)	BLQ(LOQ5)	BLQ(LOQ5)	BLQ(LOQ5)	BLQ(LOQ5)

Noise Environment

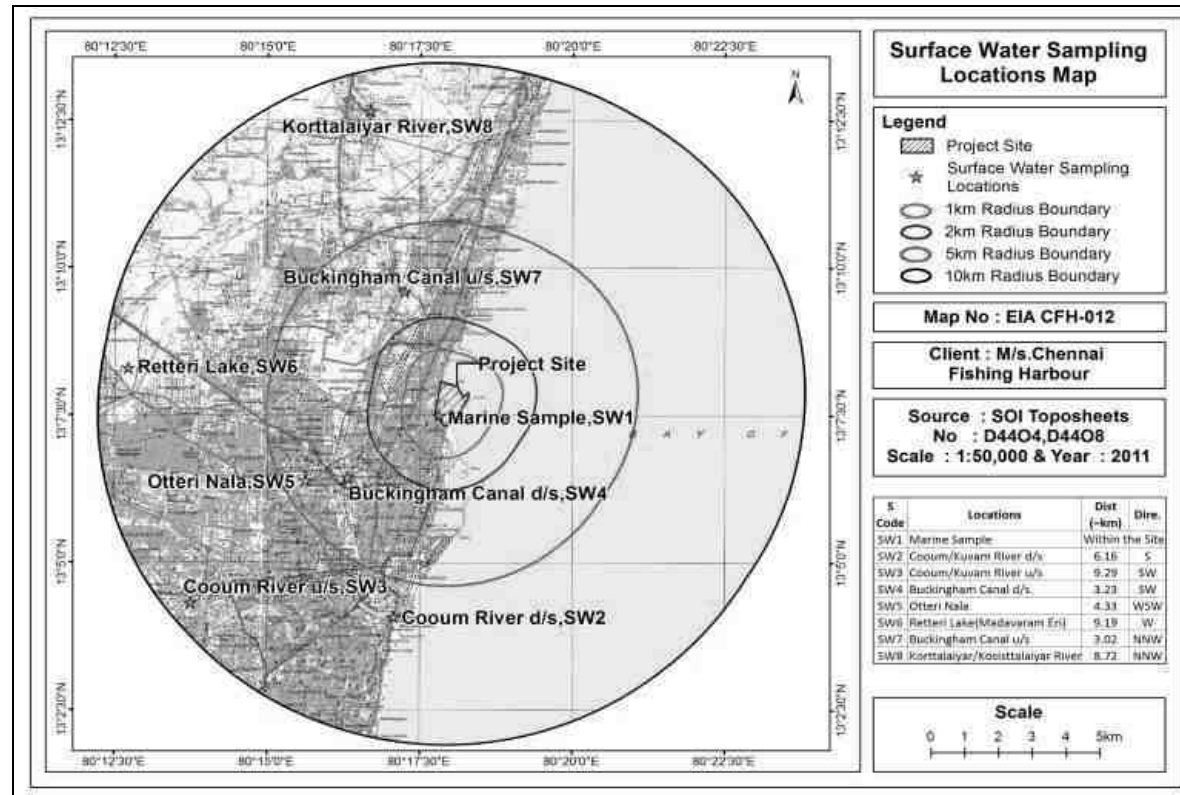
S. No	Location	Location Code	Distance (~km) from Project boundary	Direction	Noise level in dB(A) Leq		CPCB Standard		Environmental Setting
					Day	Night	Lday (Ld)	LNight (Ln)	
1.	Project Site	N1	Within the Site		50.5	43.4	75	70	Industrial
2.	Tiruvottiyur	N2	3.16	N	52.3	44.7	55	45	Residential
3.	Royapuram	N3	0.37	S	51.7	43.3	55	45	Residential
4.	George Town	N4	3.16	SSW	52.3	42.8	55	45	Residential
5.	Veysarpadi	N5	3.96	WSW	54.8	44.3	55	45	Residential
6.	Tondiarpet	N6	0.44	W	53.2	42.2	55	45	Residential
7.	Kodangiyur	N7	4.16	W	54.6	41.5	55	45	Residential
8.	Chinna Sekkadu	N8	4.88	NW	53.6	40.2	55	45	Residential

Surface Water Environment

Details of Surface Water Sampling Locations

S. No	Name of the Water body	Location Code	Distance from Project Boundary (~Km)	Direction
1	Marine Sample	SW1	Within the Site	
2	Cooum/Kuvam River d/s	SW2	6.16	S
3	Cooum/Kuvam River u/s	SW3	9.29	SW
4	Bukingham Canal d/s	SW4	3.23	SW
5	Otteri Nala	SW5	4.33	WSW
6	Retteri Lake (Madavaram Eri)	SW6	9.19	W

7	Bukingham Canal u/s	SW7	3.02	NNW
8	Korttalaiyar/Kosissttalaiyar River	SW8	8.72	NNW



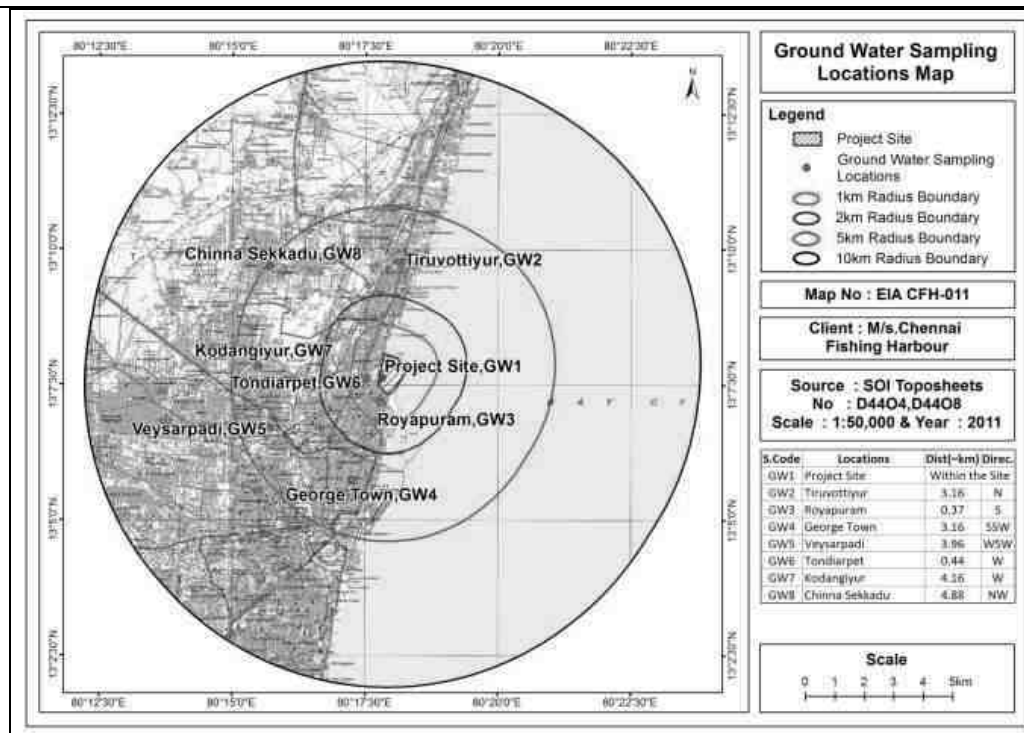
Parameter	Unit	Surface water standards (IS 2296 Class-A)	Marine sample near project site	Adyar River d/s	Adyar River u/s	Buckingham Canal d/s	Cooum River u/s	Buckingham Canal u/s	Otteri Nala	Cooum River
			SW1	SW 2	SW 3	SW 4	SW 5	SW 6	SW 7	
pH (at 25°C)	--	6.5-8.5	8.17	6.78	7.23	6.69	7.42	7.47	7.58	6.72
Electrical Conductivity	µS/cm	-	52008	14797	4305	40314	39369	33087	2817	4305
Total Dissolved	mg/l	500	30233	8729	2336	23670	23135	19635	1576	2600

Solids											
Total Suspended Solids	mg/l	-	19	48	41	38	46	29	25	52	
Total Alkalinity as CaCO ₃	mg/l	-	436.9	327.4	278.9	367.5	334.5	307.8	231.9	389.5	
Total Hardness as CaCO ₃	mg/l	300	5503.8	1563.8	574.7	4306.0	4209.3	3569.7	297.0	4813.0	
Sodium as Na	mg/l	-	8924	2535	618	6982	6825	5788	481	7804	
Potassium as K	mg/l	-	398	113	27	311	304	258	21	348	
Calcium as Ca	mg/l	-	1249.4	355.0	130.5	977.5	955.5	810.3	67.4	1092.6	
Magnesium as Mg	mg/l	-	578.4	164.3	60.4	452.5	442.4	375.2	31.2	505.8	
Chloride as Cl	mg/l	250	13280.0	3773.3	920.0	10390.0	10156.7	8613.3	574.1	11613.3	
Sulphate as SO ₄	mg/l	400	5511.2	1565.9	381.8	4311.9	4215.0	3574.5	238.2	4819.5	
Nitrate as NO ₃	mg/l	20	2.8	5.1	4.0	3.8	6.0	3.7	3.4	4.4	
Fluorides as F	mg/l	1.5	0.87	0.52	0.45	0.63	0.71	0.64	0.41	0.69	
Cyanide	mg/l	0.05	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	
Arsenic	mg/l	0.05	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)	
Boron as B	mg/l	-	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	
Cadmium as Cd	mg/l	0.01	BLQ(LOQ 0.001)	BLQ(LOQ 0.001)	BLQ(LOQ 0.001)	BLQ(LOQ 0.001)	BLQ(LOQ 0.001)	BLQ(LOQ 0.001)	BLQ(LOQ 0.001)	BLQ(LOQ 0.001)	
Chromium, Total	mg/l	0.05	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	
Copper as Cu	mg/l	1.5	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	
Lead as Pb	mg/l	0.1	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	
Manganese as Mn	mg/l	0.5	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	
Mercury	mg/l	0.001	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	
Nickel as Ni	mg/l	-	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	
Selenium as Se	mg/l	0.01	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	
Dissolved Oxygen	mg/l	6	6.5	5.7	5.9	5.5	5.2	5.9	5.7	5.1	
Chemical	mg/l	-	16.0	68.0	50.0	80.0	98.0	62.0	54.0	112.0	

Oxygen Demand as O ₂										
BOD, 3 days @ 27°C as O ₂	mg/l	2	2.0	12.0	8.0	12.0	16.0	10.0	8.0	1

Ground water Environment

Station Code	Location	Distance (~km) from Project boundary	Directions
GW1	Project Site	Within the site	
GW2	Tiruvottiyur	3.16	N
GW3	Royapuram	0.37	S
GW4	George Town	3.16	SSW
GW5	Veysarpadi	3.96	WSW
GW6	Tondiarpet	0.44	W
GW7	Kodangiyur	4.16	W
GW8	Chinna Sekkadu	4.88	NW



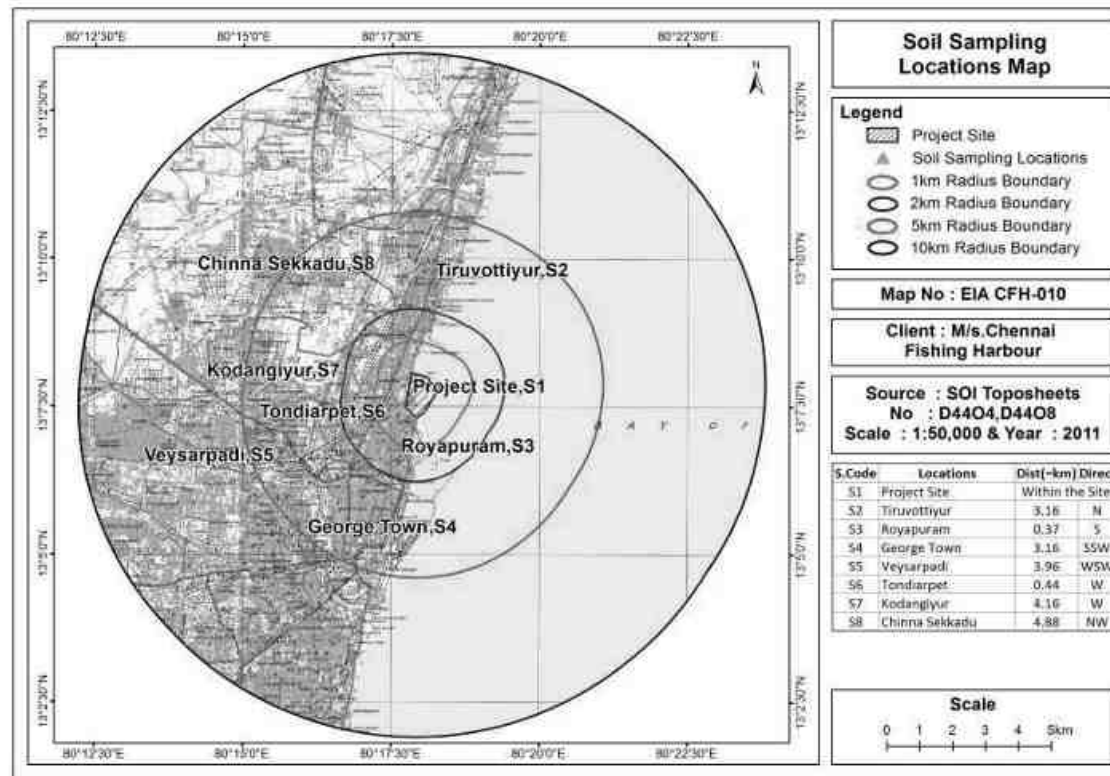
Parameters	Unit	Drinking water Standard (IS 10500: 2012) Permissible Limit	Drinking water Standard (IS 10500: 2012) Acceptable Limit	Near Project Site	Tiruvottiyur	Royapuram	George Town	Veysarpadi	Tondiarpet	Kodangiyur	Chinna Sekkadu
				GW1	GW2	GW3	GW4	GW5	GW6	GW7	
Colour	Hazen	15	5	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)
Turbidity	NTU	5	1	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)
pH	--	NR	6.5-8.5	7.98	7.6	7.37	7.96	7.8	7.75	7.41	
Conductivity	µS/cm	-	-	2098	1887	1675	1732	1427	1526	1843	
Total Dissolve Solids	mg/l	2000	500	1166	1040	911	934	802	835	1018	
Total Suspended Solids		-	-	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)

35.	Alkalinity as CaCO ₃	mg/l	600	200	301	269	234	241	198	215	261		209
36.	Total Hardness as CaCO ₃	mg/l	600	200	478	427	372	390	315	348	415		338
37.	Sodium as Na	mg/l	-	-	221	197	172	177	178	157	191		153
38.	Potassium as K	mg/l	-	-	15	14	12	10	7	8	13		7
39.	Calcium as Ca	mg/l	200	75	108.6	96.9	84.5	88.5	71.5	79.0	94.1		76.7
40.	Magnesium as Mg	mg/l	100	30	50.3	44.9	39.1	41.0	33.1	36.6	43.6		35.5
41.	Chloride as Cl	mg/l	1000	250	395.0	352.5	307.5	316.0	260.0	282.0	342.5		274.0
42.	Sulphate SO ₄	mg/l	400	200	163.9	146.3	127.6	131.1	107.9	117.0	142.1		113.7
43.	Nitrate as NO ₃	mg/l	NR	45	4.3	6.5	7.8	4.8	5.5	6.2	7.1		5.4
44.	Fluorides as F		1.5	1	0.48	0.46	0.44	0.43	0.41	0.40	0.45		0.42
45.	Cyanide	mg/l	NR	0.05	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)		BLQ(LOQ 0.01)
46.	Arsenic as As	mg/l	0.05	0.01	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)		BLQ(LOQ 0.005)
47.	Boron as B	mg/l	1.0	0.5	BQL(LOQ 0.1)	BQL(LOQ 0.1)	BQL(LOQ 0.1)	BQL(LOQ 0.1)	BQL(LOQ 0.1)	BQL(LOQ 0.1)	BQL(LOQ 0.1)		BQL(LOQ 0.1)
48.	Cadmium as Cd	mg/l	NR	0.003	BQL(LOQ 0.001)	BQL(LOQ 0.001)	BQL(LOQ 0.001)	BQL(LOQ 0.001)	BQL(LOQ 0.001)	BQL(LOQ 0.001)	BQL(LOQ 0.001)		BQL(LOQ 0.001)
49.	Chromium as Cr	mg/l	NR	0.05	BQL(LOQ 0.01)	BQL(LOQ 0.01)	BQL(LOQ 0.01)	BQL(LOQ 0.01)	BQL(LOQ 0.01)	BQL(LOQ 0.01)	BQL(LOQ 0.01)		BQL(LOQ 0.01)
50.	Copper as Cu	mg/l	1.5	0.05	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)		BLQ(LOQ 0.01)
51.	Lead as Pb	mg/l	NR	0.01	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)		BLQ(LOQ 0.005)
52.	Manganese as Mn	mg/l	0.3	0.1	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)		BLQ(LOQ 0.05)
53.	Mercury	mg/l	NR	0.001	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)		BLQ(LOQ 0.0005)
54.	Nickel as Ni	mg/l	NR	0.02	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)		BLQ(LOQ 0.01)
55.	Selenium as Se	mg/l	NR	0.01	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)		BLQ(LOQ 0.005)

										0.005)			
56.	Zinc as Zn	mg/l	15	5	BLQ(LOQ 0.1)	BLQ(LO Q 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LO Q 0.1)	BLQ(L OQ 0.1)	BLQ(LO Q 0.1)	BLQ(LOQ 0.1)	

Soil Environment

Location Code	Location	Distance (km) from Project boundary	Azimuth Directions
S1	Project Site	Within the Site	
S2	Tiruvottiyur	3.16	N
S3	Royapuram	0.37	S
S4	George Town	3.16	SSW
S5	Veysarpadi	3.96	WSW
S6	Tondiarpet	0.44	W
S7	Kodungaiyur	4.16	W
S8	Chinna Sekkadu	4.88	NW



S.No	Parameters	Units	Project Site	Tiruvottiyur	Royapuram	George Town	Veysarpadi	Tondiarpet	Kodangiyur	Chinna Sekkadu
			S1	S2	S3	S4	S5	S6	S7	S8
1.	Soil Texture	-	Sandy Clay	Clay loam	Sandy Clay	Clay loam	Sandy Clay	Clay loam	Sandy Clay loam	Clay loam
2.	Sand	%	45.2	35.4	46.2	33.1	46.5	32.7	45.6	33.4
3.	Silt	%	19.4	26.6	17.4	29.9	18.3	30.8	20.2	31.2
4.	Clay	%	35.4	38.0	36.4	37.0	35.2	36.5	34.2	35.4

5.	pH	-	7.52	7.32	7.54	7.10	7.12	7.12	7.43	6.12
6.	Electrical conductivity	$\mu\text{S/cm}$	175	157	143	168	136	129	186	182
7.	Nitrogen as N	mg/kg	120.2	115.3	110.6	115.8	120.7	95.4	98.6	105.2
8.	Phosphorus	mg/kg	5.83	5.16	4.93	5.16	5.38	4.26	4.39	4.71
9.	Potassium	mg/kg	75.25	69.82	66.79	69.82	72.86	57.68	59.50	63.75
10.	Boron	mg/kg	BLQ(LOQ0.1)	BLQ(LOQ0.1)	BLQ(LOQ0.1)	BLQ(LOQ0.1)	BLQ(LOQ0.1)	BLQ(LOQ0.1)	BLQ(LOQ0.1)	BLQ(LOQ0.1)
11.	Cadmium	mg/kg	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)
12.	Chromium	mg/kg	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)
13.	Porosity	-	0.42	0.75	0.42	0.73	0.42	0.74	0.42	0.71
14.	Water holding Capacity	%	15.80	17.80	15.80	17.60	16.20	17.70	19.80	18.00

14	Heavy metals studies in water and sediments shall be conducted	The following heavy metals analyzed in the water and sediment samples are:									
		Sr.No.	Heavy Metals	SW1	SW 2	SW 3	SW 4	SW 5	SW 6	SW 7	SW 8
		1	Mercury	mg/l	0.001	BLQ(LOQ 0.01)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)

2	Nickel as Ni	mg/l	-	BLQ(LOQ 0.005)	BLQ(LO Q 0.01)	BLQ(LOQ 0.01)	BLQ(LO Q 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)
3	Lead as Pb	mg/l	0.1	BLQ(LOQ 0.05)	BLQ(LO Q 0.005)	BLQ(LOQ 0.005)	BLQ(LO Q 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)
4	Manganese as Mn	mg/l	0.5	BLQ(LOQ 0.0005)	BLQ(LO Q 0.05)	BLQ(LOQ 0.05)	BLQ(LO Q 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)
5	Arsenic	mg/l	0.05	BLQ(LOQ 0.01)	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)
6	Cadmium as Cd	mg/l	0.01	BLQ(LOQ 0.001)	BLQ(LO Q 0.001)	BLQ(LOQ 0.001)	BLQ(LO Q 0.001)	BLQ(LOQ 0.001)	BLQ(LOQ 0.001)
7	Chromium, Total	mg/l	0.05	BLQ(LOQ 0.01)	BLQ(LO Q 0.01)	BLQ(LOQ 0.01)	BLQ(LO Q 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)
8	Cyanide	mg/l	0.05	BLQ (LOQ0.01)	BLQ(LO Q 0.01)	BLQ(LOQ 0.01)	BLQ(LO Q 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)

Note: **BLQ – Below Limit of Quantification; LOQ – Limit of Quantification**

The heavy metal analysis has been conducted for 8 location within the 10km radius. From which it is observed that the level of the presence is very minimal i.e. below the prescribed limit in the water and sediments.

15	The report should include the proposal for the proper treatment for waste water generated from fish handling platforms so as to	<p>There will be no ground water discharge and marine disposal all the waste water will be properly treated in STP of 40 KLD capacity and ETP of 80 KLD capacity. The treated water will be then utilized for fishing activities and greenbelt.</p> <p>The STP specification and ETP specification is attached as Annexure 6 & 7.</p>
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	ensure no pollution to the ground water as well as the sea water from harbour operation.																					
16	The study proposal shall include details pertaining to collection, treatment and disposal of solid wastes both municipal and fish waste.	<p>Municipal Solid waste Management :</p> <table border="1"> <thead> <tr> <th>Sr.No</th> <th>Waste type</th> <th>Existing phase (kg/day)</th> <th>Proposed phase (kg/day)</th> <th>Management measure</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Organic waste</td> <td>1.44</td> <td>1.44</td> <td rowspan="3">Collected in Municipal Bins and directly disposed through Greater Chennai Corporation dumping yard at Kodungaiyur.</td> </tr> <tr> <td>2</td> <td>Inorganic waste</td> <td>0.96</td> <td>0.96</td> </tr> <tr> <td colspan="2">Total</td> <td>2.4</td> <td>2.4</td> </tr> </tbody> </table> <p>Manpower: 40nos.</p> <p>Fish Waste Management:</p> <p>The liquid waste from the fish will be treated in the ETP of capacity 80 KLD and the solid wastes will be disposed by authorized dealers.</p>	Sr.No	Waste type	Existing phase (kg/day)	Proposed phase (kg/day)	Management measure	1	Organic waste	1.44	1.44	Collected in Municipal Bins and directly disposed through Greater Chennai Corporation dumping yard at Kodungaiyur.	2	Inorganic waste	0.96	0.96	Total		2.4	2.4		
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17	The project proponent shall submit a comprehensive monitoring plan for coastal ecology covering coastal	<p align="center">Environmental Monitoring Program during construction phase</p> <table border="1"> <thead> <tr> <th>Sr.No</th> <th>Area of Monitoring</th> <th>Number of Sampling Stations</th> <th>Frequently of Sampling</th> <th>Parameters to be Analyzed</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Ambient Air Quality</td> <td>4 Stations</td> <td>Twice a week:24 hourly period</td> <td>PM10, PM2.5, SO_x, NO_x CO and TVOC</td> </tr> <tr> <td>2</td> <td>Noise</td> <td>4 (two within premises and two outside premises)</td> <td>Weekly</td> <td>Ambient Equivalent continuous Sound Pressure Levels (L_{eq}) at day and Night time.</td> </tr> <tr> <td>3</td> <td>Surface water and Ground water</td> <td>4 Stations (one within the premises and two outside premises)</td> <td>Weekly</td> <td>pH, Conductivity, TSS, TDS, BOD,COD, DO, Heavy metals (Ar, Pb, Ch, Ni etc), Chloride, Sulphate, Total</td> </tr> </tbody> </table>	Sr.No	Area of Monitoring	Number of Sampling Stations	Frequently of Sampling	Parameters to be Analyzed	1	Ambient Air Quality	4 Stations	Twice a week:24 hourly period	PM10, PM2.5, SO _x , NO _x CO and TVOC	2	Noise	4 (two within premises and two outside premises)	Weekly	Ambient Equivalent continuous Sound Pressure Levels (L _{eq}) at day and Night time.	3	Surface water and Ground water	4 Stations (one within the premises and two outside premises)	Weekly	pH, Conductivity, TSS, TDS, BOD,COD, DO, Heavy metals (Ar, Pb, Ch, Ni etc), Chloride, Sulphate, Total
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ecosystem and riverine system for both construction and operation period. All physical, Chemical and biological parameters including planktons, productivity, benthic fauna and flora, fishery etc shall be covered in monitoring plan. Monitoring during construction period will be done on weekly basis and during the operational period on seasonal basis (4 times a year, a

				Coliform
4	Vehicular Emissions	2 Stations Inside and Outside premises	Weekly	Air emission and noise, PUC
5	Soil	4 Stations (one within the premises and two outside premises)	Weekly	pH, Physicochemical properties like N,P,K,B,Cu,Heavy metals
6	Terrestrial and Marine Ecology	Within 10 km radius	Weekly	Symptoms of injuries and total count of Phytoplankton, Flora, Fisheries productivity,benthic fauna .

Environmental Monitoring Program during operation phase

Sr.No	Area of Monitoring	Number of Sampling Stations	Frequently of Sampling	Parameters to be Analyzed
1	Ambient Air Quality	4 Stations	Once in three months	PM10, PM2.5, SO _x , NO _x CO and TVOC
2	Noise	4 (two within premises and two outside premises)	Once in three months	Ambient Equivalent continuous Sound Pressure Levels (L _{eq}) at day and Night time.
3	Surface water and Ground water	4 Stations (one within the premises and two outside premises)	Once in three months	pH, Conductivity, TSS, TDS, BOD,COD, DO, Heavy metals (Ar, Pb, Ch, Ni etc), Chloride, Sulphate, Total Coliform
4	Vehicular Emissions	2 Stations Inside and Outside premises	Once in three months	Air emission and noise, PUC
5	Soil	4 Stations (one within the premises and two outside premises)	Once in three months	pH, Physicochemical properties like N,P,K,B,Cu,Heavy metals
6	Terrestrial and Marine Ecology	Within 10 km radius	Once in three months	Symptoms of injuries and total count of Phytoplankton, Flora, Fisheries productivity,benthic fauna .

Environmental monitoring programme will be conducted for weekly basis for construction phase and once in three months (4 times a year) for operation phase for a period of five years.

	minimum for 5 years)	
18	There should not any damage/impact on these resources and associated biodiversity- the project proponent shall submit the detailed proposal to implement mangrove afforestation by involving reputed institution like Annamalai University (Marine Biology Centre) and detailed plan with budget	<ul style="list-style-type: none"> ➤ An integrated approach was used for studying the environmental parameters and biodiversity of the Chennai Fishing harbor. Satellite, drone images and ground truth survey indicate absence of mangroves in the study area. Mangroves are present 5.5 km and 13.5 km, North and South, respectively of the Chennai Fishing harbor. ➤ Based on the observations, we conclude that since mangroves were historically absent in the site and environmental conditions are unfavourable, plantation of mangroves is not recommended. ➤ The closest turtle nesting site is located 13 km south, in the Besant Nagar -Neelankarai coastal stretch. Therefore, developmental activities in the Chennai Fishing harbour will have no influence on the turtle nesting sites. ➤ As marine litter was observed during the field, recommendations have been suggested to improve marine litter management at Chennai Fishing harbor which is one of the major objectives of UN SDG 14 target and the aim of “Swachh Sagar Surakshit” campaign of the Government of India.

	<p>shall be for mangrove afforestation and monitoring for a period of minimum 5 years in consultation with said institution and submit a copy of the same along with the EIA Report. The proponent shall also sign MoU and submit a copy of the same along with EIA Report.</p>	
19	<p>The study shall be conducted on reputed institutions like Annamalai University (Marine Biology Department</p>	<ul style="list-style-type: none"> ➤ An integrated approach was used for studying the environmental parameters and biodiversity of the Chennai Fishing harbor. Satellite, drone images and ground truth survey indicate absence of mangroves in the study area. ➤ Mangroves are present 5.5 km and 13.5 km, north and south, respectively of the Chennai Fishing harbor. Based on the observations, we conclude that since mangroves were historically absent in the site and environmental conditions are unfavourable, plantation of mangroves is not recommended. ➤ The closest turtle nesting site is located 13 km south, in the Besant Nagar -Neelankarai coastal stretch. Therefore, developmental activities in the Chennai Fishing harbour will have no influence on the turtle nesting sites. ➤ As marine litter was observed during the field, recommendations have been suggested to improve marine litter management at Chennai Fishing harbor which is

	t), etc. the impact on the proposed modernization of fishing harbour on movement of turtles and other aquatic species.	<p>one of the major objectives of UN SDG 14 target and the aim of “Swachh Sagar Surakshit” campaign of the Government of India.</p> <ul style="list-style-type: none"> ➤ The detailed study is conducted and report given by NCCR for the proposed modernization of fishing harbour. The NCCR Report has been attached as Annexure 10.
20	A detail study on impact of oil spillage from the operation of the fishing harbour and its mitigation measures shall be part of EIA study	<p>The quantity of oil spent will be minimal and there is no chance of storage and disposal in the proposed area.</p> <p>The used Engine oils will be reused in their boats for other purposes like spraying on the engines and other machinery parts to avoid rust and the remaining oil has been sold out by the boat owners, which are being taken out by the purchaser from Chennai Fishing Harbour for secondary purposes. However, Oil Spill Management report has been attached as Annexure 8.</p>
21	Impact on the Distortion effects on the proposed modernization of the fishing harbour	<p>There will not be any major distortion in the current site due to the proposed modernization of the fishing harbour. The distortion effects will be limited only to the construction phase.</p> <p>The distortion effects may include:</p> <ul style="list-style-type: none"> ➤ Accumulation of construction debris ➤ The concrete may spill into the sea during the construction may cause the water pollution.

	shall be part of EIA.	<ul style="list-style-type: none"> ➤ During Construction, the transport of the fine materials like, sand, cement may cause air pollution. ➤ Deposition of fugitive dust on leaves of nearby vegetation may lead to temporary reduction of photosynthesis. Such impacts will, however, be confined mostly to the initial periods of the construction phase.
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1.9.2 Additional ToR Compliance-SEAC-ToR Amendment -06.06.2023

Sr.	Additional ToR	Compliance
1.	Necessary supporting documents including land documents approval from Competent Authority for supply of fresh water, first and latest	<p>The necessary documents supporting documents including land documents approval is attached as Annexure 3</p> <p>Supply of fresh water from Competent Authority is attached as Annexure 4.</p> <p>The consents from TNPCB is obtained as Annexure 5.</p>

	valid consents of TNPCB for the existing operation shall be furnished .																						
2.	There shall not be any treated/ untreated wastewater discharge into the sea water.	There will not be any treated/untreated wastewater discharge into the sea water. As, STP of 40 KLD and ETP of 80 KLD has been proposed and their treated water will be lined for greenbelt and other fishing purposes.																					
3.	The PP shall furnish project timeline enlisting the proposed activities in	<p>The project timeline enlisting the proposed activities has been enlisted in the below table:</p> <table border="1"> <thead> <tr> <th>Sr.No.</th> <th>Project Components</th> <th>Tentative completion</th> </tr> </thead> <tbody> <tr> <td>1.</td> <td>Administration & Centralized Control Block with Commercial Complex on the ground floor – 25m x 15m (G+2)</td> <td>August 2024</td> </tr> <tr> <td>2.</td> <td>Boat repair spare parts complex - 15m x 15m</td> <td>August 2024</td> </tr> <tr> <td>3.</td> <td>CCTV Surveillance System</td> <td>August 2024</td> </tr> <tr> <td>4.</td> <td>Cleaning, Packaging and Cold Storage Facility – 20m x 10m</td> <td>August 2024</td> </tr> <tr> <td>5.</td> <td>Controlled Entry and Exit Arrangements, Elevated Compound wall and 2Nos. of Arched Entrances</td> <td>August 2024</td> </tr> <tr> <td>6.</td> <td>Dredging</td> <td>August 2024</td> </tr> </tbody> </table>	Sr.No.	Project Components	Tentative completion	1.	Administration & Centralized Control Block with Commercial Complex on the ground floor – 25m x 15m (G+2)	August 2024	2.	Boat repair spare parts complex - 15m x 15m	August 2024	3.	CCTV Surveillance System	August 2024	4.	Cleaning, Packaging and Cold Storage Facility – 20m x 10m	August 2024	5.	Controlled Entry and Exit Arrangements, Elevated Compound wall and 2Nos. of Arched Entrances	August 2024	6.	Dredging	August 2024
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chronological order	7.	Drinking water arrangements by RO – 5Nos. of 25LPH capacity + 2Nos. of 500LPH capacity + 2Nos. of 1000L Storage Tanks	August 2024
	8.	Electrical High Mast Lights and Street Light arrangements	August 2024
	9.	Fish Handling Shed at the Trawler Wharf – 100m x 27m	August 2024
	10.	Fish Handling Shed at the Trawler Wharf – 100m x 27m	August 2024
	11.	Overhead Tank (100KLD Capacity), Low Level Reservoir (200KLD Capacity) and Water distribution System	August 2024
	12.	Providing Two numbers of solar operated with electrical backup fish drying machine (1 Tonne capacity) including civil structure as Pilot Project	August 2024
	13.	Providing Net Mending shed at southern side	August 2024
	14.	Providing New open shed with Arabian Tent Roofing for fish cutting stalls near retail shops	August 2024
	15.	Providing rooms for stacking unsold items in the rear side of fish cutting stall	August 2024
	16.	Providing Eurocon tile flooring for retail shop portion	August 2024
	17.	Providing New open sheds with Arabian Tent roofing for prawn sale point	August 2024
	18.	Provision for improvement of internal roads and drains	August 2024
	19.	Sanitary Complex – 10m x 5m	August 2024
	20.	Solid and Liquid Waste Management (ETP & STP)	August 2024
	21.	Ship lift facility and Boat repair yard	August 2024
	22.	Truck Paved parking area facility near proposed two & four wheeler parking no1	August 2024
	23.	Two-lane peripheral road with stormwater drain, cable truff and pedestrian path + widening/ repair of existing internal road network	August 2024
	24.	Two-wheeler/ Four-wheeler Parking Area – 16m x 45m + 44m x 35m	August 2024
	25.	Two nos. of shead over Northern Wharf , supporting with exisiting structure	August 2024
	26.	Two wheeler and Car Parking for administrative and commercial complex and two wheeler parking shed in the Eastern side of the Administrative and commercial complex building	August 2024
	27.	Vessel Monitoring and Control System	August 2024

4.	The PP shall explore the alternate potable water resources and shall furnish feasibility study report for in-situ desalination plant	<p>The fresh water requirement is 200 KLD.</p> <p>Moreover, the RO Plants of capacity 25LPH & 500 LPH are to be proposed as Potable drinking water is a necessity for the users of the fishing harbour. The potable water at the harbour is primarily used in large quantities by the fishing boats (MFBs) before sailing out. On-shore fishermen, labourers, vendors, retailers and buyers also require potable water.</p> <p>For the storage of water, Ground Level Reservoir (GLR) and Over Head Tank (OHT) will be proposed. Therefore, In-situ desalination plant will not be feasible and required.</p>									
5.	The proposed modernisation of fishing harbour by the PP shall conform to the state-of-the-art facilities to the sellers and buyers	<table border="1"> <thead> <tr> <th>Sr.No.</th> <th>Proposed Facilities</th> <th>Description</th> </tr> </thead> <tbody> <tr> <td>1.</td> <td>Ship lift facility and boat repair yard</td> <td> <p>Problems faced: Since the existing slipway complex is non-operational, there is no proper boat repair facility for Mechanized Fishing Boats as well FRP boats within the Harbour.</p> <p>State of the Art proposed:</p> <ul style="list-style-type: none"> ➤ A state-of-the-art MFB and FRP boat repair/ boat building complex with a vessel-lifting mechanism is a must to cater to the soaring demand in this region. ➤ This facility is expected to reduce the maintenance downtime of the vessels thereby increasing prospects of revenue generation for fishers. </td> </tr> </tbody> </table>	Sr.No.	Proposed Facilities	Description	1.	Ship lift facility and boat repair yard	<p>Problems faced: Since the existing slipway complex is non-operational, there is no proper boat repair facility for Mechanized Fishing Boats as well FRP boats within the Harbour.</p> <p>State of the Art proposed:</p> <ul style="list-style-type: none"> ➤ A state-of-the-art MFB and FRP boat repair/ boat building complex with a vessel-lifting mechanism is a must to cater to the soaring demand in this region. ➤ This facility is expected to reduce the maintenance downtime of the vessels thereby increasing prospects of revenue generation for fishers. 			
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		2.	Boat repair spare parts complex	<p>State of the Art proposed:</p> <ul style="list-style-type: none"> ➤ This facility will enable fishing-boat owners and repair service providers to carry out their maintenance and repair work faster. ➤ The spare part complex will facilitate storage and selling of fishing equipment, consumables and spares for fishing crafts. 	
		3.	Controlled Entry and Exit Arrangements, Elevated Compound wall and 2Nos. of Arched Entrances	<p>State of the Art proposed:</p> <p>In order to maintain the safety and security of the harbour, public as well as personal properties, it is proposed to construct a compound wall 3 meters high and 1700m long all along the periphery of the Chennai Fishing Harbour.</p>	
		4.	Two-lane peripheral road with stormwater drains, cable truff and a pedestrian path including widening and repair of existing road network	<p>State of the Art proposed:</p> <ul style="list-style-type: none"> ➤ It is proposed to construct a two-lane road all along the harbour compound wall inwards to facilitate seamless movement through the road. ➤ This arterial road will be interconnected with all the existing road network and provide easier access to new flagship modernization projects. ➤ The proposed peripheral road is running South – North orientation for a length of 1600m and width of 7.5m. Catering for two lanes for hassle free movement of traffic of Two wheelers, Three wheelers, and Four wheelers trucks. 	
		5.	Fish Handling Shed at Trawler Wharf	<p>State of the Art proposed:</p> <ul style="list-style-type: none"> ➤ Based on the primary demand of the stakeholders, it is proposed to construct a fish handling shed with sufficient focus lighting arrangements for illumination during pre-dawn hours and CCTV cameras to ensure secure and safe operation at the trawler wharf. ➤ The shed is planned to have a prefabricated roofing with intermittent translucent roofing sheets to allow natural light during the day. ➤ Since the trawler wharf is an old structure and not designed to take the load of such shed, marine pilings with an RCC fender beam will be installed to take the load of the structure. 	

			<ul style="list-style-type: none"> ➤ The covered shed will shield fishermen, vendors, and labourers from the weather
		6.	<p>Cleaning, Packaging and Cold Storage Facility</p> <p>Problems faced: During the stakeholder consultations, it was understood that there is a lack of a unified and dedicated facility for processing, packaging and storing fish catches in the fishing harbour</p> <p>State of the Art proposed:</p> <ul style="list-style-type: none"> ➤ It is proposed to construct a cleaning, packaging and cold storage facility near Northern Lower Wharf with five segregated units. Similar facility with 5 additional units is planned in the Southern Fish Handling Complex. ➤ Based on the recommendations of GoTN, the proposal for 30 segregated units is reduced to 10 segregated units. ➤ This integrated facility will help local fishermen to quickly pack and freeze their catches for selling it to distant vendors or even export immediately by using chillers. ➤ This facility will help local fishermen to become global and earn a better price for their products.
		7.	<p>Administration & Centralized control Block with Commercial Complex on the Ground Floor</p> <p>Problems faced: In order to ensure better governance and operation of the harbour, it is highly important that an administration and control block building is planned at a conspicuous place to encompass all the governing bodies.</p> <p>State of the Art proposed:</p> <ul style="list-style-type: none"> ➤ The ground floor is planned to be developed as a Commercial Complex to facilitate visitors and fishermen with diverse facilities. ➤ The commercial complex will have varied facilities, such as restaurants, shops, ATMs, groceries, fishing equipment shops, etc. to serve the basic needs of the fishing harbour.
		8.	<p>Vessel Monitoring and Control System at the Harbour Entrance</p> <p>State of the Art proposed:</p> <ul style="list-style-type: none"> ➤ In order to monitor the movement of fishing vessels, provide a safe

			<p>access channel and aid in rescue operations, it is proposed to implement a vessel monitoring and control system.</p> <ul style="list-style-type: none"> ➤ The vessel monitoring system is used to provide advance warning to the fishermen and fishing boats at the harbour in the event of natural calamities, such as cyclones, Tsunamis, etc. ➤ This mechanism will also help in regulating the movement of boats during unfavourable weather conditions. The facility will help in tracking the movement of fishing boats at the harbour entrance area. ➤ An operational mechanism may be put in place to dissuade fishing boats from leaving the harbour in rough weather conditions.
		9.	<p>Two-wheeler/ four-wheeler Parking Area</p> <p>State of the Art proposed: Two different locations will ensure organized parking of vehicles at these dedicated areas and help alleviate traffic congestions on the internal roads of the harbour</p>
		10.	<p>Electrical High Mast Lights and Street Lights arrangements</p> <p>State of the Art proposed: In order to facilitate safe berthing of fishing boats, ensure safe fish landing and transport operations, especially during the peak time of pre-dawn hours, it is proposed to install 6 highmast towerlights and 300 street light poles with LED fittings inside the Fishing Harbour (actually proposed area and in addition all Finger Jetty, Eastern and Northern breakwater).</p>
		11.	<p>Sanitary Complex</p> <p>State of the Art proposed:</p> <ul style="list-style-type: none"> ➤ This facility will have separate arrangements for males and females. It can be accessed by a ramp as well as a staircase. ➤ Sanitary water supply will be through an overhead tank and a fixed piping arrangement. ➤ Lighting arrangements shall allow using the facility during dark hours.
		12.	<p>Overhead Tank, Low-level Reservoir and Internal water distribution</p> <p>State of the Art proposed: A fixed supply and distribution for tap water is proposed which will be used for RO plants, supply to MFBs, sanitation, cleaning of fish catches, repair and maintenance activities, etc. it is proposed to develop an Overhead Tank (OHT)</p>

			and Low-level reservoir (LLR) with a fixed piping arrangement to provide water inside the Chennai Fishing Harbour.
		13.	Drinking water arrangements by RO State of the Art proposed: <ul style="list-style-type: none"> ➤ The RO Plants of capacity 25LPH & 500 LPH are to be proposed as Potable drinking water is a necessity for the users of the fishing harbour. ➤ The potable water at the harbour is primarily used in large quantities by the fishing boats (MFBs) before sailing out. ➤ On-shore fishermen, labourers, vendors, retailers and buyers also require potable water. ➤ For the storage of water, Ground Level Reservoir (GLR) and Over Head Tank (OHT) will be proposed.
		14.	Solid and Liquid Waste Management State of the Art proposed: <p>All the domestic sewage facilities will be equipped by proposing STP with SBR technology of capacity 40KLD and the STP specification is attached as Annexure 6.</p> <p>Effluent generation from washing will be treated by proposing ETP of 80 KLD capacity and the ETP specification is attached as Annexure 7.</p>
		15.	CCTV Surveillance System State of the Art proposed: <ul style="list-style-type: none"> ➤ The centralized surveillance and monitoring of CCTV feed will ensure a secure environment inside the harbour. ➤ The proposed locations for CCTV cameras are harbour gates, proposed southern fish-handling complex and peripheral road, Northern and Southern breakwaters and fish-handling shed at the trawler wharf.
		16.	Solar Operated with Electrical Backup Fish Drying Machine State of the Art proposed: <ul style="list-style-type: none"> ➤ It usually takes 3-5 days to dry the fish depending on the type of fish and weather conditions. In the process, the fish is exposed and attracts a lot of insects & flies and accumulates a lot of dust and sand while drying.

			<ul style="list-style-type: none"> ➤ The solar fish dryers are standalone structures which do not require electricity and providing electrical backup also, and which could provide high quality dried fish with no contamination.
		<p>17. Two-wheeler/ four-wheeler Parking Area – 2 Nos (22m x 16m and 22m x 4m)</p>	<p>State of the Art proposed:</p> <ul style="list-style-type: none"> ➤ Many two-wheelers and cars belonging to the fishermen, vendors and buyers are parked at various places inside the Fishing Harbour in an unorganized manner. ➤ 2 nos. of proposed parking facilities viz. 22m x 16m and 22m x 4m in two locations will ensure organized parking of vehicles at these dedicated areas and help alleviate traffic congestions on the internal roads of the harbour.
		<p>18. Net Mending Shed at Southern Side</p>	<p>State of the Art proposed:</p> <ul style="list-style-type: none"> ➤ The existing net mending sheds that are being utilized by the fishermen community. However, these sheds are operating at max capacity during peak days. ➤ During peak days, some fishermen mend nets directly under the Sun and at times under rain. ➤ The southern side new net mending shed construct with RCC structure with covered shed will shield fishermen, vendors, and labourers from the weather.
		<p>19. Truck Paved Two-wheeler/ four-wheeler Parking Area – 2 Nos (27m x 35m and 28m x 35m)</p>	<p>State of the Art proposed:</p> <ul style="list-style-type: none"> ➤ Many two-wheelers and cars belonging to the fishermen, vendors and buyers are parked at various places inside the Fishing Harbour in an unorganized manner. <p>2 nos. of proposed parking facilities viz. 22m x 16m and 22m x 4m in two locations will ensure organized parking of vehicles at these dedicated areas and help alleviate traffic congestions on the internal roads of the harbour.</p>

		<p>20. Fish Handling Shed at Trawler Wharf – 100m x 27m</p>	<p>State of the Art proposed:</p> <p>Based on the primary demand of the stakeholders, it is proposed to construct a additional fish handling shed with sufficient focus lighting arrangements for illumination during pre-dawn hours and CCTV cameras to ensure secure and safe operation at the trawler wharf.</p>	
		<p>21. Shed over Northern Wharf – 2 Nos</p>	<p>State of the Art proposed:</p> <ul style="list-style-type: none"> ➤ In order to inspect and repair the fishing nets, fishermen use net mending sheds at different places inside the CFH to protect themselves from scorching Sunlight or rains. ➤ Fuel, ice blocks and drinking water are carried on trucks and driven to the boats for loading. ➤ The ice blocks are crushed at berth using mobile crushers which run on diesel. The crushed ice is then transferred to the boats using a chute. 	
		<p>22. Additional Fish Handling Shed at Trawler Wharf– 100mx 27m</p>	<p>State of the Art proposed:</p> <p>The Commissioner, State Fisheries GoTN, highlighted this in one of the meeting. Hence, based on the primary demand of the stakeholders, it is proposed to construct a additional fish handling shed of size 100 m X 27 m in the southern side of the already proposed shed of size 100 m X 27m with sufficient focus lighting arrangements for illumination during pre-dawn hours and CCTV cameras to ensure secure and safe operation at the trawler wharf.</p>	
		<p>23. Rooms for stacking unsold items (72m x 5m)</p>	<p>State of the Art proposed:</p> <ul style="list-style-type: none"> ➤ Presently the unsold catches from retail shops are stored in temporary sheds. These temporary sheds are covered with tints sheets, AC sheet sheets with sides and roof. ➤ Presently there is no such facilities available in Chennai Fishing Harbour near retail shops. Hence, it is proposed to provide 15 to 20 	

			rooms made of RCC roof and side covering with brick work in an area of 72 m X 5m.
		24. Net Mending shed over Northern Wharf of size 80m x 5.60M	<p>State of the Art proposed:</p> <ul style="list-style-type: none"> ➤ It is proposed to provide Net mending shed of size 80 m X 5.6 m on Eastern side of the Eastern net mending shed matching in width with existing net mending shed such that without affecting ice loading operation. ➤ The proposed net mending shed has to be developed over the existing wharf constructed recently by state Fisheries after checking load carrying capacity of the existing Piles and beams.

6.	Lead-free paints shall be used for painting boats/docks	When discussed with the boat builders and the owners, regarding the type of paints being used for fishing boats, it is stated that since other paints are higher in price value, only normal lead free paints are only used of around 15-20 litres for a MFB once a year.
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7.	Implications of drilling operations proposed on the local ecology shall be detailed.	Impact Matrix for Drilling Activities							
		Activities	Environmental Attributes						
			Air	Noise	Water	Land & Soil	Ecology	Socio-Economics	Aesthetics
		Well site & access road construction	Yes	Yes	Yes	Yes	Yes	-	Yes
		Site preparation and cleaning	Yes	Yes	-	Yes	Yes	-	Yes
		Storage and handling of construction waste	Yes	-	Yes	Yes	-	Yes	Yes
Transportation of drilling rig and ancillaries	Yes	Yes	-	Yes	-	Yes	Yes		

		Generation of waste water & discharge from construction activity & labor	-	-	Yes	Yes	Yes	-	Yes								
		Operation of DG sets and machinery	Yes	Yes	-	-	-	Yes	-								
		Operation of drilling rig	-	Yes	-	Yes	-	-	-								
		Storage and disposal of drill cuttings and mud	-	-	Yes	Yes	-	-	Yes								
		Flaring during testing and process upset	Yes	-	-	-	-	Yes	-								
		Blow out	Yes	-	-	-	-	Yes	-								
		Spillage of chemical & Oil	Yes		Yes	Yes	Yes	Yes	-								
		Decommissioning and aftercare	-	Yes	-	Yes	-	Yes	-								
		Removal of well site construction materials & disposal	-	Yes	-	Yes	-	Yes	-								
		Site restoration	-	-	-	Yes	-	Yes	-								
8.	The PP shall furnish detailed plan for providing solar Panels as alternate source of energy	<p>All the lights and other decorative luminaries can utilise the solar energy. Solar panel will be installed at the roof of the shades with proper cleaning system.</p> <p>The alternative energy will be equipped from Solar panels which will be installed on the roof of the Adminstrative Complex for all the lightings around the project site.</p> <table border="1"> <thead> <tr> <th>Description</th> <th>Quantity</th> </tr> </thead> <tbody> <tr> <td>Total Roof Area of the Adminstrative Complex (Sq.m)</td> <td>187 Sq.m</td> </tr> <tr> <td>Sq.m/ 1KW</td> <td>10</td> </tr> <tr> <td>KW</td> <td>18.70</td> </tr> </tbody> </table>								Description	Quantity	Total Roof Area of the Adminstrative Complex (Sq.m)	187 Sq.m	Sq.m/ 1KW	10	KW	18.70
Description	Quantity																
Total Roof Area of the Adminstrative Complex (Sq.m)	187 Sq.m																
Sq.m/ 1KW	10																
KW	18.70																

		Sun hour/day	5
		Average units/day	93.5
9.	PP shall detail environment priorities of fishing port, environment policy of the port, environment management cell available at the port and eco-friendly port assessment model.	<p>The environmental priorities of fishing port are given below:</p> <ol style="list-style-type: none"> 1. Enhance and maintain the Environmental Management System (EMS), consistent with its activities, services and environment impacts that include planning and setting EMS objectives and targets. 2. Risk Assessment techniques will be implemented and followed. 3. All the preventive and mitigation measures will be taken to control the pollution created by the Port activities. 4. Environmental Management System will be implemented in the proper disposal and treated waste materials. 5. Continuous improvement of environment management system and its performance. 	



CHENNAI PORT AUTHORITY

ENVIRONMENTAL POLICY

Chennai Port Authority (ChPA) recognizes the environmental, social and economic importance for operating all port activities in an environmentally sustainable and responsible manner. Chennai Port Authority is committed to achieve a high-level environmental performance ensuring continual improvement.

To achieve environmental performance consistent with this policy, ChPA will

- Develop and maintain an Environmental Management System (EMS), consistent with its activities, services and environmental impacts, that includes planning and setting EMS objectives and targets, implementation and operation, monitoring performance, review and continual improvement.
- Implement risk management techniques to identify environmental risk and opportunities (method) to assess impacts of ChPA's activities, introducing appropriate mitigation measures.
- Comply with all applicable environmental laws, regulation, policies and standards which relate to its activities and services in a transparent manner.
- Seek to prevent: Minimize the pollution resulting from Port activities and services.
- Communicate this policy and ChPA's progress in meeting the objectives and targets defined in its Environmental Management System, to concerned interested parties, including employees and stakeholders.
- Implement the Environmental Management System for reduction in generation of waste, consumption of natural resources like water, energy, etc., safe disposal of waste, waste usage wherever possible, usage of treated water and to rely on renewable sources of energy.
- Continually improve its Environmental Management and Environmental Performance through providing sufficient resources and training to achieve the targets defined in its Environmental Management System.

For the effective implementation of this policy all the interested parties like officers, employees, licensees, licensees, service providers, other persons and those otherwise engaged at the workplace are responsible and expected to reasonably comply with requirements of this policy.

DATE: 07.02.2023

Sd/-
CHAIRMAN

Environmental Policy of ChPA

Environmental Management Cell of ChPA:

Chief Manager

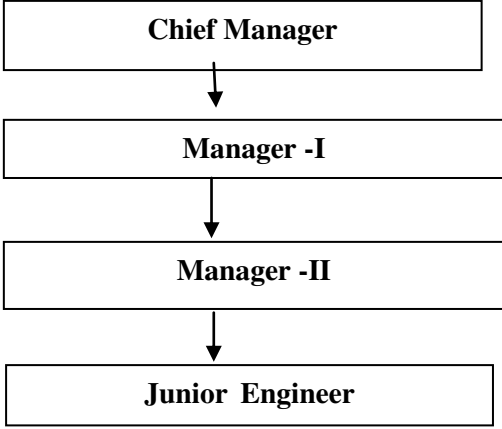
- The chief manager has to lead the whole team and totally responsible for the Environment and safety of the port.
- He will provide strategic vision and plan in the implementation of various environmental and security initiatives of the port.
- Responsible for improving the ports environmental compliance including implementation management of various environmental and security plans.
- Environmental project permitting sustainability and environmental policy development and implementation.
- He is responsible for developing environmental management and monitoring plans.
- Encourage the integration of appropriate environmental management considerations into decision making processes there by preventing or minimizing the potential for environmental harm.
- Provide framework for continually improving environmental performance of the organization and communicate the same to TCPCB/CPCB and MoEF.
- He has to represent the port in local state and federal agency meetings.
- Implementation of IOS 14001-2004 standards in Chennai port co-ordination with external surveillance authors. Incorporation of suggestions in the manual and implementation of the same.
- To comply with all legal social and community obligations etc.
- Monitoring of periodical returns and consent every month.

Manager - I

- The manager is responsible for safety, operations and industrial health in all parts of the port.
- He has to take all safety measures to prevent accidents on the road, wharf and anywhere inside the port and to minimize the occupational risk.
- To ensure all port workers adhere to the safety norms and wear personal equipment while working in the operational area.
- He has taken care of marine oil pollution, workshop waste etc. and take all remedial measures for the safe disposal of the above pollutants as directed by TNPCB/MoEF.
- To implement the Disaster management plan for the entire port.
- Conducting awareness training programme on environmental, safety and industrial health in Chennai port.
- submission of periodical reports to TNPCB and Administration every month.

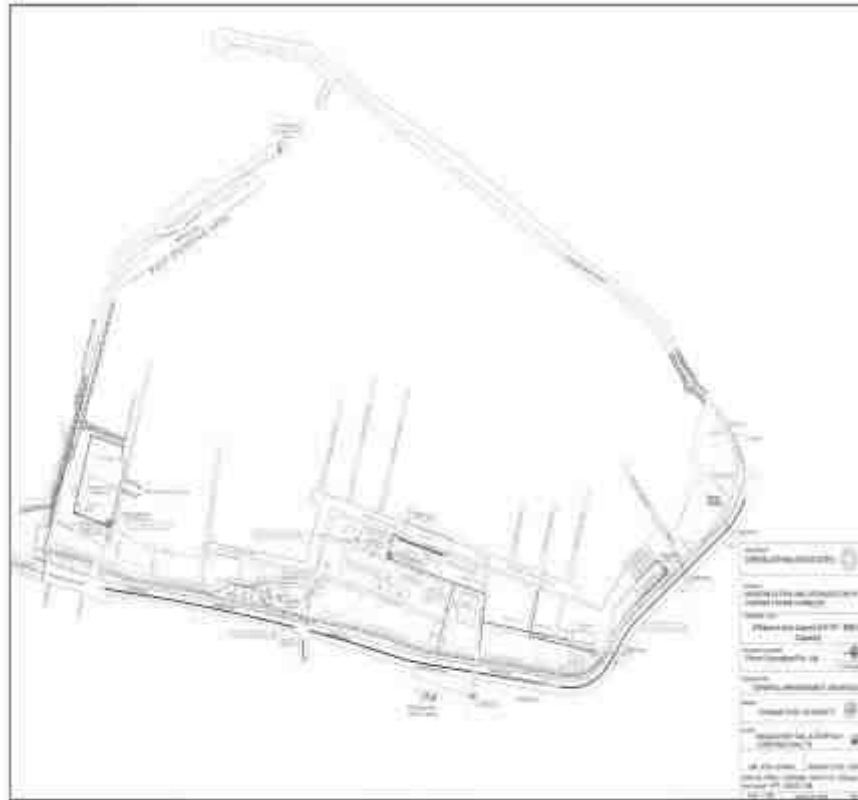
Manager - II

- The manager is responsible for getting project clearances under EIA/CRZ notification.
- Preparation of EIA/EMP report as per standard TOR.
- Conducting public hearings whenever required.
- Represent the port in local state and federal agency meetings.
- He has to get consent approval for establishment under Air and Water Act.
- Compliance of clearance conditions during construction stage.
- Development of green belt, dust suppression system etc. to reduce the adverse pollutant parameters in consultation with SE(Plantation

		<p>Cell).</p> <ul style="list-style-type: none"> ➤ Wastewater management and disposal plan. ➤ Distribution of pamphlets and display of message boards on Environmental Management. ➤ Conducting awareness training programme on control of pollution in port. ➤ To comply with all legal social and community obligations etc. <p>Junior Engineer</p> <ul style="list-style-type: none"> ➤ Marine oil spill response and disposal. ➤ Project clearance under EIA/CRZ notifications ➤ Preparing EIA/EMP as per ToR. ➤ Development of green belt, dust suppression system etc. to reduce the adverse pollutant parameters. ➤ To comply with all legal, social and community obligations etc. ➤ Prepare the periodical reports and sent to the Administration every month. ➤ Keep the records up to date <div style="text-align: center;">  <pre> graph TD CM[Chief Manager] --> M1[Manager -I] M1 --> M2[Manager -II] M2 --> JE[Junior Engineer] </pre> </div>
10.	The propo- nent should	<p>The proponent will ensure that the boats are properly maintained and there is no oil spillage.</p> <p>The used Engine oils will be reused in their boats for other purposes like spraying on the engines and other machinery parts to avoid rust and the remaining oil has been sold out by the boat owners, which are being taken out by the purchaser from Chennai Fishing Harbour for</p>

	ensure that the boats are properly maintained and there is no oil spillage. Used oil disposal details shall be furnished.	secondary purposes. Oil Spill Management Plan is attached as Annexure 8 .
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11. The proponent should prepare a comprehensive line diagram in which all the facilities to be created should be marked. Then for each facility the probable effluent generation and waste generation should be indicated



Comprehensive Line Diagram with all the facilities

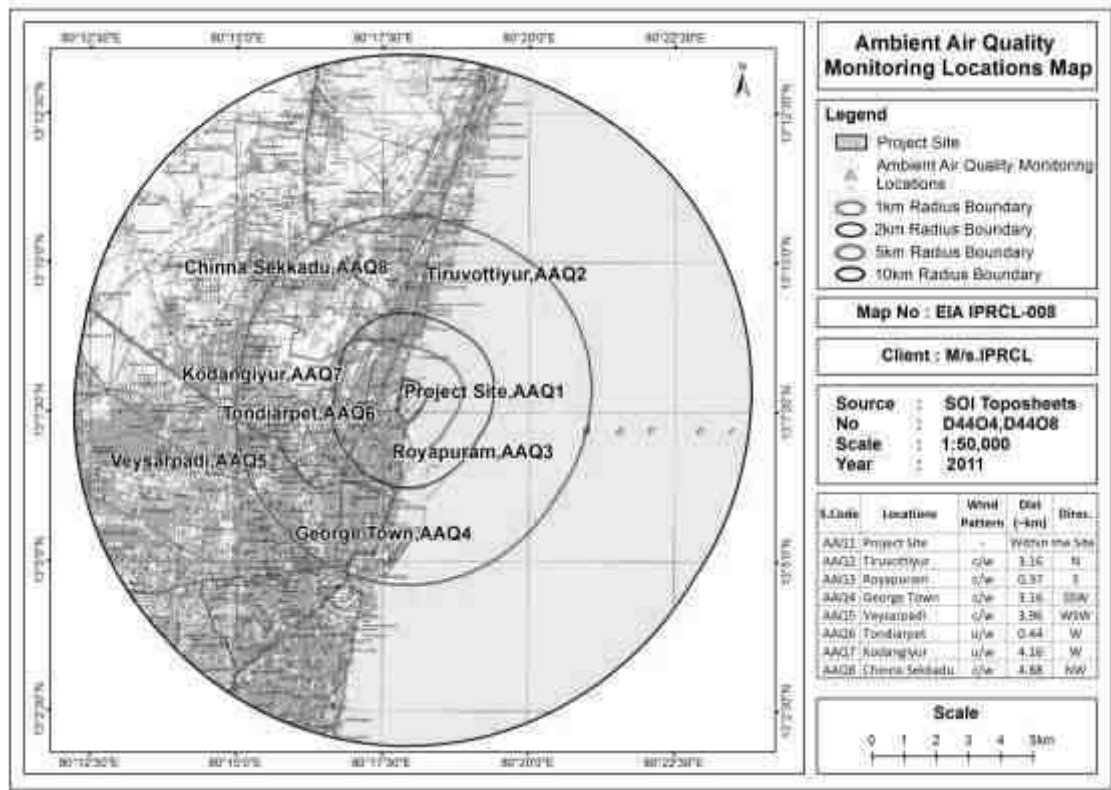
The methodology of ETP has been detailed in its specification and it is attached as **Annexure 7**.

There will not be any sort of marine discharges from the proposed activity.

	<p>d with quantity and quality. Finally, methodology for collection, treatment, and reuse/disposal of the liquid and solid waste should be indicated. Specific attention should be paid to the marine discharges.</p>	
12.	<p>Within 10km radius</p>	<p>The parameters like air, sediment and biology which includes coastal ecology are studied within the 10km radius.</p> <p>Air Environment :</p>

	all the parameters like air, sediment and biology including coastal ecology should be studied in detail.	Parameters	Co nc.	NAA Q Standards	Locations							
					Project Site	Tiruvottiy ur	Royapura m	Georg e Town	Veysarpa di	Tondiarpe t	Kodangiy ur	Chinna Sekkadu
					AAQ 1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7	AAQ 8
PM10 Conc. (µg/m ³)	Min .	100 (24 Hours)	44.98	35.55	38.04	39.09	40.28	39.73	40.57	39.69		
	Ma x.		64.11	50.66	54.22	55.72	57.41	56.62	57.82	56.56		
	Avg .		53.94	42.63	45.62	46.88	48.31	47.64	48.66	47.59		
	98t h 'tile		63.73	50.36	53.90	55.39	57.07	56.29	57.49	56.23		
PM2.5 Conc. (µg/m ³)	Min .	60 (24 Hours)	26.99	21.33	22.83	23.46	24.17	23.84	24.34	23.81		
	Ma x.		38.46	30.39	32.53	33.43	34.44	33.97	34.69	33.94		
	Avg .		32.37	25.58	27.38	28.13	28.99	28.59	29.20	28.56		
	98t h 'tile		38.24	30.22	32.34	33.24	34.24	33.78	34.49	33.74		
SO2 Conc. (µg/m ³)	Min .	80 (24 Hours)	6.91	6.86	6.88	6.53	6.42	6.40	6.88	6.82		
	Ma x.		9.85	9.77	9.81	9.31	9.15	9.13	9.81	9.72		
	Avg .		8.30	8.23	8.26	7.84	7.71	7.69	8.26	8.19		
	98t h 'tile		9.80	9.71	9.75	9.25	9.10	9.07	9.75	9.67		
NO2 Conc.	Min .	80 (24	13.83	13.70	13.68	12.96	12.76	12.71	13.68	13.57		
	Ma		19.71	19.53	19.81	18.47	18.19	18.11	19.50	19.33		

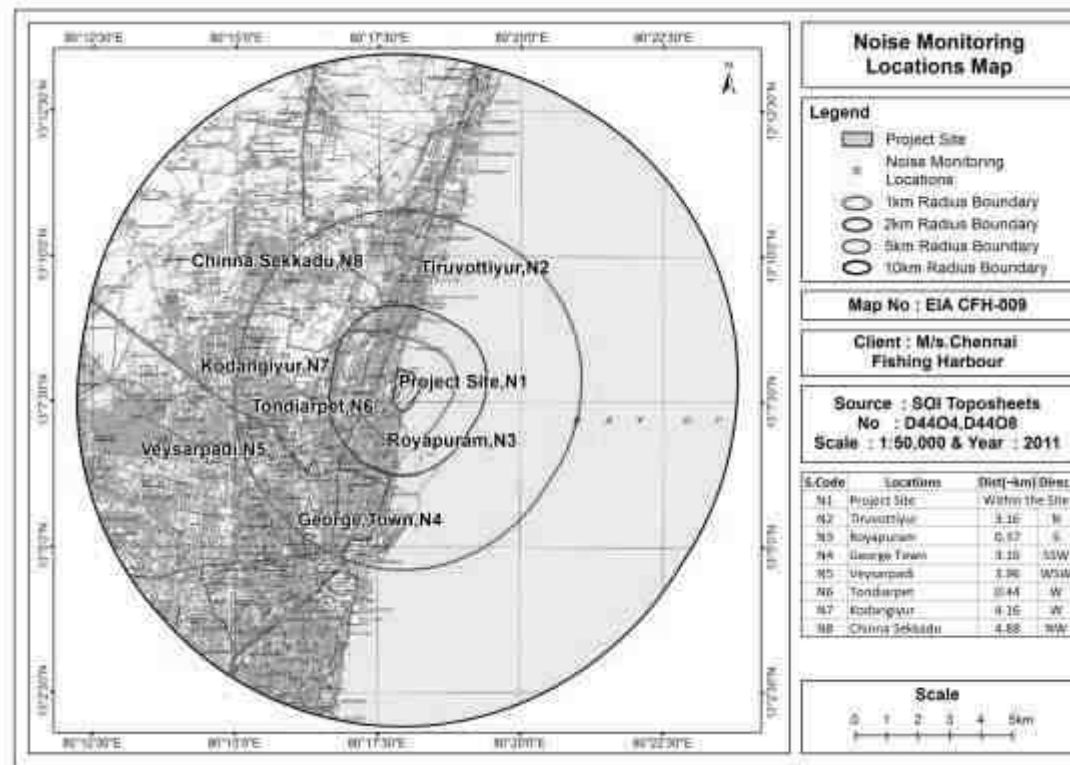
		(µg/m3)	x.	Hours								
			Avg		16.59	16.44	16.42	15.54	15.31	15.25	16.41	16.27
			98th		19.59	19.42	19.55	18.36	18.08	18.01	19.39	19.22
			tile									
		Pb (µg/m3)	Avg	1	BLQ	BLQ (LOQ	BLQ	BLQ	BLQ	BLQ	BLQ	
			.	(24	(LOQ	0.05)	(LOQ	(LOQ	(LOQ	(LOQ	(LOQ	
				hour)	0.05)	0.05)	0.05)	0.05)	0.05)	0.05)	0.05)	
		CO	Avg	4	0.54	0.43	0.46	0.47	0.48	0.48	0.49	
		(mg/m3)	.	(1hour)								
		Ozone(O3)	Avg	180	10.4	10.60	10.30	10.80	10.20	10.11	10.23	
		, µg/m3	.	(1hour)								
		Benzene,	Avg	5	BLQ	BLQ (LOQ	BLQ	BLQ	BLQ	BLQ	BLQ	
		µg/m3	.		(LOQ 1)	1)	(LOQ 1)	(LOQ 1)	(LOQ 1)	(LOQ 1)	(LOQ 1)	
		Benzo (a)	Avg	1	BLQ	BLQ (LOQ	BLQ(LOQ	BLQ(LO	BLQ(LOQ	BLQ(LOQ	BLQ(LO	
		pyrene,	.	(Annua	(LOQ	1)	1)	Q	1)	1)	Q	
		ng/m3		l)	1)		1)	1)	1)	1)	1)	
		As (ng/	Avg	6(Annua	BLQ	BLQ (LOQ	BLQ	BLQ	BLQ	BLQ	BLQ	
		m3)	.	l)	(LOQ	2)	(LOQ	(LOQ	(LOQ	(LOQ	(LOQ	
					2)	2)	2)	2)	2)	2)	2)	
		Ni (ng/m3)	Avg	20(Annua	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	BLQ	
			.	l)	(LOQ 10)	(LOQ 10)	(LOQ 10)	(LOQ 10)	(LOQ 10)	(LOQ 10)	(LOQ 10)	
		NH3	Avg	400	BLQ(LO	BLQ(LOQ	BLQ(LOQ	BLQ(LO	BLQ(LOQ	BLQ(LOQ	BLQ(LO	
		(µg/m3)	.	(24hour	Q5)	5)	5)	Q5)	5)	5)	Q5)	
				s)								



Noise Environment:

S. No	Location	Location Code	Distance (~km) from Project boundary	Direction	Noise level in dB(A) Leq		CPCB Standard		Environmental Setting
					Day	Night	Lday (Ld)	LNight (Ln)	
1.	Project Site	N1	Within the Site		50.5	43.4	75	70	Industrial
2.	Tiruvottiyur	N2	3.16	N	52.3	44.7	55	45	Residential
3.	Royapuram	N3	0.37	S	51.7	43.3	55	45	Residential
4.	George Town	N4	3.16	SSW	52.3	42.8	55	45	Residential

5.	Veysarpadi	N5	3.96	WSW	54.8	44.3	55	45	Residential
6.	Tondiarpet	N6	0.44	W	53.2	42.2	55	45	Residential
7.	Kodangiur	N7	4.16	W	54.6	41.5	55	45	Residential
8.	Chinna Sekkadu	N8	4.88	NW	53.6	40.2	55	45	Residential



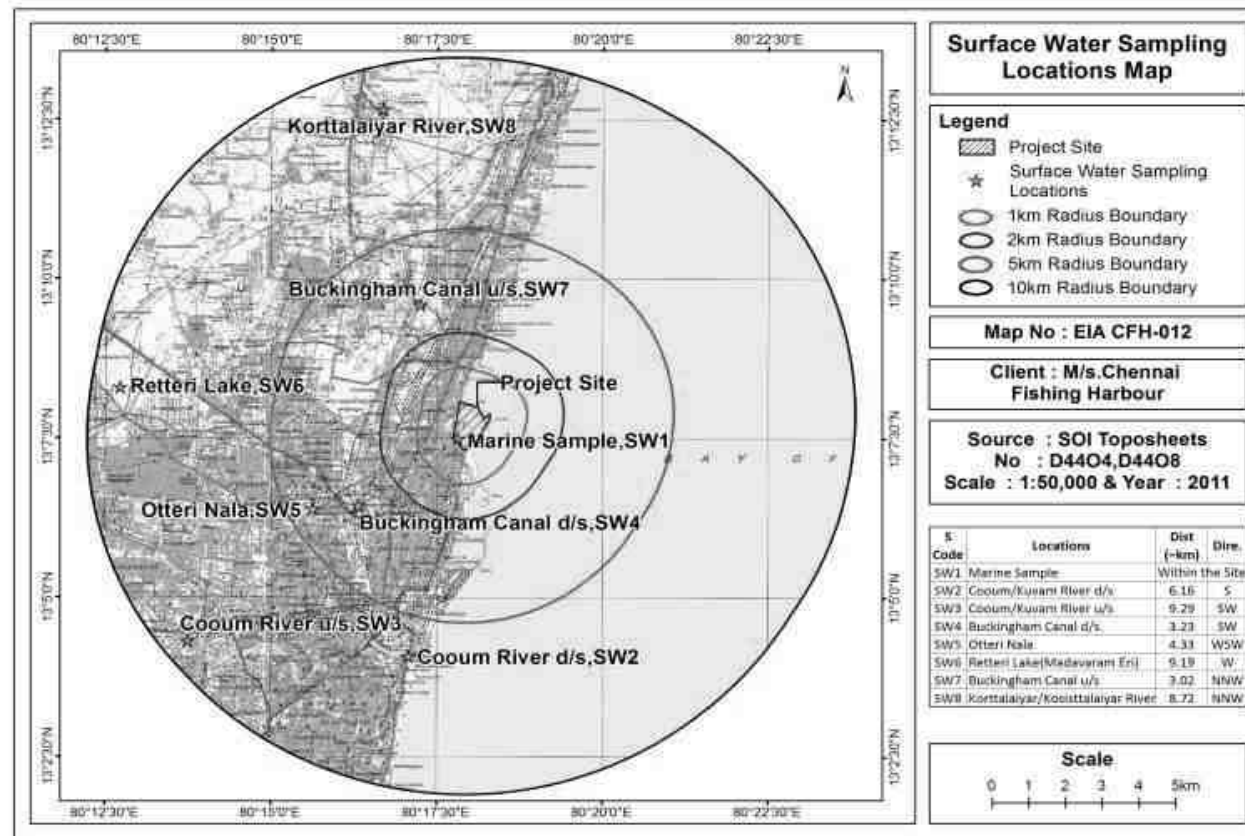
Surface Water Environment:

Parameter	Unit	Surface	Marine	Adyar	Adyar	Buckingham	Coou	Buckingham	Otteri	Cooum
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		water standards (IS 2296 Class-A)	sample near project site	River d/s	River u/s	am Canal d/s	m River u/s	am Canal u/s	Nala	River d/s	
			SW1	SW 2	SW 3	SW 4	SW 5	SW 6	SW 7	SW 8	
	pH (at 25°C)	--	6.5-8.5	8.17	6.78	7.23	6.69	7.42	7.47	7.58	6.90
	Electrical Conductivity	µS/cm	-	52008	14797	4305	40314	39369	33087	2817	43350
	Total Dissolved Solids	mg/l	500	30233	8729	2336	23670	23135	19635	1576	26450
	Total Suspended Solids	mg/l	-	19	48	41	38	46	29	25	52
	Total Alkalinity as CaCO ₃	mg/l	-	436.9	327.4	278.9	367.5	334.5	307.8	231.9	389.5
	Total Hardness as CaCO ₃	mg/l	300	5503.8	1563.8	574.7	4306.0	4209.3	3569.7	297.0	4813.0
	Sodium as Na	mg/l	-	8924	2535	618	6982	6825	5788	481	7804
	Potassium as K	mg/l	-	398	113	27	311	304	258	21	348
	Calcium as Ca	mg/l	-	1249.4	355.0	130.5	977.5	955.5	810.3	67.4	1092.6
	Magnesium as Mg	mg/l	-	578.4	164.3	60.4	452.5	442.4	375.2	31.2	505.8
	Chloride as Cl	mg/l	250	13280.0	3773.3	920.0	10390.0	10156.7	8613.3	574.1	11613.3
	Sulphate as SO ₄	mg/l	400	5511.2	1565.9	381.8	4311.9	4215.0	3574.5	238.2	4819.5

	Nitrate as NO ₃	mg/l	20	2.8	5.1	4.0	3.8	6.0	3.7	3.4	4.4
	Fluorides as F	mg/l	1.5	0.87	0.52	0.45	0.63	0.71	0.64	0.41	0.69
	Cyanide	mg/l	0.05	BLQ(LOQ 0.01)	BLQ(L OQ 0.01)	BLQ(L OQ 0.01)	BLQ(LOQ 0.01)	BLQ(L OQ 0.01)	BLQ(LOQ 0.01)	BLQ(L OQ 0.01)	BLQ(LO Q 0.01)
	Arsenic	mg/l	0.05	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)
	Boron as B	mg/l	-	BLQ(LOQ 0.1)	BLQ(L OQ 0.1)	BLQ(L OQ 0.1)	BLQ(LOQ 0.1)	BLQ(L OQ 0.1)	BLQ(LOQ 0.1)	BLQ(L OQ 0.1)	BLQ(LO Q 0.1)
	Cadmium as Cd	mg/l	0.01	BLQ(LOQ 0.001)	BLQ(L OQ 0.001)	BLQ(L OQ 0.001)	BLQ(LOQ 0.001)	BLQ(L OQ 0.001)	BLQ(LOQ 0.001)	BLQ(L OQ 0.001)	BLQ(LO Q 0.001)
	Chromium, Total	mg/l	0.05	BLQ(LOQ 0.01)	BLQ(L OQ 0.01)	BLQ(L OQ 0.01)	BLQ(LOQ 0.01)	BLQ(L OQ 0.01)	BLQ(LOQ 0.01)	BLQ(L OQ 0.01)	BLQ(LO Q 0.01)
	Copper as Cu	mg/l	1.5	BLQ(LOQ 0.01)	BLQ(L OQ 0.01)	BLQ(L OQ 0.01)	BLQ(LOQ 0.01)	BLQ(L OQ 0.01)	BLQ(LOQ 0.01)	BLQ(L OQ 0.01)	BLQ(LO Q 0.01)
	Lead as Pb	mg/l	0.1	BLQ(LOQ 0.005)	BLQ(L OQ 0.005)	BLQ(L OQ 0.005)	BLQ(LOQ 0.005)	BLQ(L OQ 0.005)	BLQ(LOQ 0.005)	BLQ(L OQ 0.005)	BLQ(LO Q 0.005)
	Manganese as Mn	mg/l	0.5	BLQ(LOQ 0.05)	BLQ(L OQ 0.05)	BLQ(L OQ 0.05)	BLQ(LOQ 0.05)	BLQ(L OQ 0.05)	BLQ(LOQ 0.05)	BLQ(L OQ 0.05)	BLQ(LO Q 0.05)
	Mercury	mg/l	0.001	BLQ(LOQ 0.0005)	BLQ(L OQ 0.0005)	BLQ(L OQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(L OQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(L OQ 0.0005)	BLQ(LO Q 0.0005)
	Nickel as Ni	mg/l	-	BLQ(LOQ 0.01)	BLQ(L OQ 0.01)	BLQ(L OQ 0.01)	BLQ(LOQ 0.01)	BLQ(L OQ 0.01)	BLQ(LOQ 0.01)	BLQ(L OQ 0.01)	BLQ(LO Q 0.01)
	Selenium as Se	mg/l	0.01	BLQ(LOQ 0.005)	BLQ(L OQ 0.005)	BLQ(L OQ 0.005)	BLQ(LOQ 0.005)	BLQ(L OQ 0.005)	BLQ(LOQ 0.005)	BLQ(L OQ 0.005)	BLQ(LO Q 0.005)
	Dissolved	mg/l	6	6.5	5.7	5.9	5.5	5.2	5.9	5.7	5.1

		Oxygen										
		Chemical Oxygen Demand as O ₂	mg/l	-	16.0	68.0	50.0	80.0	98.0	62.0	54.0	112.0
		BOD, 3 days @ 27°C as O ₂	mg/l	2	2.0	12.0	8.0	12.0	16.0	10.0	8.0	17.0



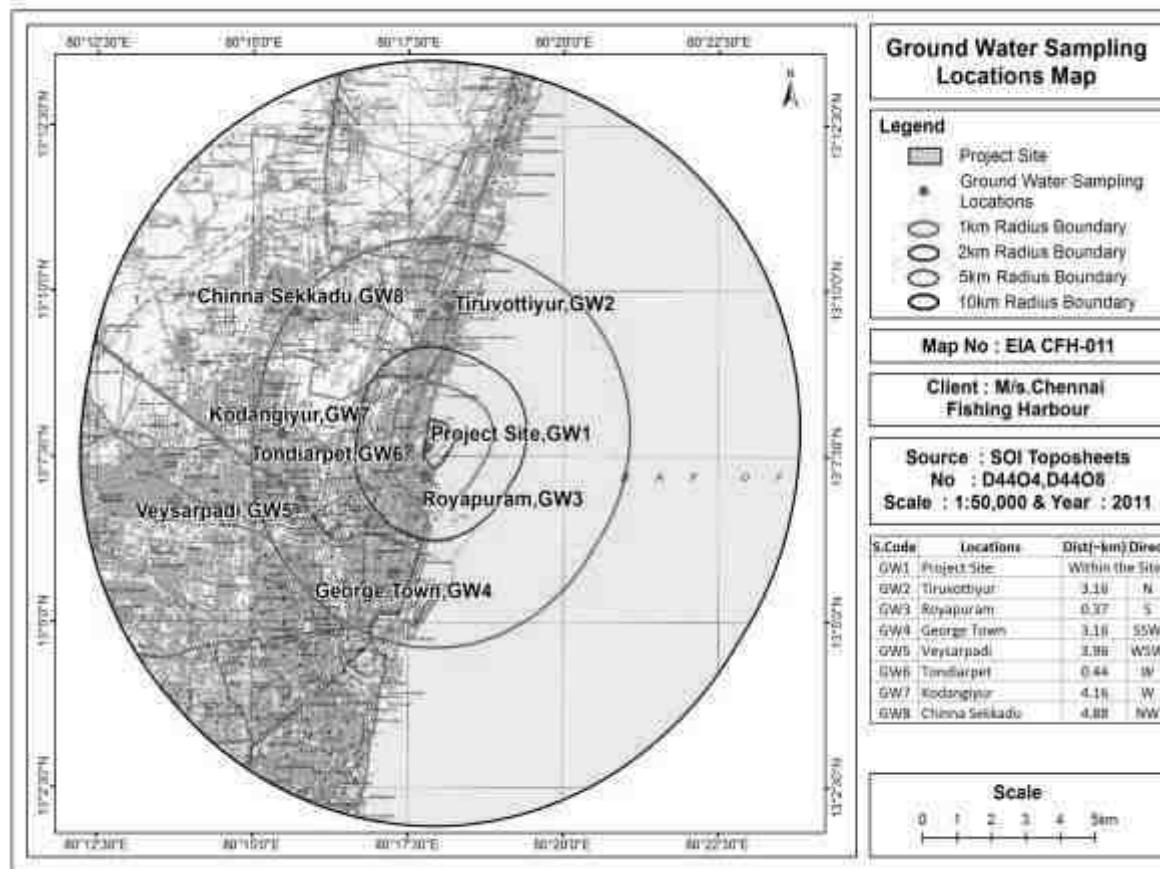
Ground water Environment:

Sl. No	Parameters	Unit	Drinking water Standard	Drinking water Standard	Near Project Site	Tiruvottiyur	Royapuram	George Town	Veysarpadi	Tondiarpet	Kodangiur	Chinna Sekkadu

			(IS 10500: 2012) Permissible Limit	d (IS 10500: 2012) Acceptable Limit	GW1	GW2	GW3	GW4	GW5	GW6	GW7	GW8
1.	Colour	Hazen	15	5	BLQ(LO Q 1)	BLQ(LOQ 1)	BLQ(LO Q 1)	BLQ(LO Q 1)	BLQ(LOQ 1)	BLQ(LO Q 1)	BLQ(LOQ 1)	BLQ(LO Q 1)
2.	Turbidity	NTU	5	1	BLQ(LO Q 0.1)	BLQ(LOQ 0.1)	BLQ(LO Q 0.1)	BLQ(LO Q 0.1)	BLQ(LOQ 0.1)	BLQ(LO Q 0.1)	BLQ(LOQ 0.1)	BLQ(LO Q 0.1)
3.	pH	--	NR	6.5-8.5	7.98	7.6	7.37	7.96	7.8	7.75	7.41	7.83
4.	Conductivity	µS/cm	-	-	2098	1887	1675	1732	1427	1526	1843	1478
5.	Total Dissolve Solids	mg/l	2000	500	1166	1040	911	934	802	835	1018	812
6.	Total Suspended Solids		-	-	BLQ(LO Q 1)	BLQ(LOQ 1)	BLQ(LO Q 1)	BLQ(LO Q 1)	BLQ(LOQ 1)	BLQ(LO Q 1)	BLQ(LOQ 1)	BLQ(LO Q 1)
7.	Alkalinity as CaCO ₃	mg/l	600	200	301	269	234	241	198	215	261	209
8.	Total Hardness as CaCO ₃	mg/l	600	200	478	427	372	390	315	348	415	338
9.	Sodium as Na	mg/l	-	-	221	197	172	177	178	157	191	153
10.	Potassium as K	mg/l	-	-	15	14	12	10	7	8	13	7
11.	Calcium as Ca	mg/l	200	75	108.6	96.9	84.5	88.5	71.5	79.0	94.1	76.7
12.	Magnesium as Mg	mg/l	100	30	50.3	44.9	39.1	41.0	33.1	36.6	43.6	35.5
13.	Chloride as Cl	mg/l	1000	250	395.0	352.5	307.5	316.0	260.0	282.0	342.5	274.0

		14.	Sulphate SO ₄	mg/l	400	200	163.9	146.3	127.6	131.1	107.9	117.0	142.1	113.7
		15.	Nitrate as NO ₃	mg/l	NR	45	4.3	6.5	7.8	4.8	5.5	6.2	7.1	5.4
		16.	Fluorides as F		1.5	1	0.48	0.46	0.44	0.43	0.41	0.40	0.45	0.42
		17.	Cyanide	mg/l	NR	0.05	BLQ(LO Q 0.01)	BLQ(LOQ 0.01)	BLQ(LO Q 0.01)	BLQ(LO Q 0.01)	BLQ(LOQ 0.01)	BLQ (LO Q 0.01)	BLQ(LOQ 0.01)	BLQ(LO Q 0.01)
		18.	Arsenic as As	mg/l	0.05	0.01	BLQ(LO Q 0.005)	BLQ(LOQ 0.005)	BLQ(LO Q 0.005)	BLQ(LO Q 0.005)	BLQ(LOQ 0.005)	BLQ (LO Q 0.005)	BLQ(LOQ 0.005)	BLQ(LO Q 0.005)
		19.	Boron as B	mg/l	1.0	0.5	BQL(LO Q 0.1)	BQL(LOQ 0.1)	BQL(LO Q 0.1)	BQL(LO Q 0.1)	BQL(LOQ 0.1)	BQL (LO Q 0.1)	BQL(LOQ 0.1)	BQL(LO Q 0.1)
		20.	Cadmium as Cd	mg/l	NR	0.003	BQL(LO Q 0.001)	BQL(LOQ 0.001)	BQL(LO Q 0.001)	BQL(LO Q 0.001)	BQL(LOQ 0.001)	BQL (LO Q 0.001)	BQL(LOQ 0.001)	BQL(LO Q 0.001)
		21.	Chromium as Cr	mg/l	NR	0.05	BQL(LO Q 0.01)	BQL(LOQ 0.01)	BQL(LO Q 0.01)	BQL(LO Q 0.01)	BQL(LOQ 0.01)	BQL (LO Q 0.01)	BQL(LOQ 0.01)	BQL(LO Q 0.01)
		22.	Copper as Cu	mg/l	1.5	0.05	BLQ(LO Q 0.01)	BLQ(LOQ 0.01)	BLQ(LO Q 0.01)	BLQ(LO Q 0.01)	BLQ(LOQ 0.01)	BLQ (LO Q 0.01)	BLQ(LOQ 0.01)	BLQ(LO Q 0.01)
		23.	Lead as Pb	mg/l	NR	0.01	BLQ(LO Q 0.005)	BLQ(LOQ 0.005)	BLQ(LO Q 0.005)	BLQ(LO Q 0.005)	BLQ(LOQ 0.005)	BLQ (LO Q 0.005)	BLQ(LOQ 0.005)	BLQ(LO Q 0.005)

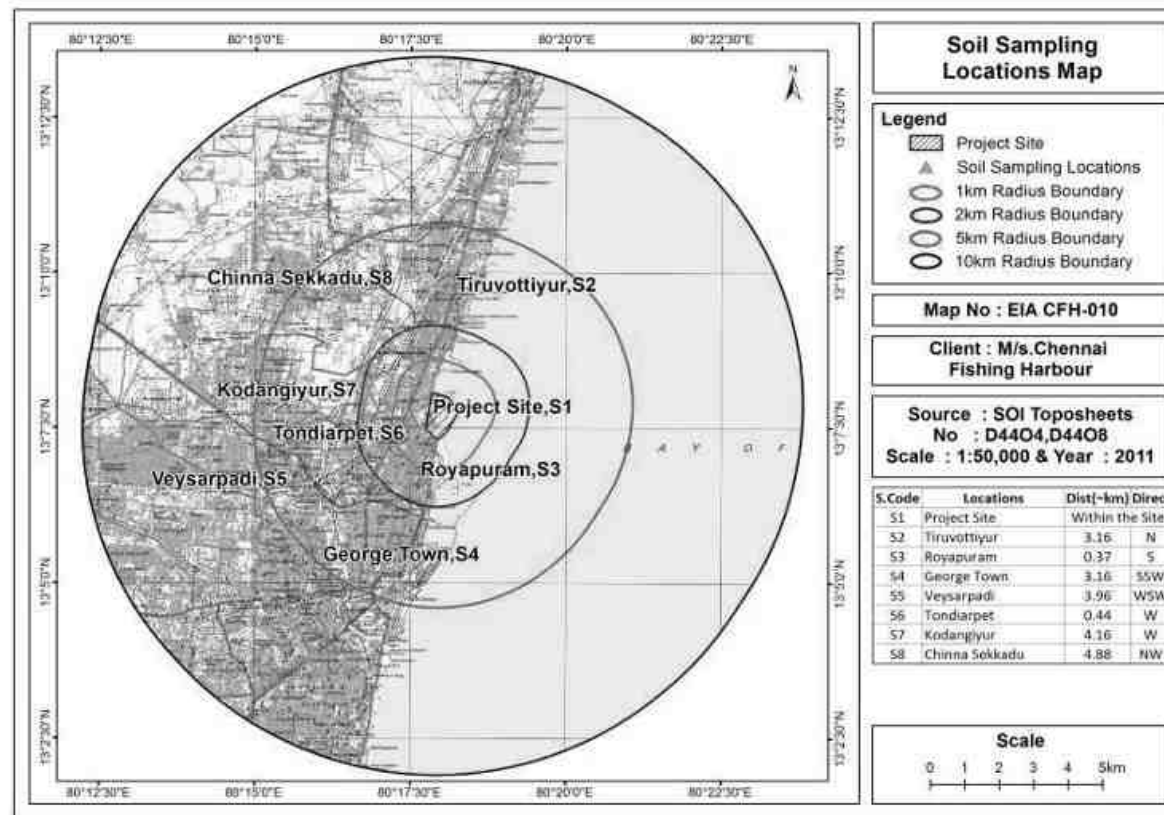
		24.	Manganese as Mn	mg/l	0.3	0.1	BLQ(LO Q 0.05)	BLQ(LOQ 0.05)	BLQ(LO Q 0.05)	BLQ(LO Q 0.05)	BLQ(LOQ 0.05)	BLQ(LO Q 0.05)	BLQ(LOQ 0.05)
		25.	Mercury	mg/l	NR	0.001	BLQ(LO Q 0.0005)	BLQ(LOQ 0.0005)	BLQ(LO Q 0.0005)	BLQ(LO Q 0.0005)	BLQ(LOQ 0.0005)	BLQ(LO Q 0.0005)	BLQ(LOQ 0.0005)
		26.	Nickel as Ni	mg/l	NR	0.02	BLQ(LO Q 0.01)	BLQ(LOQ 0.01)	BLQ(LO Q 0.01)	BLQ(LO Q 0.01)	BLQ(LOQ 0.01)	BLQ(LO Q 0.01)	BLQ(LOQ 0.01)
		27.	Selenium as Se	mg/l	NR	0.01	BLQ(LO Q 0.005)	BLQ(LOQ 0.005)	BLQ(LO Q 0.005)	BLQ(LO Q 0.005)	BLQ(LOQ 0.005)	BLQ(LO Q 0.005)	BLQ(LOQ 0.005)
		28.	Zinc as Zn	mg/l	15	5	BLQ(LO Q 0.1)	BLQ(LOQ 0.1)	BLQ(LO Q 0.1)	BLQ(LO Q 0.1)	BLQ(LOQ 0.1)	BLQ(LO Q 0.1)	BLQ(LOQ 0.1)



Soil Environment:

S.No	Parameters	Units	Project Site	Tiruvotti yur	Royapur am	George Town	Veysarpa di	Tondiarpet	Kodangiy ur	Chinna Sekkadu
			S1	S2	S3	S4	S5	S6	S7	S8

1.	Soil Texture	-	Sandy Clay	Clay loam	Sandy Clay	Clay loam	Sandy Clay	Clay loam	Sandy Clay loam	Clay loam
2.	Sand	%	45.2	35.4	46.2	33.1	46.5	32.7	45.6	33.4
3.	Silt	%	19.4	26.6	17.4	29.9	18.3	30.8	20.2	31.2
4.	Clay	%	35.4	38.0	36.4	37.0	35.2	36.5	34.2	35.4
5.	pH	-	7.52	7.32	7.54	7.10	7.12	7.12	7.43	6.12
6.	Electrical conductivity	µS/cm	175	157	143	168	136	129	186	182
7.	Nitrogen as N	mg/kg	120.2	115.3	110.6	115.8	120.7	95.4	98.6	105.2
8.	Phosphorus	mg/kg	5.83	5.16	4.93	5.16	5.38	4.26	4.39	4.71
9.	Potassium	mg/kg	75.25	69.82	66.79	69.82	72.86	57.68	59.50	63.75
10.	Boron	mg/kg	BLQ(LO Q0.1)	BLQ(LO Q0.1)	BLQ(LO Q0.1)	BLQ(LO Q0.1)	BLQ(LO Q0.1)	BLQ(LO Q0.1)	BLQ(LO Q0.1)	BLQ(LO Q0.1)
11.	Cadmium	mg/kg	BLQ(LO Q 0.1)	BLQ(LO Q 0.1)	BLQ(LO Q 0.1)	BLQ(LO Q 0.1)	BLQ(LO Q 0.1)	BLQ(LO Q 0.1)	BLQ(LO Q 0.1)	BLQ(LO Q 0.1)
12.	Chromium	mg/kg	BLQ(LO Q 0.1)	BLQ(LO Q 0.1)	BLQ(LO Q 0.1)	BLQ(LO Q 0.1)	BLQ(LO Q 0.1)	BLQ(LO Q 0.1)	BLQ(LO Q 0.1)	BLQ(LO Q 0.1)
13.	Porosity	-	0.42	0.75	0.42	0.73	0.42	0.74	0.42	0.71
14.	Water holding Capacity	%	15.80	17.80	15.80	17.60	16.20	17.70	19.80	18.00



Biological Environment:

Flora Study

- The assessment of the flora of the study area is done by extensive secondary source information of the area of 10 km radius.
- Plants species were documented based on their habit characters of family, genus and species using available floral, other related literature.
- Besides the identification of plant species, information was collected on the vernacular names and uses of plants made by local inhabitants.

Floristic Composition within the study area

The ecology and diversity assessed within the 10 km radius in the study area. It is observed that human settlements present in and surround the project site and within the study area of 10 km radius and many of construction building area/ colonies have very low level of plantations.

There were total 53 species and 25 genera under 25 family found in the study area. The study area does not have any forest land or permanent natural vegetation and the main land use feature of the study area is comprised habitation and cultivating lands. From the primary observation, the tree species recorded in the plantation area were *Cocos nucifera*, *Azadirachta indica*, *Ficus benghalensis*, *Mangifera indica*, *Musa paradise* were found.

Rare and endangered Floral species

During the vegetation documentation for the study area recorded any such species which are endangered or threatened under IUCN (International Union for Conservation of Nature and Natural resources) guidelines found in the Indian Biodiversity Portal

S.No	Scientific name	Family	Habit	Venacular Name	IUCN status
1	<i>Abutilon indicum</i>	Malvaceae	Shrub	Thuthi	NA
2	<i>Acalypha indica</i>	Euphorbiaceae	Herb	Kuppaimeni	NA
3	<i>Acanthospermum hispidum</i>	Asteraceae	Herb	Kombu mull	NA
4	<i>Aerva persica</i>	Amaranthaceae	Shrub	Perumpulai	NA
5	<i>Aristida setacea</i>	Poaceae	Herb	—	NA
6	<i>Atriplex repens</i>	Chenopodiaceae	Herb	—	NA
7	<i>Azadirachta indica</i>	Meliaceae	Tree	Veppamaram	NA
8	<i>Boerhavia diffusa</i>	Nyctaginaceae	Herb	Mukurattai	NA
9	<i>Borassus flabellifer</i>	Arecaceae	Tree	Panaimaram	NA
10	<i>Bulbostylis barbata</i>	Cyperaceae	Herb	—	NA
11	<i>Calotropis gigantea</i>	Asclepiadaceae	Shrub	Erukku	NA
12	<i>Canavalia cathartica</i>	Fabaceae	Climber	—	NA
13	<i>Canavalia rosea</i>	Fabaceae	Climber	—	NA

			14	<i>Cassia italica</i>	Caesalpiniaceae	Herb	Nilavahai	NA
			15	<i>Casuarina litorea</i>	Casuarinaceae	Tree	Chavuku	NA
			16	<i>Catharanthus roseus</i>	Apocynaceae	Herb	Nithyakalyani	NA
			17	<i>Cenchrus ciliaris</i>	Poaceae	Herb	Kolukattaipul	NA
			18	<i>Citrullus colocynthis</i>	Cucurbitaceae	Herb	Peykkumatti	NA
			19	<i>Cocos nucifera</i>	Arecaceae	Tree	Thennaiaram	NA
			20	<i>Croton bonplandianus</i>	Euphorbiaceae	Herb	Mannannaichedi	NA
			21	<i>Datura metel</i>	Solanaceae	Herb	Oomathai	NA
			22	<i>Euphorbia hirta</i>	Euphorbiaceae	Herb	Amampatchaiarisi	NA
			23	<i>Euphorbia tortilis</i>	Euphorbiaceae	Shrub	Tirukukalli	NA
			24	<i>Fimbristylis cymosa</i>	Cyperaceae	Herb	—	NA
			25	<i>Gisekia pharnaceoides</i>	Aizoaceae	Herb	Manalkeerai	NA
			26	<i>Gomphrena serrata</i>	Amaranthaceae	Herb	—	NA
			27	<i>Hibiscus tiliaceus</i>	Malvaceae	Tree	Neerparuthi	LC
			28	<i>Launaea intybacea</i>	Asteraceae	Herb	—	NA
			29	<i>Launaea sarmentosa</i>	Asteraceae	Herb	—	NA
			30	<i>Leucas aspera</i>	Lamiaceae	Herb	Thumbai	NA
			31	<i>Lopholepisoritho cephalo</i>	Poaceae	Herb	—	NA
			32	<i>Opuntia stricta</i>	Cactaceae	Shrub	Sappathikalli	LC
			33	<i>Panicum repens</i>	Poaceae	Herb	—	NA
			34	<i>Passiflora foetida</i>	Passifloraceae	Climber	Sirupunaikali	NA
			35	<i>Pedaliium murex</i>	Pedaliaceae	Herb	Perunerunji	NA
			36	<i>Percularia daemia</i>	Asclepiadaceae	Climber	—	NA
			37	<i>Phyla nodiflora</i>	Verbenaceae	Herb	Koduppai	LC
			38	<i>Prosopis juliflora</i>	Mimosaceae	Tree	Veelikkaruvai	NA
			39	<i>Pycneus polystachyos</i>	Poaceae	Herb	—	LC
			40	<i>Sida cordifolia</i>	Malvaceae	Herb	Nilathuthi	NA
			41	<i>Spinifex littoreus</i>	Poaceae	Herb	Ravananmeesai	NA
			42	<i>Tephrosia purpurea</i>	Fabaceae	Under Shrub	Kolingi	NA

43	<i>Thespesia populnea</i>	Malvaceae	Tree	Poovarasu	LC
44	<i>Tribulus terrestris</i>	Zygophyllaceae	Herb	Nerinji	NA
45	<i>Vernonia cinerea</i>	Asteraceae	Herb	Mukuttipundu	NA
46	<i>Zoysia matrella</i>	Poaceae	Grass	—	NA
47	<i>Canavalia cathartica</i>	Fabaceae	Climber	Maunaloa	LC
48	<i>Ipomoea pes-caprae</i>	Convolvulaceae	Creeper	Bayhops	LC
49	<i>Pupalia lappacea</i> var. <i>orbiculata</i>	Amaranthaceae	Herb	—	LC
50	<i>Turnera subulata</i>	Passifloraceae	Herb	White buttercup	LC
Aquatic Plants					
51	<i>Avicennia marina</i>	Acanthaceae	Tree	Mangrove	LC
52	<i>Calophyllum inophyllum</i>	Calophyllaceae	Tree	Mangrove	LC
53	<i>Pontederia crassipes</i>	Pontederiaceae	hydrophyte	Water hyacinth	LC

LC-Least Concern; NA-Not Assessed

Reptiles and Amphibian

S.No	Reptiles & Amphibians	Common name	IUCN Status
1	<i>Hemidactylus sp.</i>	House lizard	Not Assessed
2	<i>Eutropis macularia</i>	Common skink	Not Assessed
3	<i>Bungarus caeruleus</i>	Common Krait	Not Assessed
4	<i>Ophisops leschenault</i>	Snake-eyed lizard	Not Assessed
5	<i>Rana tigrina</i>	Common yellow frog	Least Concern
6.	<i>Lepidochelys olivacea</i>	Olive Ridley Turtle	Vulnerable

Butterfly

S.No	Zoological Name	Family	Common Name	IUCN status
1	<i>Ariadne merione</i>	Nymphalidae	Common Caster	Least Concern
2	<i>Atrophaneura aristolochiae</i>	Papilionidae	Common Rose	Least Concern
3	<i>Catopsilia pomona</i>	Pieridae	Common Emigrant	Least Concern

4	<i>Catopsilia pyranthe</i>	Pieridae	Mottled Emigrant	Least Concern
5	<i>Colotis etrida</i>	Pieridae	Small Orange Tip	Least Concern
6	<i>Danaus chrysippus</i>	Nymphalidae	Plain Tiger	Least Concern
7	<i>Danaus genutia</i>	Nymphalidae	Striped Tiger	Least Concern
8	<i>Delias eucharis</i>	Pieridae	Common Jezebel	Least Concern
9	<i>Euchrysops cnejus</i>	Lycaenidae	Gram Blue	Least Concern
10	<i>Eurema hecabe</i>	Pieridae	Common Grass Yellow	Least Concern
11	<i>Hypolimnas bolina</i>	Nymphalidae	Great Egg Fly	Least Concern
12	<i>Hypolimnas misippus</i>	Nymphalidae	Danaid Egg Fly	Not Assessed
13	<i>Junonia almana</i>	Nymphalidae	Peacock Pansy	Least Concern
14	<i>Junonia hierta</i>	Nymphalidae	Yellow Pansy	Least Concern
15	<i>Junonia iphita</i>	Nymphalidae	Chocolate Pansy	Least Concern
16	<i>Junonia lemonias</i>	Nymphalidae	Lemon Pansy	Least Concern
17	<i>Junonia orithya</i>	Nymphalidae	Blue Pansy	Least Concern
18	<i>Leptosia nina</i>	Pieridae	Psyche	Least Concern
19	<i>Mycalesis perseus</i>	Nymphalidae	Common Bush Brown	Least Concern
20	<i>Phalanta phalantha</i>	Nymphalidae	Common Leopard	Least Concern

Aquatic Ecology

S.No	Phytoplankton
1	<i>Oscillatoria subbrevis</i>
2	<i>Pediastrum duplex</i>
3	<i>Spirogyra sp.</i>
4	<i>Navicula rhynchocephala</i>
5	<i>Microcystis aeruginosa</i>

Source:

a) *Birds:*

Ali, S. (2002). The Book of Indian Birds (13th Revised Edition). Oxford University Press, New Delhi, 326pp.

b) Butterflies:
 Kehimkar I. The Book of Indian Butterflies. Bombay Natural History Society, 2008, 497.

Evans WH. Identification of Indian butterflies. The Bombay Natural History Society, Bombay, 1927, 32.

Kunte K (2000a). Butterflies of Peninsular India. Indian Academy of Science, University of Press (India) Limited, Hyderabad, India, 354.

c) Mammals:
 Kamalakannan, M. & P.O. Nameer (2019). A checklist of mammals of Tamil Nadu, India. Journal of Threatened Taxa 11(8): 13992–14009; <https://doi.org/10.11609/jott.4705.11.8.13992–14009>.

d) Reptiles:
 Aengals, R., Sathish Kumar, V.M., Palot, M.J. & Ganesh, S.R. (2018). A Checklist of Reptiles of India. 35 pp

13. The sampling should be done in grid pattern and every one kilometre the samples (air, water, sediment and biological samples)

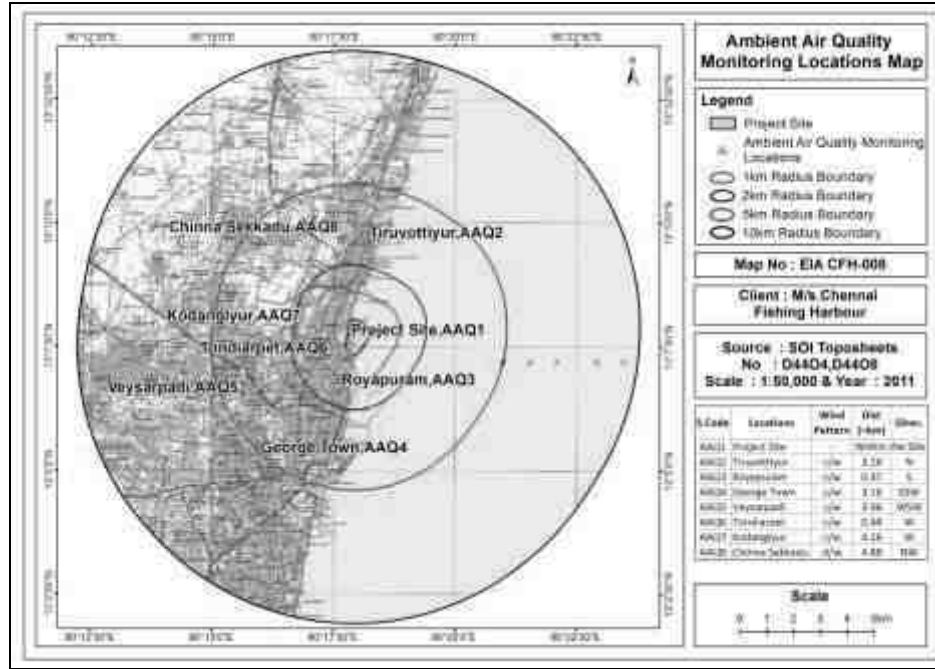
The sampling of Air, Noise, Water, Soil and Biological Environment has been taken for a period of 3 months from Jan 2023-April 2023. Each sampling study has been conducted at 8 different location along the 10km radius of the proposed project site.

Station Code	Location	Wind Pattern	Distance (~km) from Project boundary	Directions
AAQ1	Project Site	-	Within the Site	
AAQ2	Tiruvottiyur	c/w	3.16	N
AAQ3	Royapuram	c/w	0.37	S
AAQ4	George Town	c/w	3.16	SSW
AAQ5	Veysarpadi	c/w	3.96	WSW
AAQ6	Tondiarpet	c/w	0.44	W
AAQ7	Kodangiyur	c/w	4.16	W
AAQ8	Chinna Sekkadu	d/w	4.88	NW

within
10km
radius.

Ambient Air Quality

Details of Ambient Air Quality Monitoring Locations

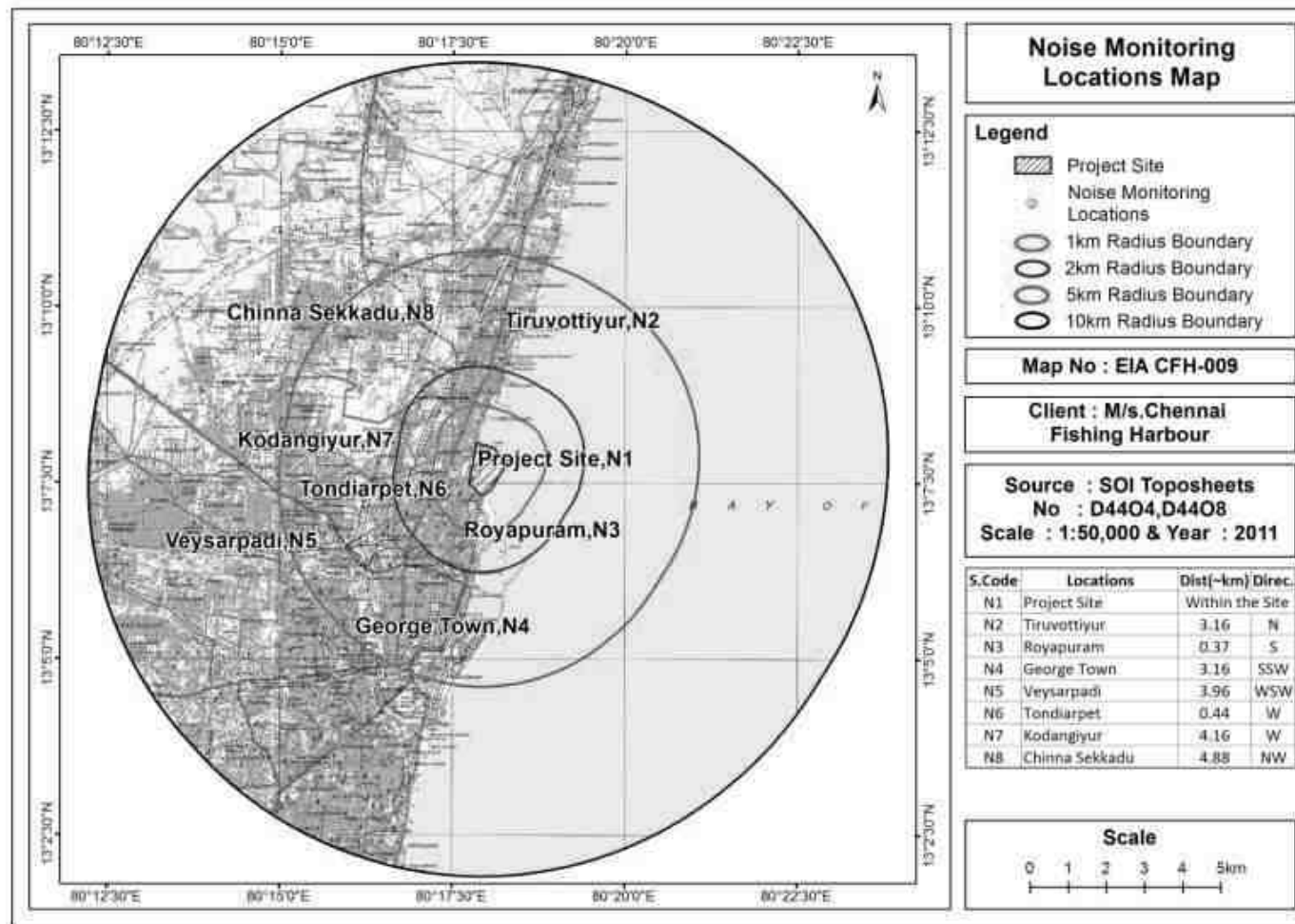


Parameter s	Co nc.	NAA Q Standards	Locations							
			Proj ect Site	Tiruvottiy ur	Royapura m	Georg e Town	Veysarpa di	Tondiarpe t	Kodangiy ur	Chinna Sekkadu
			AAQ 1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7	AAQ 8
PM10	Min .		44.98	35.55	38.04	39.09	40.28	39.73	40.57	39.69

		Conc. (µg/m³)	Ma x.	100 (24 Hours)	64.11	50.66	54.22	55.72	57.41	56.62	57.82	56.56
			Avg .		53.94	42.63	45.62	46.88	48.31	47.64	48.66	47.59
			98t h 'tile		63.73	50.36	53.90	55.39	57.07	56.29	57.49	56.23
		PM2.5 Conc. (µg/m3)	Min .	60 (24 Hours)	26.99	21.33	22.83	23.46	24.17	23.84	24.34	23.81
			Ma x.		38.46	30.39	32.53	33.43	34.44	33.97	34.69	33.94
			Avg .		32.37	25.58	27.38	28.13	28.99	28.59	29.20	28.56
			98t h 'tile		38.24	30.22	32.34	33.24	34.24	33.78	34.49	33.74
		SO2 Conc. (µg/m3)	Min .	80 (24 Hours)	6.91	6.86	6.88	6.53	6.42	6.40	6.88	6.82
			Ma x.		9.85	9.77	9.81	9.31	9.15	9.13	9.81	9.72
			Avg .		8.30	8.23	8.26	7.84	7.71	7.69	8.26	8.19
			98t h 'tile		9.80	9.71	9.75	9.25	9.10	9.07	9.75	9.67
		NO2 Conc. (µg/m3)	Min .	80 (24 Hours)	13.83	13.70	13.68	12.96	12.76	12.71	13.68	13.57
			Ma x.		19.71	19.53	19.81	18.47	18.19	18.11	19.50	19.33
			Avg .		16.59	16.44	16.42	15.54	15.31	15.25	16.41	16.27
			98t h 'tile		19.59	19.42	19.55	18.36	18.08	18.01	19.39	19.22
		Pb (µg/m3)	Avg .	1 (24	BLQ (LOQ	BLQ (LOQ	BLQ (LOQ	BLQ (LOQ	BLQ (LOQ	BLQ (LOQ	BLQ (LOQ	BLQ (LOQ

			hour)	0.05)		0.05)	0.05)		0.05)		0.05)
	CO (mg/m3)	Avg .	4 (1hour)	0.54	0.43	0.46	0.47	0.48	0.48	0.49	0.48
	Ozone(O3) , µg/m3	Avg .	180 (1hour)	10.4	10.60	10.30	10.80	10.20	10.11	10.23	10.40
	Benzene, µg/m3	Avg .	5	BLQ (LOQ 1)	BLQ (LOQ 1)	BLQ (LOQ 1)	BLQ (LOQ 1)	BLQ (LOQ 1)	BLQ (LOQ 1)	BLQ (LOQ 1)	BLQ (LOQ 1)
	Benzo (a) pyrene, ng/m3	Avg .	1 (Annua l)	BLQ (LOQ 1)	BLQ (LOQ 1)	BLQ(LOQ 1)	BLQ(LO Q 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ (LOQ 1)	BLQ(LO Q 1)
	As (ng/ m3)	Avg .	6(Annua l)	BLQ (LOQ 2)	BLQ (LOQ 2)	BLQ (LOQ 2)	BLQ (LOQ 2)	BLQ (LOQ 2)	BLQ (LOQ 2)	BLQ (LOQ 2)	BLQ (LOQ 2)
	Ni (ng/m3)	Avg .	20(Annua l)	BLQ (LOQ 10)	BLQ (LOQ 10)	BLQ (LOQ 10)	BLQ (LOQ 10)	BLQ (LOQ 10)	BLQ (LOQ 10)	BLQ (LOQ 10)	BLQ (LOQ 10)
	NH3 (µg/m3)	Avg .	400 (24hour s)	BLQ(LO Q5)	BLQ(LOQ 5)	BLQ(LOQ 5)	BLQ(LO Q5)	BLQ(LOQ 5)	BLQ(LOQ 5)	BLQ(LOQ 5)	BLQ(LO Q5)

Noise Environment



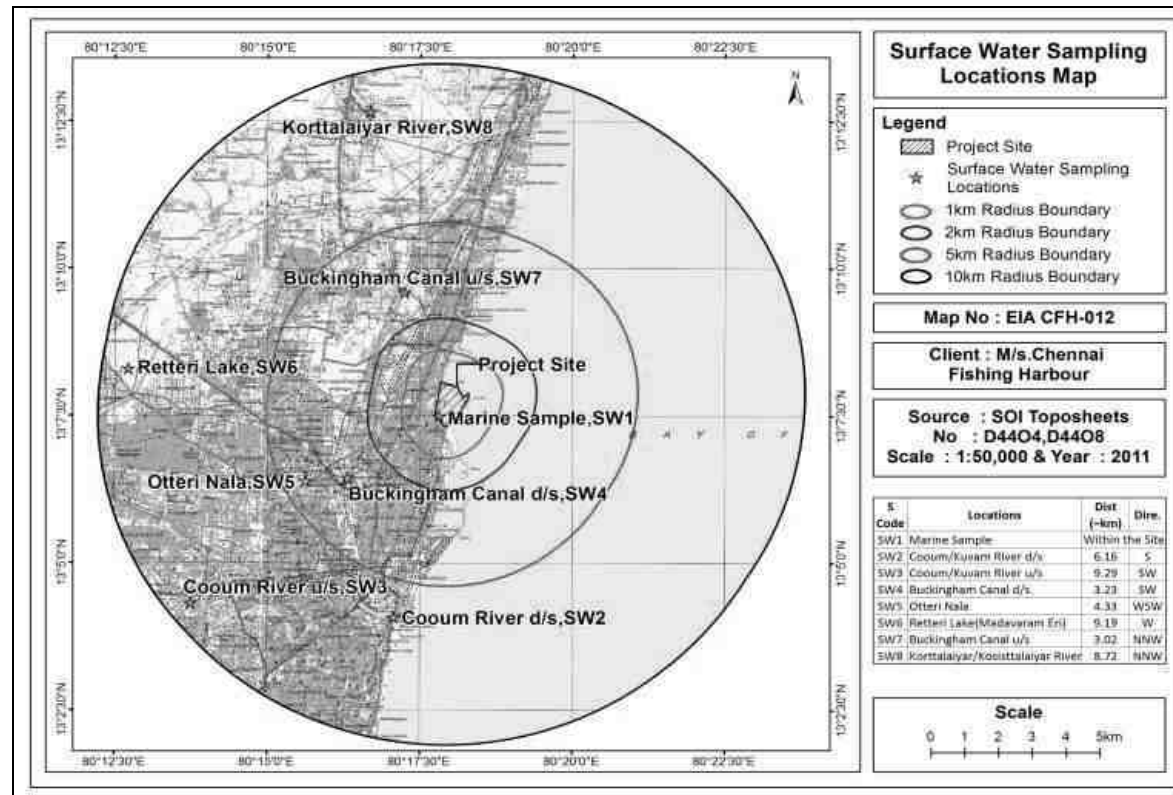
S. No	Location	Location Code	Distance (~km) from Project boundary	Direction	Noise level in dB(A) Leq		CPCB Standard		Environmental Setting
					Day	Night	Lday (Ld)	LNight (Ln)	
1.	Project Site	N1	Within the Site		50.5	43.4	75	70	Industrial
2.	Tiruvottiyur	N2	3.16	N	52.3	44.7	55	45	Residential

3.	Royapuram	N3	0.37	S	51.7	43.3	55	45	Residential
4.	George Town	N4	3.16	SSW	52.3	42.8	55	45	Residential
5.	Veysarpadi	N5	3.96	WSW	54.8	44.3	55	45	Residential
6.	Tondiarpet	N6	0.44	W	53.2	42.2	55	45	Residential
7.	Kodangiur	N7	4.16	W	54.6	41.5	55	45	Residential
8.	Chinna Sekkadu	N8	4.88	NW	53.6	40.2	55	45	Residential

Surface Water Environment

Details of Surface Water Sampling Locations

S. No	Name of the Water body	Location Code	Distance from Project Boundary (~Km)	Direction
1.	Marine Sample	SW1	Within the Site	
2.	Cooum/Kuvam River d/s	SW2	6.16	S
3.	Cooum/Kuvam River u/s	SW3	9.29	SW
4.	Buckingham Canal d/s	SW4	3.23	SW
5.	Otteri Nala	SW5	4.33	WSW
6.	Retteri Lake (Madavaram Eri)	SW6	9.19	W
7.	Buckingham Canal u/s	SW7	3.02	NNW
8.	Korttalaiyar/Kosissttalaiyar River	SW8	8.72	NNW



Parameter	Unit	Surface water standards (IS 2296 Class-A)	Marine sample near project site	Adyar River d/s	Adyar River u/s	Buckingham Canal d/s	Cooum River u/s	Buckingham Canal u/s	Otteri Nala	
			SW1	SW 2	SW 3	SW 4	SW 5	SW 6	SW 7	
pH (at 25°C)	--	6.5-8.5	8.17	6.78	7.23	6.69	7.42	7.47	7.58	
Electrical Conductivity	µS/cm	-	52008	14797	4305	40314	39369	33087	2817	4

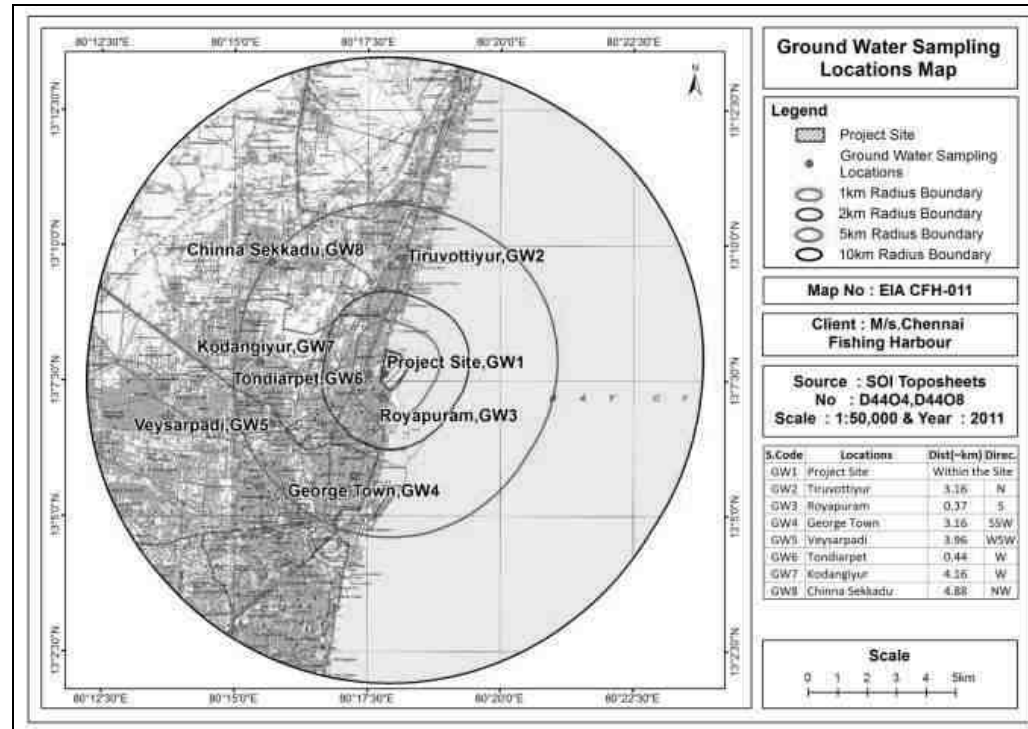
	Total Dissolved Solids	mg/l	500	30233	8729	2336	23670	23135	19635	1576	26450
	Total Suspended Solids	mg/l	-	19	48	41	38	46	29	25	52
	Total Alkalinity as CaCO ₃	mg/l	-	436.9	327.4	278.9	367.5	334.5	307.8	231.9	389.5
	Total Hardness as CaCO ₃	mg/l	300	5503.8	1563.8	574.7	4306.0	4209.3	3569.7	297.0	4813.0
	Sodium as Na	mg/l	-	8924	2535	618	6982	6825	5788	481	7804
	Potassium as K	mg/l	-	398	113	27	311	304	258	21	348
	Calcium as Ca	mg/l	-	1249.4	355.0	130.5	977.5	955.5	810.3	67.4	1092.6
	Magnesium as Mg	mg/l	-	578.4	164.3	60.4	452.5	442.4	375.2	31.2	505.8
	Chloride as Cl	mg/l	250	13280.0	3773.3	920.0	10390.0	10156.7	8613.3	574.1	11613.3
	Sulphate as SO ₄	mg/l	400	5511.2	1565.9	381.8	4311.9	4215.0	3574.5	238.2	4819.5
	Nitrate as NO ₃	mg/l	20	2.8	5.1	4.0	3.8	6.0	3.7	3.4	4.4
	Fluorides as F	mg/l	1.5	0.87	0.52	0.45	0.63	0.71	0.64	0.41	0.69
	Cyanide	mg/l	0.05	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)
	Arsenic	mg/l	0.05	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)
	Boron as B	mg/l	-	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)
	Cadmium as	mg/l	0.01	BLQ(LOQ	BLQ(LOQ	BLQ(LOQ	BLQ(LOQ	BLQ(LOQ	BLQ(LOQ	BLQ(LOQ	BLQ(LOQ

Cd			0.001)	0.001)	0.001)	0.001)	0.001)	0.001)	0.001)	0.001)	0
Chromium, Total	mg/l	0.05	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BL
Copper as Cu	mg/l	1.5	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BL
Lead as Pb	mg/l	0.1	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BL
Manganese as Mn	mg/l	0.5	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BL
Mercury	mg/l	0.001	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	BL
Nickel as Ni	mg/l	-	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BL
Selenium as Se	mg/l	0.01	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BL
Dissolved Oxygen	mg/l	6	6.5	5.7	5.9	5.5	5.2	5.9	5.7		
Chemical Oxygen Demand as O ₂	mg/l	-	16.0	68.0	50.0	80.0	98.0	62.0	54.0		1
BOD, 3 days @ 27°C as O ₂	mg/l	2	2.0	12.0	8.0	12.0	16.0	10.0	8.0		

Ground water Environment

Station Code	Location	Distance (~km) from Project boundary	Directions
GW1	Project Site	Within the site	
GW2	Tiruvottiyur	3.16	N
GW3	Royapuram	0.37	S
GW4	George Town	3.16	SSW
GW5	Veysarpadi	3.96	WSW

GW6	Tondiarpet	0.44	W
GW7	Kodangiyur	4.16	W
GW8	Chinna Sekkadu	4.88	NW



Parameters	Unit	Drinking water Standard (IS 10500: 2012) Permissible Limit	Drinking water Standard (IS 10500: 2012) Acceptable Limit	Near Project Site	Tiruvot tiyur	Royapura m	George Town	Veysar padi	Tondi arpet	Kodan giyur	Ch Sel
				GW1	GW2	GW3	GW4	GW5	GW6	GW7	
Colour	Hazen	15	5	BLQ(LOQ	BLQ(L	BLQ(LOQ	BLQ(LOQ	BLQ(L	BLQ(BLQ(L	B

					1)	OQ 1)	1)	1)	OQ 1)	LOQ 1)	OQ 1)		1)
58.	Turbidity	NTU	5	1	BLQ(LOQ 0.1)	BLQ(L OQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(L OQ 0.1)	BLQ(LOQ 0.1)	BLQ(L OQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)
59.	pH	--	NR	6.5-8.5	7.98	7.6	7.37	7.96	7.8	7.75	7.41	7.83	
60.	Conductivity	µS/cm	-	-	2098	1887	1675	1732	1427	1526	1843	1478	
61.	Total Dissolve Solids	mg/l	2000	500	1166	1040	911	934	802	835	1018	812	
62.	Total Suspended Solids		-	-	BLQ(LOQ 1)	BLQ(L OQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(L OQ 1)	BLQ(LOQ 1)	BLQ(L OQ 1)	BLQ(LOQ 1)	
63.	Alkalinity as CaCO ₃	mg/l	600	200	301	269	234	241	198	215	261	209	
64.	Total Hardness as CaCO ₃	mg/l	600	200	478	427	372	390	315	348	415	338	
65.	Sodium as Na	mg/l	-	-	221	197	172	177	178	157	191	153	
66.	Potassium as K	mg/l	-	-	15	14	12	10	7	8	13	7	
67.	Calcium as Ca	mg/l	200	75	108.6	96.9	84.5	88.5	71.5	79.0	94.1	76.7	
68.	Magnesium as Mg	mg/l	100	30	50.3	44.9	39.1	41.0	33.1	36.6	43.6	35.5	
69.	Chloride as Cl	mg/l	1000	250	395.0	352.5	307.5	316.0	260.0	282.0	342.5	274.0	
70.	Sulphate SO ₄	mg/l	400	200	163.9	146.3	127.6	131.1	107.9	117.0	142.1	113.7	
71.	Nitrate as NO ₃	mg/l	NR	45	4.3	6.5	7.8	4.8	5.5	6.2	7.1	5.4	
72.	Fluorides as F		1.5	1	0.48	0.46	0.44	0.43	0.41	0.40	0.45	0.42	
73.	Cyanide	mg/l	NR	0.05	BLQ(LOQ 0.01)	BLQ(L OQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(L OQ 0.01)	BLQ(LOQ 0.01)	BLQ(L OQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)
74.	Arsenic as As	mg/l	0.05	0.01	BLQ(LOQ 0.005)	BLQ(L OQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(L OQ 0.005)	BLQ(LOQ 0.005)	BLQ(L OQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)
75.	Boron as B	mg/l	1.0	0.5	BQL(LOQ 0.1)	BQL(L OQ 0.1)	BQL(LOQ 0.1)	BQL(LOQ 0.1)	BQL(L OQ 0.1)	BQL(LOQ 0.1)	BQL(L OQ 0.1)	BQL(LOQ 0.1)	BQL(LOQ 0.1)
76.	Cadmium as Cd	mg/l	NR	0.003	BQL(LOQ 0.001)	BQL(L OQ 0.001)	BQL(LOQ 0.001)	BQL(LOQ 0.001)	BQL(L OQ 0.001)	BQL(LOQ 0.001)	BQL(L OQ 0.001)	BQL(LOQ 0.001)	BQL(LOQ 0.001)

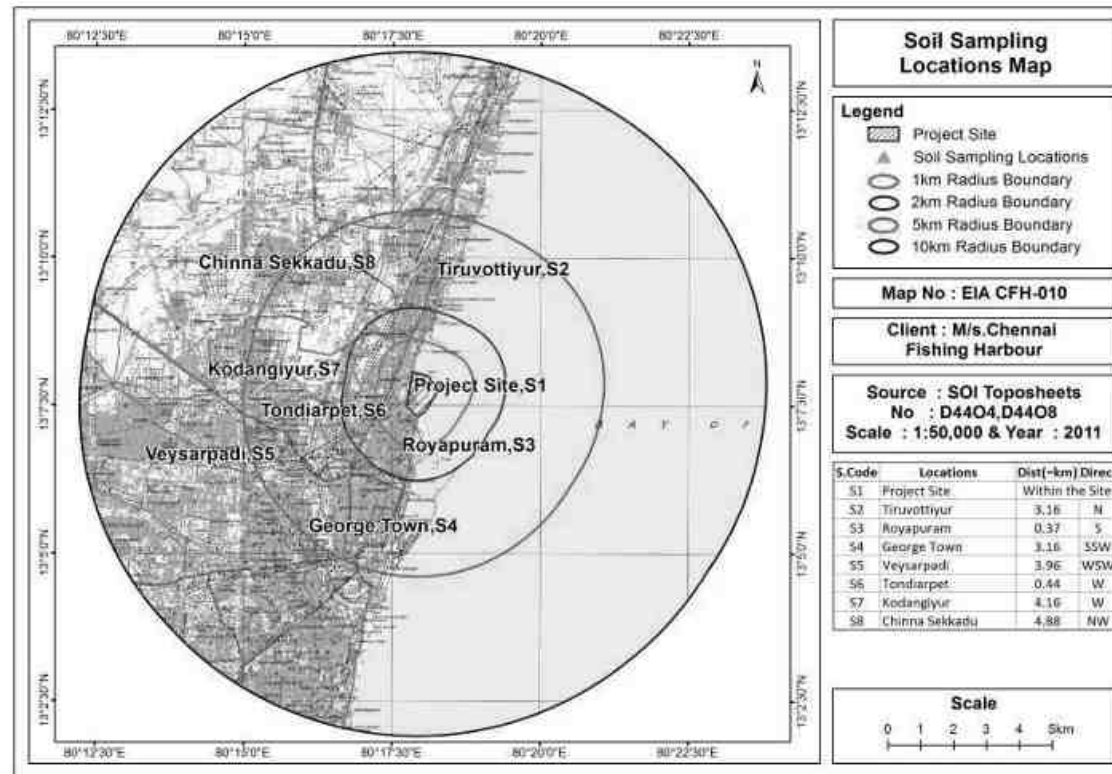
						0.001)				0.001)	0.001)	0.001)		
77.	Chromium as Cr	mg/l	NR	0.05	BQL(LOQ 0.01)	BQL(L OQ 0.01)	BQL(LOQ 0.01)	BQL(LOQ 0.01)	BQL(LOQ 0.01)	BQL(L OQ 0.01)	BQL(LOQ 0.01)	BQL(L OQ 0.01)	BQL(LOQ 0.01)	
78.	Copper as Cu	mg/l	1.5	0.05	BLQ(LOQ 0.01)	BLQ(L OQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(L OQ 0.01)	BLQ(LOQ 0.01)	BLQ(L OQ 0.01)	BLQ(LOQ 0.01)	
79.	Lead as Pb	mg/l	NR	0.01	BLQ(LOQ 0.005)	BLQ(L OQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(L OQ 0.005)	BLQ(LOQ 0.005)	BLQ(L OQ 0.005)	BLQ(LOQ 0.005)	
80.	Manganese as Mn	mg/l	0.3	0.1	BLQ(LOQ 0.05)	BLQ(L OQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(L OQ 0.05)	BLQ(LOQ 0.05)	BLQ(L OQ 0.05)	BLQ(LOQ 0.05)	
81.	Mercury	mg/l	NR	0.001	BLQ(LOQ 0.0005)	BLQ(L OQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(L OQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(L OQ 0.0005)	BLQ(LOQ 0.0005)	
82.	Nickel as Ni	mg/l	NR	0.02	BLQ(LOQ 0.01)	BLQ(L OQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(L OQ 0.01)	BLQ(LOQ 0.01)	BLQ(L OQ 0.01)	BLQ(LOQ 0.01)	
83.	Selenium as Se	mg/l	NR	0.01	BLQ(LOQ 0.005)	BLQ(L OQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(L OQ 0.005)	BLQ(LOQ 0.005)	BLQ(L OQ 0.005)	BLQ(LOQ 0.005)	
84.	Zinc as Zn	mg/l	15	5	BLQ(LOQ 0.1)	BLQ(L OQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(L OQ 0.1)	BLQ(LOQ 0.1)	BLQ(L OQ 0.1)	BLQ(LOQ 0.1)	

Soil Environment

Soil Quality Monitoring Locations

Location Code	Location	Distance (km) from Project boundary	Azimuth Directions
S1	Project Site	Within the Site	
S2	Tiruvottiyur	3.16	N

S3	Royapuram	0.37	S
S4	George Town	3.16	SSW
S5	Veysarpadi	3.96	WSW
S6	Tondiarpet	0.44	W
S7	Kodungaiyur	4.16	W
S8	Chinna Sekkadu	4.88	NW



S.No	Parameters	Units	Project Site	Tiruvotti yur	Royapur am	George Town	Veysarparadi	Tondiarp et	Kodangiyur	Chinna Sekkadu
			S1	S2	S3	S4	S5	S6	S7	S8
1.	Soil Texture	-	Sandy Clay	Clay loam	Sandy Clay	Clay loam	Sandy Clay	Clay loam	Sandy Clay loam	Clay loam
2.	Sand	%	45.2	35.4	46.2	33.1	46.5	32.7	45.6	33.4
3.	Silt	%	19.4	26.6	17.4	29.9	18.3	30.8	20.2	31.2
4.	Clay	%	35.4	38.0	36.4	37.0	35.2	36.5	34.2	35.4
5.	pH	-	7.52	7.32	7.54	7.10	7.12	7.12	7.43	6.12
6.	Electrical conductivity	µS/cm	175	157	143	168	136	129	186	182
7.	Nitrogen as N	mg/kg	120.2	115.3	110.6	115.8	120.7	95.4	98.6	105.2
8.	Phosphorus	mg/kg	5.83	5.16	4.93	5.16	5.38	4.26	4.39	4.71
9.	Potassium	mg/kg	75.25	69.82	66.79	69.82	72.86	57.68	59.50	63.75
10.	Boron	mg/kg	BLQ(LO Q0.1)	BLQ(LO Q0.1)	BLQ(LO Q0.1)	BLQ(LO Q0.1)	BLQ(LO Q0.1)	BLQ(LO Q0.1)	BLQ(LO Q0.1)	BLQ(LO Q0.1)
11.	Cadmium	mg/kg	BLQ(LO Q 0.1)	BLQ(LO Q 0.1)	BLQ(LO Q 0.1)	BLQ(LO Q 0.1)	BLQ(LO Q 0.1)	BLQ(LO Q 0.1)	BLQ(LO Q 0.1)	BLQ(LO Q 0.1)
12.	Chromium	mg/kg	BLQ(LO Q 0.1)	BLQ(LO Q 0.1)	BLQ(LO Q 0.1)	BLQ(LO Q 0.1)	BLQ(LO Q 0.1)	BLQ(LO Q 0.1)	BLQ(LO Q 0.1)	BLQ(LO Q 0.1)
13.	Porosity	-	0.42	0.75	0.42	0.73	0.42	0.74	0.42	0.71

		14.	Water holding Capacity	%	15.80	17.80	15.80	17.60	16.20	17.70	19.80	18.00
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14. Heavy metals studies in water and sediments shall be conducted

The following heavy metals analyzed in the water and sediment samples are:

Sr.No.	Heavy Metals	SW1	SW 2	SW 3	SW 4	SW 5	SW 6	SW 7	SW 8
1.	Mercury	mg/l	0.001	BLQ(LO Q 0.01)	BLQ(L OQ 0.0005)	BLQ(LO Q 0.0005)	BLQ(L OQ 0.0005)	BLQ(LO Q 0.0005)	BLQ(LOQ 0.0005)
2.	Nickel as Ni	mg/l	-	BLQ(LO Q 0.005)	BLQ(L OQ 0.01)	BLQ(LO Q 0.01)	BLQ(L OQ 0.01)	BLQ(LO Q 0.01)	BLQ(LOQ 0.01)
3.	Lead as Pb	mg/l	0.1	BLQ(LO Q 0.05)	BLQ(L OQ 0.005)	BLQ(LO Q 0.005)	BLQ(L OQ 0.005)	BLQ(LO Q 0.005)	BLQ(LOQ 0.005)
4.	Manganese as Mn	mg/l	0.5	BLQ(LO Q 0.0005)	BLQ(L OQ 0.05)	BLQ(LO Q 0.05)	BLQ(L OQ 0.05)	BLQ(LO Q 0.05)	BLQ(LOQ 0.05)
5.	Arsenic	mg/l	0.05	BLQ(LO Q 0.01)	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)
6.	Cadmium as Cd	mg/l	0.01	BLQ(LO Q 0.001)	BLQ(L OQ 0.001)	BLQ(LO Q 0.001)	BLQ(L OQ 0.001)	BLQ(LO Q 0.001)	BLQ(LOQ 0.001)
7.	Chromium , Total	mg/l	0.05	BLQ(LO Q 0.01)	BLQ(L OQ 0.01)	BLQ(LO Q 0.01)	BLQ(L OQ 0.01)	BLQ(LO Q 0.01)	BLQ(LOQ 0.01)
8.	Cyanide	mg/l	0.05	BLQ (LOQ0.01)	BLQ(L OQ 0.01)	BLQ(LO Q 0.01)	BLQ(L OQ 0.01)	BLQ(LO Q 0.01)	BLQ(LOQ 0.01)

Note: **BLQ – Below Limit of Quantification; LOQ – Limit of Quantification**

The heavy metal analysis has been conducted for 8 location within the 10km radius. From which it is observed that the level of the presence is

		very minimal i.e. below the prescribed limit in the water and sediments.
15.	The report should include the proposal for the proper treatment for waste water generated from fish handling platforms so as to ensure no pollution to the ground water as well as the sea	<p>There will be no ground water discharge and marine disposal all the waste water will be properly treated in STP of 40 KLD capacity and ETP of 80 KLD capacity. The treated water will be then utilized for fishing activities and greenbelt.</p> <p>The STP specification and ETP specification is attached as Annexure 6 & 7.</p>

	water from harbour operation.																					
16.	The study proposal shall include details pertaining to collection, treatment and disposal of solid wastes both municipal and fish waste.	<p>Municipal Solid waste Management :</p> <table border="1"> <thead> <tr> <th>Sr. No</th> <th>Waste type</th> <th>Existing phase (kg/day)</th> <th>Proposed phase (kg/day)</th> <th>Management measure</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Organic waste</td> <td>1.44</td> <td>1.44</td> <td rowspan="3">Collected in Municipal Bins and directly disposed through Greater Chennai Corporation dumping yard at Kodungaiyur.</td> </tr> <tr> <td>2</td> <td>Inorganic waste</td> <td>0.96</td> <td>0.96</td> </tr> <tr> <td colspan="2">Total</td> <td>2.4</td> <td>2.4</td> </tr> </tbody> </table> <p>Manpower: 40nos.</p> <p>Fish Waste Management:</p> <p>The liquid waste from the fish will be treated in the ETP of capacity 80 KLD and the solid wastes will be disposed by authorized dealers.</p> <p>The GCC agreement letter is attached as Annexure 9.</p>	Sr. No	Waste type	Existing phase (kg/day)	Proposed phase (kg/day)	Management measure	1	Organic waste	1.44	1.44	Collected in Municipal Bins and directly disposed through Greater Chennai Corporation dumping yard at Kodungaiyur.	2	Inorganic waste	0.96	0.96	Total		2.4	2.4		
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17.	The project proponent shall submit a comprehensive monitoring plan for coastal	<p align="center">Environmental Monitoring Program during construction phase</p> <table border="1"> <thead> <tr> <th>Sr. No</th> <th>Area of Monitoring</th> <th>Number of Sampling Stations</th> <th>Frequently of Sampling</th> <th>Parameters to be Analyzed</th> </tr> </thead> <tbody> <tr> <td>1.</td> <td>Ambient Air Quality</td> <td>4 Stations</td> <td>Twice a week:24 hourly period</td> <td>PM10, PM2.5, SO_x, NO_x CO and TVOC</td> </tr> <tr> <td>2.</td> <td>Noise</td> <td>4 (two within premises and two outside premises)</td> <td>Weekly</td> <td>Ambient Equivalent continuous Sound Pressure Levels (L_{eq}) at day and Night time.</td> </tr> <tr> <td>3.</td> <td>Surface water</td> <td>4 Stations (one</td> <td>Weekly</td> <td>pH, Conductivity, TSS, TDS,</td> </tr> </tbody> </table>	Sr. No	Area of Monitoring	Number of Sampling Stations	Frequently of Sampling	Parameters to be Analyzed	1.	Ambient Air Quality	4 Stations	Twice a week:24 hourly period	PM10, PM2.5, SO _x , NO _x CO and TVOC	2.	Noise	4 (two within premises and two outside premises)	Weekly	Ambient Equivalent continuous Sound Pressure Levels (L _{eq}) at day and Night time.	3.	Surface water	4 Stations (one	Weekly	pH, Conductivity, TSS, TDS,
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ecology covering coastal ecosystem and riverine system for both construction and operation period. All physical, Chemical and biological parameters including planktons, productivity, benthic fauna and flora, fishery etc shall be covered in monitoring plan. Monitoring during construction		and Ground water	within the premises and two outside premises)		BOD,COD, DO, Heavy metals (Ar, Pb, Ch, Ni etc), Chloride, Sulphate, Total Coliform
	4.	Vehicular Emissions	2 Stations Inside and Outside premises	Weekly	Air emission and noise, PUC
	5.	Soil	4 Stations (one within the premises and two outside premises)	Weekly	pH, Physicochemical properties like N,P,K,B,Cu,Heavy metals
	6.	Terrestrial and Marine Ecology	Within 10 km radius	Weekly	Symptoms of injuries and total count of Phytoplankton, Flora, Fisheries productivity,benthic fauna .

Environmental Monitoring Program during operation phase

Sr. No	Area of Monitoring	Number of Sampling Stations	Frequently of Sampling	Parameters to be Analyzed
1.	Ambient Air Quality	4 Stations	Once in three months	PM10, PM2.5, SO _x , NO _x CO and TVOC
2.	Noise	4 (two within premises and two outside premises)	Once in three months	Ambient Equivalent continuous Sound Pressure Levels (L _{eq}) at day and Night time.
3.	Surface water and Ground water	4 Stations (one within the premises and two outside premises)	Once in three months	pH, Conductivity, TSS, TDS, BOD,COD, DO, Heavy metals (Ar, Pb, Ch, Ni etc), Chloride, Sulphate, Total Coliform
4.	Vehicular Emissions	2 Stations Inside and Outside premises	Once in three months	Air emission and noise, PUC

	on period will be done on weekly basis and during the operational period on seasonal basis (4 times a year, a minimum for 5 years)		5.	Soil	4 Stations (one within the premises and two outside premises)	Once in three months	pH, Physicochemical properties like N,P,K,B,Cu,Heavy metals	
			6.	Terrestrial and Marine Ecology	Within 10 km radius	Once in three months	Symptoms of injuries and total count of Phytoplankton, Flora, Fisheries productivity,benthic fauna .	
		Environmental monitoring programme will be conducted for weekly basis for construction phase and once in three months (4 times a year) for operation phase for a period of five years.						
18.	There should not any damage/impact on these resources and associated biodiversity- the project proponent shall submit the	<p>The proposed project will not damage/impact on these resources and associated biodiversity.</p> <p>However, the detailed study is conducted and report given by NCCR for the proposed modernization of fishing harbour. The NCCR Report has been attached as Annexure 10.</p>						

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	<p>period of minimum 5 years in consultation with said institution and submit a copy of the same along with the EIA Report. The proponent shall also sign MoU and submit a copy of the same along with EIA Report.</p>	
19.	<p>The study shall be conducted</p>	<p>➤ An integrated approach was used for studying the environmental parameters and biodiversity of the Chennai Fishing harbor. Satellite, drone images and ground truth survey indicate absence of mangroves in the study area. Mangroves are present 5.5 km and 13.5 km, North and South, respectively of the Chennai Fishing harbor.</p>

	<p>d on reputed instituti ons like Annama lai Universi ty (Marine Biology Departm ent), etc. the impact on the propose d moderni zation of fishing harbour on moveme nt of turtles and other aquatic species.</p>	<ul style="list-style-type: none"> ➤ Based on the observations, we conclude that since mangroves were historically absent in the site and environmental conditions are unfavourable, plantation of mangroves is not recommended. ➤ The closest turtle nesting site is located 13 km south, in the Besant Nagar -Neelankarai coastal stretch. Therefore, developmental activities in the Chennai Fishing harbour will have no influence on the turtle nesting sites. <p>The NCCR Report has been attached as Annexure 10.</p>
20.	<p>A detail study on impact</p>	<p>The quantity of oil spent will be minimal and there is no chance of storage and disposal in the proposed area.</p> <p>The used Engine oils will be reused in their boats for other purposes like spraying on the engines and other machinery parts to avoid rust and</p>

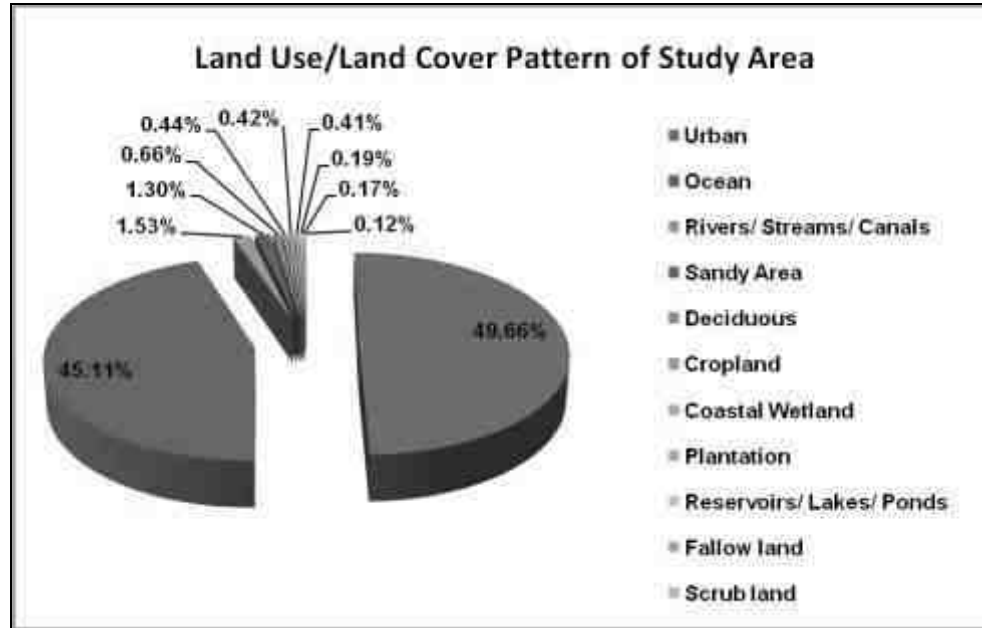
	of oil spillage from the operation of the fishing harbour and its mitigation measures shall be part of EIA study	the remaining oil has been sold out by the boat owners, which are being taken out by the purchaser from Chennai Fishing Harbour for secondary purposes. However, Oil Spill Management report has been attached as Annexure 8 .
21.	Impact on the Distortion effects on the proposed modernization of the fishing harbour shall be part of EIA.	<p>There will not be any major distortion in the current site due to the proposed modernization of the fishing harbour. The distortion effects will be limited only to the construction phase.</p> <p>The distortion effects may include:</p> <ol style="list-style-type: none"> 1. Accumulation of construction debris 2. The concrete may spill into the sea during the construction may cause the water pollution. 3. During Construction, the transport of the fine materials like, sand, cement may cause air pollution. 4. Deposition of fugitive dust on leaves of nearby vegetation may lead to temporary reduction of photosynthesis. Such impacts will, however, be confined mostly to the initial periods of the construction phase.

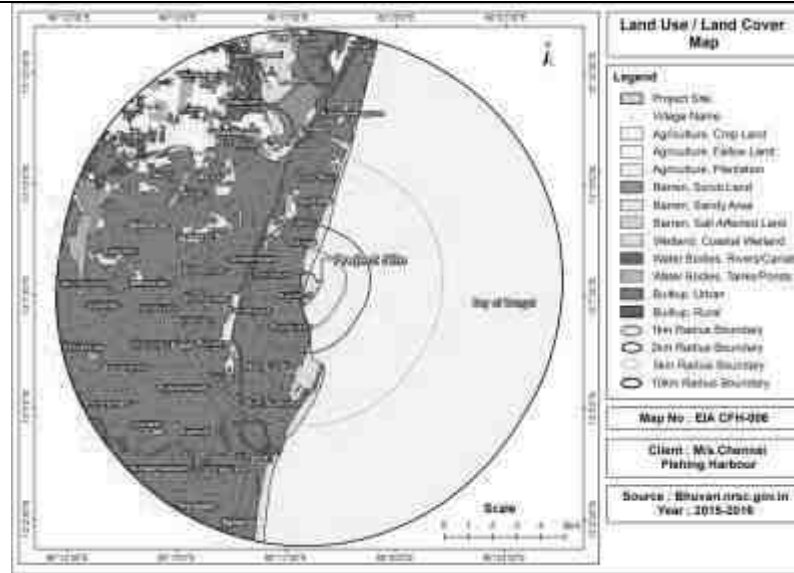
1.9.3 Standard ToR Compliance-SEAC & SEIAA

Sr.No.	Terms of Reference	Compliance																																																												
1.	Reasons for selecting the site with details of alternate sites examined/rejected/selected on merit with the comparative statement and reason/basis for selection. The examination should justify site suitability in terms of environmental angle, resources sustainability associated with selected site as compared to rejected sites. The analysis should include parameters considered along with weightage criteria for short-listing selected site.	The proposed project site of Modernization and Upgradation of Chennai Fishing Harbour is the expansion project in the existing land.																																																												
2.	Details of the land use break-up for the proposed project. Details of land use around 10 km radius of the project site. Examine and submit detail of land use around 10 km radius of the project site and map of the project area and 10 km area from boundary of the proposed/existing project area, delineating Project areas notified under the wild life (Protection) Act,	<p style="text-align: center;">Land Use/Land Cover statistics of 10 km radius of the Study Area</p> <table border="1"> <thead> <tr> <th>Sr.No</th> <th>Division of Land Use/Land Cover</th> <th>Area in Sq.km</th> <th>Area in Acres</th> <th>Area in Ha</th> <th>Total Area %</th> </tr> </thead> <tbody> <tr> <td>1.</td> <td>Urban</td> <td>161.46</td> <td>39897.57</td> <td>16146</td> <td>49.66</td> </tr> <tr> <td>2.</td> <td>Ocean</td> <td>146.65</td> <td>36237.95</td> <td>14665</td> <td>45.11</td> </tr> <tr> <td>3.</td> <td>Rivers/ Streams/ Canals</td> <td>4.98</td> <td>1230.58</td> <td>498</td> <td>1.53</td> </tr> <tr> <td>4.</td> <td>Sandy Area</td> <td>4.23</td> <td>1045.25</td> <td>423</td> <td>1.30</td> </tr> <tr> <td>5.</td> <td>Deciduous</td> <td>2.13</td> <td>526.33</td> <td>213</td> <td>0.66</td> </tr> <tr> <td>6.</td> <td>Cropland</td> <td>1.43</td> <td>353.36</td> <td>143</td> <td>0.44</td> </tr> <tr> <td>7.</td> <td>Coastal Wetland</td> <td>1.35</td> <td>333.59</td> <td>135</td> <td>0.42</td> </tr> <tr> <td>8.</td> <td>Plantation</td> <td>1.33</td> <td>328.65</td> <td>133</td> <td>0.41</td> </tr> <tr> <td>9.</td> <td>Reservoirs/ Lakes/ Ponds</td> <td>0.62</td> <td>153.21</td> <td>62</td> <td>0.19</td> </tr> </tbody> </table>	Sr.No	Division of Land Use/Land Cover	Area in Sq.km	Area in Acres	Area in Ha	Total Area %	1.	Urban	161.46	39897.57	16146	49.66	2.	Ocean	146.65	36237.95	14665	45.11	3.	Rivers/ Streams/ Canals	4.98	1230.58	498	1.53	4.	Sandy Area	4.23	1045.25	423	1.30	5.	Deciduous	2.13	526.33	213	0.66	6.	Cropland	1.43	353.36	143	0.44	7.	Coastal Wetland	1.35	333.59	135	0.42	8.	Plantation	1.33	328.65	133	0.41	9.	Reservoirs/ Lakes/ Ponds	0.62	153.21	62	0.19
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1972/critically polluted areas as identified by the CPCB from time to time/notified eco-sensitive areas/interstate boundaries and international boundaries. Analysis should be made based on latest satellite imagery for land use with raw images.

10.	Fallow land	0.55	135.91	55	0.17
11.	Scrub land	0.39	96.37	39	0.12
		325.12	80338.78	32512	100.00

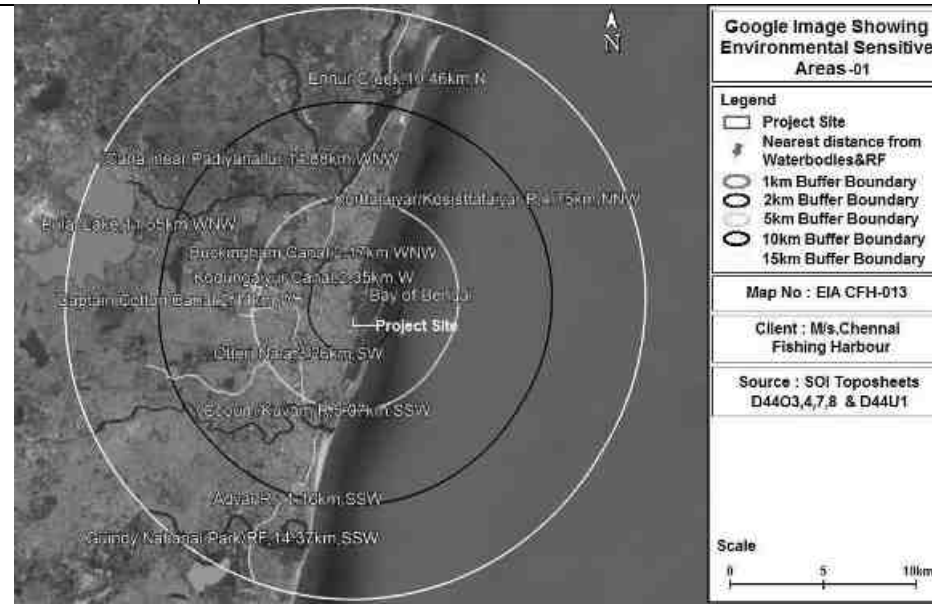


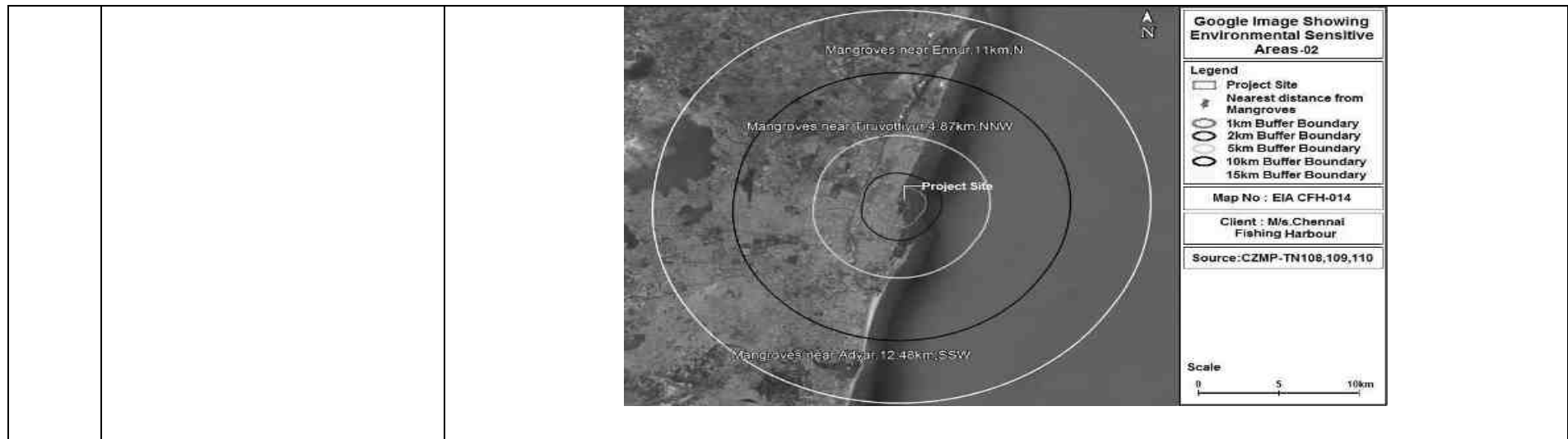


S. No.	Areas	Distance & Direction from project boundary		
		Description	Dist. (~km)	Dire.
1.	List of Reserve forest / National Park	Guindy National Park/ RF	14.37	SSW
2.	List of Water Bodies			
		Description	Dist (~km)	Dire~
		Bay of Bengal	Site is within Bay of Bengal	
		Buckingham Canal	2.17	WNW
		Kodungaiyur Canal	2.35	W
		Captain Cotton Canal	2.44	W
		Otteri Nala	3.26	SW
		Korttalaiyar/Kosisttalaiyar R	4.75	NNW
		Cooum/Kuvam R	5.07	SSW
		Ennur Creek	10.46	N

			Adyar R	11.16	SSW
			Pulal/Red Hills Lake	11.55	WNW
			Canal near Padiyanallur	14.88	WNW
			Water Bodies:		
			Description	Dist. (~km)	Dire.
			Periyathoppu Lake	6.06	NW
			Kadapakkam Lake	8.37	NW
			Retteri Lake/Madavaram Eri	8.91	W
			Korattur Tank	11.30	W
	3.	Nearest Highways	Description	Dist. (~km)	Dire.
			SH-114(Chennai-Ennore Rd)	0.01	W
			Chennai-Srikakulam Highway	3.34	SW
	4.	Defence installations	Description	Dist. (~km)	Dire.
			INS Adyar	5.23	S
	5.	Nearest Villages	Description	Dist. (~km)	Dire.
			Royapuram	Site is within the Village	
			Tondiarpet	0.03	W
			Old Washermanpet	0.81	WSW
			Tiruvottiyur	1.02	N
			George Town	2.31	S
	6.	Nearest Mangroves	Description	Dist. (~km)	Dire.
			Mangroves near Tiruvottiyur	4.87	NNW
			Mangroves near Ennur	11	N

		Mangroves near Adyar	12.48	SSW
7.	Areas susceptible to natural hazard which could cause the project to present environmental problems, (earthquakes, subsidence, landslides, erosion or extreme or adverse climatic conditions)	<p>The study area falls under Zone-III (Moderate risk) according to the Indian Standard Seismic Zoning Map. Suitable seismic coefficients in horizontal and vertical directions respectively, will to be adopted while designing the structures.</p> <p>The place is also prone for Cyclone and Tsunami.</p>		





3. Submit the present land use and permission required for any conversion such as forest, agriculture etc. land acquisition status, rehabilitation of communities/ villages and present status of such activities.

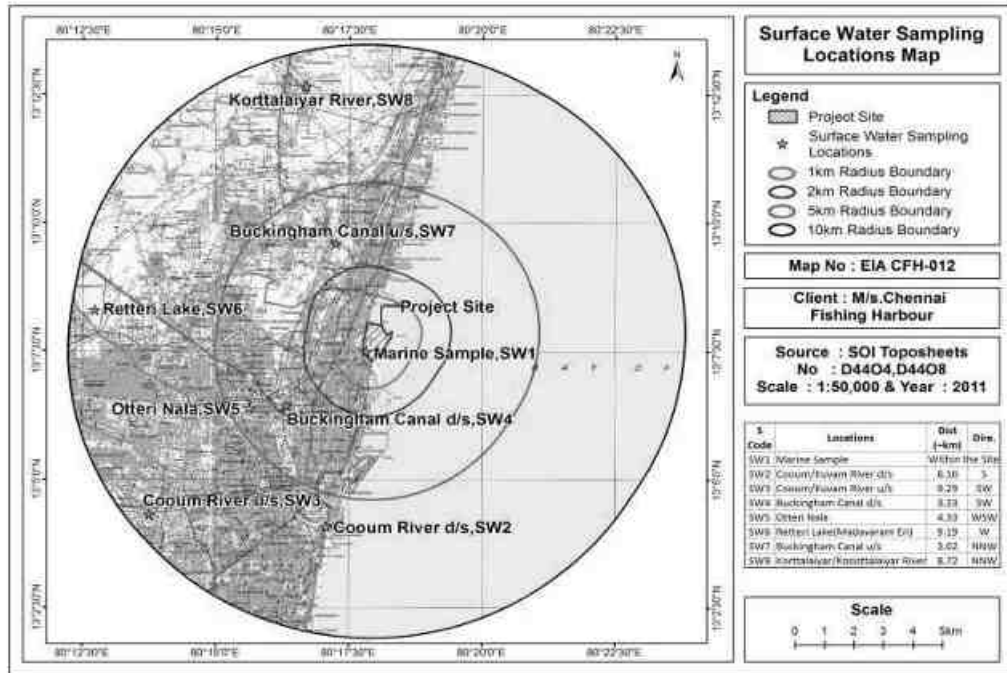
The present land does not involve any forest, agriculture etc. and no land acquisition and rehabilitation of communities/ villages in not applicable.

Existing land use:
The existing built up area of the infrastructure facilities is **3.2182 Hectare**. The proposed project of modernizing and upgrading the Chennai fishing harbour, Kasimedu has the land area is **31.956 Hectare** and water spread area is **48.56 Hectare**.

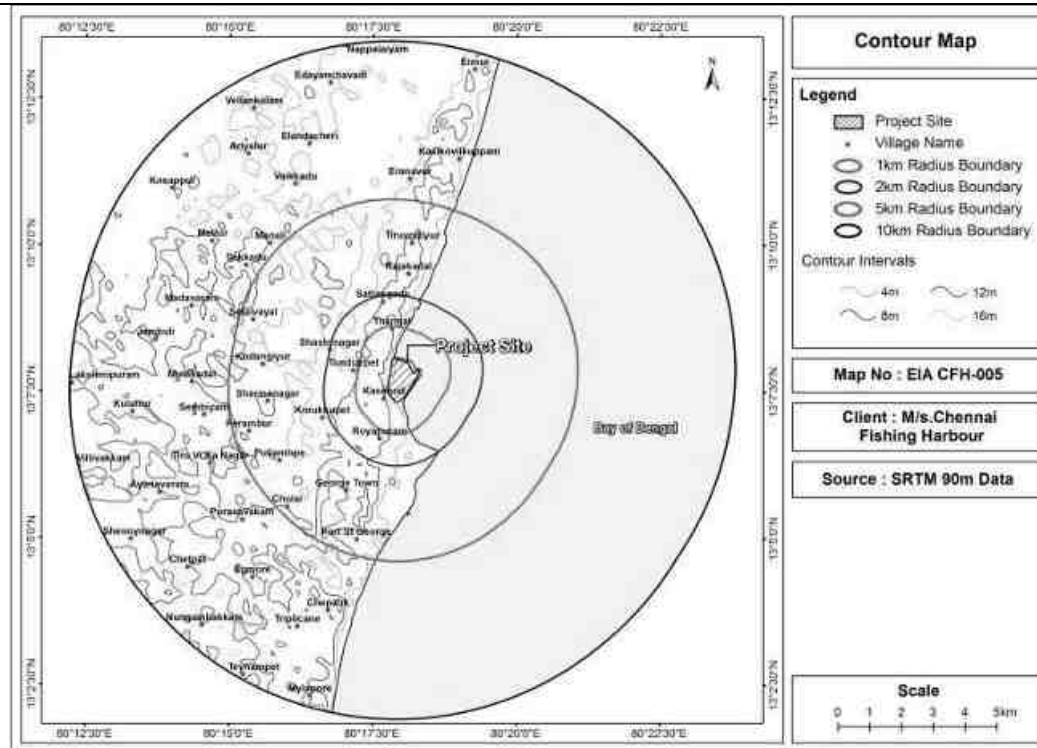
4. Examine and submit the water bodies including the seasonal ones within the corridor of impacts along with their status, volumetric capacity, quality likely impacts on them due to the project.

Details of Surface Water Sampling Locations				
Sr. No	Name of the Water body	Location Code	Distance from Project Boundary (~Km)	Direction from project boundary
1.	Marine Sample	SW1	Within the Site	
2.	Cooum /Kuvam River d/s	SW2	6.16	S
3.	Cooum /Kuvam River u/s	SW3	9.29	SW

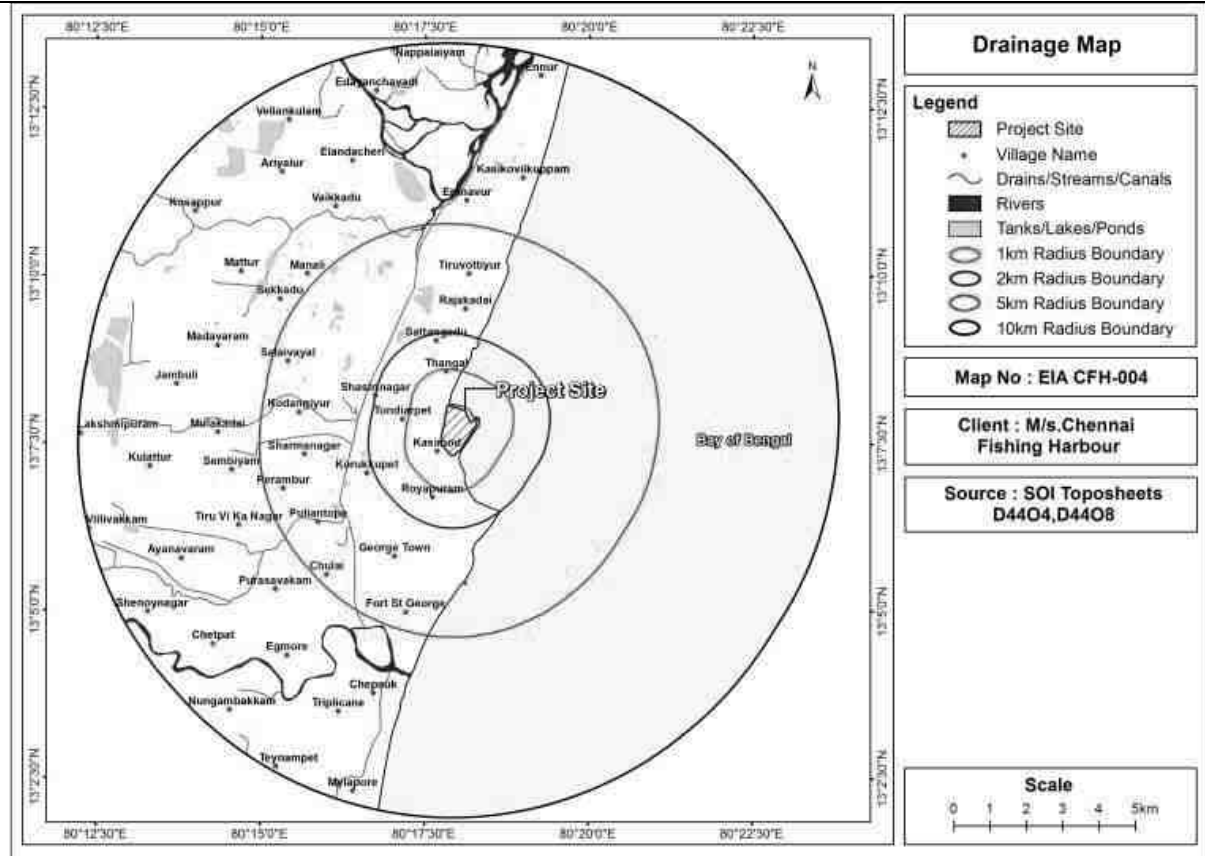
4.	Buckingham Canal d/s	SW4	3.23	SW
5.	Otteri Nala	SW5	4.33	WSW
6.	Retteri lake	SW6	9.19	W
7.	Buckingham Canal u/s	SW7	3.02	NNW
8.	Kosisttalaiyar river	SW8	8.72	NNW



5. Submit a copy of the contour plan with slopes, drainage pattern of the site and surrounding area



Contour Map of the study area



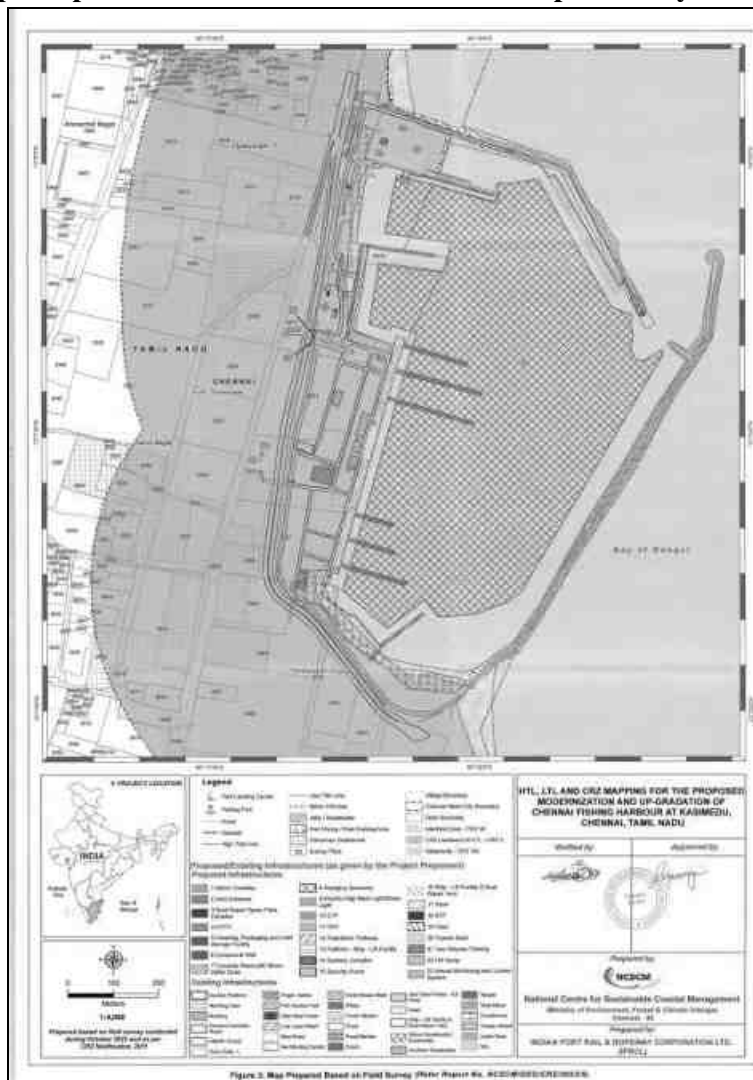
Drainage Map of the study area

- Adyar River originates at the confluence (Thiruneermalai) of two streams that drains the upstream area of Chembarambakkam tank.
- It is a small river of 42 km length and a catchment of 800 Sq. km.
- The river carries flow all through 365 days of a year with an average discharge of 89.43 MCM/Year at Kattipara cause way.
- It drains the southern part of the district and remains flooded during monsoon. During the high tides, the backwaters from the Bay of Bengal enter inland up to 3 – 4 km.

		<ul style="list-style-type: none"> ➤ Cooum is the other main river flowing through the central part of the district and carries only drainage water, which is highly polluted. ➤ It originates from the surplus waters from the Cooum tank in Tiruvallur Taluk and the tanks, which are in enroute, discharge their surplus water into the river during flood season. ➤ The flow of Cooum River at Korattur is 40.2 MCM/year for an average duration of 31 days in a year. Otteri Nulla is another small stream flowing in the northern part of the city. ➤ Buckingham canal is the man made one for navigation purposes earlier, but now it act as sewerage carrier in the city 																																								
6.	Submit the details of terrain, level with respect to MSL, filling required, source of filling materials and transportation details etc.	Not applicable																																								
7.	Examine road/rail connectivity to the project site and impact on the existing traffic network due to the proposed project/activities. A detailed traffic and transportation study should be made for existing and projected passenger and cargo traffic.	<p>The project site is situated in the prime location of the Chennai city. It is well connected by roadways, railways and water ways.</p> <table border="1"> <thead> <tr> <th>Sr.No.</th> <th>Features</th> <th colspan="3">Description</th> </tr> </thead> <tbody> <tr> <td rowspan="2">1</td> <td rowspan="2">Nearest Railway station</td> <td>Description</td> <td>Dist. (~km)</td> <td>Dire.</td> </tr> <tr> <td>V.O.C.Nagar Railway Station</td> <td>1.22km</td> <td>WNW</td> </tr> <tr> <td rowspan="2">2</td> <td rowspan="2">Nearest Port</td> <td>Description</td> <td>Dist. (~km)</td> <td>Dire.</td> </tr> <tr> <td>Chennai Port</td> <td>Adjacent to Site</td> <td>S</td> </tr> <tr> <td rowspan="2">3</td> <td rowspan="2">Nearest Airport</td> <td>Description</td> <td>Dist. (~km)</td> <td>Dire.</td> </tr> <tr> <td>Chennai International Airport</td> <td>18.14</td> <td>SW</td> </tr> <tr> <td rowspan="3">4</td> <td rowspan="3">Highway</td> <td>Description</td> <td>Dist. (~km)</td> <td>Dire.</td> </tr> <tr> <td>SH-114(Chennai-Ennore Rd)</td> <td>0.01</td> <td>W</td> </tr> <tr> <td>Chennai-Srikakulam Highway</td> <td>3.34</td> <td>SW</td> </tr> </tbody> </table>	Sr.No.	Features	Description			1	Nearest Railway station	Description	Dist. (~km)	Dire.	V.O.C.Nagar Railway Station	1.22km	WNW	2	Nearest Port	Description	Dist. (~km)	Dire.	Chennai Port	Adjacent to Site	S	3	Nearest Airport	Description	Dist. (~km)	Dire.	Chennai International Airport	18.14	SW	4	Highway	Description	Dist. (~km)	Dire.	SH-114(Chennai-Ennore Rd)	0.01	W	Chennai-Srikakulam Highway	3.34	SW
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8.	Submit details regarding R&R involved in the project	No resettlement and rehabilitation (R&R) action plan are required; as the land already belongs to Chennai Port Authority; which is devoid of any forest or resident land.																																								

Superimposed HTL LTL CRZ 1:4000 scale map issued by NCSCM.

9. Submit a copy of layout superimposed on the HTL/LTL map demarcated by an authorized agency on 1:4000 scale along with the recommendation of the SCZMA.



10. Submit the status of shoreline change at the project site

There are no major changes in shoreline activity due to the project site. As per the NCCR Report (2018), it is depicted as the low accretion region.



11. Details of the layout plan including details of channel, breakwaters, dredging, disposal and reclamation.

Breakwaters:

- **Eastern break water :** One break water is already existing on the Eastern side of a length of 1085m to ensure safe waters and tranquility in the Fishing Harbour.
- **Northern break water:** One break water already exists on the Northern side of a length of 830m to ensure safe waters and tranquility in the Fishing Harbour.

Dredging:

It is proposed to carry out maintenance dredging activity within the fishing harbour to facilitate

effective and optional utilization of harbour. The depth of the dredging is varying from 1- 2m in accordance with the site conditions.

The area of dredging is 454214 sq.m. Quantity of dredging material is 5,60,000 Cum.

The dredged materials are proposed to be transported through self propelled dump barge (bottom open drop barge) .

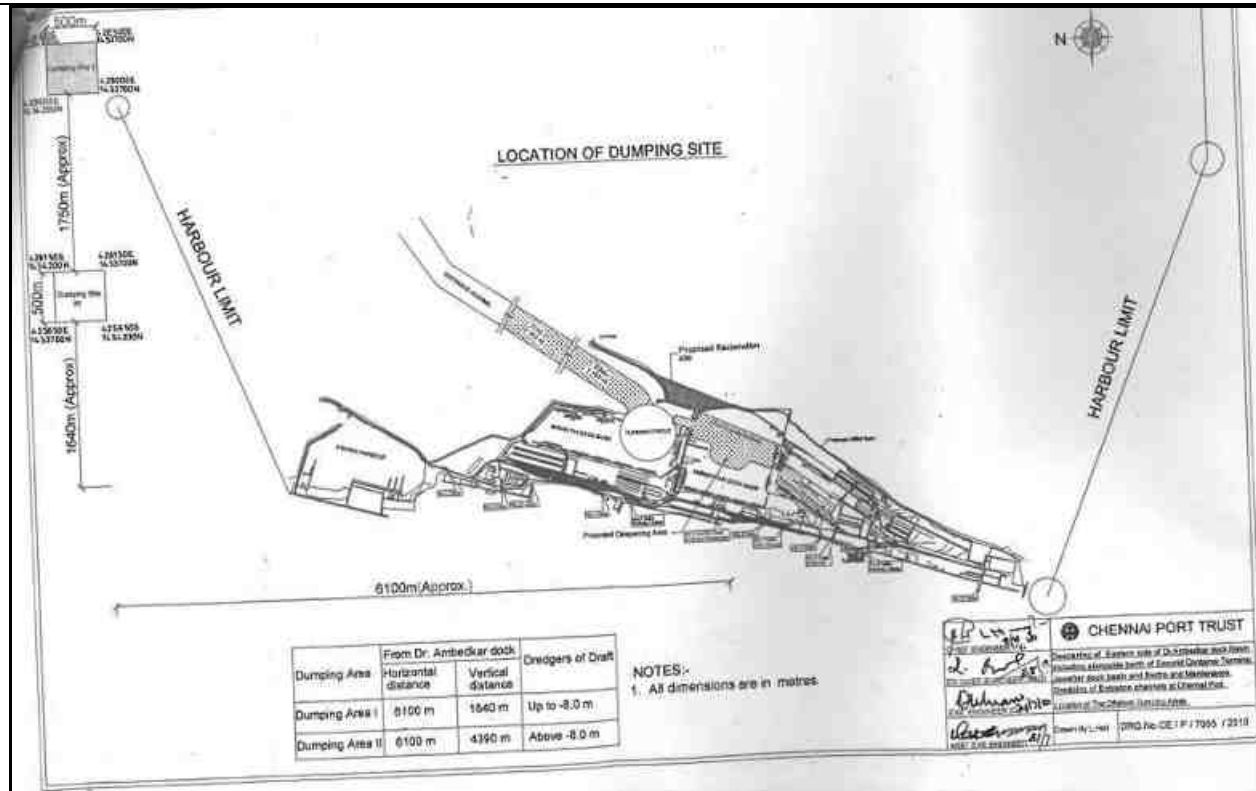
The impact on coastal environment during construction phase would be mainly from the activities in the inter-tidal phase due to construction of fishing harbour.

Sr.No.	Potential Direct Impacts	Potential Indirect Impacts
1.	Increased sediment Loading and deterioration in water quality	Impacts to fisher revenue stream for a shorter period of time
2.	Destruction/Entanglement of fishing gears	Decreased in the supply of catchment of fishes to the market
3.	Obstruction to travel routes	Reduced water quality

Hence, as a part of the management strategy various activities shall be well coordinated and optimized to avoid time and cost, which are given below:

- As part of conservation strategy, dredging will not be carried out during the fish breeding season.
- Dredging and construction activities to be scheduled and planned to minimize the impacts on fishermen and marine ecology providing necessary mechanisms to trap the spillage of fuel / engine oil and lubricants from the construction site to minimize impacts on benthos.
- Temporary colonies of the construction workers would be established sufficiently away from the High Tide Level (HTL) with adequate sanitation facilities and waste treatment measures. Construction debris shall be disposed safely in the designated areas.

		<ul style="list-style-type: none">➤ Proper covered storage area shall be used for dumping, transporting and disposal of the dredged material from the project site to designated dumping site outside the CRZ limits.➤ Vehicles transporting reclamation materials must have their loads covered using tarpaulin or canvas sheet when utilizing the public road to prevent spillage of materials that can become a source of dust pollution.➤ Minimise or even prevent dewatering or overflow from dredger.➤ Good practice when loading and transporting unsuitable dredged material.➤ Regular maintenance of ships and barges so as to prevent accidental leaks and spillage.➤ Deflectors should be installed on the draghead and to ensure marine mammal and turtle observers are on board during dredge operations.➤ As part of this exercise, the dredger will be equipped with spill response kits and dredging will be carried out in confined manner to reduce the impacts on marine environment.➤ All the standards preparatory will be taken to reduce the impact on marine water quality. Eventhough, the impacts will be for a short period only.
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Reclamation: No land reclamation is involved

12. Details of handling of each cargo, storage, transport along with spillage control, dust preventive measures. In case of coal, mineral cargo, details of storage and closed conveyance , dust suppression and prevention filters.

Not Applicable; as it is modernization and Upgradation of Chennai Fishing Harbour at Kasimedu, Chennai.

13. Submit the details of fishing activity and likely impacts on the fishing activity due to the project.
Specific study on effects of construction activity and pile driving on marine life.

There are over 2000 fishing vessels that ply from Chennai Fishing Harbour and land approx. 300 MT of catches daily at the western trawler wharf. The number of fishing crafts and other traffic-related details are below:

Sr.No	Components	Description
1	Mechanized Fishing Boats	Total Registered Boats are 1024; in which Gill Netter is 272 , Trawler is 729 and liner is 23
2	Country Crafts (CC)	<ul style="list-style-type: none"> ➤ Total Registered boats are 1416 ➤ Motorized non-mechanical are 1332 (Diesel = 1322 & Petrol = 10); ➤ Non-motorized are 84 ➤ 849 Motorized non-mechanical boats are berthed within the harbour, while remaining 483 motorized non-mechanical crafts are berthed in villages of South-Chennai
3	Fish Landing Boats Arrival	<ul style="list-style-type: none"> ➤ MFBs are 100 to 150 Nos./ day ➤ Country Crafts are 260 Nos./ day [Morning = 180 + Evening = 80]
4	Onboard Fishing Crew	10 to 15 Nos./ MFBs 5 to 8 Nos./ Double Engine CCs 2 to 4 Nos./ Single Engine CCs
5	Expected Fish Landing	250 tonnes /day
6	Peak days Fish Landing	300 to 500 tonnes/ day [Peak days = Sundays and Wednesdays]
7	Landing workers	Approx 400 Nos./day
8	Fish Landing tricycles	Approx. 60 Nos.
9	Transporters	Approx. 80 Nos. [Insulated vehicles]

10	Auctioneer	Approx. 600 Nos.
11	Export Processors	40 to 50 Nos.
12	Ice sellers/ suppliers	98 Nos.
13	Ice usage	40 tonnes/ day
14	Retailers	Approx. 220 Nos. [Old auction hall = 100 Nos. + New Auction Hall = 120 Nos.]
15	Street Vendors (Women)	450 to 600 Nos./ day
16	Two-wheeler vendors	Approx. 400 Nos./day
17	Fish cutters and cleaners	Approx. 230 Nos. / day [Men = 40 + Women = 190]
18	Customers	2500 to 3000 Nos./ day [Peak days = 3500 to 4000 Nos./ day]
19	Tea Sellers	25 Nos.

The major effects during construction phase are :

- Site Preparation-fencing, boundary and clearing of site will cause disturbance to the surroundings.
- Release of suspended particles (sediments) from dredging activities
- Dredging and other construction activities will increase turbidity level in the water column. This will be short term and restricted to the construction period only

- Noise during construction phase will involve movement and operation of machinery and equipment as well as handling, loading, unloading of materials. Operation of mixer machines, cranes, winch machine, dumpers, pile drivers, metal works etc., as well as movement of trucks will generate noise
- During the construction phase there will be land use change because of construction of training wall and revetment. Land / soil erosion due to earthwork as well as civil construction is likely to occur in the construction area.

Terrestrial Ecology

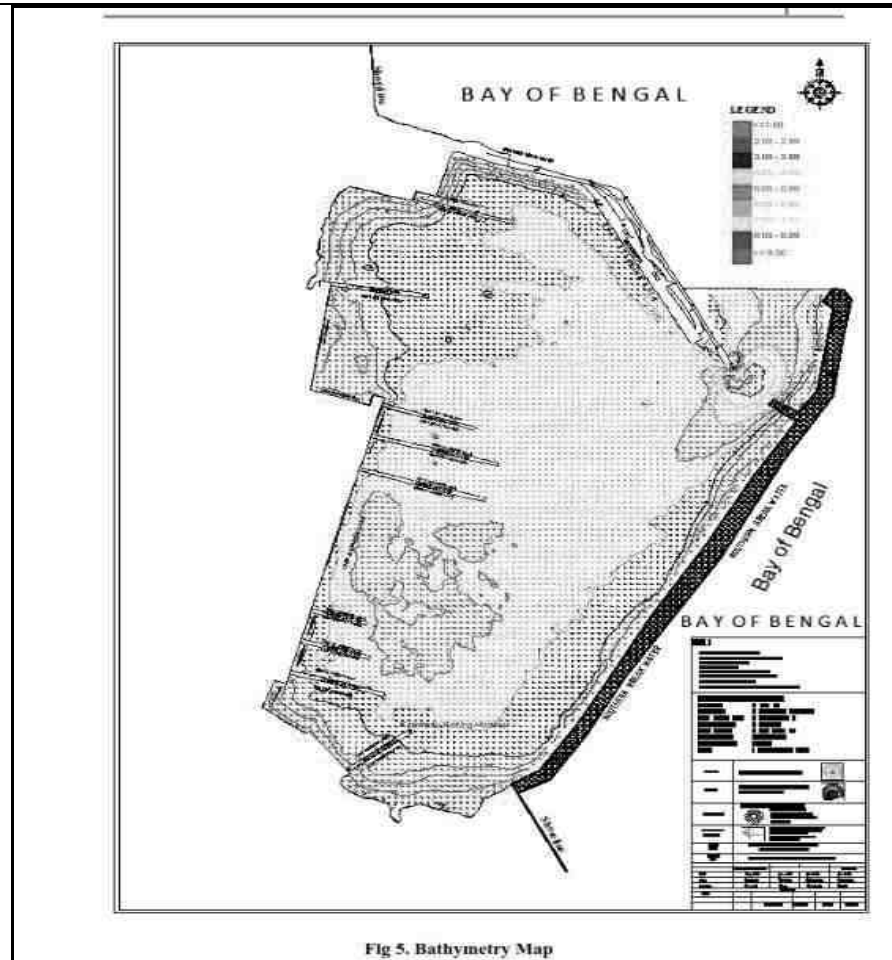
- The impact of construction activities will be primarily confined to the project site. As stated earlier, the site is a piece of land with minimal habitation.
- Deposition of fugitive dust on leaves of nearby vegetation may lead to temporary reduction of photosynthesis. Such impacts will, however, be confined mostly to the initial periods of the construction phase.
- The levels of pollutants expected to be maintained around the project site are much lower and are not envisaged to cause any stress on the biota.
- There is no likely tangible impact from higher noise and emissions during construction on the common animals and birds in the area.

Aquatic Ecology

- As the water quality may be changed due to the construction activities, minimal impact on the aquatic life is expected.
- During dredging, the existing habitat of creatures and organism that depends on the original composition of the soil may be affected. However, during our marine survey, the presence of sensitive species were not observed.

		<ul style="list-style-type: none"> ➤ The water could get polluted because of the soil particles mixing with the water. This may inturn affect the aquatic life temporarily. ➤ All the precautions will be taken not to discharge any material, solid or liquid to the marine environment. <p>Marine Environment</p> <ul style="list-style-type: none"> ➤ Construction Material Handling/transportation of construction material : Generation of dust and vehicular movements during the transportation, which is also for a short term and non-significant. ➤ Construction of offshore structures: Use of pile drivers, boring equipment, power tools, change in suspended solids and turbidity are expected due to these activities. Piling is proposed to be carried out by use of bored cast-in-situ concrete piles by use of permanent liner by rotary drilling. The structures being built on piles will not obstruct or block the natural flow of water in the area. ➤ Waste water disposal to sea: No waste water will be discharged to the marine environment, hence no impacts on marine environment due to the waste water generation
14.	Details of oil spill contingency plan.	Oil Spill Contingency Plan is prepared as is attached as Annexure 8 .

15. Details of bathymetry study.



The total estimated dredging quantity is 5.60 lakhs cubic meter. The bathymetry report is attached as **Annexure 11**.

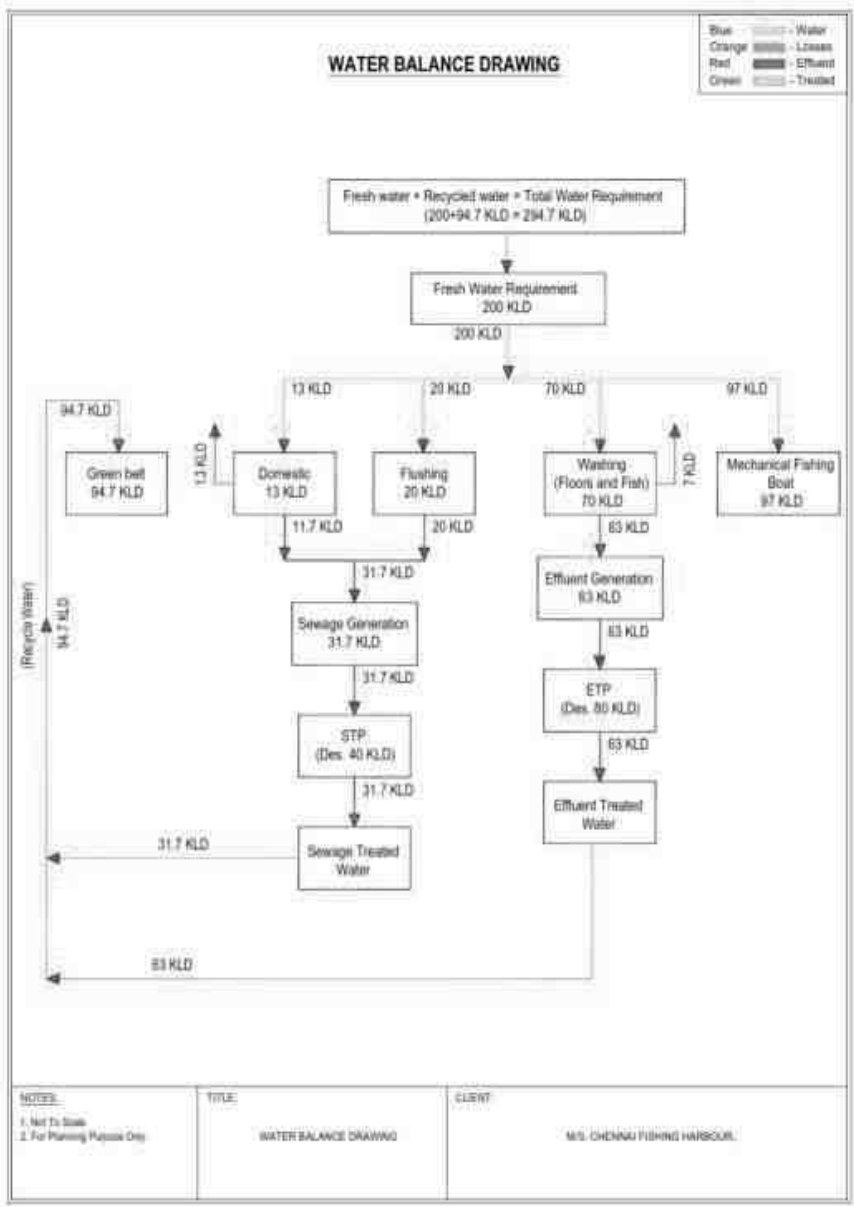
16. Details of ship tranquillity study.

The ship tranquillity study for Chennai fishing Harbour was conducted by Central water & power research station dated 20th Nov 1975.

The tranquillity limits set down before for the worst possible wave conditions viz 4.90 m high waves

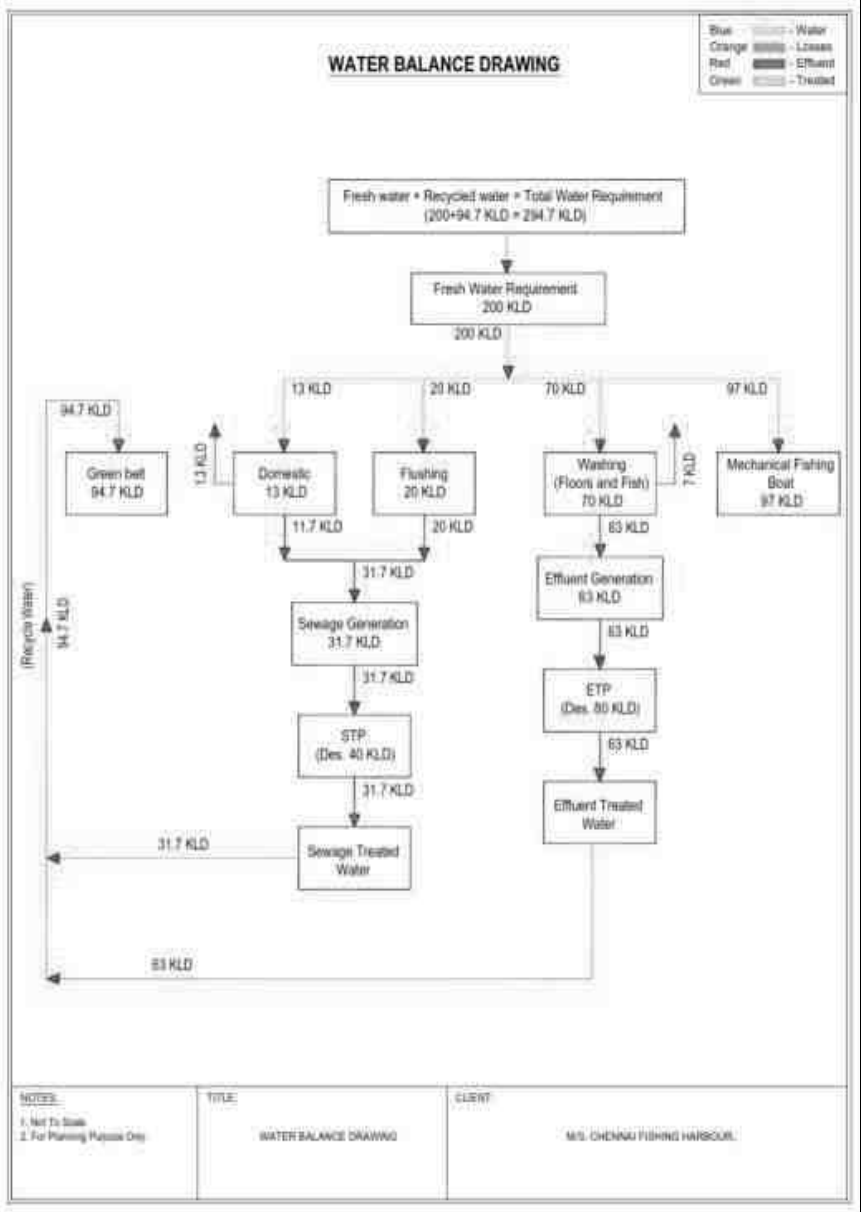
		<p>from 65 degree bearing are :</p> <p>Berths- 0.30 m</p> <p>Mooring area- 0.45 m</p> <p>The studies indicated that the modified layout meets the tranquillity requirements adequately for values up to 4.9 m height approaching from 65 degree bearing.</p> <p>The ship tranquillity study has been attached as Annexure 12.</p>															
17.	<p>Examine the details of water requirement, impact on competitive user, treatment details, use of treated waste water. Prepare a water balance chart.</p>	<p>During construction phase, approx 80 KLD will be required for both domestic and construction purpose.</p> <p>Total water requirement is 294.7 KLD, which is been already and is sufficient for proposed phase also.</p> <p>The source of water is met through Chennai Chennai Metro Water provided the dedicated pipe line to the site. Moreover, the RO Plants of capacity 25LPH & 500 LPH are to be proposed as Potable drinking water is a necessity for the users of the fishing harbour.</p> <p>The potable water at the harbour is primarily used in large quantities by the fishing boats (MFBs) before sailing out. On-shore fishermen, labourers, vendors, retailers and buyers also require potable water.</p> <p>For the storage of water, Ground Level Reservoir (GLR) and Over Head Tank (OHT) will be proposed. The water requirement given below is applicable both for Existing and Proposed Operation Phase.</p> <table border="1"> <thead> <tr> <th>Sr.No.</th> <th>Description</th> <th>Fresh Water Requirement (KLD)</th> </tr> </thead> <tbody> <tr> <td>1.</td> <td>Domestic</td> <td>13</td> </tr> <tr> <td>2.</td> <td>Flushing</td> <td>20</td> </tr> <tr> <td>3.</td> <td>Washing (Floor/Fish)</td> <td>70</td> </tr> <tr> <td>4.</td> <td>Mechanized Fish Boats (MFB) Requirement</td> <td>97</td> </tr> </tbody> </table>	Sr.No.	Description	Fresh Water Requirement (KLD)	1.	Domestic	13	2.	Flushing	20	3.	Washing (Floor/Fish)	70	4.	Mechanized Fish Boats (MFB) Requirement	97
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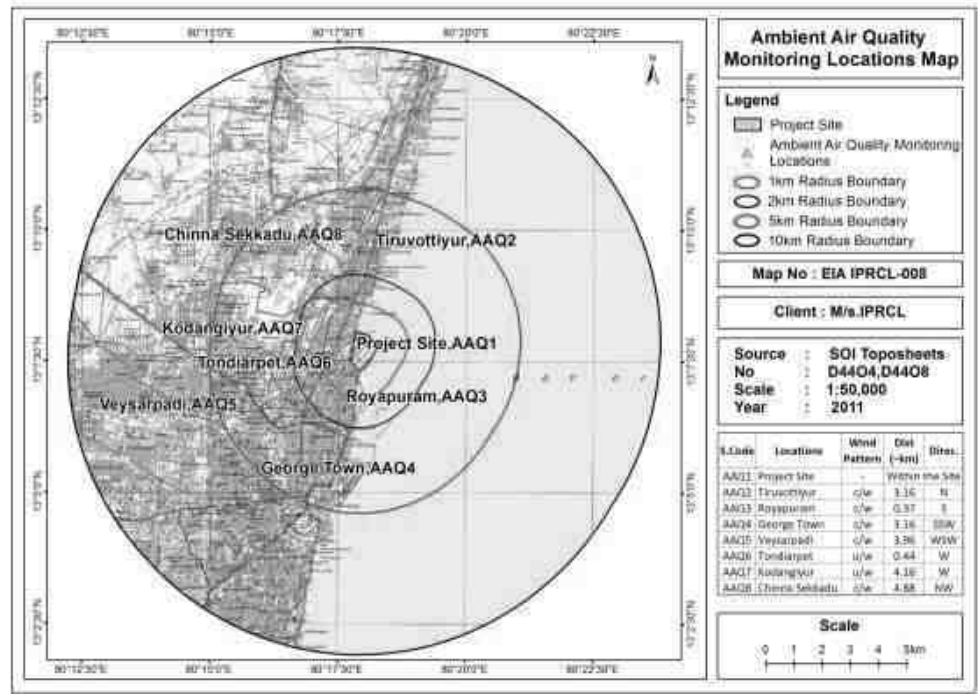


18.	Details of rainwater harvesting and utilization of rain water.	Not applicable; as it is Modernization and Upgradation of Chennai Fishing Harbour at Kasimedu, Chennai.																		
19.	Examine details of Solid waste generation treatment and its disposal.	<p>Improper waste handling is a perennial issue at most fishing harbours in India. In order to properly segregate, store, process and dispose of the waste generated at the Chennai Fishing Harbour, it is proposed to develop a solid and liquid waste disposal mechanism including the aggregation and disposal of the waste.</p> <p>This waste management intervention will ensure a clean and sustainable environment inside and around the fishing harbour. For, all the category of waste separate bins has been kept by GCC and the Environmental Cell of ChPA will monitor continuously. The GCC Agreement has been obtained in this regard and attached as Annexure 9.</p> <p>All the domestic sewage facilities will be equipped by proposing STP with SBR technology of capacity 40KLD and the STP specification is attached as Annexure 6. Effluent generation from washing will be treated by proposing ETP of 80 KLD capacity and the ETP specification is attached as Annexure 7.</p> <p>The generation of municipal Solid waste and its management is given below:</p> <table border="1"> <thead> <tr> <th>Sr.No</th> <th>Waste type</th> <th>Existing phase (kg/day)</th> <th>Proposed phase (kg/day)</th> <th>Management measure</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>Organic waste</td> <td>1.44</td> <td>1.44</td> <td rowspan="3">Collected in Municipal Bins and directly disposed through Greater Chennai Corporation dumping yard at Kodungaiyur.</td> </tr> <tr> <td>2</td> <td>Inorganic waste</td> <td>0.96</td> <td>0.96</td> </tr> <tr> <td colspan="2">Total</td> <td>2.4</td> <td>2.4</td> </tr> </tbody> </table>	Sr.No	Waste type	Existing phase (kg/day)	Proposed phase (kg/day)	Management measure	1	Organic waste	1.44	1.44	Collected in Municipal Bins and directly disposed through Greater Chennai Corporation dumping yard at Kodungaiyur.	2	Inorganic waste	0.96	0.96	Total		2.4	2.4
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		Note: Manpower Nos. – 40 Nos.																		
20.	Details of desalination plant and the study for outfall and intake.	<p>Not applicable; because the quantity of water consumption would be very less as population influx ratio is less and proposing RO plants will be adequate.</p> <p>During construction phase, approx 80 KLD will be required for both domestic and construction purpose. The total water requirement is 294.7 KLD is been already and is sufficient for proposed phase also. The source of water will be met from dedicated pipeline from CMWSSB.</p> <p>Moreover, the RO Plants of capacity 25LPH & 500 LPH are to be proposed as Potable drinking water is a necessity for the users of the fishing harbour. The potable water at the harbour is primarily used in large quantities by the fishing boats (MFBs) before sailing out. On-shore fishermen, labourers, vendors, retailers and buyers also require potable water.</p> <p>For the storage of water, Ground Level Reservoir (GLR) and Over Head Tank (OHT) will be proposed. The water requirement given below is applicable both for Existing and Proposed Operation Phase</p> <table border="1"> <thead> <tr> <th>Sr.No.</th> <th>Description</th> <th>Fresh Water Requirement (KLD)</th> </tr> </thead> <tbody> <tr> <td>1.</td> <td>Domestic</td> <td>13</td> </tr> <tr> <td>2.</td> <td>Flushing</td> <td>20</td> </tr> <tr> <td>3.</td> <td>Washing (Floor/Fish)</td> <td>70</td> </tr> <tr> <td>4.</td> <td>Mechanized Fish Boats (MFB) Requirement</td> <td>97</td> </tr> <tr> <td colspan="2">Total</td> <td>200</td> </tr> </tbody> </table>	Sr.No.	Description	Fresh Water Requirement (KLD)	1.	Domestic	13	2.	Flushing	20	3.	Washing (Floor/Fish)	70	4.	Mechanized Fish Boats (MFB) Requirement	97	Total		200
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21.	Examine baseline environmental quality along with projected incremental load due to the proposed Project/activities.	<p>Baseline environmental quality along with projected incremental load due to proposed activities :</p> <ol style="list-style-type: none"> 1. Sewage Treatment Plant- All the domestic sewage facilities will be equipped by proposing STP of 40 KLD and other waste will be treated by proposing ETP of 80 KLD capacity and will be utilized for the proposed project. 2. DG Stack- There is no new DG been proposed; Therefore, there will be only minor incremental load due to proposed activity. 				
22.	The air quality monitoring should be carried out according to the notification issued on 16th November,2009	To evaluate the baseline air quality of the study area, Eight (08) monitoring locations have been identified as per annual period wind predominance. The annual wind predominance is from West.				
		Station Code	Location	Wind Pattern	Distance (km) from Project boundary	Azimuth Directions
		AAQ1	Near Project Site		Within the Site	
		AAQ 2	Tiruvottiyur	c/w	3.16	N
		AAQ 3	Royapuram	c/w	0.37	S
		AAQ 4	George Town	c/w	3.16	SSW
		AAQ 5	Veysarpadi	c/w	3.96	WSW
		AAQ 6	Tondiarpet	u/w	0.44	W
		AAQ 7	Kodangiyur	u/w	4.16	W
		AAQ 8	Chinna Sekkadu	c/w	4.88	NW



23. Examine separately the details for construction and operation phases both for Environmental Management Plan and Environmental Monitoring Plan with cost and parameters.

Land environment

- The surface roads, which are proposed to be utilized during construction, shall be black topped to avoid fugitive dust.
- No new quarry is proposed to be specifically opened and the construction material is to be extracted from existing operating quarries, located outside the study area.
- Hence, project proponents are not required to implement management measures related to quarry slope stabilization.

Solid Waste Disposal

- Many of the waste items can be recycled and reused. This involves collecting and sorting the discarded materials suitable for recycling, paper, plastic, glass and aluminium cans, etc.
- Wet organic matter can be converted into compost. It is advisable to have separate containers to facilitate the segregation of wastes into bio-degradable and non biodegradable components.
- Floating garbage is best collected by small boats using a scoop net or two vessels working

together using a floating net boom at the designated dumping areas of the local administration. Plastic drums of 100-litre capacity with airtight lids shall be bought and used to collect offal from fish markets or moored boats.

- Other organic fish wastes generated near the quay and auction hall area will be collected in air tight containers and sent to the organic waste composter, bio- mechanical composter of the local body.

Water Environment

- The major source of water pollution in the construction and operation phases is the sewage generated by the workers and employees. As a part of control of water pollution adequate numbers of community toilets connected to one septic tank will be constructed.
- The main source of wastewater generated during operation phase, will be the effluent generated from the fish washing, auction hall cleaning etc.
- The sewage will be generated from existing, toilet blocks etc. and it will be treated in septic tank.
- For treatment of sewage, an Effluent Treatment Plant and sewage treatment plant has been proposed within the fishery harbour.

Air Environment

The following measures are recommended to control air pollution:

- Contractor will be responsible for maintaining properly functioning of construction equipment to minimize exhaust.
- Construction equipment and vehicles will be turned off when not used for extended periods of time.
- Unnecessary idling of construction vehicles to be prohibited.
- Effective traffic management to be implemented.
- Road damage caused by sub-project activities will be promptly attended to with proper road repair and maintenance work.

Control of Pollution due to Increased Vehicles

- The vehicles emitting pollutants above the standards should not be allowed to ply either in the project construction or in the operation phases.

- Vehicles and construction equipment shall be fitted with internal devices i.e. catalytic converters to reduce CO and HC emissions.
- Water sprinkling shall be done at least thrice a day at the construction sites, haul roads and other access roads.
- Measures such as covering the trucks while transporting the construction material shall be initiated to control fugitive dust as also to control the re-suspension of particulate matters from the excavated materials.
- Staff involved in construction shall be provided with suitable Personnel Protective Equipment (PPE) such as dust masks, ear plugs, gum boots, gloves, etc.
- Idling of delivery trucks or other equipment shall be avoided during loading and unloading of construction material.

Noise Environment

- It is proposed to develop a greenbelt along the road stretches. The contractors will be required to maintain properly functioning equipment and comply with occupational safety and health standards.
- The construction equipment will be required to use available noise suppression devices and properly maintained mufflers.
- Ear protective devices should be used by the construction workers where they are exposed to steady noise levels above 85 dB.
- Noise from the DG set shall be controlled by providing an acoustic enclosure.
- To prevent the adverse effects of noise the exposure period of affected persons be limited as specified by Occupational Safety and Health Administration (OSHA).

Prevention of Soil Contamination

- Vehicle/machinery and equipment operation, maintenance and refueling will be carried out in such a fashion that spillage of fuels and lubricants does not contaminate the ground.
- Oil interceptors will be provided within the construction camps.
- All spills and collected petroleum products will be disposed off in accordance with CPCB norms.

Traffic Management

- The following measures are recommended as a part of Traffic Management Plan.

- Local villagers will be informed about the construction schedule.
- Traffic management with diversion through alternate routes will be implemented by providing adequate sign boards.
- Upon project completion, quick clearance of debris, etc. will facilitate access by customers to local business and residents to their households.
- Placement of traffic staff to facilitate easy of movement.

Odour Management

- A number of systems and indigenous low-cost methods are applied to reduce the impact of typical odour from fishing harbour areas.
- These technologies includes Odour neutralising agents, windbreak walls, Air scrubber, Bio filter, Short, Active oxygen, Ozone treatment, etc.

First-aid posts

- It is proposed to maintain one first-aid post manned by a qualified doctor and support staff during construction phase.
- The first-aid post will have all emergency medicines and appliances required for meeting emergencies arising during construction as well as a stand-by ambulance.
- The activities of this centre will include coordinating local vector control programmes / campaigns

Social Upliftment of the Fishermen Community

The social upliftment of the local habitations and villages will include village roads, community halls, bus shelters, footpaths, distribution of free medicine, etc

Dredging Management Plan

- It is proposed to carry out maintenance dredging activity within the fishing harbour to facilitate effective and optional utilization of harbour. The depth of the dredging is varying from 1- 2m in accordance with the site conditions.
- The area of dredging is 454214sq.m. Quantity of dredging material is 5,60,000 Cum.
- The dredged materials are proposed to be transported through self propelled dump barge

(bottom open drop barge) .

- The impact on coastal environment during construction phase would be mainly from the activities in the inter-tidal phase due to construction of fishing harbour.

Sr.No.	Potential Direct Impacts	Potential Indirect Impacts
1.	Increased sediment Loading and deterioration in water quality	Impacts to fisher revenue stream for a shorter period of time
2.	Destruction/Entanglement of fishing gears	Decreased in the supply of catchment of fishes to the market
3.	Obstruction to travel routes	Reduced water quality

Hence, as a part of the management strategy various activities shall be well coordinated and optimized to avoid time and cost, which are given below:

- As part of conservation strategy, dredging will not be carried out during the fish breeding season.
- Dredging and construction activities to be scheduled and planned to minimize the impacts on fishermen and marine ecology providing necessary mechanisms to trap the spillage of fuel / engine oil and lubricants from the construction site to minimize impacts on benthos.
- Temporary colonies of the construction workers would be established sufficiently away from the High Tide Level (HTL) with adequate sanitation facilities and waste treatment measures. Construction debris shall be disposed safely in the designated areas.
- Proper covered storage area shall be used for dumping, transporting and disposal of the dredged material from the project site to designated dumping site outside the CRZ limits.
- Vehicles transporting reclamation materials must have their loads covered using tarpaulin or

canvas sheet when utilizing the public road to prevent spillage of materials that can become a source of dust pollution.

- Minimise or even prevent dewatering or overflow from dredger.
- Good practice when loading and transporting unsuitable dredged material.
- Regular maintenance of ships and barges so as to prevent accidental leaks and spillage.
- Deflectors should be installed on the draghead and to ensure marine mammal and turtle observers are on board during dredge operations.
- As part of this exercise, the dredger will be equipped with spill response kits and dredging will be carried out in confined manner to reduce the impacts on marine environment.

All the standards preparatory will be taken to reduce the impact on marine water quality. Eventhough, the impacts will be for a short period only.

Environmental Monitoring Program during construction and Operation phase

Sr. No	Area of Monitoring	Number of Sampling Stations	Frequently of Sampling	Parameters to be Analyzed
1.	Meteorology	One	Hourly and Daily basis.	Wind speed and direction, Temperature, Relative Humidity, Atmospheric pressure, Rainfall.
2.	Ambient Air Quality	4 Stations	Twice a week:24 hourly period	RPM, SO ₂ and NO _x
3.	Noise	4 (two within plant premises and two outside plant premises)	Once every season	Ambient Equivalent continuous Sound Pressure Levels (L _{eq}) at day and Night time.
4.	Liquid Effluents	Main Plant Effluents	Weekly	pH, Temp, Conductivity, TSS, TDS, BOD, Phenolics.
		Sanitary Effluents	Monthly	pH, TSS, BOD
5	Vehicular Emissions	Parking area	Periodic monitoring of vehicles	Air emission and noise, PUC

		6	Soil	Two Locations within the Project Site	Monthly once	Physicochemical properties, Nutrients, Heavy metals
		Adequate budgetary provisions have been made for execution of environmental management plan. The cost estimate of INR 3.23 crores is allotted for establishing STP and ETP.				
24.	Submit details of a comprehensive Risk Assessment and Disaster Management Plan including emergency evacuation during natural and man-made disasters	The risk assessment and disaster management plan is prepared and is attached as Annexure 13 .				
25.	Submit details of the trees to be cut including their species and whether it also involves any protected or endangered species. Measures taken to reduce the number of the trees to be removed should be Explained in detail. Submit the details of compensatory plantation. Explore the possibilities of relocating the existing trees.	There are no trees to be cut including their species and whether it also involves any protected or endangered species.				
26.	Examine the details of afforestation measures indicating land and financial outlay. Landscape plan, green	It is proposed to plant trees to create Green belt area for an area of 4200Sqm. The plant species selected for greenbelt will include the native species. These saplings will be planted in rows. The plantation at the proposed project will be taken into consideration of the existing social forestry in the region. The				

	belts and open spaces may be described. A thick green belt should be planned all around the nearest settlement to mitigate noise and vibrations. The identification of species/plants should be made based on the botanical studies.	<p>type of species to be planted in the region are:</p> <ol style="list-style-type: none"> 1. Clerodendrum 2. Acalypha Red and green 3. Royal palms 4. Ficus Panda 5. Plumeria 6. Suitable Native Trees 7. Euphorbia
27.	The Public Hearing should be conducted for the project in accordance with provisions of Environmental Impact Assessment Notification, 2006 and the issues raised by the public should be addressed in the Environmental Management Plan. The Public Hearing should be conducted based on the ToR letter issued by the Ministry and not on the basis of Minutes of the Meeting available on the web-site.	The Public Hearing will be conducted for the project in accordance with provisions of Environmental Impact Assessment Notification, 2006 and the issues raised by the public will be addressed in the Environmental Management Plan
28.	A detailed draft EIA/EMP report should be prepared in	A detailed draft EIA/EMP report will be prepared in accordance with the above additional TOR and will be submitted to the Ministry in accordance with the Notification

	accordance with the above additional TOR and should be submitted to the Ministry in accordance with the Notification.																																		
29.	Details of litigation pending against the project, if any, with direction /order passed by any Court of Law against the Project should be given.	There is no litigation pending against the project.																																	
30.	The cost of the Project (capital cost and recurring cost) as well as the cost towards implementation of EMP should be clearly spelt out.	<p>The cost of the project is INR 89.62 crores.</p> <table border="1"> <thead> <tr> <th>Sr.No.</th> <th>Projects Identified</th> <th>Tentative Cost (Rs in Lakhs)</th> </tr> </thead> <tbody> <tr> <td>1.</td> <td>Ship-Lift Facility and Boat Repair Yard</td> <td>1000</td> </tr> <tr> <td>2.</td> <td>Boat Repair Spare Parts Complex – 15m x 15m</td> <td>60</td> </tr> <tr> <td>3.</td> <td>Controlled Entry and Exit Arrangements, Elevated Compound wall 2Nos. of Arched Entrances</td> <td>650</td> </tr> <tr> <td>4.</td> <td>Two-lane peripheral road with stormwater drain, cable truss Pedestrian path + widening/ repair of existing internal road network</td> <td>1200</td> </tr> <tr> <td>5.</td> <td>Fish Handling Shed at the Trawler Wharf – 100m x 27m</td> <td>600</td> </tr> <tr> <td>6.</td> <td>Cleaning, Packaging and Cold Storage Facility – 20m x 10m</td> <td>100</td> </tr> <tr> <td>7.</td> <td>Administration & Centralized Control Block with Commercial Complex on the ground floor – 25m x 15m (G+2)</td> <td>300</td> </tr> <tr> <td>8.</td> <td>Vessel Monitoring and Control System</td> <td>100</td> </tr> <tr> <td>9.</td> <td>Two-wheeler/ Four-wheeler Parking Area – 16m x 45m + 44m x 35m</td> <td>85</td> </tr> <tr> <td>10.</td> <td>Electrical High Mast Lights and Street Light arrangements</td> <td>200</td> </tr> </tbody> </table>	Sr.No.	Projects Identified	Tentative Cost (Rs in Lakhs)	1.	Ship-Lift Facility and Boat Repair Yard	1000	2.	Boat Repair Spare Parts Complex – 15m x 15m	60	3.	Controlled Entry and Exit Arrangements, Elevated Compound wall 2Nos. of Arched Entrances	650	4.	Two-lane peripheral road with stormwater drain, cable truss Pedestrian path + widening/ repair of existing internal road network	1200	5.	Fish Handling Shed at the Trawler Wharf – 100m x 27m	600	6.	Cleaning, Packaging and Cold Storage Facility – 20m x 10m	100	7.	Administration & Centralized Control Block with Commercial Complex on the ground floor – 25m x 15m (G+2)	300	8.	Vessel Monitoring and Control System	100	9.	Two-wheeler/ Four-wheeler Parking Area – 16m x 45m + 44m x 35m	85	10.	Electrical High Mast Lights and Street Light arrangements	200
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		11.	Sanitary Complex – 10m x 5m	20
		12.	Over-Head Tank, Low-level Reservoir and Water Distribution System	400
		13.	Drinking water arrangements by RO – 5nos of 25LPH capacity + 2nos of 500LPH capacity + 2nos of 1000liters storage tanks	50
		14.	Solid and liquid waste management	150
		15.	CCTV surveillance system	50
		16.	Additional Fish Handling Shed at Trawler Wharf	800
		17.	Northern Wharf supporting existing structure	400
		18.	Two Nos. Of solar operated with electrical backup Fish drying machine	75
		19.	Truck Paved parking area facility near proposed two & four wheeler parking no1	48
		20.	Two wheeler and Car Parking for administrative and commercial complex and two wheeler parking shed in the Eastern side of the Administrative and commercial complex building	16.5
		21.	Net Mending shed at southern side	80
		22.	New open shed with Arabian Tent Roofing for fish cutting stalls near retail shops	54
		23.	Proposed rooms for stacking unsold items in the rear side of fish cutting stall	93
		24.	Eurocon tiles flooring for retail shop portion	36
		25.	New open sheds with Arabian Tent roofing for prawn sale point	236
		26.	Provision for improvement of internal roads & drains	300
		27.	Dredging (exact amount to be ascertained by Bathymetry survey)	300
		28.	Consultancy and preparation of DPR	150
			Sub Total before GST	7553.50

		Add for Contingency @3% (7553.50)	226.60
		Add work Changes Establishment @2% (7553.50)	151.07
		Sub Total before GST	7931.17
		Provision for Labour Welfrae Fund/Labour Cess@ 1% (7931.17)	79.31
		GST @ 12% (7931.17)	951.74
		Grand Total Including GST	8962.22
Adequate budgetary provisions have been made for execution of environmental management plan. The cost estimate of INR 3.23 crores is allotted for establishing STP and ETP			

1.9.4 Additional ToR Compliance-SEIAA

Sr.No.	Terms of Reference	Compliance			
		Sr.No	Demersal varieties	Sr.No	Pelagic varieties
1.	Enlist all species of fish handled/to be handled in the port	1	Sharks	1	Chirocentrus
		2	Skates & Rays	2	Oil Sardines
		3	Eels	3	Lesser Sardines
		4	Cat fishes	4	Hilsa illsha
		5	Saurida & Saurus	5	Other illisha
		6	Perches	6	Anchovy
		7	Red Mulletts	7	Thrissocles
		8	Polynemids	8	Other Clupeids
		9	Sciaenids	9	Harpodon nehereus
		10	Silver bellies	10	Hemirhamphus & Belone
		11	Gazza	11	Flying fish
		12	Lactarius	12	Ribbon fish
		13	Pomfrets	13	Caranx
		14	Bregmaceres	14	Chironemus
		15	Soles	15	Trachynotus
		16	Penaeid Prawns	16	Other Carangids
		17	Non -Penaeid Shrimps	17	Elacate
		18	Lobsters	18	Mackerel

		19	Crabs	19	Seerfish
		20	Turtle	20	Tunnies
		21	Cephalopods	21	Sphyreana
		22	Nemipterus	22	Mugil-mulletts
		23	Miscellaneous	23	Lethrinus
				24	Sillago
				25	Balisters
				26	Ora
				27	Spotted Ray
				28	Drepane
				29	Coryphaena
				30	Miscellaneous

		Usage of toxic compounds	Impacts	Mitigation Measures
2.	The study proposal shall include impact due to the toxic compounds like paints, packaging materials, shredded ice etc	Usage of Paints for boats and other Port buildings	Release of VOCs, Lead and other toxic compound which subsequently affects the environment and marine life.	Boats and other building will be painted with only Lead free paints.
		LDPE Plastics used for packaging materials	<ul style="list-style-type: none"> ➤ Harms Marine & Terrestrial Life ➤ Ground water exploitation ➤ Produces Chemical Pollution. ➤ Creates Microplastics 	All the steps will be taken to minimize the usage of plastics and proper disposal methodology will be followed.
		Shredded ice used for fish storage	The chemical agents used for de-icing will lead to degradation of the ecosystem	Shredded ice will be properly stored and quality de-icing practices will be implemented.
		Usage of diesel and oil for mechanized boats	Leakage of oils, oily wastes and mixtures may directly cause damage to fishery resources, aquatic biota and	All the spent oils will be stored in designated place away from the shoreline.

			coastal habitat. These effects may seriously damage marine and coastal ecology.	The disposal of the oil waste will be done by authorized vendors.
		Sewage and Garbage	Waste from packaging materials; floating garbage will affect the aesthetic value and degrade the marine environment	<p>In order to properly segregate, store, process and dispose of the waste generated at the Chennai Fishing Harbour, it is proposed to develop a solid and liquid waste disposal mechanism including the aggregation and disposal of the waste. This waste management intervention will ensure a clean and sustainable environment inside and around the fishing harbour.</p> <p>All the domestic sewage facilities will be equipped by proposing STP with SBR technology of capacity 40 KLD and the STP specification is attached as Annexure 6.</p> <p>Effluent generation from washing will be treated by proposing ETP of 80 KLD capacity and the ETP specification is attached as Annexure 7.</p>
3.	To elaborate the impact of proposed construction on the population of sea crustaceans such as crabs molluscs and other	Impacts of proposed construction		Mitigation Measures
		During construction, waste will be generated which is an inert and non-		➤ All the construction waste should be sorted and stored within the site itself.

life forms.	biodegradable material such as concrete, plastic, metal, wood etc.	<ul style="list-style-type: none"> ➤ The proper screen should be provided so that the waste will not scatter and pollute the sea shore and sea water.
	<ul style="list-style-type: none"> ➤ The machinery used in the construction may exceed the level and may cause vibration also. ➤ Due to excessive exposure of more noise can lead to loss of hearing and also affect the marine life. 	<ul style="list-style-type: none"> ➤ The machinery used for the construction work will be well maintained and well lubricated. ➤ Providing noise barrier or acoustic enclosures which will block the direct path of sound wave. It will reduce the level of noise. ➤ Noise shield will be used around the noise producing equipment. The noise shield will be any physical barrier which can reduce the noise level.
	<ul style="list-style-type: none"> ➤ The waste generated in the process of the construction waste thrown in the sea causing water contamination. ➤ The concrete may spill into the sea during the construction may cause the water pollution. 	<ul style="list-style-type: none"> ➤ Built erosion control blankets, sedimentation ponds and silt fences to avoid erosion of construction material to the sea. ➤ Laying debris trap close to the location will stop the debris from leaving the site. To avoid tourist disruption, the debris trap should be placed away from the shore ➤ Ensure ground water is not contaminated by the penetration of leaches from the stockpile or waste dump. Geo textile can be used in the waste dumping area to prevent the penetration of leaches.
	<ul style="list-style-type: none"> ➤ During Construction, the transport of the fine materials like, sand, cement may cause air pollution. 	<ul style="list-style-type: none"> ➤ The vehicle and equipment used for construction should be maintained and pollution emission should check frequently and equipment should be switched off when it is not in the use.

		<ul style="list-style-type: none"> ➤ The smog from the vehicle can pollute the air. 	<ul style="list-style-type: none"> ➤ The speed of the vehicles can be restricted to 20 kmph to reduce dust emission due to movement of the vehicle. ➤ Sprinkling of water near the construction area while running the equipment may reduce the dust production
		<ul style="list-style-type: none"> ➤ The seismic operation like drilling, Pile driving, can cause noise and vibration which can temporarily affect the fish and marine ecology. ➤ Due to construction, the disturbance may cause temporary displacement of fishery resources and affect other aquatic fauna and flora. ➤ The waste from the construction can affect the marine water 	<ul style="list-style-type: none"> ➤ Identify the sensitive area for marine life such as feeding, breeding, calving and spawning area and plan the seismic activity like pile driving, according to that to avoid the damage of the marine life and ecosystem. ➤ To avoid underwater noise generated by pile driving will be reduced by providing air bubble curtains, temporary noise attenuation piles, air filled fabric barriers. ➤ If a marine life mammals are sighted within 500m of the proposed construction site, the work will be stopped until it move away. ➤ The disposal to the marine will be maintained as per the standards
		<ul style="list-style-type: none"> ➤ When the structure is opened to tourism, a proper solid waste management should be maintained by providing Dust bins in required distance. ➤ A proper screening system can be done for avoiding plastic in to the bridge covering the sea area. ➤ The waste collected is disposed as per the municipal solid waste management 	<p>Solid waste shall be segregated as hazardous waste, municipal waste and disposed as per the municipal solid waste criteria.</p>

		Impacts on fresh water, underground water and soil environment	Mitigation Measures
4.	Impact on fresh water quality, underground water and soil environment	<p>Breakwaters and landfills may change current patterns and cause stagnation of water behind the structures.</p> <p>If municipal or industrial effluents flow into a port, stagnant port water may deteriorate through a dramatic increase of phytoplankton and a decrease of dissolved oxygen, resulting from eutrophication of water.</p> <p>The parameters that have an impact on soil environment in ports are: Spills from bulk handling (oil, rubber, etc.) and dust spread during handling. Oil and other spillage from vehicles dissolve the surface</p>	<p>Careful site selection and port design should be carried out focusing on possibility of water stagnation.</p> <p>If the basic pollution level is critically high, a sewage treatment system should be planned as part of the environment management of the area.</p> <p>In order to be able to minimize the pollution from port operation, preferred handling methods for different types of bulk products should be followed to effectively prevent spillage.</p>
5.	To detail the strategy to be adopted for waste reduction at the port	<p>In order to properly segregate, store, process and dispose of the waste generated at the Chennai Fishing Harbour, it is proposed to develop a solid and liquid waste disposal mechanism including the aggregation and disposal of the waste. This waste management intervention will ensure a clean and sustainable environment inside and around the fishing harbour.</p> <p>All the domestic sewage facilities will be equipped by proposing STP with SBR technology of capacity 40KLD and the STP specification is attached as Annexure 6.</p> <p>Effluent generation from washing will be treated by proposing ETP of 80 KLD capacity and the ETP specification is attached as Annexure 7.</p>	
6.	The study proposal shall address the impact of the construction activity on the food cycle/food chain.	As the construction phase is temporary and all the minor effects are mitigated by EMP; there will not be any major impacts on food cycle/chain.	
7.	The study proposal shall include impacts such as sea warming and acidification including deoxygenation due to proposed and post	As, there is no only minor construction involved in the sea region; no sea warming, acidification including deoxygenation is caused. The mitigation measures for post construction activity are:	

	construction activity	<ul style="list-style-type: none"> ➤ Consider safety precautions like installing handrails, ladders, fire extinguishers on the structure and upkeep of the fixtures. ➤ Precautionary measures will be undertaken to minimise the risk of injury or disturbance to marine ecology and fisheries around memorial by ensuring safe disposal of wastes generated every day and educating through proper signage. ➤ Plan and provide proper evacuation and escape routes, protocols in the event of natural calamities such as fire, earthquake and immediately once the tsunami warning is issued. ➤ Public visitors and tourists should be restricted and prevented from the walkway and memorial deck during periods of Cyclonic conditions, heavy rainfall, and heavy winds.
8.	Steps taken to combat pollution caused by plastics, pesticides etc	<p>The following steps will be taken to combat the pollution caused by plastics and pesticides are:</p> <ol style="list-style-type: none"> 1. Minimization of usage of LDPE plastics bags. 2. Proper disposal bins will be kept in areas within the premises for segregation of biodegradable and non-biodegradable wastes. 3. Eliminate the total usage of chemical pesticides and alternate methods will be adopted. 4. Plastic waste management measures will be taken in accordance with the Chennai Port Trust Environment Policy. 5. An Environmental Management system will be implemented to reduce and minimize the waste generation.
9.	To detail the safety measures taken to prevent over fishing	<p>The safety measures taken to prevent the over fishing are :</p> <ol style="list-style-type: none"> 1. The subsidies for fuel, fishing gear, and building new vessels to be used in the sustained level. 2. Several regulations to be applied and monitoring to be done for the usage of fishing nets; in order to avoid the untargeted marine species. 3. Time restrictions to be implied on fishing; mainly during the fish breeding seasons. 4. Only licensed boats and authorized persons are allowed to do fishing.
10.	Impact on invasive species shall be detailed	No invasive species are found in the proposed project region.
11.	Study shall include impacts on the rights of the local community living near the coastal area	No major impacts will be caused to the local community living near the coastal area.

		<p>There will be only positive impacts for the local community near the coastal area:</p> <ol style="list-style-type: none"> 1. Direct and Indirect employment opportunity 2. Improves the welfare and livelihood of the fishermen
12.	Study shall include impact on terrestrial, coastal and marine biodiversity, flora and fauna	<p>Impact on Terrestrial Biodiversity:</p> <ul style="list-style-type: none"> ➤ The impact of construction activities will be primarily confined to the project site. As stated earlier, the site is a piece of land with minimal habitation. ➤ Deposition of fugitive dust on leaves of nearby vegetation may lead to temporary reduction of photosynthesis. Such impacts will, however, be confined mostly to the initial periods of the construction phase. ➤ The levels of pollutants expected to be maintained around the project site are much lower and are not envisaged to cause any stress on the biota. ➤ There is no likely tangible impact from higher noise and emissions during construction on the common animals and birds in the area. <p>Impact on Marine Biodiversity:</p> <ul style="list-style-type: none"> ➤ As the water quality may be changed due to the construction activities, minimal impact on the aquatic life is expected. ➤ During dredging, the existing habitat of creatures and organism that depends on the original composition of the soil may be affected. However, during our marine survey, the presence of sensitive species was not observed. ➤ The water could get polluted because of the soil particles mixing with the water. This may in turn affect the aquatic life temporarily. ➤ All the precautions will be taken not to discharge any material, solid or liquid to the marine environment. <p>Impacts on Flora & Fauna:</p> <ul style="list-style-type: none"> ➤ The construction materials and their processing will have a major impact on biodiversity. ➤ Maintenance dredging impacts on the air, noise and water pollution due to the release of suspended particles and accumulation of sediments making the land infertile. ➤ However, by implying the Environmental Management Plan (EMP), there will not be any effect on existing vegetation and habitat quality. ➤ Discharge of contaminants into the sea will also be minimized in order to protect the marine life.
13.	To detail how the proposed project shall influence the blue economy	<ul style="list-style-type: none"> ➤ During the Budget Speech on 01.02.2021, the Honourable Union Finance Minister has proposed substantial investments in the development of Modernizing the

		<p>Fishing Harbour and Fish landing centres .The proposed project is the Modernization and Upgradation of Chennai fishing harbour at Kasimedu, Chennai.</p> <ul style="list-style-type: none"> ➤ Government of India and State/UT Governments have undertaken many schemes to support fisheries. ➤ Under ‘Blue Revolution’ scheme, consistent investments have been made in areas, such as Fisheries Institute for skill development, deep-sea fishing, landing centres, auction halls, net mending sheds, ice plants, retail fish outlets, including fishermen welfare activities, such as housing for fishermen, insurance against accidents, relief assistance, etc.
14.	Strategy to be adopted for raising conservation awareness among the local community	<p>The strategy to be adopted for raising conservation awareness among the local community are:</p> <ol style="list-style-type: none"> 1. Public gatherings to be conducted in order to raise the conservation awareness. 2. Proper understandable sign boards will be kept installed wherever possible. 3. Proper education about environment conservation will be provided. 4. Do’s /Don’ts policy to be issued and publicized in the premises; with the guidance of municipality. 5. Conservative legislative regulations to be implemented and followed.
15.	To study the impact due to increase in footfall (fish vendors, public and employees)	<p>The impact due to the increase in footfall like fish vendors, public, employees etc:</p> <ol style="list-style-type: none"> 1. Marine plastic pollution may affect human health along the food chain, primarily through the consumption of sea salt, aquatic products, livestock and poultry that feed on marine fishmeal. 2. Undesirable smoke, dust, other pollutants and stagnant water created by fish vendors, public and employees can affect sea salt, aquatic products. 3. Inadequate working space shall be provided for unhygienic handling of fishery products. 4. Improper drainage system can cause health disease for fish vendors, public and working employees. 5. Solid and liquid wastes formation (eg. Plastic waste, water for cleaning Floors, walls, partitions, ceilings, utensils, instruments and other food contact surfaces). 6. Entry of insects, rodents and other pests into the landing, auction and storage areas.
16.	To detail the method adopted for disposal of biological waste, blood waste etc	<p>Methods adopted for disposal of biological waste, blood waste etc:</p> <ol style="list-style-type: none"> 1. Proper collection and segregation of biological waste. 2. Biological wastes will not be sent to the Landfill or discharge into the Sewer

		<p>System.</p> <ol style="list-style-type: none"> 3. All the segregated biological waste will be further treated by Authorized recyclers. 4. Proper disinfection will be done for cleaning blood waste. 5. The untreated bio hazardous waste will be clearly identified and labelled as Bio hazard symbol. 6. Further, all sorts of treated and untreated waste will be sorted specifically, stored in special tight containers and finally transported to authorized dealers/recyclers. 7. Public awareness will be given through sign boards in the whole premises. 	
17.	To elaborate the measures taken to safeguard the safety standard and the health of people working in the area	<p>Measures taken to safeguard the safety standard and the health of the people working in the area:</p> <ol style="list-style-type: none"> 1. Safe working procedures will be adopted inside the port. 2. Awareness and training programs in terms of health and safety will be conducted for the people in working area. 3. Information, Instruction and training for fishermen will be implemented. 4. Personal protective equipment (PPE's) will be distributed to all labourers. 5. A safe system for storing, handling and using articles and substances. 6. Discuss your work schedule with your employer or skipper. 7. Frequent medical camp will be conducted for all employees, fish vendors and labourers. 	
18.	Implications of construction activities on the local ecology shall be detailed.	<p>Impacts of proposed construction</p> <p>During construction, waste will be generated which is an inert and non- biodegradable material such as concrete, plastic, metal, wood etc.</p>	<p>Mitigation Measures</p> <ul style="list-style-type: none"> ➤ All the construction waste should be sorted and stored within the site itself. ➤ The proper screen should be provided so that the waste will not scatter and pollute the sea shore and sea water.
		<ul style="list-style-type: none"> ➤ The machinery used in the construction may exceed the level and may cause vibration also. ➤ Due to excessive exposure of more noise can lead to loss of hearing and also affect the marine life. 	<ul style="list-style-type: none"> ➤ The machinery used for the construction work will be well maintained and well lubricated. ➤ Providing noise barrier or acoustic enclosures which will block the direct path of sound wave. It will reduce the level of noise. ➤ Noise shield will be used around the noise producing equipment. The noise shield will

			be any physical barrier which can reduce the noise level.
		<ul style="list-style-type: none"> ➤ The waste generated in the process of the construction waste thrown in the sea causing water contamination. ➤ The concrete may spill into the sea during the construction may cause the water pollution. 	<ul style="list-style-type: none"> ➤ Built erosion control blankets, sedimentation ponds and silt fences to avoid erosion of construction material to the sea. ➤ Laying debris trap close to the location will stop the debris from leaving the site. To avoid tourist disruption, the debris trap should be placed away from the shore. ➤ Ensure ground water is not contaminated by the penetration of leaches from the stockpile or waste dump. Geo textile can be used in the waste dumping area to prevent the penetration of leaches.
		<ul style="list-style-type: none"> ➤ During Construction, the transport of the fine materials like, sand, cement may cause air pollution. ➤ The smog from the vehicle can pollute the air. 	<ul style="list-style-type: none"> ➤ The vehicle and equipment used for construction should be maintained and pollution emission should check frequently and equipment should be switched off when it is not in the use. ➤ The speed of the vehicles can be restricted to 20 kmph to reduce dust emission due to movement of the vehicle. ➤ Sprinkling of water near the construction area while running the equipment may reduce the dust production
		<ul style="list-style-type: none"> ➤ The seismic operation like drilling, Pile driving, can cause noise and vibration which can temporarily affect the fish and marine ecology. ➤ Due to construction, the disturbance may cause temporary displacement of fishery resources and affect other aquatic fauna and 	<ul style="list-style-type: none"> ➤ Identify the sensitive area for marine life such as feeding, breeding, calving and spawning area and plan the seismic activity like pile driving, according to that to avoid the damage of the marine life and ecosystem. ➤ To avoid underwater noise generated by pile driving will be reduced by providing air bubble curtains, temporary noise attenuation piles, air filled fabric barriers.

		<p>flora.</p> <ul style="list-style-type: none"> ➤ The waste from the construction can affect the marine water 	<ul style="list-style-type: none"> ➤ If a marine life mammals are sighted within 500m of the proposed construction site, the work will be stopped until it move away. ➤ The disposal to the marine will be maintained as per the standards
		<ul style="list-style-type: none"> ➤ When the structure is opened to tourism, a proper solid waste management should be maintained by providing Dust bins in required distance. ➤ A proper screening system can be done for avoiding plastic in to the bridge covering the sea area. ➤ The waste collected is disposed as per the municipal solid waste management 	<p>Solid waste shall be segregated as hazardous waste, municipal waste and disposed as per the municipal solid waste criteria.</p>

CHAPTER 2

PROJECT DESCRIPTION

2 Project Description

2.1 Type of Project

This is Modernization and Upgradation project of Chennai fishing harbour at Kasimedu, Chennai. The total land area 31.956 Hectare. The water spread area is 48.56 Hectare.

As per the EIA Notification 2006, the proposed project falls under 7(e) –Ports, Harbours and Breakwaters. Category-B1.

The proposed project focuses on upgrading the existing facilities at Chennai Fishing Harbour:

- Water facilities (drinking and tap water), drainage infrastructure
- Sanitation, Solid and liquid waste management
- Roads and lighting arrangements
- Sheds, fish processing and storage facilities
- Boat repair facility

2.2 Need for the Project

During the Budget Speech on 01.02.2021, the Honorable Union Finance Minister has proposed substantial investments in the development of Modern Fishing Harbour and Fish landing centers. Accordingly, the Union Ministry of Fisheries, Animal Husbandry and Dairying (GoI) have informed that the Chennai Fishing Harbour is one among the first five major fishing harbours which will be developed as “Hubs of Economic Activity”.

The major objectives of the project:

- To manage and maintain the Fishing Harbour for all-weather use for fishing vessels.
- To provide convenient landing facilities to the fishing crafts.
- To facilitate handling of catches, auctioning, fueling, repairing, etc.
- To provide hygienic conditions for the pre-processes, handling of fish to match international standards, and
- To maintain hygienic standards at the international levels in the handling of marine catches

The proposed project of the Modernization and Upgradation of fishing harbour at Kasimedu, Chennai. The total land area **31.956 Hectare**. The water spread area is **48.56 Hectare**.

The proposed modernization mainly contributes to the welfare of fishermen community along with the increase in the country's GDP growth.

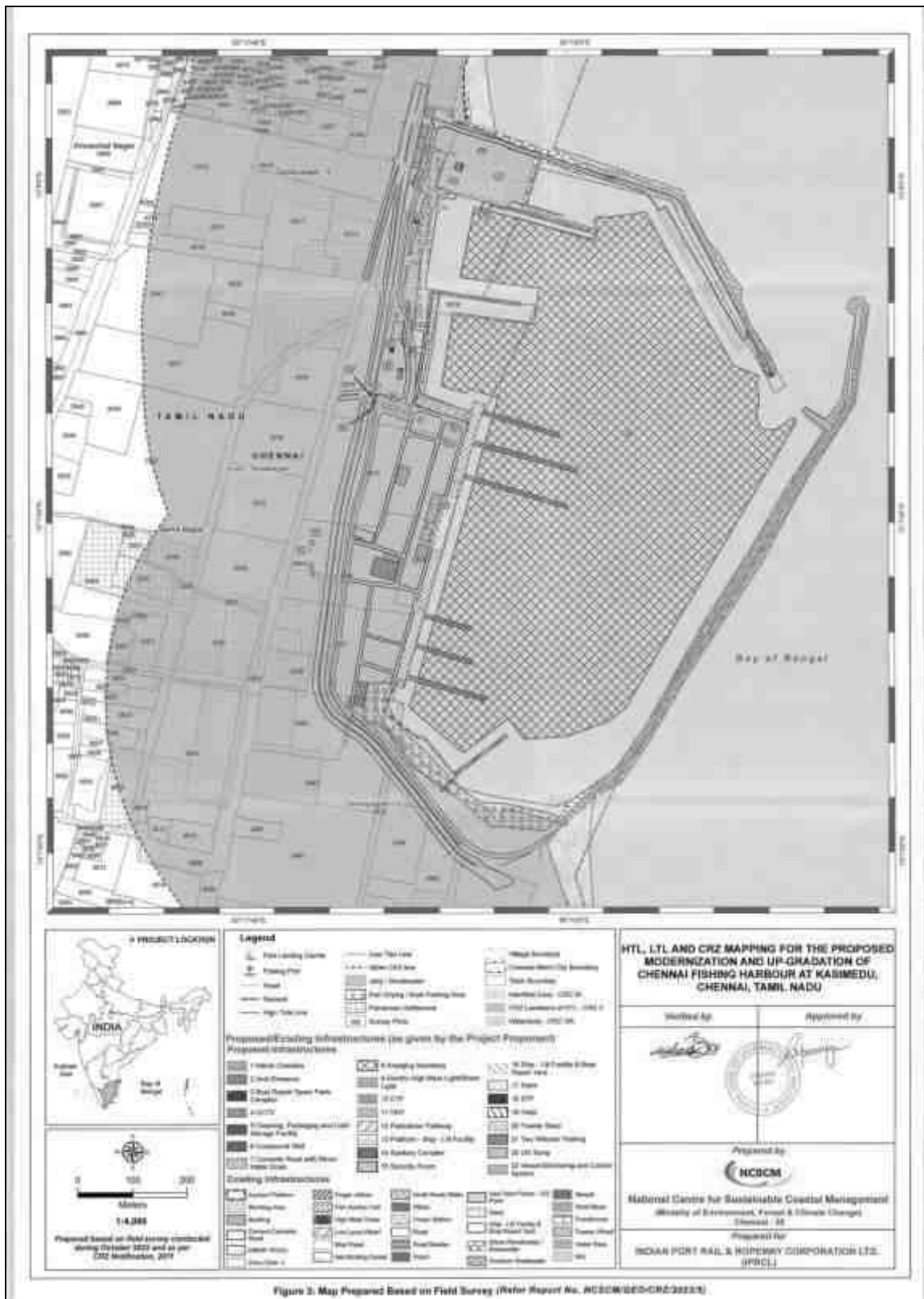


Figure 2.1: HTL LTL CRZ Demarcation (1:4000 Scale) Map

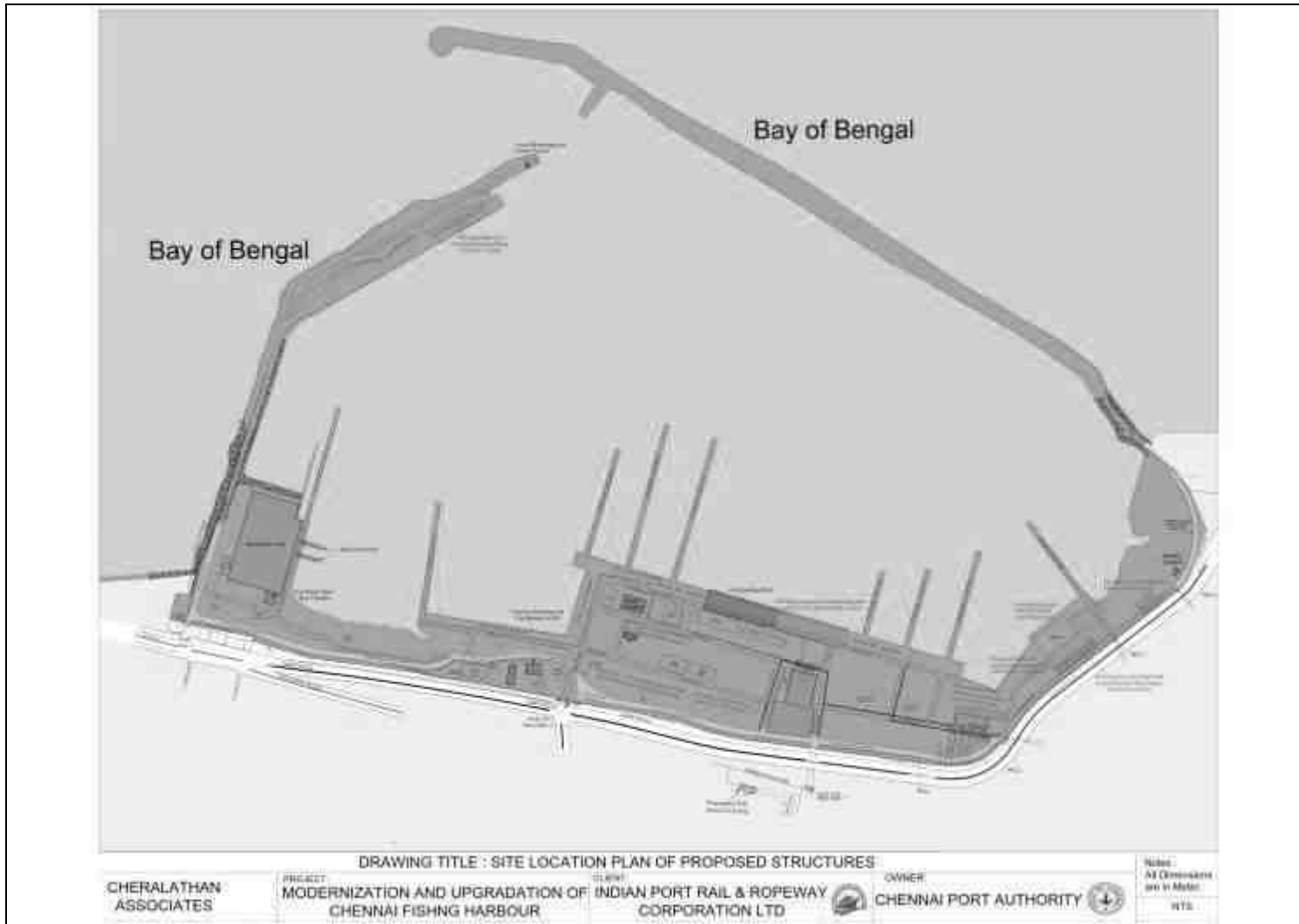


Figure 2.2:Proposed Project Layout

2.3 Site location

The total land area **31.956 Hectare**. The water spread area is **48.56 Hectare**. The index map of the study area is shown in **Figure 2.3**. The Google image showing proposed project site along with the coordinates is provided in **Figure 2.4**. The Topo Map of the study area are shown in **Figure 2.5** and site photographs of project site is given in **Figure 2.6**. The Google satellite imageries of the project site, 1 km, 5 km and 10 km radius around the project area are appended in, **Figure 2.7, Figure 2.8, Figure 2.9** and **Figure 2.10** respectively. Environmental Sensitivity map is given in and **Figure 2.11 & Figure 2.12**.

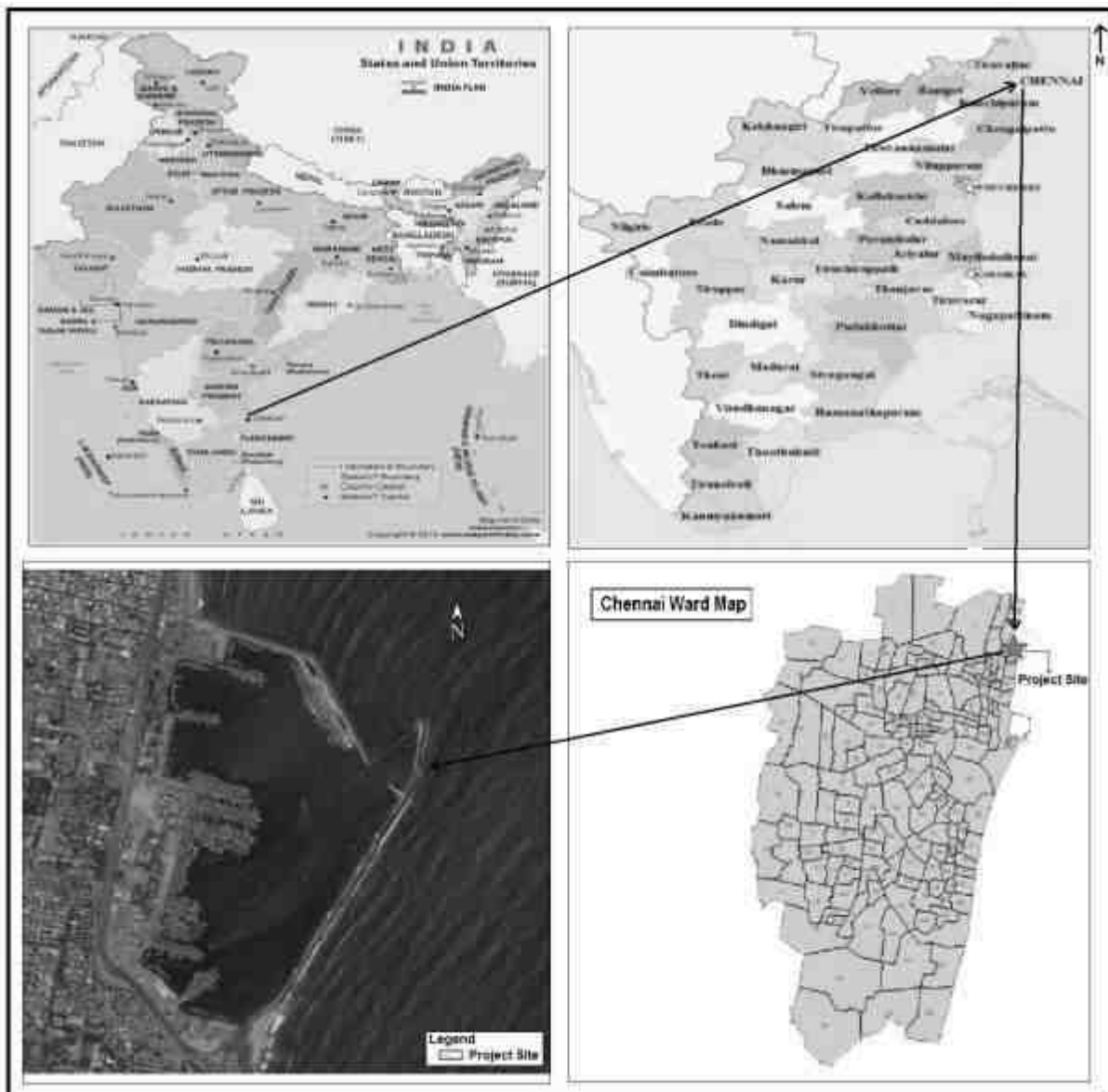


Figure 2.3: Index Map of the study area



Figure 2.4 Google image showing proposed project site along with coordinates

S.No	Latitude	Longitude
1	13° 8'4.22"N	80°17'50.67"E
2	13° 7'59.45"N	80°18'6.74"E
3	13° 7'48.70"N	80°18'12.30"E
4	13° 7'52.97"N	80°18'18.16"E
5	13° 7'46.31"N	80°18'17.07"E
6	13° 7'24.14"N	80°18'2.55"E
7	13° 7'19.19"N	80°17'55.60"E
8	13° 7'20.21"N	80°17'53.18"E
9	13° 7'29.40"N	80°17'44.89"E

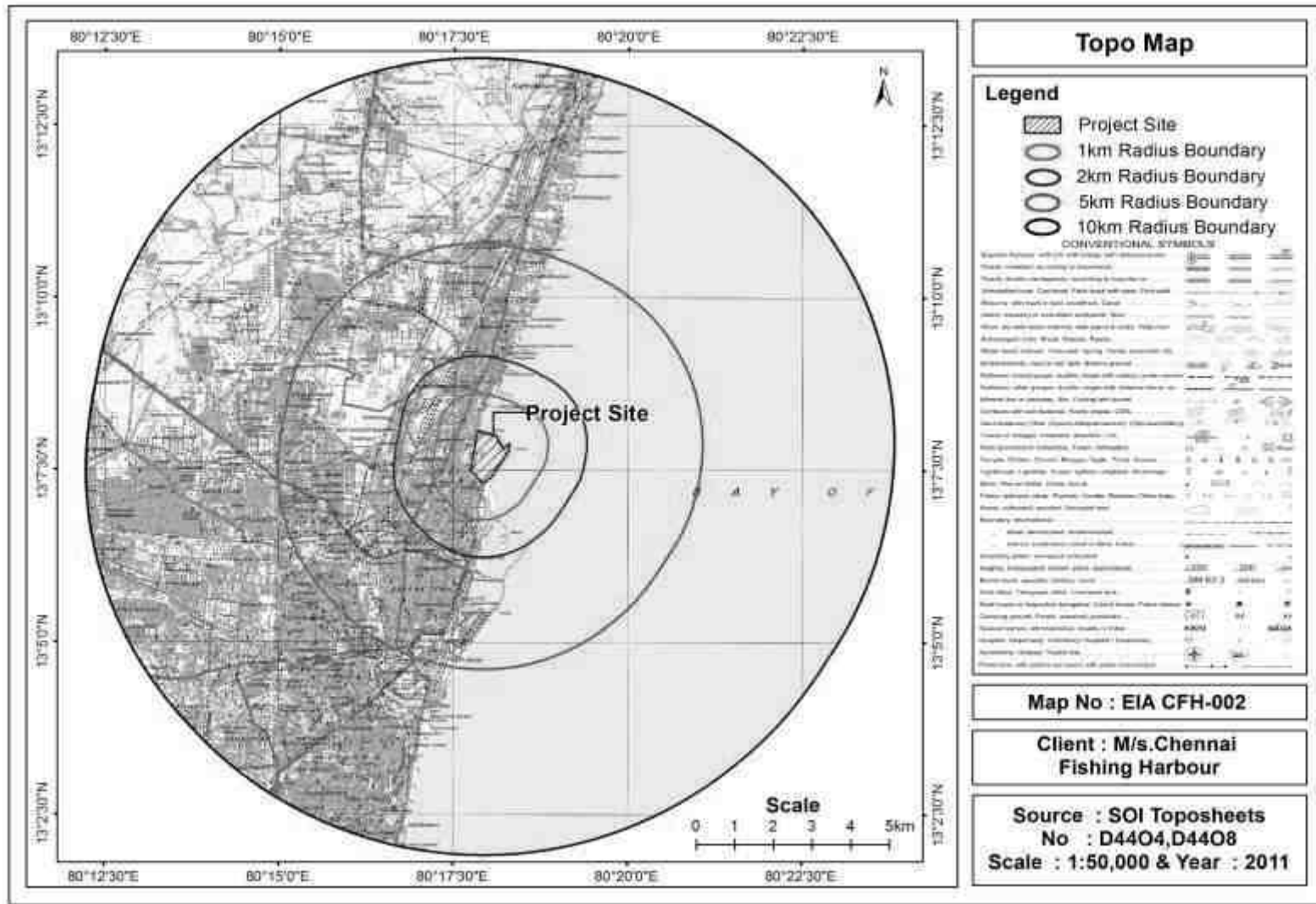


Figure 2.5 Topo Map of Study Area



Chennai Fishing Harbour Breakwaters



Western Trawler Wharf



Southern Lower-Level Wharf for FRP Boats



Southern Lower-Level Wharf for FRP Boats



Northern Lower-Level Wharf for FRP Boats



Northern breakwater wharf for MFBs, non-landing wharf



Southern finger jetty



Net Mending Sheds



Retail Sheds



Sanitary Block

Figure 2.6: Site Photographs



Figure 2.7: Satellite Image of the Project Site



Figure 2.8: Google Image of 1 km radius

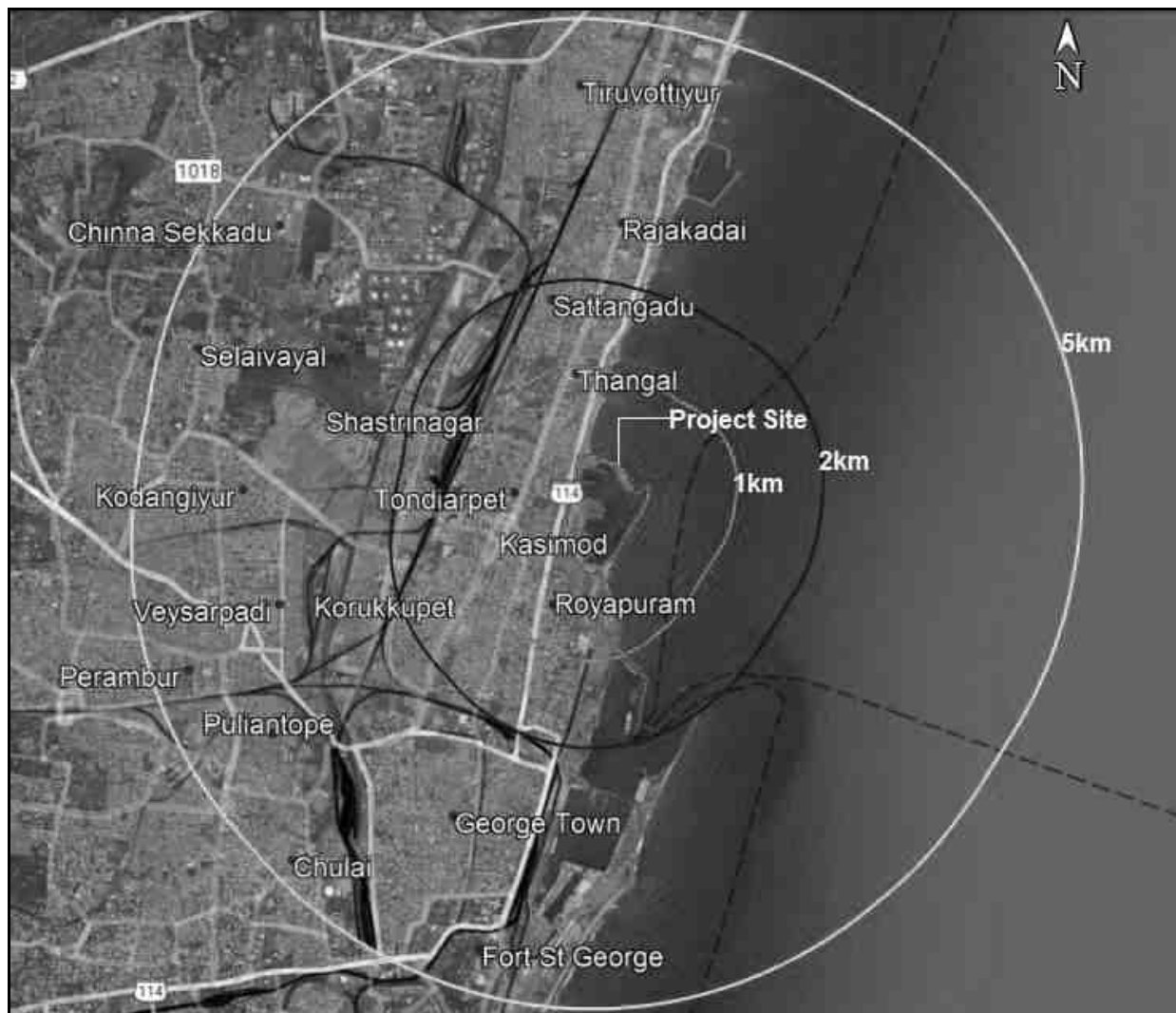


Figure 2.9: Google Image of 5 km radius

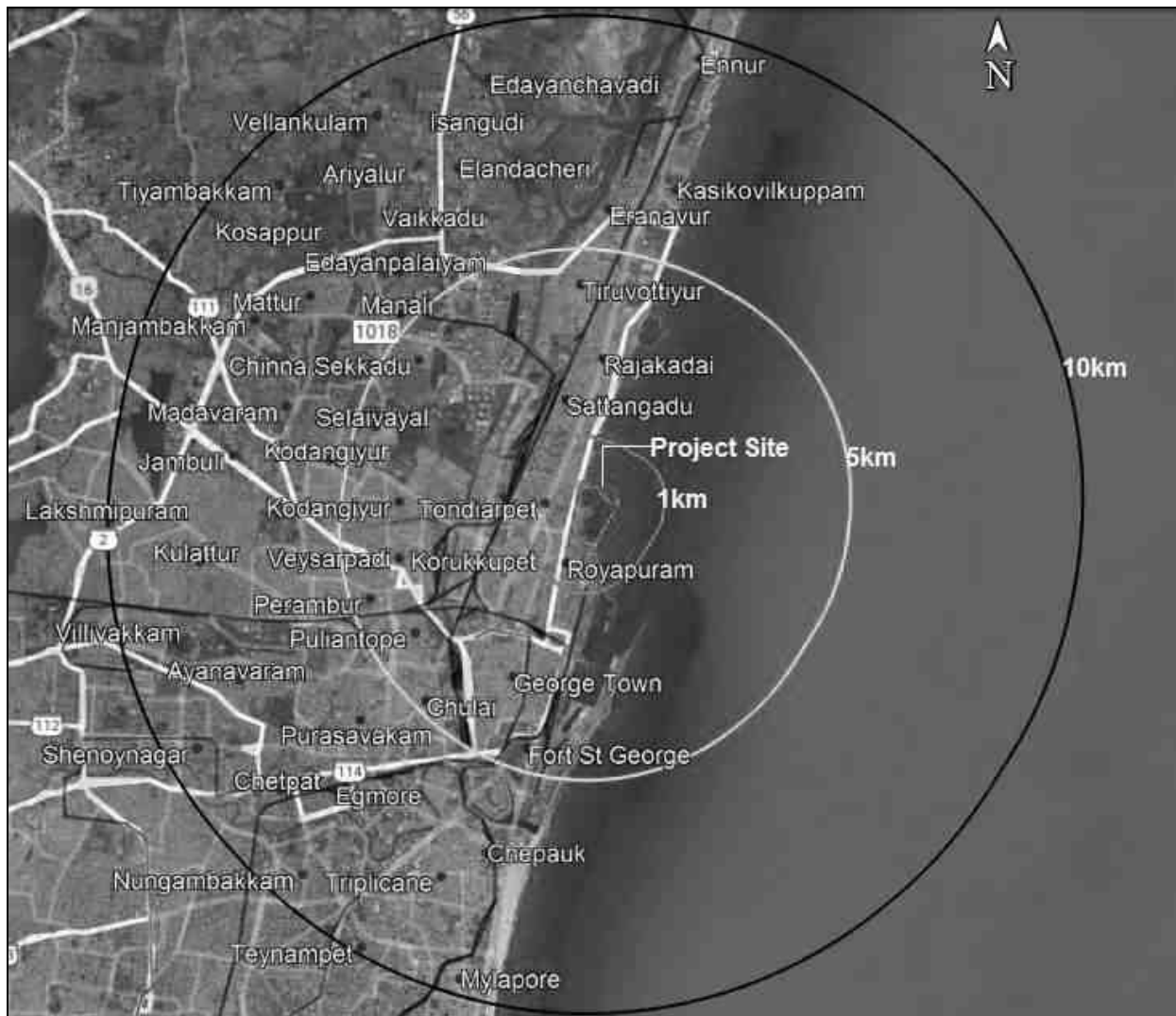


Figure 2.10: Google Image of 10 km radius

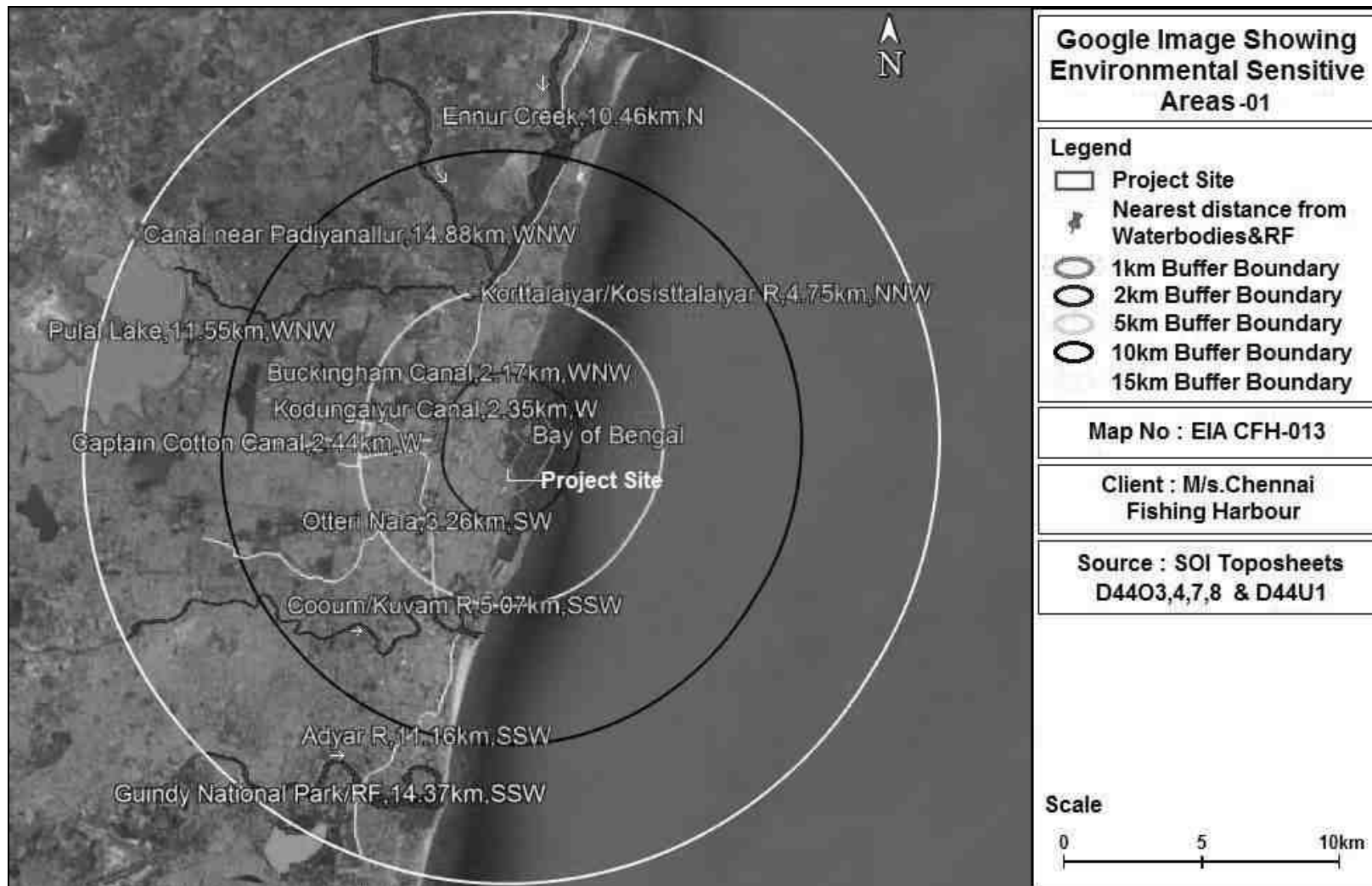


Figure 2.11: Environmental Sensitivity Map-1 (15km radius)

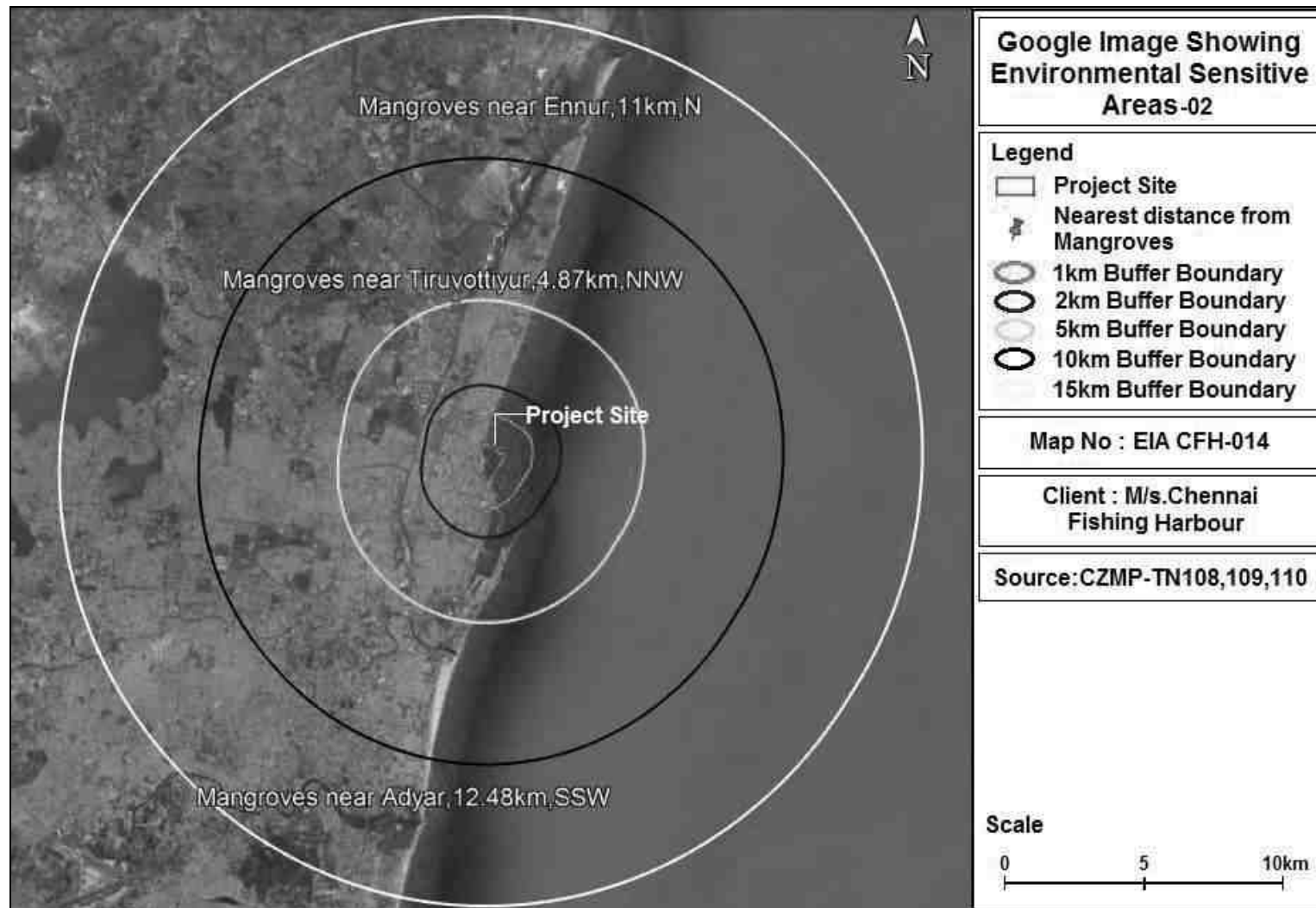


Figure 2.12: Environmental Sensitivity Map -2 (15km radius)

2.4 Existing Environmental Setup

List of Industries within 10km radius of the study area is given in **Table 2.1 2.1.**

Table 2.1 List of industries within 10km radial distance

Industries	Dist (km)	Direc
Divakar Steel Traders	0.05	W
Customs Warehouse	0.27	S
Tablets India Ltd	0.42	W
R&V Tube Sales Pvt Ltd	0.42	W
Central Ware Housing Corporation	0.53	S
Hindustan Petroleum Corporation	0.63	S
IOCL Foreshore Terminal	0.66	S
Madras Metal Works	0.9	N
BPCL	1.22	W
Chennai Container Terminal Pvt Ltd	1.34	S
Hindustan Petroleum Lube Plant	1.39	W
Indian Oil Corporation Limited- Tondairpet Terminal	1.71	WNW
Indian Oil Corporation Ltd Korukkupet Terminal	1.76	W
CPCI	2.27	WNW
Fusion Air Products Ltd	2.51	NNW
PK Plastics & Recycling Management	2.65	NNW
The KCP Ltd	2.76	N
Manali Petrochemical Ltd Plant-II	3.08	NW
Kothari Petrochemicals Ltd	3.43	NW
Cetex Petrochemicals	3.51	WNW
Balmer Lawrie & Co. Ltd	3.57	NW
Carborundum Universal Ltd CUMI	3.97	N
Indian Additives Ltd	4.25	NNW
Indian Additives Ltd	4.25	NNW
Indian Additives Ltd	4.25	NNW
Gokul Auto Tech Pvt Ltd	4.39	N
TPL(LAB)	4.43	NNW
Manali Petrochemical Ltd Plant-I	4.61	NNW
TPL	4.70	NNW
TPL(HCD) Plant	4.79	NNW
Madras Fertilizer Ltd	5.04	NW
Petro Araldite Pvt Ltd	5.07	NNW
Madras Fluorine Pvt Ltd	5.11	NNW
Inox Air Products	5.31	NNW
SRF Ltd	5.46	NW
Sigil India	5.5	NNW
Mahalakshmi Bright Steel Industries Pvt Ltd	5.54	NNW
Crayon Roofings and Structures	5.59	NNW
Aniruth Ready Mix	5.71	NNW

GG Steels	5.82	NNW
Aavin Central Dairy	5.88	WNW
India Pistons Ltd	6.02	W
Sattva Hitech CFS	6.19	NNW
Simpson & Company Ltd	6.19	W
Ramanasekhar Steels Ltd	6.28	NNW
Addison Paints And Chemicals Ltd	6.3	W
Southern Tubes	6.34	NNW
Supreme Petrochem Ltd	6.37	NW
Tafe Sembiam Factory	6.44	W
Bimetal Bearings	6.44	W
Natco Pharma Ltd	6.52	NNW
CMG Steels Pvt Ltd	6.58	NNW
Gateway Distriparks South Pvt Ltd	6.62	NNW
Perambur Carriage & Wagon Works	6.63	WSW
Toshiba JSW Power Systems Pvt Ltd	6.75	NNW
Raj Petro Specialities	7.02	NNW
Olympic Warehouse	7.35	NNW
Amalgamations Repco Ltd	7.35	W
M/S Jivan Plastics India LLP	7.54	W
Thirurani Logistics CFS	8.06	WNW
Kailash Shipping Container Freight Station	8.22	NNW
EBM-Papst India Pvt Ltd	8.33	WNW
Ocean Star Container Solutions	8.36	NNW
Chennai Emulsifiers	8.56	NNW
VEL CONTAINERS Terminus Pvt Ltd	8.57	NNW
Mirra and Mirra Industries Pvt Ltd	8.59	NNW
Mangal Industries	8.62	NNW
Sumit pipe Industries	8.67	NNW
LG Electronics India Ltd	8.7	W
Manas warehousing Pvt Ltd	8.76	NNW
Apollo Fiege Integrated Warehouse	8.77	W
Metals & Scrap Traders	8.78	NNW
Digh vijay plastics and allied products pvt Ltd	8.78	NNW
Shri Sabhari smelters pvt Ltd	8.81	NNW
Printrove Products Pvt Ltd	8.81	W
Sriram Cold Forgings Pvt. Ltd	8.85	NNW
Sri Sai Ram Hair Industries	8.87	NNW
Vichur Sundar Chemicals	8.89	NNW
Pearl Printers and Publishers Pvt Ltd	8.89	W
Triway Container Freight Station	9.43	NNW
Integral Coach Factory	9.43	WSW
KPS Warehouse	9.97	WNW
Calyx Container Terminals Pvt Ltd	10.14	WNW
North Chennai Thermal Power Station	10.46	N

Tvs Logistics Services Ltd	10.5	WNW
CRI Pumps Pvt Ltd	10.75	WNW
Reliance Industries ltd	10.81	N
TVS Group of India	10.84	W
HPCL Terminal Ennore	11.05	N
German Express Shipping Agency (India) Pvt Ltd	11.07	N
ECCT - CFS	11.13	N
MSA Global Logistics (Chennai) Pvt Ltd	11.68	N
The India Cements Ltd	11.72	N
BPCL Terminal Ennore	11.75	N
Kences Container Terminal Ltd	11.91	N
Farm Implements (India) Pvt Ltd Factory	12.51	N
IOCL LPG Bottling Plant	12.99	N
RG Bronze Manufacturing Company Pvt Ltd	13.23	W
Ambattur Clothing Pvt Ltd	13.61	WSW
ARC Engineering Works	13.63	WSW
Zuari Cement Grinding Unit	13.73	N
Lucas Indian Service Ltd	13.78	WSW
Madras Engineering Industries Pvt Ltd	13.86	WSW
SGS India Pvt Ltd	13.98	WSW
Rane Brake Lining Ltd	14.02	WSW

Nearest Human Settlements

The details of nearest human settlement from the project site are provided in **Table 2.2**

Table 2.2 Human Settlement within 15 Km distance from the study area

Description	Distance (~km)	Direction
Royapuram	Site is within the Village	
Tondiarpet	0.03	W
Old Washermanpet	0.81	WSW
Tiruvottiyur	1.02	N
George Town	2.31	S

2.5 Size or Magnitude of operation

The total built up area of existing infrastructure is **3.2182 Hectare**. The total land area **31.956 Hectare**. The water spread area is **48.56 Hectare**.

Sr.No	Proposed Structures	L x W (m x m)	Length (m) / Area (sq.m)
1.	Boat repair spare parts complex	15 x 15	225
2.	Fish handling shed at Trawler Wharf	100 x 27	2700
3.	Cleaning, Packaging and Cold storage complex	20 x 10	200
4.	Administrative Complex & Centralized control Block with Commercial Complex on the Ground Floor, (G+2)	25 x 15	375
5.	Two & Four wheeler parking – 1	45 x 16	720
6.	Two & Four wheeler parking – 2	44 x 35	1540
7.	Sanitary Complex	10 x 5	50
8.	Two-lane peripheral road with storm water drains, cable truff and a pedestrian path including widening and repair of existing road network	1600 x 7.5	12000
9.	Ship lifting facility and Boat Repair Yard	76x123	9348
10.	Vessel Monitoring and control system at Harbour Entrance	5x5	25
11.	Additional Fish Handling Shed at Trawler Wharf	100 x 27	2700
12.	Two Nos. Of shed over Northern wharf, supporting with existing structure	50x20.5	1025
13.	Truck Paved parking area facility near proposed two & four wheeler parking no 1	(27x35)+(28x35)	1925
14.	Providing Two numbers of solar operated with electrical backup fish drying machine (1 Tonne capacity) including civil structure as Pilot Project	11x22	242
15.	Two wheeler and Car Parking for administrative and commercial complex and two wheeler parking shed in the Eastern side of the Administrative and commercial complex building	(22x16)+(22x4)	440

16.	Net Mending shed at southern side	30x12	360
17.	New open shed with Arabian Tent Roofing for fish cutting stalls near retail shops	2x30x5	300
18.	Proposed rooms for stacking unsold items in the rear side of fish cutting stall	72x5	360
19.	New open sheds with Arabian Tent roofing for prawn sale point	66x20	1320
20.	Low Level Reservoir	11.2x7.30	81.76
21.	Over Head Water Tank	Dia - 6m	28.26
22.	Effluent Treatment Plant (ETP)	321.48	321.48
23.	Sewage Treatment Plant (STP)	83.49	83.49
Built Up area			36,369.99
24.	Dredging		4,54,214
25.	Controlled Entry and Exit Arrangements, Elevated Compound wall and 2Nos. of Arched Entrances		1600

2.6 Project Cost

The total capital investment on the proposed project is **INR 89.62 Crore.**

2.7 Proposed Schedule for Approval and Implementation

Nature of Work	Tentative Time Schedule
Construction Activities	February 2024
Establishment of the Proposed project site	August 2024

2.8 Connectivity

The project site is situated in the prime location of the Chennai city. It is well connected by roadways, railways and water ways.

Sr.No.	Features	Description		
1.	Nearest Railway station	Description	Dist. (~km)	Dire.
		V.O.C.Nagar Railway Station	1.22km	WNW

2.	Nearest Port	Description	Dist. (~km)	Dire.
		Chennai Port	Adjacent to Site	S
3.	Nearest Airport	Description	Dist. (~km)	Dire.
		Chennai International Airport	18.14	SW
4.	Highway	Description	Dist. (~km)	Dire.
		SH-114(Chennai-Ennore Rd)	0.01	W
		Chennai-Srikakulam Highway	3.34	SW

2.9 Project description

The proposed project of the modernization and upgradation of Chennai fishing harbour at Kasimedu, Chennai.

Sr.No	Proposed Structures	L x W (m x m)	Length (m) / Area (sq.m)
1.	Boat repair spare parts complex	15 x 15	225
2.	Fish handling shed at Trawler Wharf	100 x 27	2700
3.	Cleaning, Packaging and Cold storage complex	20 x 10	200
4.	Administrative Complex & Centralized control Block with Commercial Complex on the Ground Floor, (G+2)	25 x 15	375
5.	Two & Four wheeler parking – 1	45 x 16	720
6.	Two & Four wheeler parking – 2	44 x 35	1540
7.	Sanitary Complex	10 x 5	50
8.	Two-lane peripheral road with storm water drains, cable truff and a pedestrian path including widening and repair of existing road network	1600 x 7.5	12000
9.	Ship lifting facility and Boat Repair Yard	76x123	9348
10.	Vessel Monitoring and control system at Harbour Entrance	5x5	25
11.	Additional Fish Handling Shed at Trawler Wharf	100 x 27	2700

12.	Two Nos. Of shed over Northern wharf, supporting with existing structure	50x20.5	1025
13.	Truck Paved parking area facility near proposed two & four wheeler parking no1	(27x35)+(28x35)	1925
14.	Providing Two numbers of solar operated with electrical backup fish drying machine (1 Tonne capacity) including civil structure as Pilot Project	11x22	242
15.	Two wheeler and Car Parking for administrative and commercial complex and two wheeler parking shed in the Eastern side of the Administrative and commercial complex building	(22x16)+(22x4)	440
16.	Net Mending shed at southern side	30x12	360
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19.	New open sheds with Arabian Tent roofing for prawn sale point	66x20	1320
20.	Low Level Reservoir	11.2x7.30	81.76
21.	Over Head Water Tank	Dia - 6m	28.26
22.	Effluent Treatment Plant (ETP)	321.48	321.48
23.	Sewage Treatment Plant (STP)	83.49	83.49
Built Up area			36,369.99
24.	Dredging		4,54,214
25.	Controlled Entry and Exit Arrangements, Elevated Compound wall and 2Nos. of Arched Entrances		1600

The major objectives of the project:

- To manage and maintain the Fishing Harbour for all-weather use for fishing vessels.
- To provide convenient landing facilities to the fishing crafts.
- To facilitate handling of catches, auctioning, fueling, repairing, etc.

- To provide hygienic conditions for the pre-processes, handling of fish to match international standards, and
- To maintain hygienic standards at the international levels in the handling of marine catches.

The employment in existing phase are 10 officers, 30 staffs and police personnel, in proposed phase there will be no new generation of employment, the same existing phase will be employed.

The water requirement will be met from through Chennai Chennai Metro Water provided the dedicated pipe line to the site. The development work entails the modernization and upgradation of basic essential requirements, construction of new berthing facilities and strengthening post-harvest infrastructure at a low cost.

There are over 2000 fishing vessels that ply from Chennai Fishing Harbour and land approx. 300 MT of catches daily at the western trawler wharf; which will remain the same after modernization too. The existing infrastructure facilities is **3.2182 Hectare**.

Brief details on the existing project details:

- **Eastern break water :** One break water is already existing on the Eastern side of a length of 1085m to ensure safe waters and tranquility in the Fishing Harbour.
- **Northern break water:** One break water already exists on the Northern side of a length of 830m to ensure safe waters and tranquility in the Fishing Harbour.
- **Entrance width:** The Entrance width available is 76m which facilities Entry and Exit of Fishing Boats.
- **Auction packaging hall:** There are two auction packaging halls available in existing infrastructure.
- **Net mending shed :** There are totally three fish net mending shed available .This facility is for repairing and maintenance of fishnets.
- **Fish handling wharf :** Length of wharf is 250m and can accommodate 40 boats at a time and is located on Western end of fishing harbour.
- **Finger jetties :** There are 9nos of finger jetties, 6nos at Western wharf one each at South, LL wharf and slipway.

Sr.No	Proposed Structures	L x W (m x m)	Length (m) / Area (sq.m)
-------	---------------------	---------------	--------------------------

1.	Boat repair spare parts complex	15 x 15	225
2.	Fish handling shed at Trawler Wharf	100 x 27	2700
3.	Cleaning, Packaging and Cold storage complex	20 x 10	200
4.	Administrative Complex & Centralized control Block with Commercial Complex on the Ground Floor, (G+2)	25 x 15	375
5.	Two & Four wheeler parking – 1	45 x 16	720
6.	Two & Four wheeler parking – 2	44 x 35	1540
7.	Sanitary Complex	10 x 5	50
8.	Two-lane peripheral road with storm water drains, cable truff and a pedestrian path including widening and repair of existing road network	1600 x 7.5	12000
9.	Ship lifting facility and Boat Repair Yard	76x123	9348
10.	Vessel Monitoring and control system at Harbour Entrance	5x5	25
11.	Additional Fish Handling Shed at Trawler Wharf	100 x 27	2700
12.	Two Nos. Of shed over Northern wharf, supporting with existing structure	50x20.5	1025
13.	Truck Paved parking area facility near proposed two & four wheeler parking no1	(27x35)+(28x35)	1925
14.	Providing Two numbers of solar operated with electrical backup fish drying machine (1 Tonne capacity) including civil structure as Pilot Project	11x22	242
15.	Two wheeler and Car Parking for administrative and commercial complex and two wheeler parking shed in the Eastern side of the Administrative and commercial complex building	(22x16)+(22x4)	440
16.	Net Mending shed at southern side	30x12	360
17.	New open shed with Arabian Tent	2x30x5	300

	Roofing for fish cutting stalls near retail shops		
18.	Proposed rooms for stacking unsold items in the rear side of fish cutting stall	72x5	360
19.	New open sheds with Arabian Tent roofing for prawn sale point	66x20	1320
20.	Low Level Reservoir	11.2x7.30	81.76
21.	Over Head Water Tank	Dia - 6m	28.26
22.	Effluent Treatment Plant (ETP)	28.2 x11.4	321.48
23.	Sewage Treatment Plant (STP)	6.6x12.65	83.49
Built Up area			36369.99
24.	Dredging		454214
25.	Controlled Entry and Exit Arrangements, Elevated Compound wall and 2Nos. of Arched Entrances		1600

Brief details on the proposed project details:

1. Boat Repair spare parts complex

This facility will enable fishing-boat owners and repair service providers to carry out their maintenance and repair work faster. The spare part complex will facilitate storage and selling of fishing equipment, consumables and spares for fishing crafts.

2. Fish Handling Shed at Trawler Wharf – 100m x 27m

The catches from mechanized boats are landed at the trawler wharf and loaded onto the tricycle or sold to exporters/whole-sellers/ retailers on the trawler wharf itself. There is huge traffic of vendors, buyers, and tricycles on the trawler wharf as can be seen below:

Based on the primary demand of the stakeholders, it is proposed to construct a fish handling shed with sufficient focus lighting arrangements for illumination during pre-dawn hours and CCTV cameras to ensure secure and safe operation at the trawler wharf.

The shed is planned to have a prefabricated roofing with intermittent translucent roofing sheets to allow natural light during the day. Since the trawler wharf is an old structure and not designed to take the load of such shed, marine pilings with an RCC fender beam will be installed to take the load of the structure. The covered shed will shield fishermen, vendors, and labourers from the weather.

3. Cleaning, Packaging and Cold Storage Facility

During the stakeholder consultations, it was understood that there is a lack of a unified and dedicated facility for processing, packaging and storing fish catches in the fishing harbour. A dedicated facility would streamline the cleaning, processing, packaging and storing of fish catches and enable faster time to market fish catches. This facility will have water supply, drainage, lighting and cold storage units to facilitate fishers to speed up their shipments to local vendors as well as exporters. The cold storage facility will maintain the freshness of the catches in case of delay in arranging dispatch vehicles.

Hence, it is proposed to construct a cleaning, packaging and cold storage facility near Northern Lower Wharf with five segregated units.

This integrated facility will help local fishermen to quickly pack and freeze their catches for selling it to distant vendors or even export immediately by using chillers. This facility will help local fishermen to become global and earn a better price for their products.

4. Administration & Centralized control Block with Commercial Complex on the Ground Floor – 25 m x 15 m (G+2)

In order to ensure better governance and operation of the harbour, it is highly important that an administration and control block building is planned at a conspicuous place to encompass all the governing bodies. The proposed building shall provide office spaces to Fishing Harbour Management Committee, State Fisheries Department Officials, Engineering Sections, Banks, Marine Enforcement Wing and CCTV Control Room. A Ground + two floors are envisaged in this plan.

The ground floor is planned to be developed as a Commercial Complex to facilitate visitors and fishermen with diverse facilities. The commercial complex will have varied facilities, such as restaurants, shops, ATMs, groceries, fishing equipment shops, etc. to serve the basic needs of the fishing harbour.

5. Two-wheeler/ four-wheeler Parking Area – 1 (45m x 16m)

Many two-wheelers and cars belonging to the fishermen, vendors and buyers are parked at various places inside the Fishing Harbour in an unorganized manner. 1 nos. of proposed parking facilities viz. 45m x 16m in one locations will ensure organized parking of vehicles

at these dedicated areas and help alleviate traffic congestions on the internal roads of the harbour.

6. Two-wheeler/ four-wheeler Parking Area – 2 (44m x 35m)

Many two-wheelers and cars belonging to the fishermen, vendors and buyers are parked at various places inside the Fishing Harbour in an unorganized manner. 1 nos. of proposed parking facilities 44m x 35m at another locations will ensure organized parking of vehicles at these dedicated areas and help alleviate traffic congestions on the internal roads of the harbour.

7. Sanitary Complex – 10m x 5m

A toilet complex of 10m x 5m dimension is proposed at the southern end of the fishing harbour.

This facility will have separate arrangements for males and females. It can be accessed by a ramp as well as a staircase. Sanitary water supply will be through an overhead tank and a fixed piping arrangement. Lighting arrangements shall allow using the facility during dark hours.

The overflow drainage of the collection tank will link to the main holding tank of the fishing harbour. It will serve as a public sanitary complex.

8. Two-lane peripheral road with stormwater drains, cable truff and a pedestrian path including widening and repair of existing road network

It is proposed to construct a two-lane road all along the harbour compound wall inwards to facilitate seamless movement through the road. This arterial road will be interconnected with all the existing road network and provide easier access to new flagship modernization projects, such as Southern Landing Wharf with Fish Handling Complex, Ship-lift and boat repair/ building facility, and Northern Idling wharf.

A provision has also been made to construct a stormwater drain and a cable chase under pedestrian path which will be adjacent to the peripheral road. This plan will ensure effective drainage of rainwater and efficient routing of cables while providing designated pedestrian walkway. Widening and repair of existing internal road network including platforms and

other backup area behind the wharves are also included in the project. This project is expected to improve the road connectivity and alleviate congestion inside the Fishing Harbour while maintaining a clean, hygienic and safe walking area inside the harbour

9. Ship Lift Facility and Boat Repair Yard

Since the existing slipway complex is non-operational, there is no proper boat repair facility for Mechanized Fishing Boats as well FRP boats within the Harbour. Hence, a state-of-the-art MFB and FRP boat repair/ boat building complex with a vessel-lifting mechanism is a must to cater to the soaring demand in this region. This facility is expected to reduce the maintenance downtime of the vessels thereby increasing prospects of revenue generation for fishers.

The ship-lift facility will have ramps extending southwards for ship-lifters to operate. The boats will approach the facility heading North. The ship-lift facility, unlike the slipway, does not depend on tidal variations. So, theoretically, a ship-lift facility can operate 24 x 7. The proposed ship-lift facility will reduce the maintenance and repair costs of the boats besides minimizing the downtime.

10. Vessel Monitoring and Control System at the Harbour Entrance

In order to monitor the movement of fishing vessels, provide a safe access channel and aid in rescue operations, it is proposed to implement a vessel monitoring and control system. The vessel monitoring system is used to provide advance warning to the fishermen and fishing boats at the harbour in the event of natural calamities, such as cyclones, Tsunamis, etc.

11. Fish Handling Shed at Trawler Wharf – 100m x 27m

The catches from mechanized boats are landed at the trawler wharf and loaded onto the tricycle or sold to exporters/whole-sellers/ retailers on the trawler wharf itself. There is huge traffic of vendors, buyers, and tricycles on the trawler wharf as can be seen below:

Based on the primary demand of the stakeholders, it is proposed to construct additional fish handling shed with sufficient focus lighting arrangements for illumination during pre-dawn hours and CCTV cameras to ensure secure and safe operation at the trawler wharf.

12. Shed over Northern Wharf – 2 Nos

Pre-fishing activities involve preparing boats and manpower for sailing. It typically involves inspection of fishing boats, machineries, fishing nets, pulleys and motors and stocking up of fuel, ice, drinking water, provision, etc.

In order to inspect and repair the fishing nets, fishermen use net mending sheds at different places inside the CFH to protect themselves from scorching Sunlight or rains. Fuel, ice blocks and drinking water are carried on trucks and driven to the boats for loading. The ice blocks are crushed at berth using mobile crushers which run on diesel. The crushed ice is then transferred to the boats using a chute.

13. Truck Paved Two-wheeler/ four-wheeler Parking Area – 2 Nos (27m x 35m and 28m x 35m)

Many two-wheelers and cars belonging to the fishermen, vendors and buyers are parked at various places inside the Fishing Harbour in an unorganized manner. 2 nos. of proposed parking facilities viz. 27m x 35m and 28m x 35m in Two locations will ensure organized parking of vehicles at these dedicated areas and help alleviate traffic congestions on the internal roads of the harbour.

14. Solar Operated with Electrical Backup Fish Drying Machine

It is observed that fish drying is carried out in open at the harbour. It usually takes 3-5 days to dry the fish depending on the type of fish and weather conditions. In the process, the fish is exposed and attracts a lot of insects & flies and accumulates a lot of dust and sand while drying. It is proposed to install mechanical and solar fish dryers at the harbour is a more efficient way of dehydrating fish, in a short period of time. The solar fish dryers are standalone structures which do not require electricity and providing electrical backup also, and which could provide high quality dried fish with no contamination. The drying time is typically about 12-14 hours of sunlight, depending on the fish, and other weather conditions.

15. Two-wheeler/ four-wheeler Parking Area – 2 Nos (22m x 16m and 22m x 4m)

Many two-wheelers and cars belonging to the fishermen, vendors and buyers are parked at various places inside the Fishing Harbour in an unorganized manner. 2 nos. of proposed parking facilities viz. 22m x 16m and 22m x 4m in Two locations will ensure organized

parking of vehicles at these dedicated areas and help alleviate traffic congestions on the internal roads of the harbour.

16. Net Mending Shed at Southern Side

The existing net mending sheds that are being utilized by the fishermen community. However, these sheds are operating at max capacity during peak days. During peak days, some fishermen mend nets directly under the Sun and at times under rain. The southern side new net mending shed construct with RCC structure with covered shed will shield fishermen, vendors, and labourers from the weather

17. Arabian Tent Roofing for Fish Cutting Stalls Near Retail Shops

The existing fish cutting stall near retail shops are being utilized by the fishermen community. While cutting some fishermen directly under the Sun and at times under rain. Now, we are providing new open sheds with Arabian Tent roofing in that area.

18. Rooms for Stacking unsold items in the rear side of fish cutting stall

The existing rooms for stacking unsold items in the rear side of fish cutting stall are being utilized by the fishermen community. Stacking unsold items some fishermen using temporary shed or directly under the Sun. Now, we are providing rooms for stacking unsold items in the rear side of fish cutting stall in that area.

19. Arabian Tent Roofing for Prawn Sale Point

The Prawn Sale Point are being utilized by the fishermen community. While saling Prawn some fishermen directly under the Sun and at times under rain. Now, we are providing new open sheds with Arabian Tent roofing in that area.

20. Overhead Tank, Low-level Reservoir and Internal water distribution

A fixed supply and distribution for tap water is proposed which will be used for RO plants, supply to MFBs, sanitation, cleaning of fish catches, repair and maintenance activities, etc. Accordingly, it is proposed to develop an Overhead Tank (OHT) and Low-level reservoir (LLR) with a fixed piping arrangement to provide water inside the Chennai Fishing Harbour. Capacity assessment of the OHT and LLR is done based on the demand at CFH. The major demand will come from the RO plant and the MFBs. The proposed RO plant of 24,000 litres/day capacity will require approx. 75,000 litres/day of tap water. Each MFB

with 15 complements onboard require 1,500 litres of tap water/voyage and approx. 50 MFBs depart harbour each day. Therefore, MFBs demand for tap water is 75,000 litres/day. Assuming 50,000 litres/day requirement of tap water for all existing tenants, proposed fish handling complex and cold storage blocks, the total demand for tap water becomes approx. 2,00,000 litres/day.

Therefore, the proposal is for 2,00,000 litres capacity Low-level reservoir and 1,00,000 litres capacity overhead tank. The project includes water distribution to all the major facilities inside the fishing harbour including water dispensing outlets at regular intervals in wharf area for intended use by fishing crafts.

In addition, a provision is made for pumping seawater at high pressure to hose down wharves, jetties, retail sheds, net mending sheds, etc. In case of an emergency, the seawater pumping arrangement can also be used as a fire-fighting means. The proposed water facility will ease multiple aspects of fisheries process. Besides preparing vessels during pre-harvest, this facility will also help land-based business such as ice factories, fish processing plants, boat repair area, etc.

21. Solid and Liquid Waste Management

Improper waste handling is a perennial issue at most fishing harbours in India. In order to properly segregate, store, process and dispose of the waste generated at the Chennai Fishing Harbour, it is proposed to develop a solid and liquid waste disposal mechanism including the aggregation and disposal of the waste.

This waste management intervention will ensure a clean and sustainable environment inside and around the fishing harbour.

22. Electrical High Mast Lights and Street Lights arrangements

In order to facilitate safe berthing of fishing boats, ensure safe fish landing and transport operations, especially during the peak time of pre-dawn hours, it is proposed to install 6 highmast towerlights and 300 street light poles with LED fittings inside the Fishing Harbour (actually proposed area and in addition all Finger Jetty, Eastern and Northern breakwater).

Each high-mast light is proposed to be 20 meters high with 10 nos. of 400 watts LEDs which will have an adequate illumination of lux up in surrounding areas. All the six highmast lights together will illuminate two acres of area inside the harbour.

Each of the proposed 300 nos. of street lights will be 7-9 meters in height with 120 watts LED. All these lights together can approximately illuminate 5 km stretch of internal roads. Half of these street lights are planned to illuminate approx. 2.2 km of new waterfront and new peripheral roads, the remaining half will be used to illuminate the dark sections of the existing roads, jetties and wharves. The underground electrical cabling work will be taken up in areas where electrical cables are non-existent. Moreover, main distribution boards (MDB), sub distribution board (SDB) and light distribution board (LDB) will also be provided. The electrical cabling work will also cover the requirement of electricity supply to all the proposed facility including ship-lift facility, fish handling complex, RO water supply, sanitary water supply and distribution, etc.

23. Drinking water arrangements by RO

Potable drinking water is a necessity for the users of the fishing harbour. The potable water at the harbour is primarily used in large quantities by the fishing boats (MFBs) before sailing out. On-shore fishermen, labourers, vendors, retailers and buyers also require potable water. The requirement for drinking water works out to be approx. 24,000 litres/day, out of which 22,500 litres are from MFBs and the remaining 1,500 liters are from fishers, vendors, retailers, visitors, etc. It is learnt that an MFB with 15 complements onboard carries approx. 400~500 litres of drinking water on a 10-days voyage and around 50 MFBs departs harbour daily.

Therefore, the drinking water requirement for MFBs is approx. 22,500 litres/day (450L/MFB x 50 MFBs/day). About 3000 people are actively engaged at the harbour in various activities, considering a nominal requirement of 0.5 litre/head/day, the total requirement would roughly be 1,500 litres/day.

Since there is an absence of a drinking water facility at Chennai Fishing Harbour, we suggest installing five numbers of 25 litres per hour (LPH) capacity RO plants (5 Plants x 25LPH/ Plant x 12 Hrs/day = 1,500 litres/day) to dispense drinking water to be used by fishermen, vendors, retailers, labourers, etc. and two numbers of 500 LPH capacity RO plants (2 Plants x 500LPH/ Plant x 22.5 Hrs/day = 22,500 litres/day) to dispense drinking water to be used by MFBs. The 500 LPH capacity RO plants will have storage tanks of 1000 litres capacity each. These larger capacity RO plants are planned at a single location for redundancy and ease of operation and maintenance.

These 500 LPH plants will be commercial units providing drinking water to the MFBs for their onward fishing journey.

24. CCTV Surveillance System

It is proposed to install CCTV cameras at strategic locations inside the harbour to monitor and regulate operations and to ensure security of the premises. The centralized surveillance and monitoring of CCTV feed will ensure a secure environment inside the harbour. The proposed locations for CCTV cameras are harbour gates, proposed southern fish-handling complex and peripheral road, Northern and southern breakwaters and fish-handling shed at the trawler wharf. The surveillance will be through 50 nos. of day/ night (or) infrared (IR) CCTV cameras. 66 nos of Bullet cameras, 6 nos ANPR cameras and 4 nos of PTZ cameras are proposed. The CCTV control room with monitors is planned in the Admin. block.

Besides assisting the Harbour Management to monitor the operations at the fishing harbour, the CCTV surveillance will help the Police department to maintain effective law and order inside the harbour. This system will reduce patrolling requirements for safety and security while maintaining a log of historic events through its recording database.

25. Dredging

The area of dredging is 4,54,214 sq.m. The quantity of dredged material is 5,60,000 Cum. It is proposed to carry out maintenance dredging activity within the fishing harbour to facilitate effective and optional utilization of harbour. The depth of the dredging is varying from 1- 2m in accordance with the site conditions. The dredged materials are proposed to be transported through self propelled dump barge (bottom open drop barge) .

26. Controlled Entry and Exit Arrangements, Elevated Compound wall and 2Nos. of Arched Entrances

In order to maintain the safety and security of the harbour, public as well as personal properties, it is proposed to construct a compound wall 3 meters high and 1700m long all along the periphery of the Chennai Fishing Harbour (East of EMRIP Road). The compound wall will have arched entrances at two of the three main gates. In addition, four wicket gates at all four underpasses will be provided.

A provision for street lighting all along the compound wall along with the CCTV cameras at the gates. In addition, four wicket gates at all four underpasses will be provided.

This mechanism will also help in regulating the movement of boats during unfavourable weather conditions. The facility will help in tracking the movement of fishing boats at the harbour entrance area.

An operational mechanism may be put in place to dissuade fishing boats from leaving the harbour in rough weather conditions.

2.10 Traffic Assessment Study

There are over 2000 fishing vessels that ply from Chennai Fishing Harbour and land approx. 300 MT of catches daily at the western trawler wharf. The number of fishing crafts and other traffic-related details are below:

Sr.No	Components	Description
1	Mechanized Fishing Boats	Total Registered Boats are 1024; in which Gill Netter is 272 , Trawler is 729 and liner is 23
2	Country Crafts (CC)	<ul style="list-style-type: none"> ➤ Total Registered boats are 1416 ➤ Motorized non-mechanical are 1332 (Diesel = 1322 & Petrol = 10); ➤ Non-motorized are 84 ➤ 849 Motorized non-mechanical boats are berthed within the harbour, while remaining 483 motorized non-mechanical crafts are berthed in villages of South-Chennai
3	Fish Landing Boats Arrival	<ul style="list-style-type: none"> ➤ MFBs are 100 to 150 Nos./ day ➤ Country Crafts are 260 Nos./ day [Morning = 180 + Evening = 80]
4	Onboard Fishing Crew	10 to 15 Nos./ MFBs 5 to 8 Nos./ Double Engine CCs 2 to 4 Nos./ Single Engine CCs
5	Expected Fish Landing	250 tonnes /day
6	Peak days Fish Landing	300 to 500 tonnes/ day [Peak days = Sundays and Wednesdays]
7	Landing workers	Approx 400 Nos./day
8	Fish Landing tricycles	Approx. 60 Nos.
9	Transporters	Approx. 80 Nos. [Insulated vehicles]
10	Auctioneer	Approx. 600 Nos.
11	Export Processors	40 to 50 Nos.

12	Ice sellers/ suppliers	98 Nos.
13	Ice usage	40 tonnes/ day
14	Retailers	Approx. 220 Nos. [Old auction hall = 100 Nos. + New Auction Hall = 120 Nos.]
15	Street Vendors (Women)	450 to 600 Nos./ day
16	Two-wheeler vendors	Approx. 400 Nos./day
17	Fish cutters and cleaners	Approx. 230 Nos. / day [Men = 40 + Women = 190]
18	Customers	2500 to 3000 Nos./ day [Peak days = 3500 to 4000 Nos./ day]
19	Tea Sellers	25 Nos.

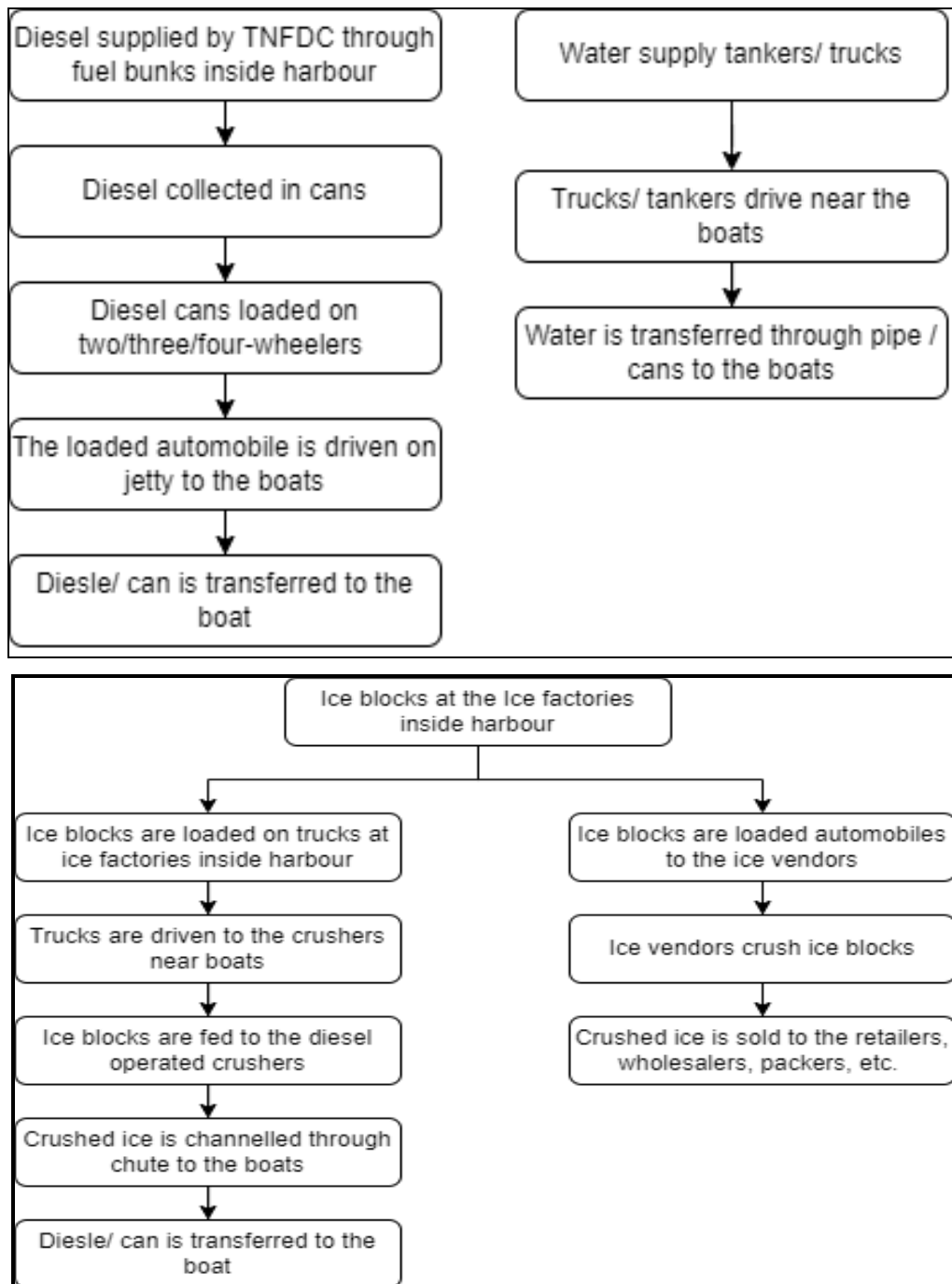
2.11 Fishing Process Assessment

The functions of the fishing harbour can broadly be divided into three categories viz. Prefishing operations, post-harvest, operations and allied activities.

Pre-fishing activities involve preparing boats and manpower for sailing. It typically involves inspection of fishing boats, machineries, fishing nets, pulleys and motors and stocking up of fuel, ice, drinking water, provision, etc.

In order to inspect and repair the fishing nets, fishermen use net mending sheds at different places inside the CFH to protect themselves from scorching Sunlight or rains. Fuel, ice blocks and drinking water are carried on trucks and driven to the boats for loading. The ice blocks are crushed at berth using mobile crushers which run on diesel.

The crushed ice is then transferred to the boats using a chute.



Sanitary Water Supply: The absence of a reliable water supply renders it necessary for the fishermen to make their own arrangements for the same. There are private water tanker operators plying tankers inside the harbour. This leaves the fishermen at the mercy of the water suppliers. A fixed and reliable water supply is necessary within the harbour for drinking as well as sanitation purposes.

Drinking Water Supply: There is no drinking water arrangement inside the harbour today. retailers, vendors, wholesalers, visitors, etc. make their own arrangements. In the absence of

drinking water supply at the harbour, the fishing boats, esp. MFBs which carry 500 litres drinking water/voyage, make their own arrangements through regional water distributors.

Net Mending Sheds: There are three existing net mending sheds that are being utilized by the fishermen community. However, these sheds are operating at max capacity during peak days. During peak days, some fishermen mend nets directly under the Sun and at times under rain.

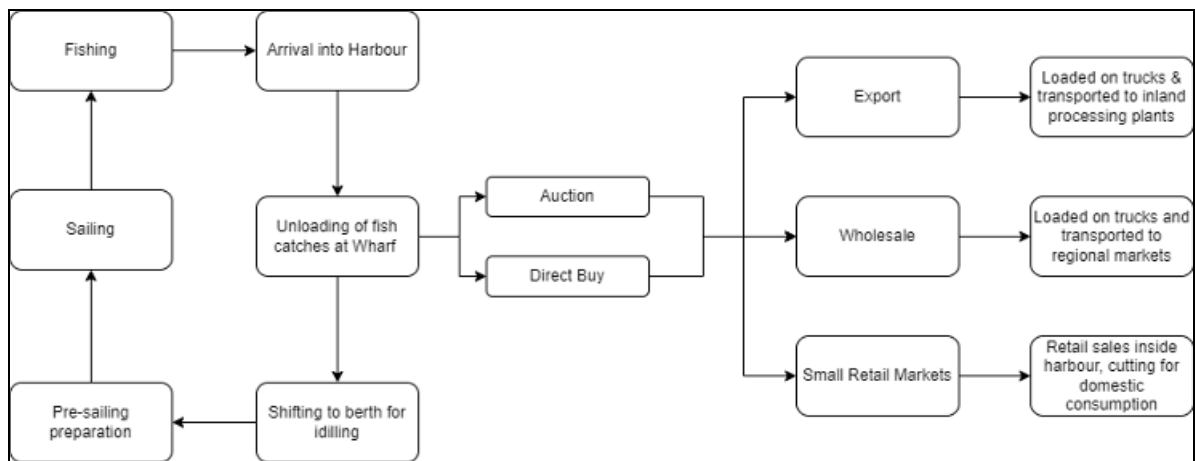
Provision: Fishermen usually carry their own meals when the duration of the fishing is less than a day. However, fishermen on multi-day voyages, need to carry raw groceries onboard their boats. The lack of quality grocery stores/ restaurants inside the harbour complicates the issue.

Boat Repair and Maintenance: The slipway facility at the northern end of the harbour is nonfunctional. The 2000+ boats operating at CFH are in need of a ship-lift repair facility which can operate without tidal limitations. It is difficult for boat owners to arrange service parts or consumables due to the lack of boat repair service center in or near the harbour.

Post-harvest activities involve berthing of boats at landing wharf, unloading of fish catches for the boats, loading of catches on tricycles for transferring to auction hall, auction of fishes, loading on insulated trucks, processing and packaging of fishes, etc.

For the landing of fish catches, the western trawler wharf and its finger jetties are used. Trawler wharf is approximately 250 meters in length which can support berthing of up to 40 MFBs at a time. The fish catches are landed on the wharf or directly on the tricycles. The fishes are then transported to the auction area. Buyers come to the auction area to bid for catches.

As and when the fishes are auctioned, the sold items are transferred to insulated trucks for transportation to processing plants for exports, or regional wholesale/ retail markets.



Landing wharf: Although the existing landing wharf – Western Trawler Wharf – is 250 meters in length, however, almost half of the southern portion of the wharf remains unutilized for landing activities since this area is occupied by idling MFBs for their berthing. The remaining area of the wharf, thus, becomes congested and can only support around 40 MFBs at a time to land their catches. In a day, around 100 to 150 MFBs land their catches, non-availability of sufficient landing wharf at the CFH causes unwanted delays and loss of quality of fish, thereby reducing the overall profit margin for the fishermen. In view of the congested landing facilities at CFH and to promote tuna harvest and processing, the State Government is developing an exclusive Tuna Fishing Harbour 3.5 km northwards with 316 meters long of landing wharf.

Landing of fish catches: Currently, the CFH lacks mechanization for landing activities, the fish catches are manually lifted off the boat and transferred to tricycles or unloaded on the wharf. From the wharf and finger jetties, the fishes are moved to the auction area on tricycles. The high-degree of involvement of manual labour and non-standardized landing operation makes landing, a sub-optimal activity. Today, the turnaround time for MFBs is around 3 to 4 hours, even though the MFBs rarely land their entire fish catches at once. Due to unorganized landing, fishes endure damages and are exposed to unhygienic conditions, fetching diminished return to the fishermen.

Auction and display: The auction halls, at present, are not being utilized effectively due to various issues such as smaller entrances/ exits, echo inside the hall, insufficient lighting, cleanliness, lack of ventilation, etc. Fishermen are utilizing the open wharf instead for auctioning fish catches. The fishes are piled up on the wharf in open and unhygienic conditions which cause loss of quality of fish catches leading to an inferior or sub-standard harvest. Department of Fisheries, Government of Tamil Nadu is taking steps to ensure an effective and optimal use of the Fish Auction Hall at the Chennai Fishing Harbour.

Storing and packaging: During stakeholder consultations, the need for a cold storage facility was discussed and highlighted by the fishermen. Due to a lack of cold storage facility at the harbour, the fish catches lose freshness and quality. In the absence of such facilities, fishermen resort to using ice, which incurs additional cost and time. Frequent delays in the arrival of insulated vehicles necessitate packaging and cold storage units inside the harbour.

2.12 Resource requirement

2.12.1 Water requirement

During construction phase, approx 80 KLD will be required for both domestic and construction purpose

200 KLD is been already and is sufficient for proposed phase also. The source of water will be met from dedicated pipeline from CMWSSB.

Moreover, the RO Plants of capacity 25LPH & 500 LPH are to be proposed as Potable drinking water is a necessity for the users of the fishing harbour. The potable water at the harbour is primarily used in large quantities by the fishing boats (MFBs) before sailing out. On-shore fishermen, labourers, vendors, retailers and buyers also require potable water.

For the storage of water, Ground Level Reservoir (GLR) and Over Head Tank (OHT) will be proposed. The water requirement given below is applicable both for Existing and Proposed Operation Phase.

Sr.No.	Description	Water Requirement (KLD)
1.	Domestic	13
2.	Flushing	20
3.	Washing (Floor/Fish)	70
4.	Mechanized Fish Boats (MFB) Requirement	97
Total		200

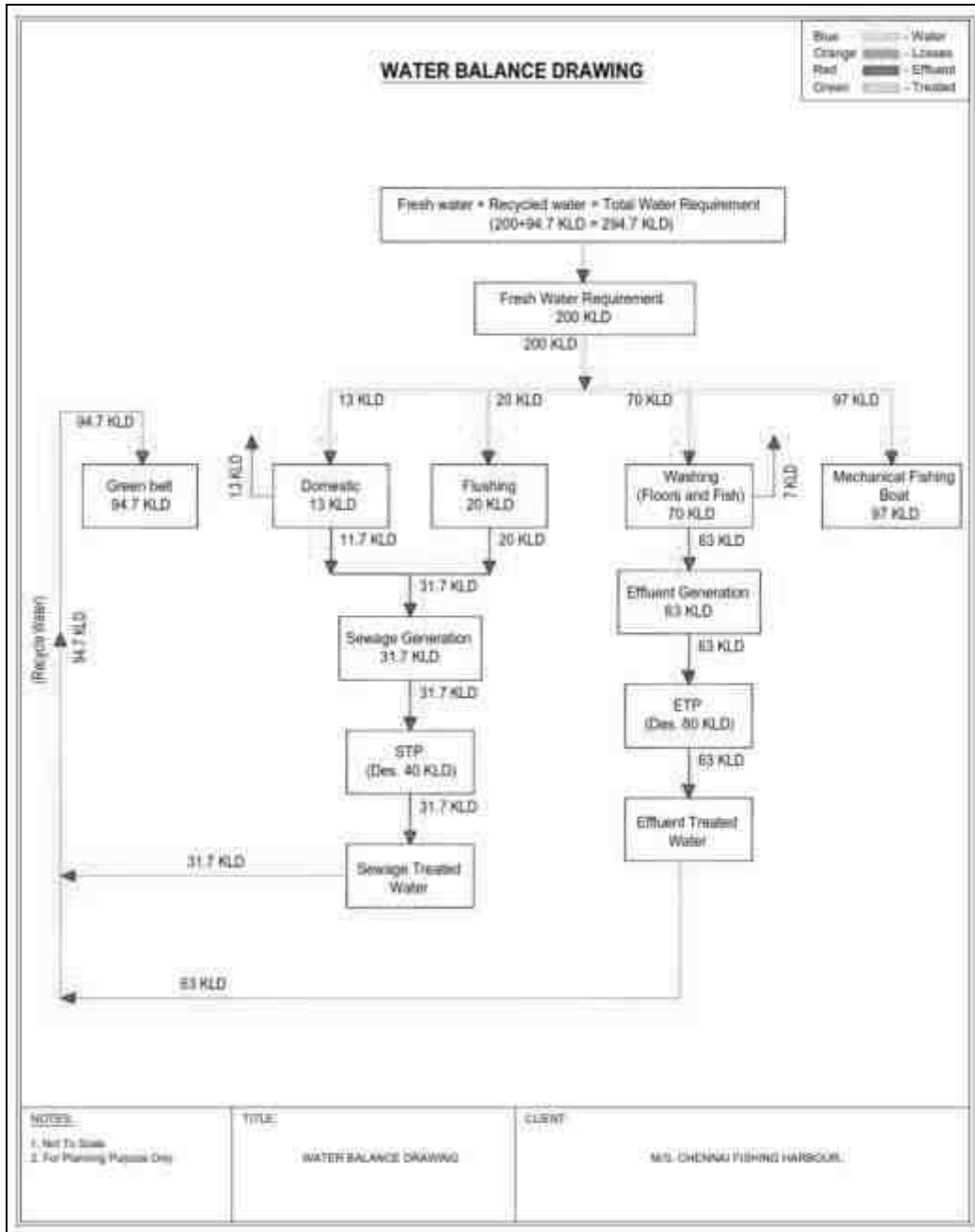


Figure 2.13: Water Balance Diagram

2.12.2 Power requirement

In existing phase, 154.67KW (LT) is equipped and its sourced from TANGEDCO. The existing will be used for proposed phase also. There are no source of DG for power back up.

2.12.3 Man power requirement

Sr.No.	Phase	Components	Requirement
1	Construction	Proposed	100
2	Operation	Existing	
		Officers	10
		Staff	30
		Police Personnel	As per the requirement

The existing manpower will be equipped for the proposed phase also.

2.13 Municipal Solid Waste Management

Improper waste handling is a perennial issue at most fishing harbours in India. In order to properly segregate, store, process and dispose of the waste generated at the Chennai Fishing Harbour, it is proposed to develop a solid and liquid waste disposal mechanism including the aggregation and disposal of the waste. This waste management intervention will ensure a clean and sustainable environment inside and around the fishing harbour.

For, all the category of waste separate bins has been kept by GCC and the Environmental Cell of ChPA will monitor continuously. The GCC Agreement has been obtained in this regard and attached as **Annexure 9**.

All the domestic sewage facilities will be equipped by proposing STP with SBR technology of capacity 40 KLD and the STP specification is attached as **Annexure 6**. Effluent generation from washing will be treated by proposing ETP of 80 KLD capacity and the ETP specification is attached as **Annexure 7**.

The generation of municipal Solid waste and its management is given in **Table 2.3**.

Table 2.3 Solid Waste Generation and Management

Sr.No	Waste type	Existing phase (kg/day)	Proposed phase (kg/day)	Management measure
1	Organic waste	1.44	1.44	Collected in Municipal Bins and directly Greater Chennai Corporation collecting from the bin and dumping yard at Kodungaiyur.
2	Inorganic waste	0.96	0.96	
Total		2.4	2.4	

Note: Manpower Nos. – 40 Nos.

2.14 Assessment of infrastructure demand

2.14.1 Buildings

As the proposed modernization of fishing harbour is being business site, the social infrastructure of the project gets improvised by continuous population influx, that requires local transport system like autos, taxis etc which would help their business.

2.14.2 Roadways

The project site is situated in the prime location of the Chennai city. It is well connected by roadways.

Table 2.4 Roadway

Description	Dist. (~km)	Dire.
SH-114(Chennai-Ennore Rd)	0.01	W
Chennai-Srikakulam Highway	3.34	SW

CHAPTER 3

BASELINE ENVIRONMENT

3 Description of Environment

This chapter depicts the establishment of baseline for valued environmental components, as identified in and around the “**Modernization and Upgradation of Chennai Fishing Harbour at Kasimedu, Chennai**”. The primary baseline data monitored covered 3 months i.e., **Mid Jan 2023-Mid April 2023**, and secondary data was collected from Government and Semi-Government organizations. The primary baseline data has been generated by M/s. Hubert Enviro Care- Systems (P) Ltd, Chennai, (NABL Accredited and MoEF&CC approved Environmental Testing Laboratory) for the following Terrestrial environmental components.

3.1 Study Area and Period

A 10 km radial distance with the proposed project site as the epicenter has been identified as the General study area for assessing the baseline environmental status. The core study area is the project area and its immediate surroundings to the tune of 1.0 km radius from the boundary. Further the Project Impact/Influence Area (PIA) is 10 km from the boundary of the core area covering the Chennai Fishing Harbour, Kasimedu. The primary baseline data monitored covered 3 months i.e., **Mid Jan 2023-Mid April 2023**.

3.2 Description of the Study Area, components & Methodologies

As Described in Chapter 1 Introduction, “**Modernization and Upgradation of Chennai Fishing Harbour at Kasimedu, Chennai**” is adjacent to Chennai port is adjacent to the site in south direction and V.O.C.Nagar Railway Station is 1.22 km WNW. Chennai International Airport is at a distance of ~18.14 km SW from site. An overall idea of the study area with reference to the physical conditions are presented for better understanding in the following sections before proceeding into the section on the prevailing environmental conditions of the study area. The map showing the satellite image study area of Project is given in **Figure 3-1** and Topo Map of the study area is given in **Figure 3-2**.

- **Meteorology:** Temperature, Relative Humidity, Rainfall, Wind Speed & Direction Refer **Section - 3.6**
- **Ambient Air Quality:** Particulate matter <10 micron size (PM₁₀), Particulate matter <2.5 micron size (PM_{2.5}), Sulphur Dioxide (SO₂), Nitrogen Dioxide (NO₂), Carbon Monoxide (CO), Lead (Pb), Ozone (O₃), Benzene (C₆H₆), Benzo (a) pyrene (C₂₀H₁₂), Arsenic (As), Nickel (Ni), Ammonia (NH₃)-Refer **Section - 3.7**

- **Ambient Noise Levels:** Day equivalent noise levels, Night equivalent noise levels
Refer **Section - 3.8**
- **Water Quality:** Groundwater Quality, Surface Water Quality - Refer **Section - 3.9**
- **Soil Quality** - Refer **Section - 3.10**
- **Ecology** – Refer **Section – 3.11**
- **Socio economic status** – Refer **Section – 3.12**

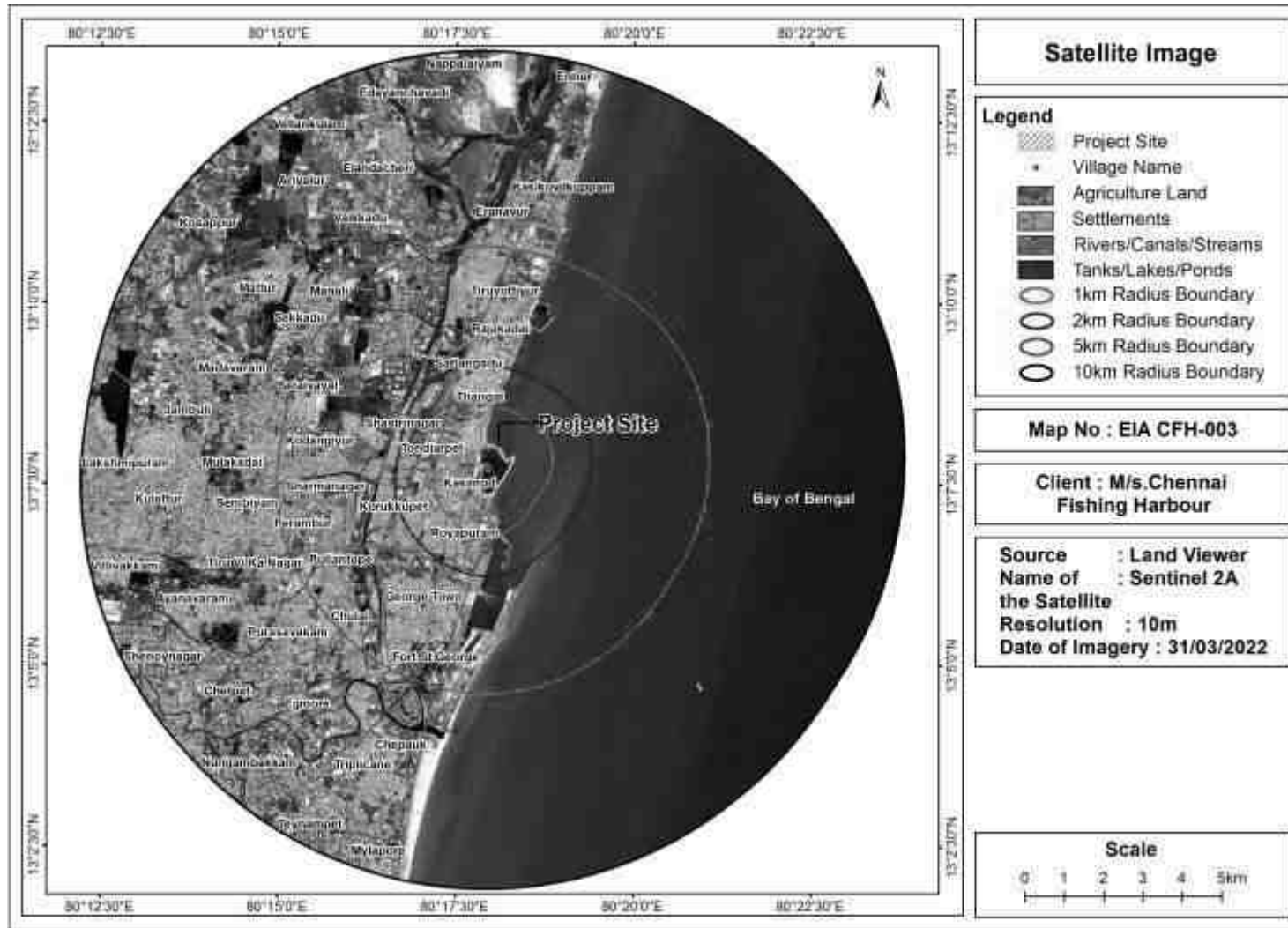


Figure 3-1 Map showing the Satellite Image of the study area

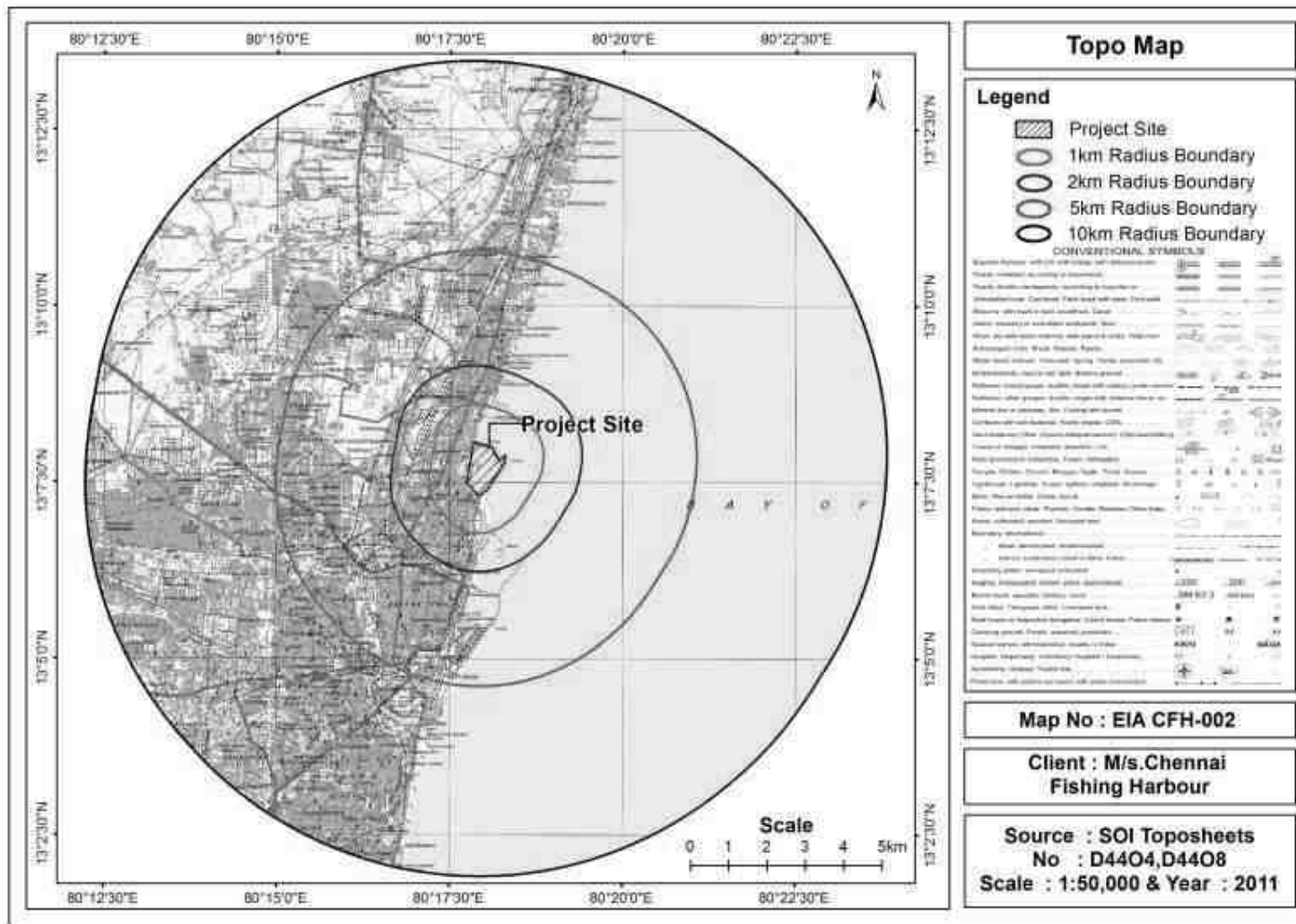


Figure 3-2 Topo Map of the study area

3.3 Environmentally/Ecologically Sensitive areas

The details of environmentally/ecologically sensitive areas covering within 15 km from project boundary are given in **Table 3.1**

Table 3.1 Environmentally Sensitive Areas Within 15km From Project Boundary

S. No.	Areas	Distance & Direction from project boundary			
		S. No	Monuments	Distance (~km)	Direction
1.	List of Monuments/Heritages	1.	Old Town Wall Tondiarpet	2.27	SSW
		2.	Tomb of David Yale and Joseph Hymners in the compound of Law College Muthialpet(George Town)	4.09	SSW
		3.	Ramparts gates bastions Ravelins with vaulted chambers and water cisterns underneath moat and defense walls all round with glacis to the extent of the existing barbed wire fence Fort St. George	4.54	SSW
		4.	King's Barracks Block No.XXV Fort St. George	4.62	SSW
		5.	Old British Infantry Officers Mess (Now housing the Fort Museum) Block No.XXXVI/2 Fort St. George	4.7	S
		6.	Guard Room Block No.V Fort St. George	4.89	SSW
		7.	St. Mary's Church with tablets laid on the ground and enclosed by a compound and a buried wall Fort St. George	4.92	S
		8.	Clives House built in 1753 Fort St. George	4.96	SSW
		9.	Nursing Sister's House (Block 1/3) Fort St. George	4.97	S
		10.	Big Warehouse south of the Church Library (in Block No.II/7) Fort St. George	4.98	S
		11.	Garrisons Engineer's Depot Block No.IV Fort St. George	5.03	SSW

		12.	Last house on the left of ‘Snobs Allay’ (oldest house in the Fort with carved staircase) – Block No.I/1 Fort St. George	5.04	S																																													
		13.	Fort St. George “Arsenal” between Wellesley house and Clive’s House with shells and cannons piled together near the Gateway Block IV/1-12 and 14-18	5.05	S																																													
		14.	Chaplain’s house including portion which the northern side of the Old Wall III/1 Fort St. George	5.06	S																																													
		15.	Wellesley House (Built in 1798) Block No.IV/13 Fort St. George	5.09	SSW																																													
		16.	Victory War Memorial	5.5	S																																													
		17.	Prehistoric settlement site- megalithic period Pulal	11.12	WNW																																													
		18.	Adyar Banyan Tree	12.8	SSW																																													
		19.	Memorial Pillar Anna Salai	12.95	SW																																													
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		Retteri Lake/Madavaram Eri	8.91	W
		Korattur Tank	11.30	W
4.	Nearest Highways	Description	Dist. (~km)	Dire.
		SH-114(Chennai-Ennore Rd)	0.01	W
		Chennai-Srikakulam Highway	3.34	SW
5.	Defence installations	Description	Dist. (~km)	Dire.
		INS Adyar	5.23	S
6.	Nearest Villages	Description	Dist. (~km)	Dire.
		Royapuram	Site is within the Village	
		Tondiarpet	0.03	W
		Old Washermanpet	0.81	WSW
		Tiruvottiyur	1.02	N
		George Town	2.31	S
7.	Areas susceptible to natural hazard which could cause the project to present environmental problems, (earthquakes, subsidence, landslides, erosion or extreme or adverse climatic conditions)	<p>The study area falls under Zone-III (Moderate risk) according to the Indian Standard Seismic Zoning Map. Suitable seismic coefficients in horizontal and vertical directions respectively, will to be adopted while designing the structures.</p> <p>The place is also prone for Cyclone and Tsunami.</p>		

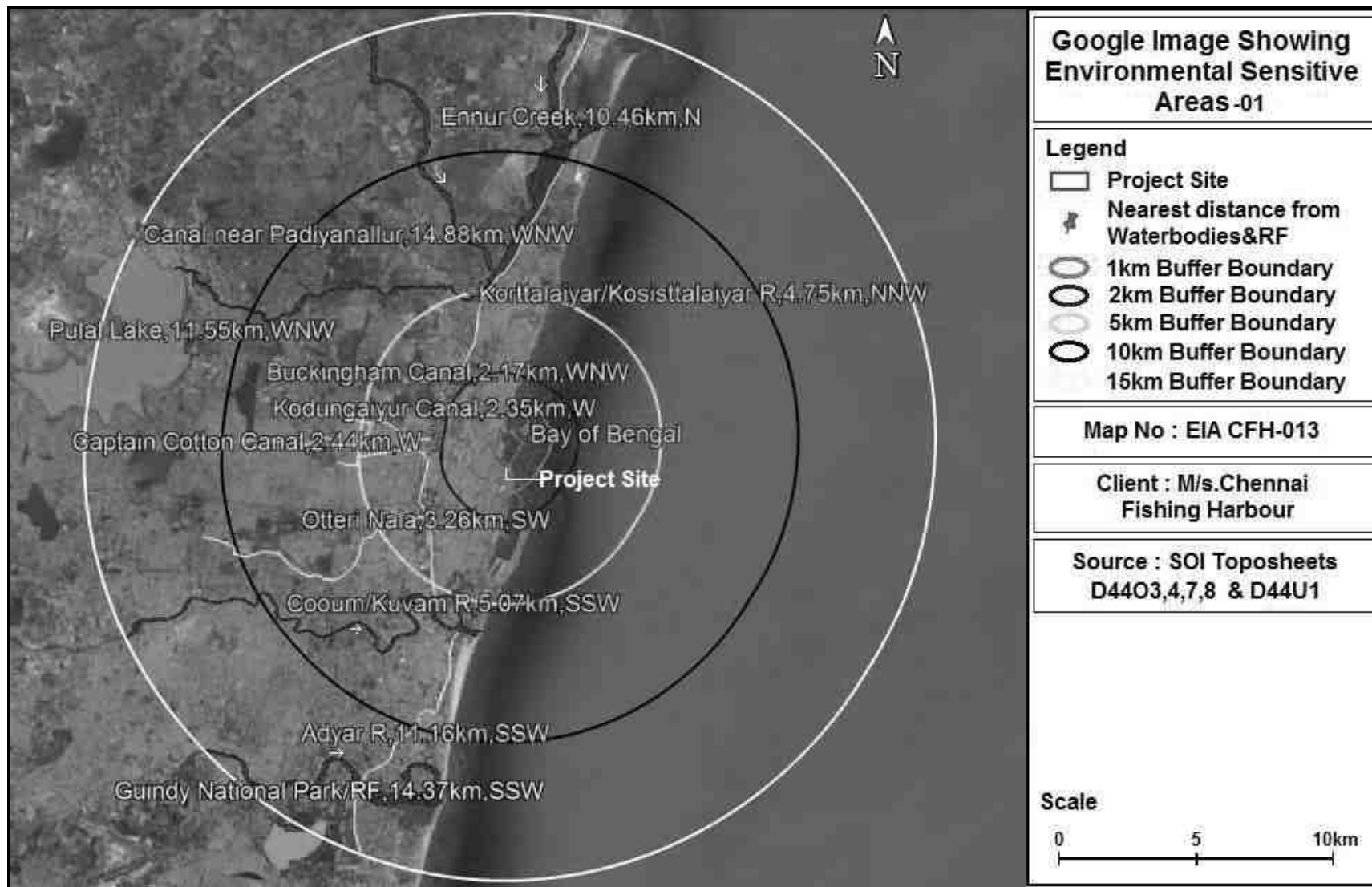


Figure 3-3 Environmentally Sensitive Areas Within 10km from Project Boundary

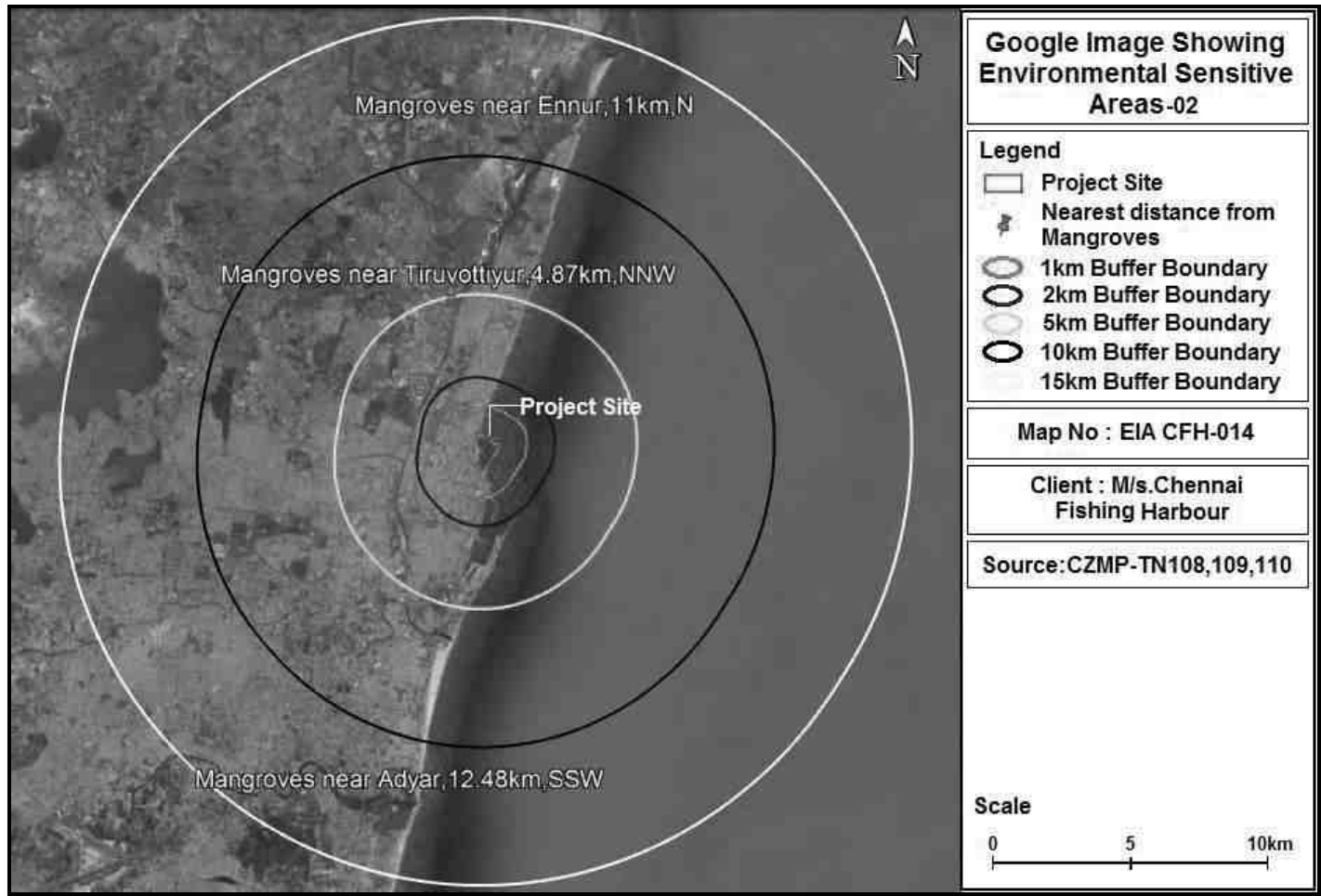


Figure 3-4 Environmentally Sensitive Areas Within 10km from Project Boundary

3.4 Physical Conditions

In this section, the physical conditions of PIA district are discussed in general and wherever possible references to the conditions prevailing in the study area in particular are also provided. The physical conditions are discussed as under:

- District profile
- Drainage, land use, geology, Physiography
- Natural resources
- Climatic conditions, seismic zone characteristics and natural hazard

3.4.1 PIA District Profile

Chennai lies between 12.90 and 13.90 of the northern latitude and 80.120 and 80.190 of the southern longitude. The geographical area of Chennai Municipal Corporations was 174 sq kms, divided in to 10 Zones, each Zone comprised with a number of Divisions. Chennai has sea coast length of about 26 kms from south to north along Bay of Bengal. The sea shore is fully sandy and inhabited by the fisher communities. The main attraction in Chennai is Marina Beach, considered one of the longest sandy beach in the world. Other beaches in the city are not popular. The bed of the sea is about 42 feet deep and slopes further in gradual stages for a distance of about 5 kms from the coast attaining a depth of about 63 feet.

Source:

https://censusindia.gov.in/nada/index.php/catalog/1090/download/3374/DH_2011_3302_PART_A_DCHB_CHENNAI.pdf

(Ref: Directorate of Census Operations-Tamil Nadu, “District Census Handbook-2011, Chennai District”, Series-34 Part XII-A)

3.4.2 Climatic Conditions

The geographical location determines the weather and climate in Chennai. The close proximity to the sea and the thermal equator makes the climate and weather in Chennai relatively consistent with less variation in the seasonal temperature. The weather in Chennai is mostly hot and humid. Experiencing the 3 major seasons namely summers, monsoons and winters, Chennai has a tropical climate. The periods from April to June are the hottest months in Chennai. The maximum temperature during these months vary from 38°C to 42°C, thus making Chennai very hot. However, the cooling breeze sometimes at night comes as a relief to the residents of Chennai. The arrival of the northeast monsoon winds marks the advent of

the monsoon in Chennai. The monsoon seasons generally prevails from June to September. The pleasant shower of rain come as a relief to all after summer season. The average moderate rainfall received by Chennai all through the year is about 1300 mm. The winter season in Chennai is for a short period from November to February. Winter is the most comfortable and pleasant time in Chennai. During the winter months, Chennai has an average moderate temperature of around 24° C and the minimum temperature of around 20° C. Moderate rainfall is also received in the winter months. This makes the weather and climate in Chennai pleasurable as well as comfortable. The lowest temperature that has been recorded in Chennai was 17.5° C while the highest temperature being recorded as 41.4° C (2009-10). The highest yearly rainfall in the city has been recorded to be 2,570 mm (101 in) in 2005. The Cyclones forming in the Bay of Bengal affects the city of Chennai sometimes. The winds that prevail in Chennai in between April and October are the southwesterly wind while the remaining year experiences the northeasterly winds. Temperature recorded during 2009-10 in 2 stations at Chennai reveal that the maximum temperature was recorded at 40.90 C in Chennai North Station in May, 2010 while the minimum temperature was 17.50 C in January, 2010. The humidity levels for the same period reveal that the highest humidity of 88% and 83% at 8.30 hours and 17.30 hours respectively were recorded at Chennai North Station in November, 2009. In Meenambakkam Station, the maximum temperature recorded was 41.40 C in June, 2009 and May, 2010, while the lowest was recorded in January and February, 2010 with 19.20 C. Novermber and December, 2009 has experienced the highest humidity level of 87% and 79% at 8.30 hours and 17.30 hours respectively. Rainfall by northeast monsoon in Tamil Nadu during 2010 was considerably high. Chennai has received more rain during October-December, 2009 compared to other seasons and one among the 6 districts which received more than 700 mm rainfall during the same period. Chennai recorded more rainfall compared to State average of 483 mm. Southwest monsoon (June-September) has also bring rainfall but not as normal rainfall. Rainfall in other seasons is negligible. The actual annual rainfall between June 2009 and may 2010 in Chennai was low compared to the normal rainfall. During the period, Chennai received actual rainfall of 1216 mm against normal rainfall of 1298 mm. However, this is again more than the State average actual rainfall of 938 mm. The tables given below explains the climatic conditions and rainfall during 2009 -10 in Chennai.

Source:

[https://censusindia.gov.in/nada/index.php/catalog/1090/download/3374/DH_2011_3302_PA
RT_A_DCHB_CHENNAI.pdf](https://censusindia.gov.in/nada/index.php/catalog/1090/download/3374/DH_2011_3302_PART_A_DCHB_CHENNAI.pdf)

(Ref: Directorate of Census Operations-Tamil Nadu, “District Census Handbook-2011, Chennai District”, Series-34 Part XII-A)

3.4.3 Natural Resources of Chennai District Forest Resources

3.4.3.1 Flora & Fauna

From the total land area of Chennai, reserved forests cover was 2.71 sq. kms and is concentrated in and around the Guindy National Park region, one of the few national parks in the world located within a city. Among 6 Forests regions in the state, Chennai Region takes care forest areas in Chennai and Vellore Circles. This region is headed by the Chief Conservator of Forests. There are short elevated hills on the periphery of Chennai, mostly rocky in nature. Besides, there are parks with densely covered with shrubs and different types of trees. In Guindy, there is a National Park and dense forest cover inside Raj Bhavan, Governor’s bungalow. Various types of wild animals are found in Children’s Park at Guindy. Spotted deer and herds of bucks are reared in Raj Bhavan forests. As Chennai being a coastal district, various types of marine fauna and flora are found in the sea and sandy shore. Different varieties of tiny crabs are found running on the sandy beaches. Various marine species are found in the sea around Chennai. Variety of fauna in the sea include mullets, silver hellies, ribbon fish, white bait, jew fish, seer, pomfront, sardines, sabre, catfish, synargis, soles, sharks, skates, rays, rockcod, pellona, letrius, engraylish lobster, barracuda, snappers, breams, borito, polynemus etc., Different types of prawns and crabs are also found in the sea. This region is headed Flora and fauna of PIA are discussed in **Section 3.11**.

Source:[http://censusindia.gov.in/2011census/dchb/DCHB_A/33/3302 PART A DCHB CH
ENNAI.pdf](http://censusindia.gov.in/2011census/dchb/DCHB_A/33/3302_PART_A_DCHB_CHENNAI.pdf)

(Ref: Directorate of Census Operations-Tamil Nadu, “District Census Handbook-2011, Chennai District”, Series-34 Part XII-A)

3.4.3.2 Forest Resources

Of the total land area of Chennai, reserved forests cover was 2.71 sq. kms and is concentrated in and around the Guindy National Park region, one of the few national parks in the world located within a city. However, the forest cover of the district as maintained by Forest Department is as follows:

Classification	Area (Ha)	Percentage
Dense forest	151.01	1.16
Moderate dense TOF	121.16	0.93
Non-forest	12215.56	94.06
Open forest	114.24	0.88
Open TOF	153.73	1.18
Water	231.46	1.78
Total	12987.16	100.00

TOF- Tree Outside Forests

Among 6 Forests Regions in the State, Chennai Region takes care forest areas in Chennai and Vellore Circles. This region is headed by the Chief Conservator of Forests. There are short elevated hills on the periphery of Chennai, mostly rocky in nature. Besides, there are parks with densely covered with shrubs and different types of trees. In Guindy, there is a National Park and dense forest cover inside Raj Bhavan, Governor's bungalow. Various types of wild animals are found in Children's Park at Guindy. Spotted deer and herds of bucks are reared in Raj Bhavan forests. As Chennai being a coastal district, various types of marine fauna and flora are found in the sea and sandy shore. Different varieties of tiny crabs are found running on the sandy beaches. Various marine species are found in the sea around Chennai. Variety of fauna in the sea include mullets, silver hellies, ribbon fish, white bait, jew fish, seer, pomfront, sardines, sabre, catfish, tnnny, synargis, soles, sharks, skates, rays, rockcod, pellona, letrius, engraylish lobster, barracuda, snappers, breams, borito, polynemus etc. Different types of prawns and crabs are also found in the sea.

Source: http://censusindia.gov.in/2011census/dchb/DCHB_A/33/3302_PART_A_DCHB_CHENNAI.pdf

(Ref: Directorate of Census Operations-Tamil Nadu, "District Census Handbook-2011, Chennai District", Series-34 Part XII-A)

3.4.3.3 Agricultural Resources

Chennai city today is devoid of any typical agriculture areas but can still be proud of some of the well maintained green belts found in the Peoples park, the Napier park, the Horticulture-gardens, My Lady's Park, Children's Park Guindy, Snake Park, Nehru Park, Nageswara Rao Park, Independence Park, Anna Square Park, the Raj Bhavan, the Theosophical Society Campus and a number of bungalows and newly developed colonies where provisions for public parks, etc. have been made. The indigenous trees found are Azadirachta indica, Mangifera indica, Tamarindus indica, Albizia saman, Albizia lebbeck, Ficus benghalensis, Cocos nucifera and Ficus religiosa. Stretches of casuarina plantations are available on the sea-coast beyond the mouth of the Adyar River in the South and Tondiarpet in the North.

Source: <http://tnenviis.nic.in/files/CHENNAI.pdf>

Mineral Resources

Quartz, silica sand and Bentonite are the available minerals in Chennai district. The Mineral map of Tamil Nadu is given in **Figure 3-5**.

Source: <http://ibm.nic.in/writereaddata/files/09232015123254Tamil%20Nadu.pdf>

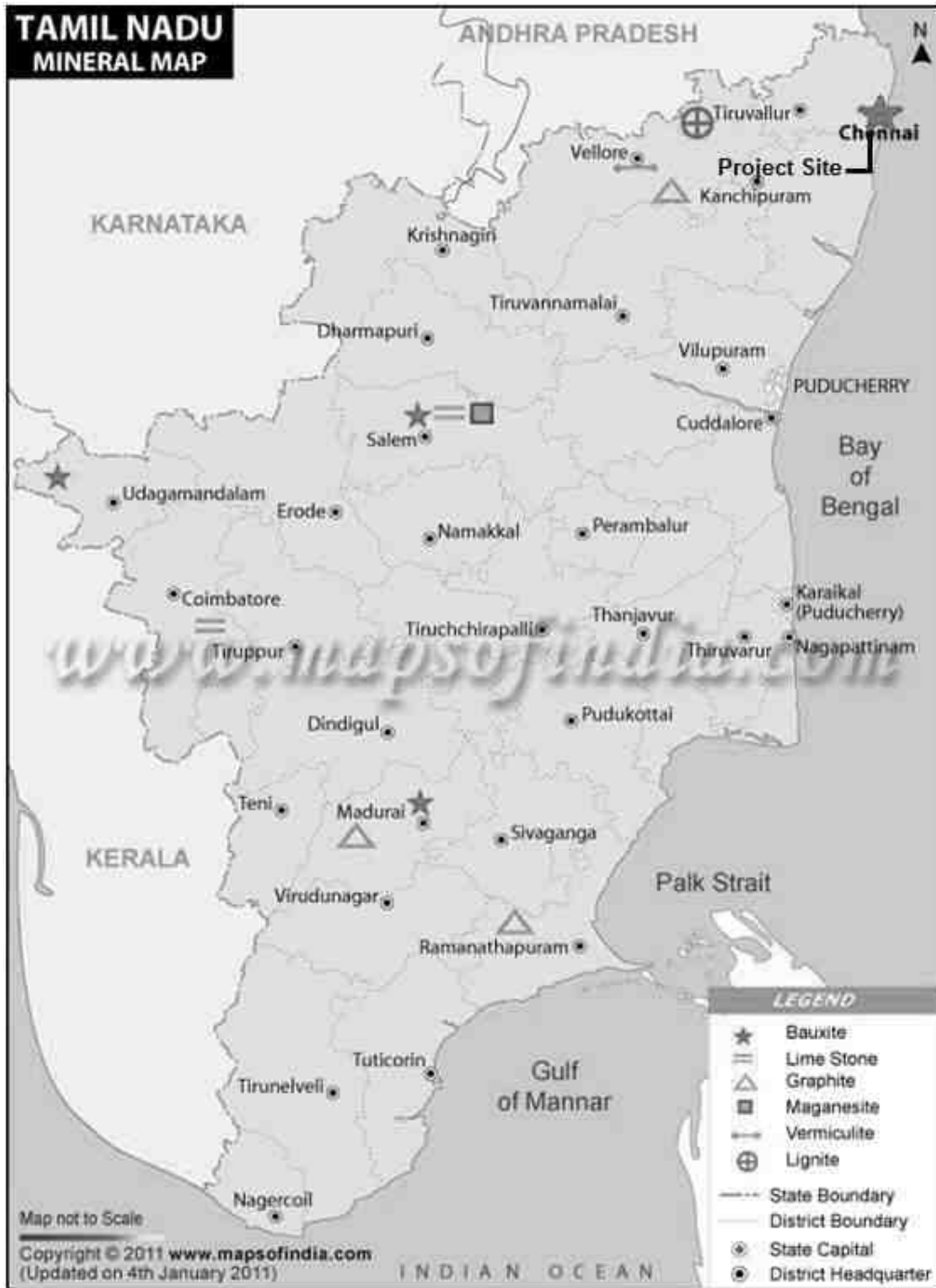


Figure 3-5 Mineral Map of Tamil Nadu

3.4.4 Land Use & Land Cover

Total geographical area of Chennai district is 171sq.km. Built-up area, Urban is 154.83sq.km. and Built-up area, Rural 0.02 sq.km. Details of district land use/land cover statistics for Chennai district is given **Table 3.2** and Land Use map of Chennai district is given in **Figure 3-6**. Land Use pattern of Chennai district is given in **Figure 3-7**.

Table 3.2 District land use/land cover statistics for Chennai district

S.No	Division of Land Use/Land Cover	Area in Sq.Km	Area in Acres	Area in Ha	Total Area %
1	Builtup,Urban	154.83	38259.27	15483	90.54
2	Builtup,Mining	0.02	4.9421	2	0.01
3	Agriculture,Plantation	0.13	32.12365	13	0.08
4	Forest,deciduous	2.54	627.6467	254	1.49
5	Barren/Unculturable/Wastelands,scrub land	0.33	81.54465	33	0.19
6	Wetlands/Water Bodies,Coastal Wetland	1.21	298.9971	121	0.71
7	Wetlands/water Bodies, Reservoir/lakes/ponds	0.92	227.3366	92	0.54
8	Builtup,Rural	0.02	4.9421	2	0.01
9	Agricultural Crop land	1.72	425.0206	172	1.01
10	Agriculture,Fallow	0.98	242.1629	98	0.57
11	Forest,Swamp/Mangroves	0.76	187.7998	76	0.44
12	Barren/Unculturable/Wastelands,sandy area	3.26	805.5623	326	1.91
13	Wetlands/water Bodies, River/stream/Canals	4.29	1060.08	429	2.51
	Total	171	42257.4	17101.0	100

Source: <https://bhuvan-app1.nrsc.gov.in/thematic/thematic/index.php>

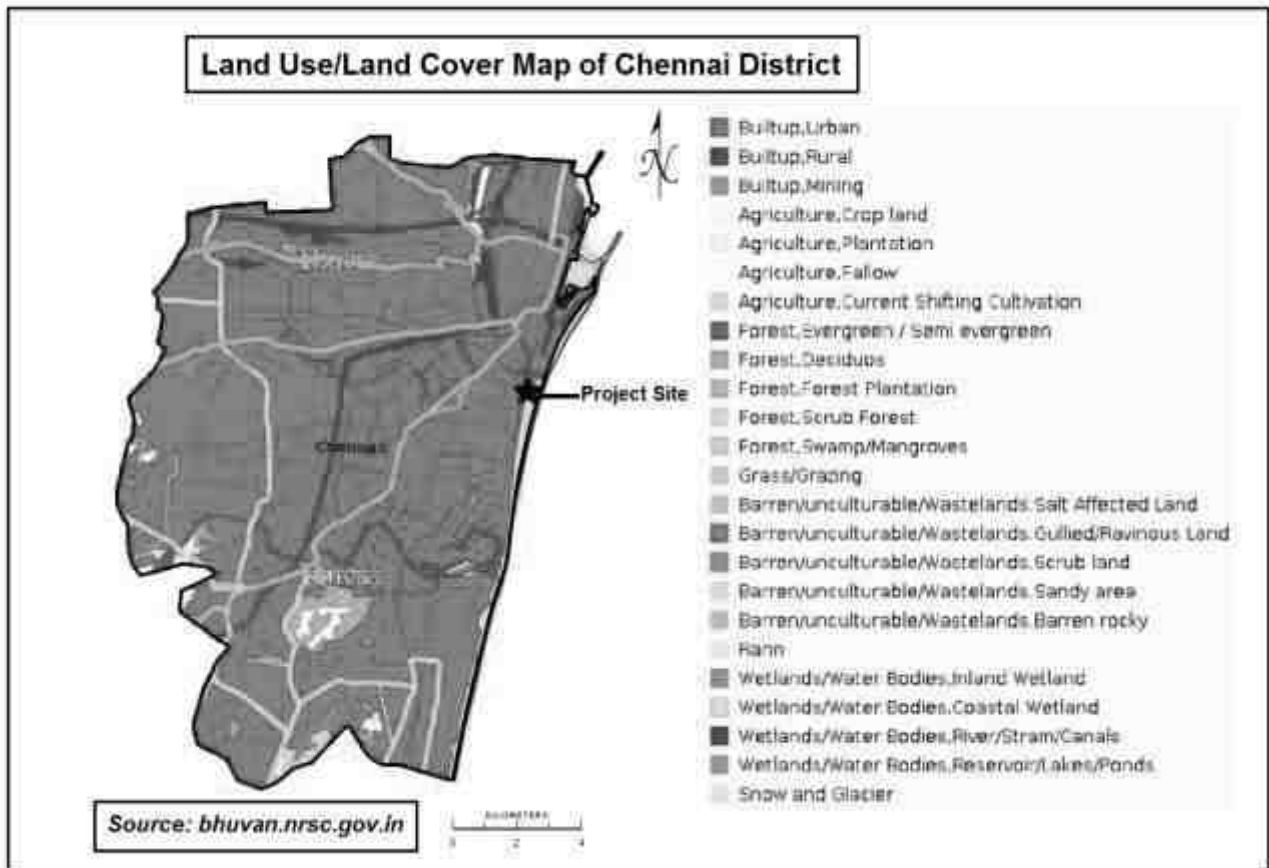


Figure 3-6 Land Use Map of Chennai district

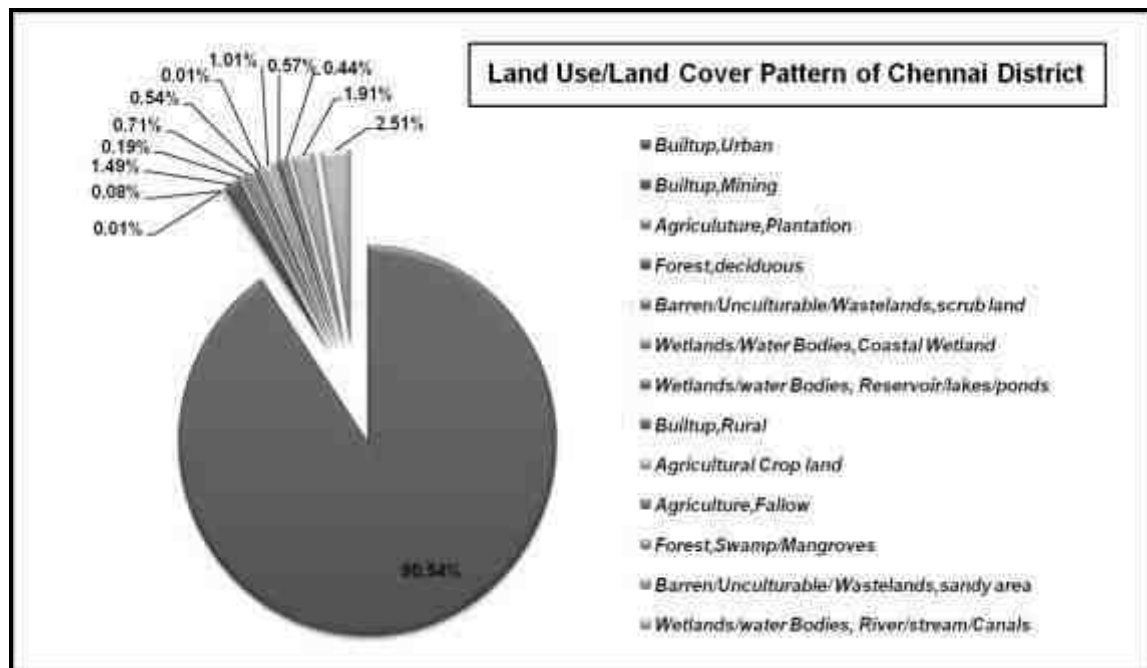


Figure 3-7 Land Use/Land Cover Pattern of Chennai District

3.4.5 Land Use Pattern of the Study Area

Total Project Study Area is 356.50 sq.km. Land Use /Land Cover statistics of 10 km radius of the Study Area is given in **Table 3.3** and land Use pattern of Study area is given in **Figure 3-8** and LULC map of the Study area is given in **Figure 3-9**.

Table 3.3 Land Use/Land Cover statistics of 10 km radius of the Study Area

Sl.No	Division of Land Use/Land Cover	Area in Sq.Km	Area in Acres	Area in Ha	Total Area %
1.	Urban	140.09	34616.94	14009	39.30
2.	Crop land	14.42	3563.25	1442	4.04
3.	Rural	7.94	1962.01	794	2.23
4.	River / Stream / Canals	7.07	1747.03	707	1.98
5.	Scrub land	5.08	1255.29	508	1.42
6.	Coastal Wetland	4.52	1116.91	452	1.27
7.	Plantation	4.02	993.36	402	1.13
8.	Tanks / Lakes / Ponds	3.90	963.71	390	1.09
9.	Sandy Area	3.34	825.33	334	0.94
10.	Fallow	1.02	252.05	102	0.29
11.	Salt Affected Land	0.04	9.88	4	0.01
12.	Ocean	165.06	40787.15	16506	46.30
Total		356.50	88092.93	35650	100.00

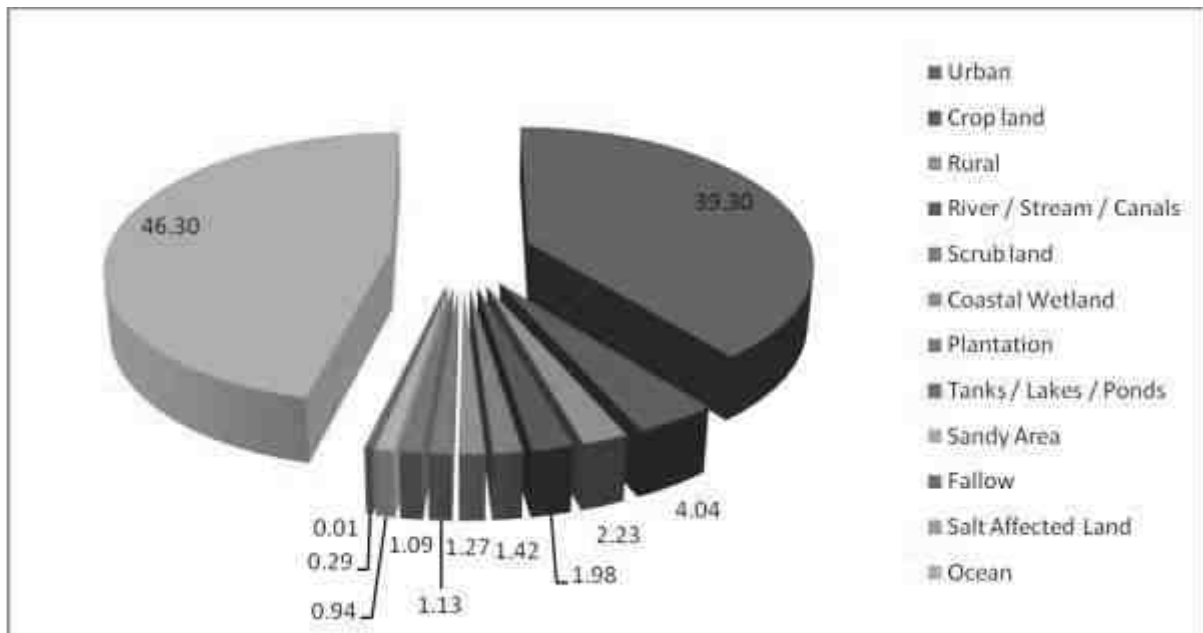


Figure 3-8 Land Use/Land Cover Pattern of the Study Area

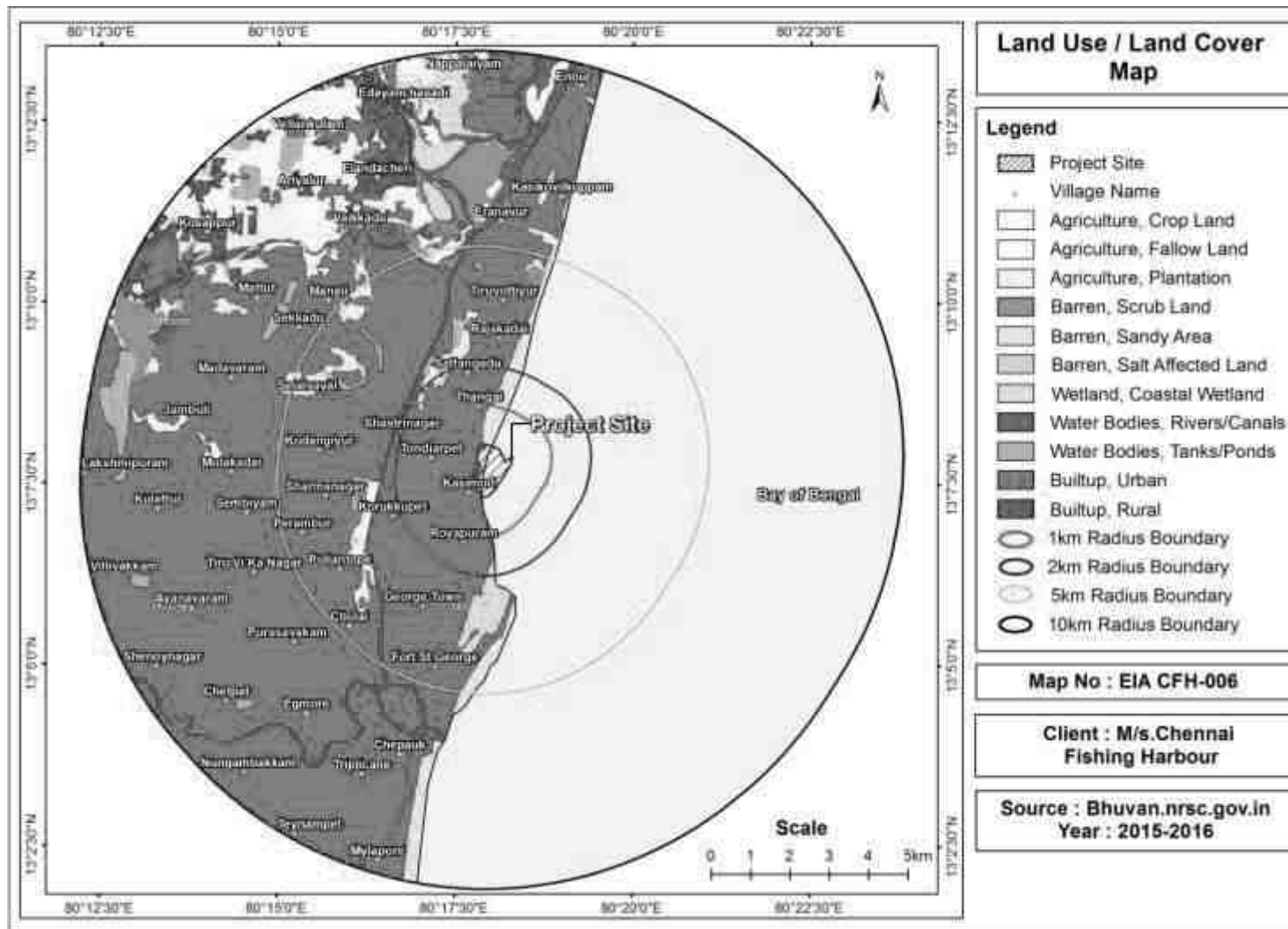


Figure 3-9 Land use/Land cover map of the Study Area

3.4.6 Topography

Chennai is a low-lying area and the land surface is almost flat like a pancake. The even topography of the land throughout the district renders sub-divisions into natural regions rather difficult. It rises slightly as the distance from the sea-shore increases but the average elevation of the city is not more than 22' above mean seal-level, while most of the localities are just at sea-level and drainage in such areas remains a serious problem. The city is intersected by two streams, viz, Cooum River and the Adyar. The Cooum River runs through the heart of the city and enters the sea. The Adyar runs through the south part of the city and enters the sea. The Buckingham canal which runs through the states of Tamil Nadu and Andhra Pradesh is a navigation canal. This canal runs almost parallel to the Coromandel coast within the limits of 5 kms from the coast. It joins up a series of natural backwaters and connects all the coastal districts from Guntur to Chennai. Physical map of Tamil Nadu is given in **Figure 3-10**.

Source: https://dcmsme.gov.in/old/dips/IPS%20Chennai_Revised.pdf

(Ref: Government of India Ministry of MSME, “Brief Industrial Profile of Chennai District,2012-13”)



Figure 3-10 Physical map of Tamil Nadu State

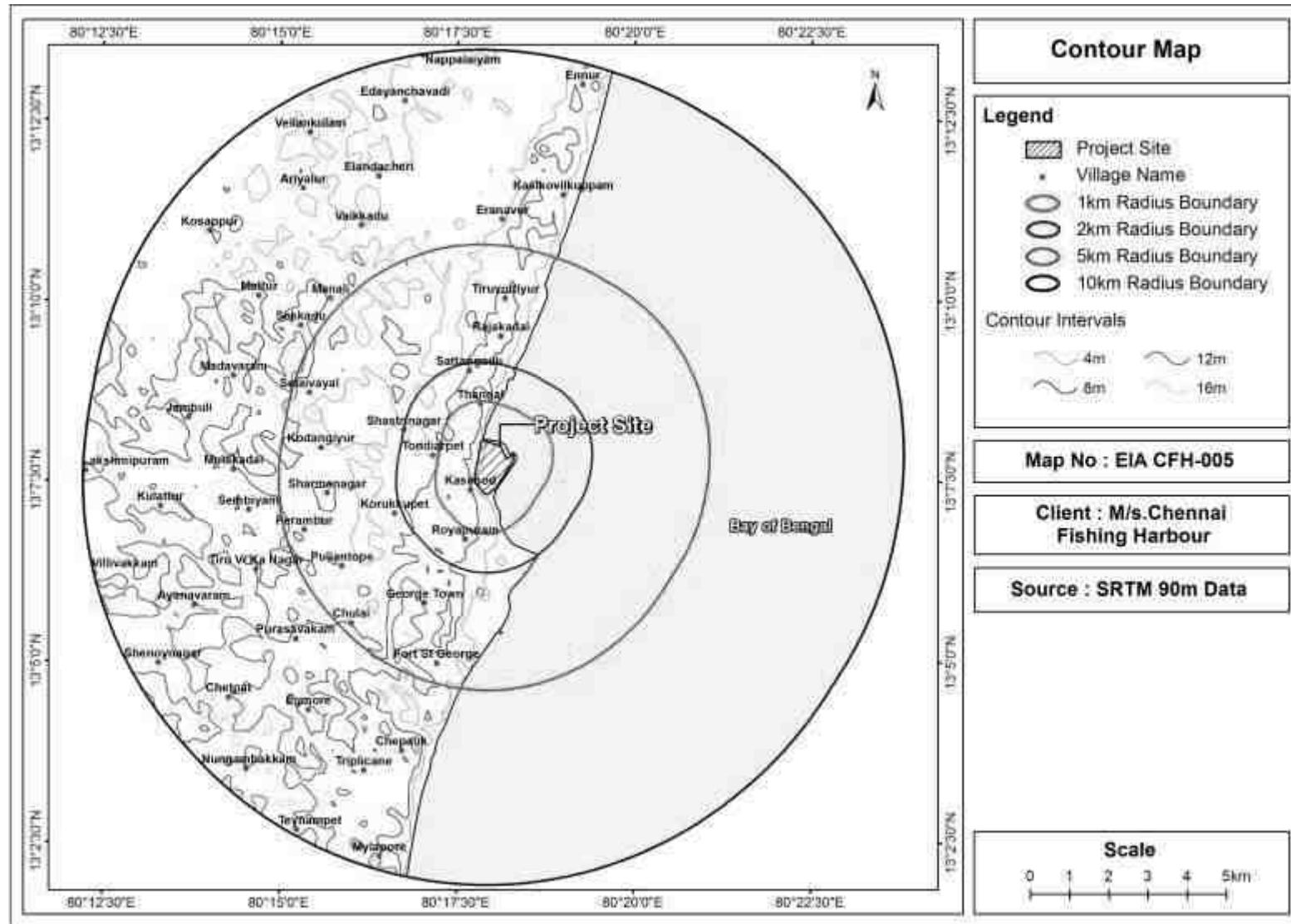


Figure 3-11 Contour map of Study Area

3.4.7 Geology of PIA District

The Chennai basin is occupied by nearly 60% of sedimentary formation and 40% of hard rock formations. Rocks of Archaean, Proterozoic, Jurassic, cretaceous, Tertiary - Quarternary age and alluvium are exposed in this basin. The hard rock formations are occupied in the west and southeastern side of the basin. Biotite Hornblend gneiss and Epidote Hornblend gneiss occur in the western part of the basin whereas charnockite occupies in the southeastern part of the basin. The Geology Map of Tamil Nadu is given in **Figure 3-12**.

Source: https://nwm.gov.in/sites/default/files/Chennai_Report.pdf



Figure 3-12 Geology map of Tamil Nadu State

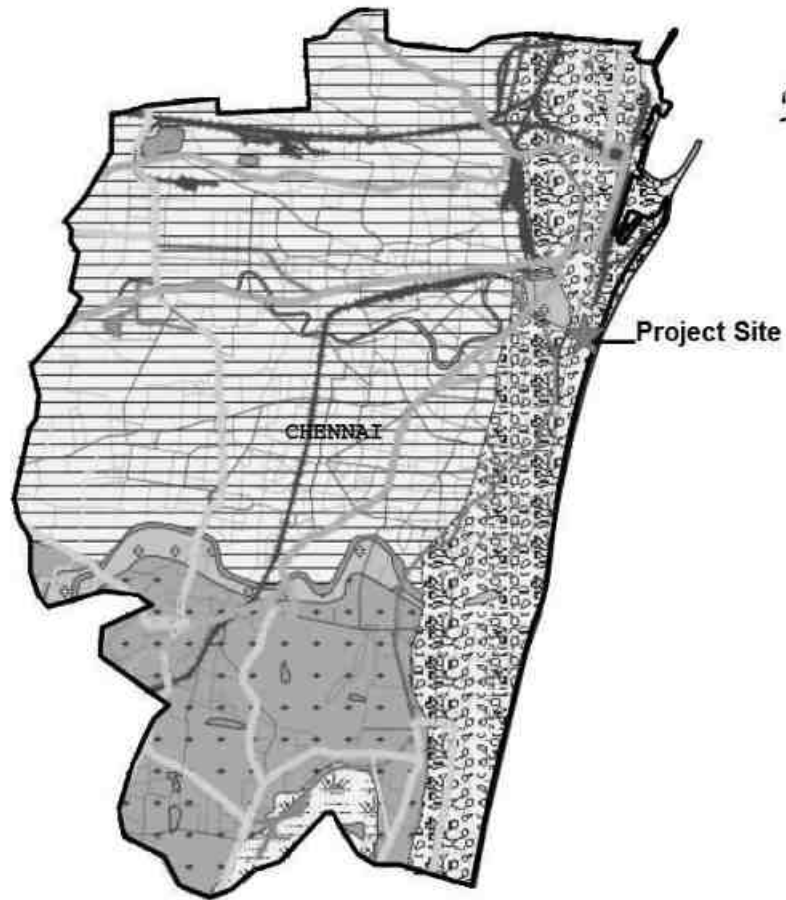
3.4.8 Geomorphology of PIA District

Chennai district forms part of coastal plains of Tamil Nadu. Major part of the district is having flat topography with very gentle slope towards east. The altitudes of land surface vary from 10 m above MSL in the west to sea level in the east. Fluvial, marine and erosional landforms are noticed in the district. Marine transgression and regressions and neotectonic activity during the recent past have influenced the morphology and resulted in various present landforms. Meandering streams with small sand bars are present along the course of Adyar River. The pediment and buried pediment in Guindy area in and around the reserved forest, is the only area where the ecological system is less disturbed, while the other areas are completely disturbed by built up area with large-scale human interference and pollution. Marina beach is the most natural beach in the world with a width varying from 150 to 600 m and a length of 5.6 km, also encroached by human activity. Theosophical society, located on the banks of Adayar river mouth is the only area with well-preserved natural coastal morphology, sand dunes, beach ridges, flora etc. Geomorphology Map of study area is given **Figure 3-15**. The Geomorphology of the study area is given in **Table 3.4** and Geomorphology pattern is given in **Figure 3-14**.

Source: <http://cgwb.gov.in/sites/default/files/2022-10/chennai.pdf>

(**Ref:** Central Ground Water Board, South Eastern Coastal Region, Chennai, “District Ground Water Broucher Chennai District, Tamil Nadu)

Geomorphology Pattern of Chennai District



Source: bhuvan.nrsc.gov.in

KILOMETERS
0 2 4

Geomorphology	
	Structural Origin
	Denudational Origin
	Fluvial Origin
	Coastal Origin
	Aeolian Origin
	Anthropogenic Origin
	Waterbodies

Figure 3-13 Geomorphology Map of Chennai District

Table 3.4 Geomorphology of the study area

S.No	Description	Area in sq.km	Area in Acres	Area in Ha	Area in %
1.	Coastal Origin-Older Deltaic Plain	119.4	29511.75	11943	33.50
2.	Coastal Origin-Younger Coastal Plain	54.73	13524.06	5473	15.35
3.	Coastal Origin-Younger Deltaic Plain	7.88	1947.19	788	2.21
4.	Waterbodies	6.61	1633.36	661	1.85
5.	Fluvial Origin-Active Flood Plain	0.83	205.10	83	0.23
6.	Ocean	167	41271.48	16702	46.85
	Total	356.50	88092.93	35650	100.00

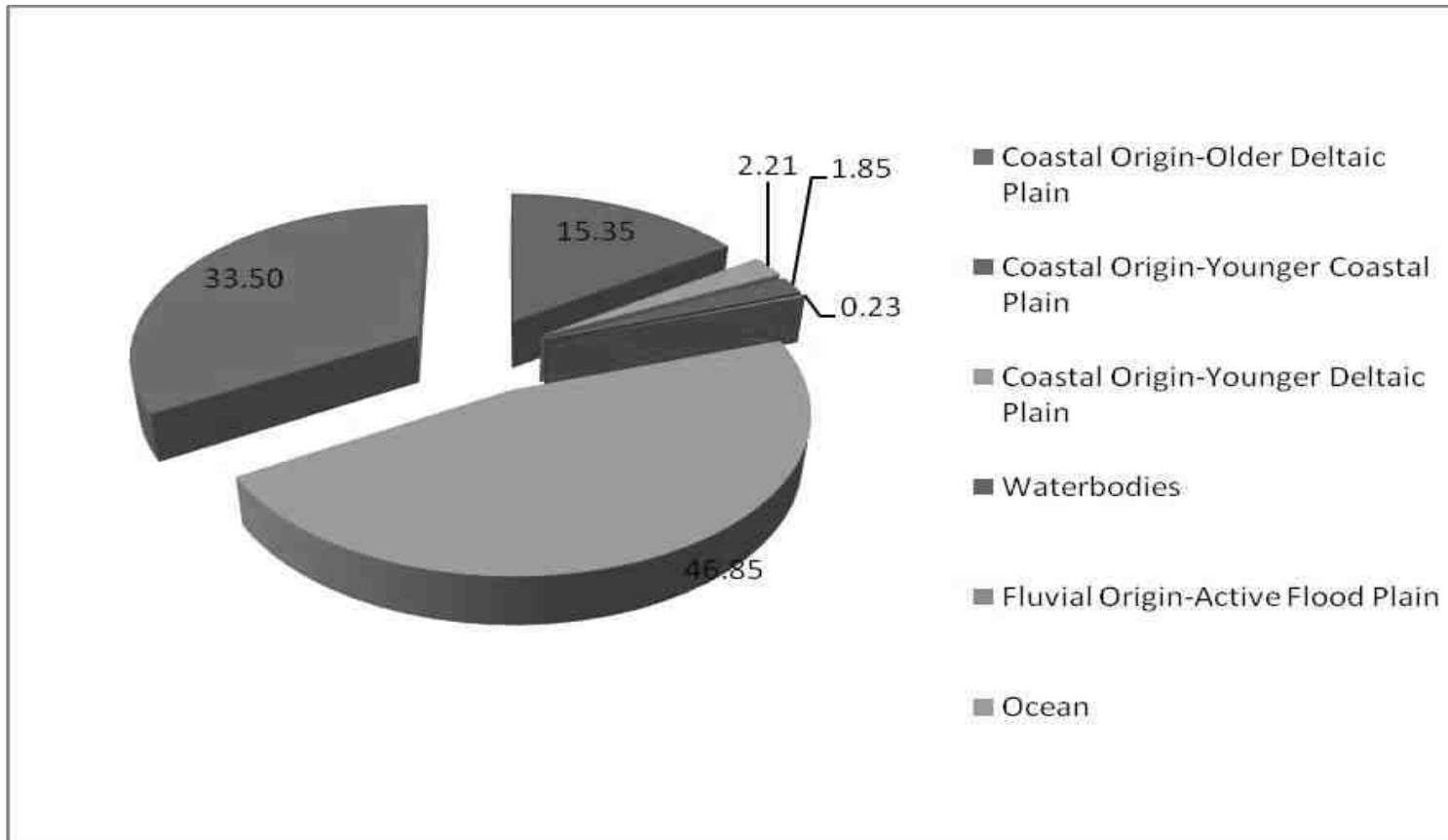


Figure 3-14 Geomorphology Pattern of the Study Area

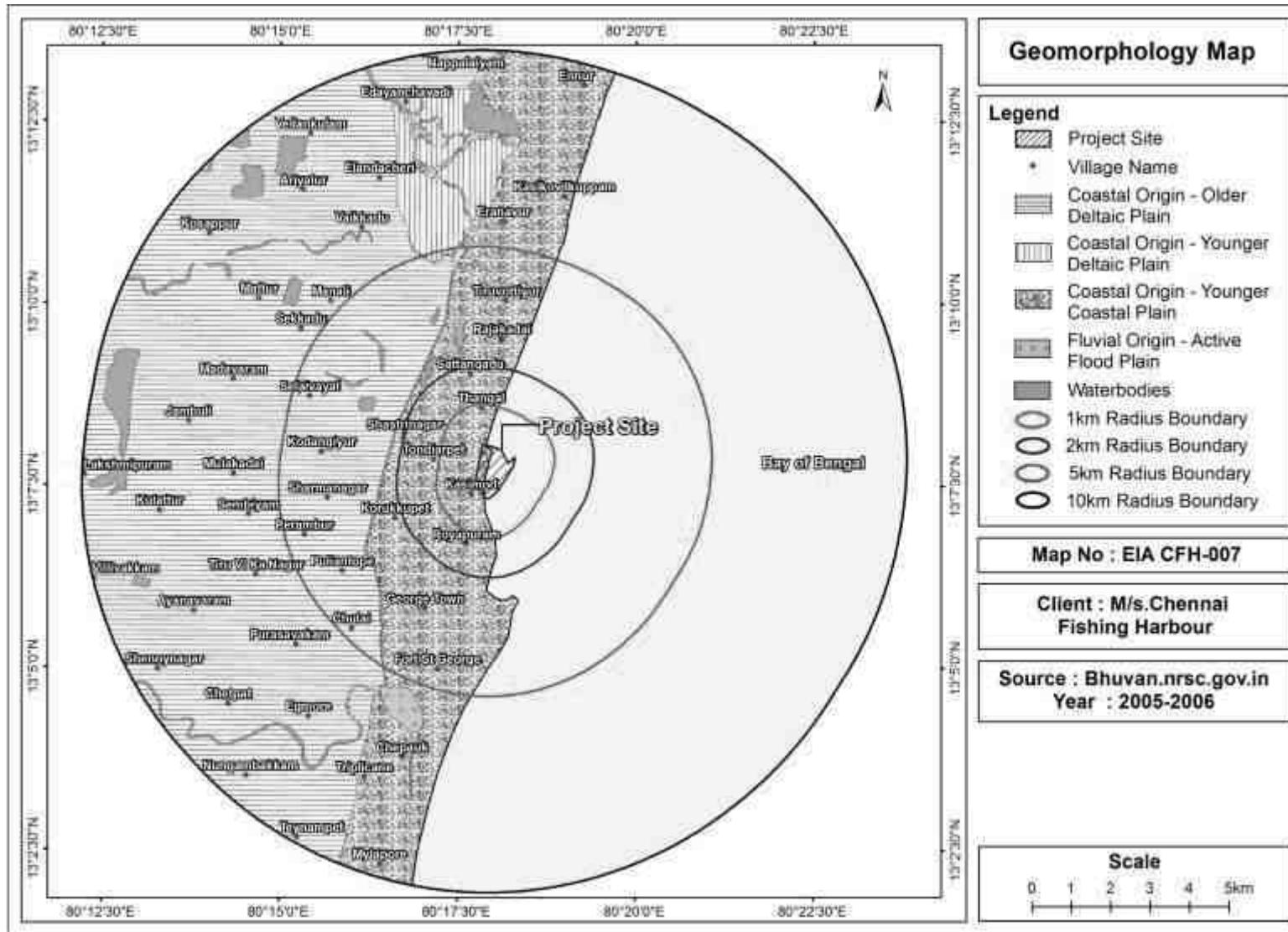


Figure 3-15 Geomorphology Map of Study Area

3.4.9 Hydrogeology of PIA District

Chennai district is underlain by various geological formations from ancient Archaean to the Recent Alluvium. The geological formations of the district can be grouped into three units, namely i) the Archaean crystalline rocks ii) consolidated Gondwana and Tertiary sediments and iii) the Recent Alluvium. The Archaean crystalline rocks of the district comprise chiefly of charnockites, gneisses and the associated basic and ultra basic intrusive. A map showing the hydrogeology of the district is given as Plate–II. The crystalline rocks are weathered and jointed/fractured. The degree and depth of weathering varies from place to place and the thickness of weathered mantle varies from less than a metre to about 12 m in this district. The successful bore wells drilled tapping the deeper fractured aquifers in Saidapet, Adyar, Kasturba nagar, Gandhi nagar and Ashok nagar revealed the existence of fracturing down to depth of 60 m below ground level. The Gondwana shale is black to dark grey in colour and is jointed/ fractured. They are encountered in a number of boreholes and their thickness varies from 24 m in Kilpauk area through 20 m in Ashok Nagar area to more than 130 m in Koyambedu area. The occurrence of Tertiaries in Chennai district is not well demarcated. However, the sandstones encountered in some of the boreholes below alluvium in Binny Road, Poes Garden, Anna Nagar and Rayapuram areas, which belong to Tertiary group. The granular zones below the Kankar layer in the depth range of 20-28 m bgl in Poes Garden probably represent Tertiary sandstones and tube wells tapping these granular zones yield 2 to 3 litre per second (LPS). Ground water in Chennai district occurs in all the geological formations viz., the Archaean crystallines, Gondwanas, Tertiaries and alluvium and is developed by means of ring wells, dug wells, filter point wells, bore wells and tube wells. The Hydrogeology map of PIA district is given in **Figure 3-16**

Source: <http://cgwb.gov.in/sites/default/files/2022-10/chennai.pdf>

(Ref: Central Ground Water Board, South Eastern Coastal Region, Chennai, “District Ground Water Broucher Chennai District, Tamil Nadu)

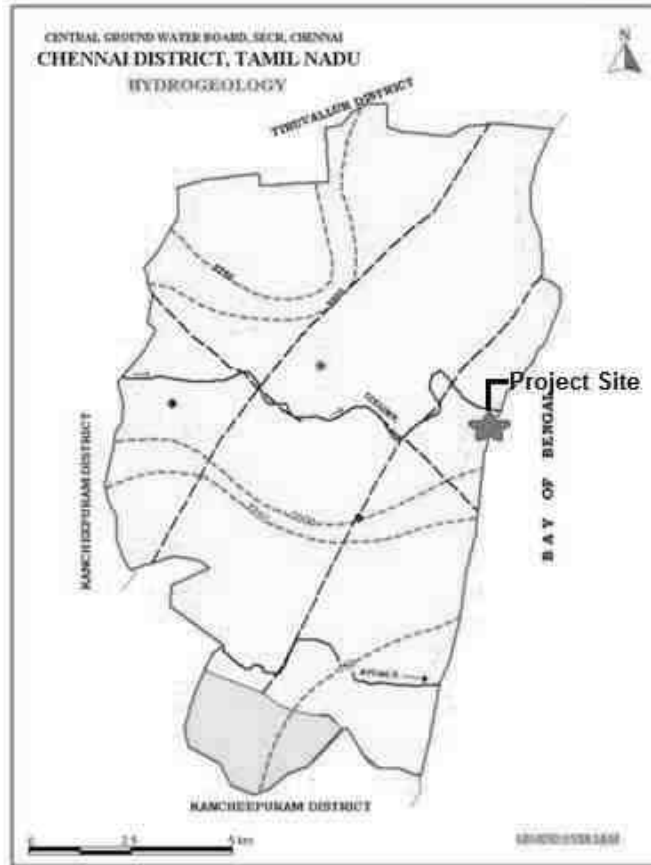


Figure 3-16 Hydrogeology Map of PIA district

Source: <http://cgwb.gov.in/sites/default/files/2022-10/chennai.pdf>

(Ref: Central Ground Water Board, South Eastern Coastal Region, Chennai, “District Ground Water Broucher Chennai District, Tamil Nadu)

3.4.10 Drainage Pattern in PIA District

Adyar River originates at the confluence (Thiruneermalai) of two streams that drains the upstream area of Chembarambakkam tank. It is a small river of 42 km length and a catchment of 800 Sq. km. The river carries flow all through 365 days of a year with an average discharge of 89.43 MCM/Year at Kattipara cause way. It drains the southern part of the district and remains flooded during monsoon. During the high tides, the backwaters from the Bay of Bengal enter inland up to 3 – 4 km. Cooum is the other main river flowing through the central part of the district and carries only drainage water, which is highly polluted. It originates from the surplus waters from the Cooum tank in Tiruvallore taluk and the tanks, which are in enroute, discharge their surplus water into the river during flood season. The flow of Cooum River at Korattur is 40.2 MCM/year for an average duration of 31 days in a year. Otteri Nulla is another small stream flowing in the northern part of the city. Buckingham canal is the man made one for navigation purposes earlier, but now it act as sewerage carrier in the city. Drainage map of the study area is given in **Figure 3-17**.

Source: <http://cgwb.gov.in/sites/default/files/2022-10/chennai.pdf>

(Ref: Central Ground Water Board, South Eastern Coastal Region, Chennai, “District Ground Water Broucher Chennai District, Tamil Nadu)

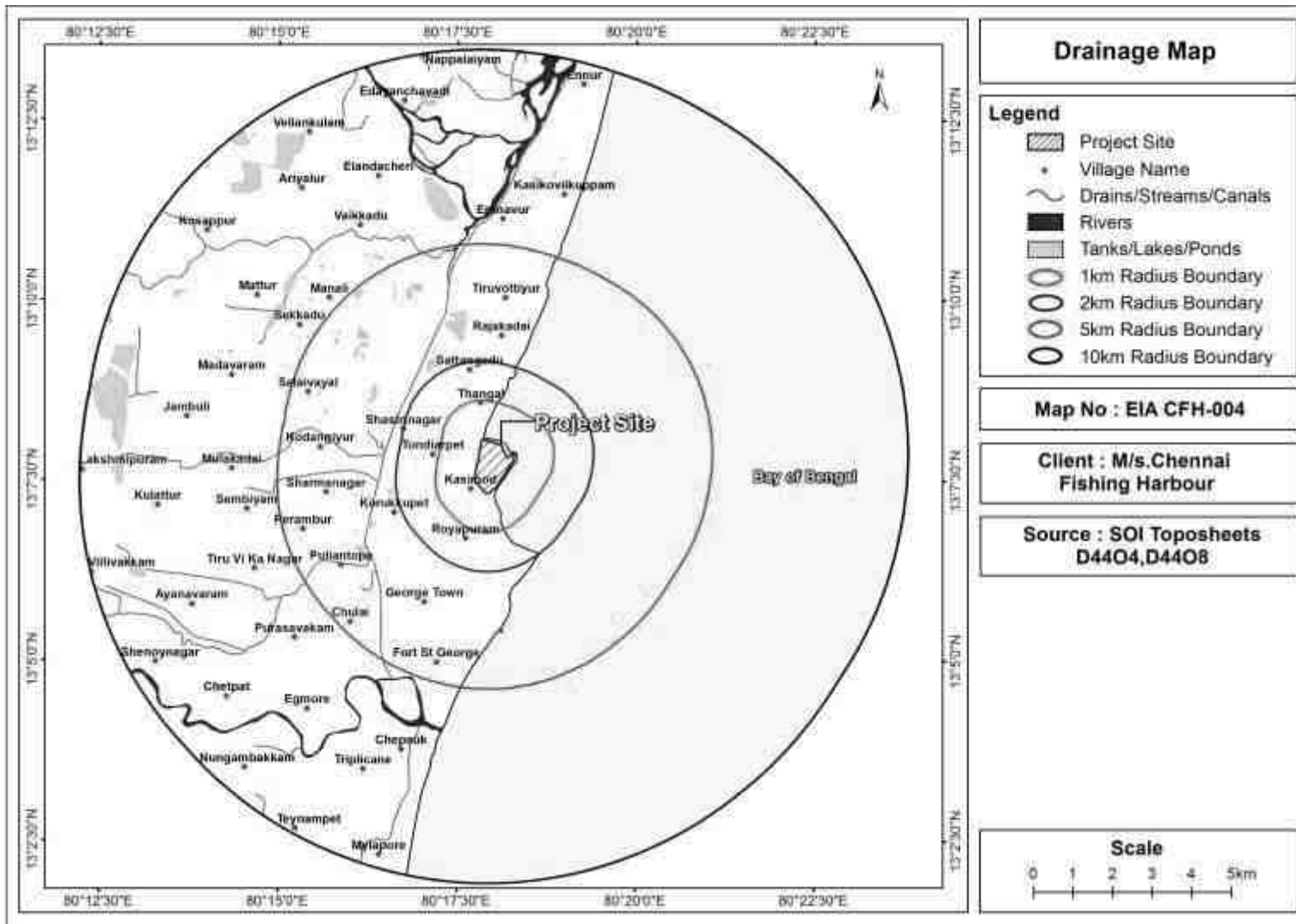
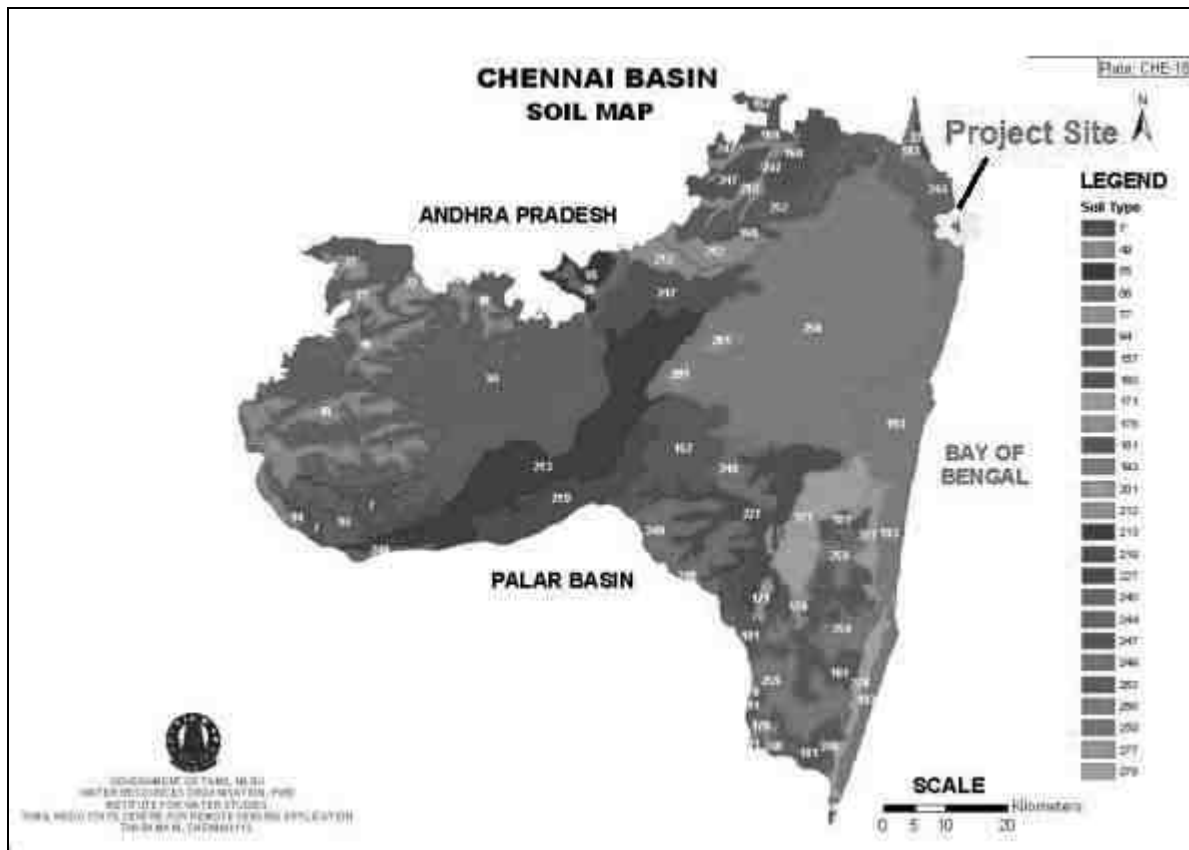


Figure 3-17 Drainage map of the study area

3.4.11 Soils in PIA District

The predominant soil types found in this river basin is Inceptisols, Alfisols, Entisols and Vertisols. Due to different stages of weathering of parent material, the above soil types are met with in combination. The study falls in the soil order of recent alluvium soil. Soil Map of Chennai is given **Figure 3-18**.



Source: https://nwm.gov.in/sites/default/files/Chennai_Report.pdf

Figure 3-18 Soil Map of India

3.4.12 Natural Hazards in PIA District

Chennai Metropolitan Area falls under Seismic Zone – III. The whole of Chennai Metropolitan Area falls in this zone. In Chennai Metropolitan Area, it extends to a distance of 20 km. from the coast. In these areas, the risk is due to (a) cyclonic wind velocities combined with heavy storm, (b) flooding by seawater due to high waves and (c) flooding due to heavy storm. In Chennai Metropolitan Area, there are a few areas along the rivers and canals and low-lying areas, which

are susceptible to flooding/inundation during heavy storms. Mapping has to be done of the areas where the tsunami of December 2004 had directly hit and flooded the coastal areas in Chennai Metropolitan Area has to be done. These areas may have to be zoned as Tsunami prone areas. However this area within Chennai Metropolitan Area will fall within the CRZ area 500 metres from HTL along the coast. The Natural Hazard Map of India is given in **Figure 3-18**.

Source:

https://www.cmdachennai.gov.in/Volume1_English_PDF/Vol1_Chapter10_Disaster%20Management.pdf

(Ref: Government of India, National Disaster Management Authority)

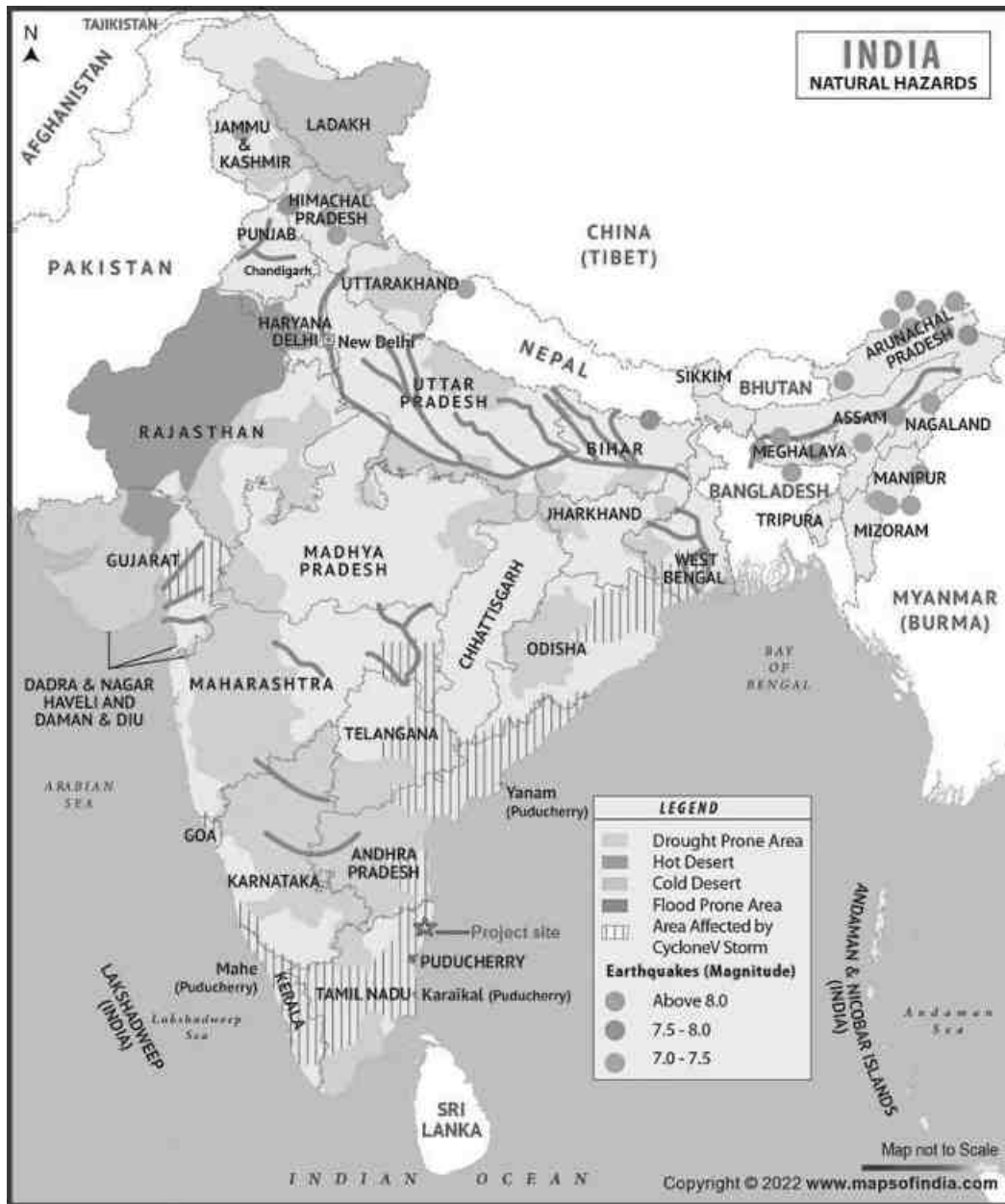


Figure 3-19 Natural Hazard Map of India

3.4.13 Seismicity

As per Vulnerability Atlas of India – 3rd Edition, the project location/study area falls in Zone III, indicating a moderate damage risk zone. The seismicity map of Tamil Nadu is shown **Figure 3-20**.

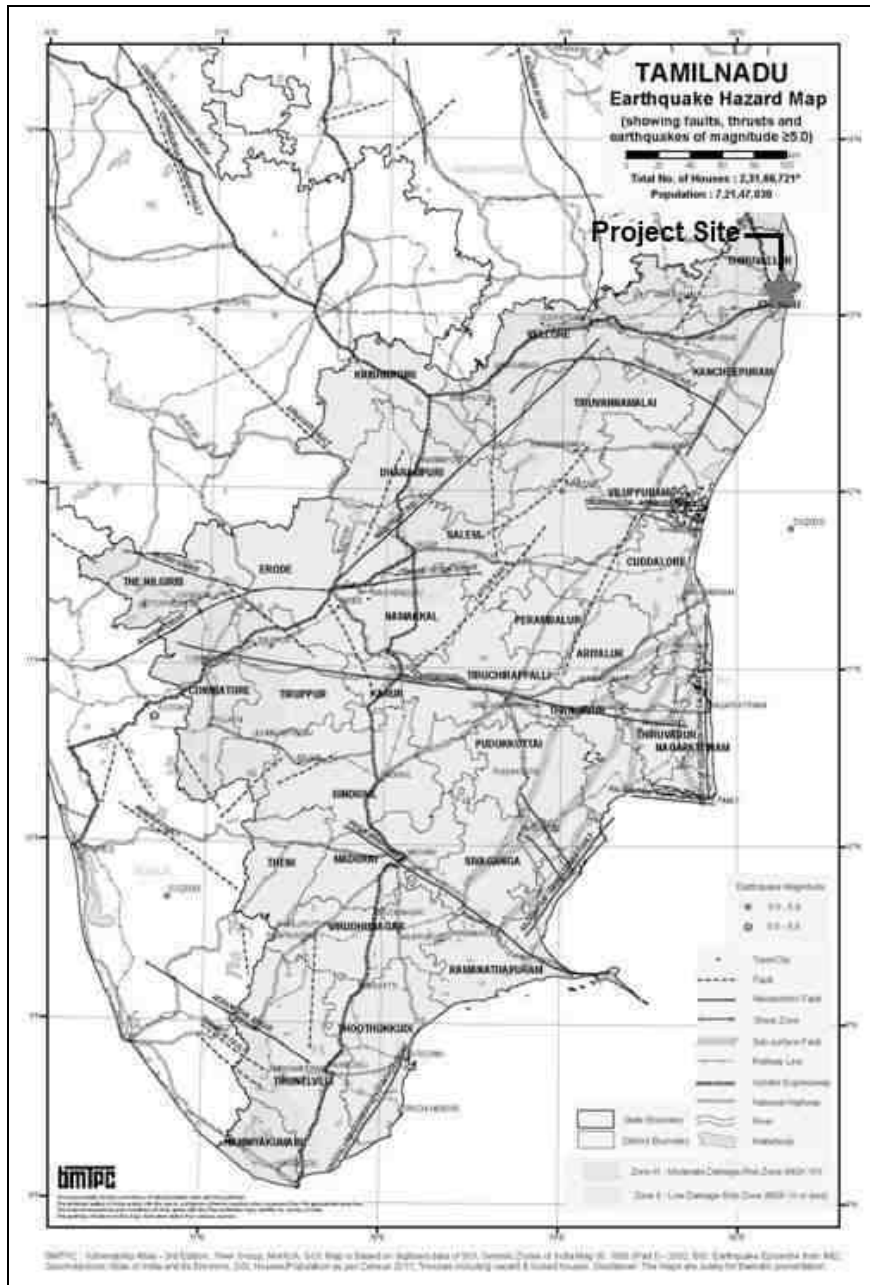


Figure 3-20 Seismicity Map of Tamil Nadu

3.5 Air Environment

Baseline ambient air quality assessment gives the status in the vicinity of site and is an indispensable part of environmental impact assessment studies. Significant changes, in predominant winds and weather conditions are observed in winter, summer and post-monsoon seasons apart from the local topographic influences. The baseline status of air environment in the study area is assessed through a systematic air quality surveillance program.

3.5.1 Meteorological Conditions

The regional air quality is influenced by the meteorology of that region. The principal weather parameters that influence the concentration of the air pollutants in the surroundings are wind speed, wind direction and temperature. The meteorological data is useful for proper interpretation of the baseline data. It is used as input for air quality dispersion models for predicting the post project environmental scenario i.e. ground level concentrations due to proposed DG sets, etc.

3.5.2 Meteorological Data Collection

Available secondary data pertaining to the meteorological parameters was obtained from the IMD Climatological tables. In addition, baseline meteorological data (primary data) was generated during the Pre-monsoon Season (**Mid Jan 2023- Mid April 2023**). The methodology adopted for monitoring surface observations is as per the standard norms laid down by Bureau of Indian Standards (BIS) i.e. IS:8829 and Indian Meteorological Department (IMD).

3.5.3 General Meteorological Scenario based on IMD Data

The nearest India Meteorological Department (IMD) station located to project site is Chennai (Minambakkam). The Climatological data for Chennai (Minambakkam) (13° 00' N and 80° 11' E), published by the IMD, based on daily observations at 08:30 and 17:30 hour IST for a 30-year period, is presented in the following sections on the meteorological conditions of the region. The monthly variations of the relevant meteorological parameters are reproduced to evaluate the baseline air quality of the study area, eight (08) monitoring locations have been identified as per annual wind predominance of Chennai (Minambakkam) from IMD data (1991-2020). The wind predominance during study period (**Mid January 2023- Mid of April 2023**) is from **South East**.

Table 3.5 Climatological Summary – Chennai (Minambakkam) Region (1991-2020)

Month	Temp (°C)		Rainfall (mm)		Relative Humidity (%)		Vapour Pressure hPa		Mean Wind Speed (Km/hr)	Predominant Wind Directions (From)*	
	Daily Max.	Daily Min.	Total	No. of days	08:30	17:30	08:30	17:30		08:30	17:30
Jan	29.9	20.9	20.0	1.4	83	64	24.6	22.8	4.8	NW	NE
Feb	31.7	21.8	4.7	0.6	80	62	25.6	23.8	5.7	NW	E
Mar	34.0	23.8	3.4	0.2	76	62	25.4	26.7	7.2	S	SE
Apr	35.9	26.2	17.5	1.0	73	66	31.4	30.5	8.7	S	SE
May	38.3	27.7	49.7	1.8	65	62	30.1	31.2	9.2	SW	SE
Jun	37.5	27.4	75.4	4.5	61	58	27.4	28.9	9.1	W	SE
Jul	35.8	26.4	113.1	6.7	67	59	27.5	28.4	8.1	W	SE
Aug	34.9	25.7	141.4	8.8	71	64	28.1	29.4	7.5	W	SE
Sep	34.4	25.4	143.9	7.4	75	68	29.3	29.8	6.4	W	SE
Oct	32.6	24.6	278.3	10.6	81	74	30.1	29.7	4.9	W	E
Nov	30.4	23.2	377.3	11.5	83	75	28.5	27.4	4.6	N	NE
Dec	29.4	21.7	183.7	5.7	83	69	25.7	24.1	5.0	N	NE
Max.	38.3	27.7	377.3	11.5	83	75	31.4	31.2	9.2	Annual predominant wind pattern is South East	
Min.	29.4	20.9	3.4	0.2	61	58	24.6	22.8	4.6		
Avg/Total	33.7	24.6	1408.4	60.2	75	65	28.1	27.7	6.8		

As per the above IMD Climatological the observations drawn are the following.

- Daily maximum temperature is 38.3°C and the daily minimum temperature is 20.9°C were recorded in the months of May and January respectively.
- Maximum and minimum relative humidity of 83% and 58% were recorded in the months of January, November, December and June respectively.
- Maximum and minimum rainfall of 377.3mm and 3.4mm was recorded in the months of November and March respectively.
- Maximum and minimum Mean wind speed is 9.2 Km/hr and 4.6 Km/hr was recorded in the months of May and November respectively. According to the above IMD data, Annual predominant wind pattern is from **South East**.

3.5.4 Meteorological Scenario during Study Period

The meteorological scenario in and around the project site is an essential requirement during study period for proper interpretation of baseline air quality status. Meteorological data was collected during the study period and is presented in Table below **Table 3-6** The wind rose for the study period is given below

Table 3-6 Meteorological Data for the Study Period

S. No	Parameter	Observation
1.	Temperature	Max Temperature : 38°C Min Temperature : 21°C Avg Temperature : 28.32°C
2.	Relative Humidity	74.44%
3.	Average Wind Speed	3.01 m/s
4.	Predominant Wind Direction	East

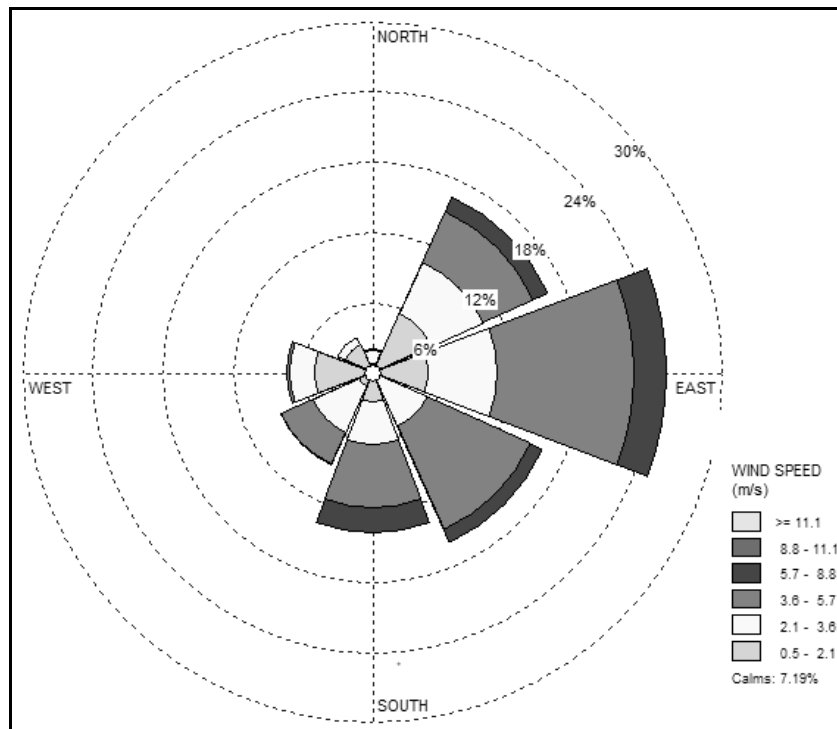


Figure 3-21 Wind Rose during Study period

3.5.5 Atmospheric Inversion

3.5.5.1 Ambient Air Quality

The selection criteria for monitoring locations are based on the following:

- Topography/Terrain
- Meteorological conditions – Upwind and Downwind locations
- Residential and sensitive areas within the study area
- Representatives of regional background air quality/pollution levels and
- Representation of likely impacted areas

3.5.5.2 Ambient Air Quality Monitoring Stations

To evaluate the baseline air quality of the study area, Eight (08) monitoring locations have been identified as per annual wind predominance of **Chennai (Minambakkam)** from IMD data (1991-2020). The wind predominance during study period (**mid of January 2023 to mid of April 2023**) is from **South East**. AAQ monitoring locations are selected based on Annual wind predominance, map showing the AAQ monitoring locations is given in **Table 3-7**.

Table 3-7 Details of Ambient Air Quality Monitoring Locations

Station Code	Location	Wind Pattern	Distance (~km) from Project boundary	Directions
AAQ1	Project Site	-	Within the Site	
AAQ2	Tiruvottiyur	c/w	3.16	N
AAQ3	Royapuram	c/w	0.37	S
AAQ4	George Town	c/w	3.16	SSW
AAQ5	Veysarpadi	c/w	3.96	WSW
AAQ6	Tondiarpet	c/w	0.44	W
AAQ7	Kodangiyur	c/w	4.16	W
AAQ8	Chinna Sekkadu	d/w	4.88	NW

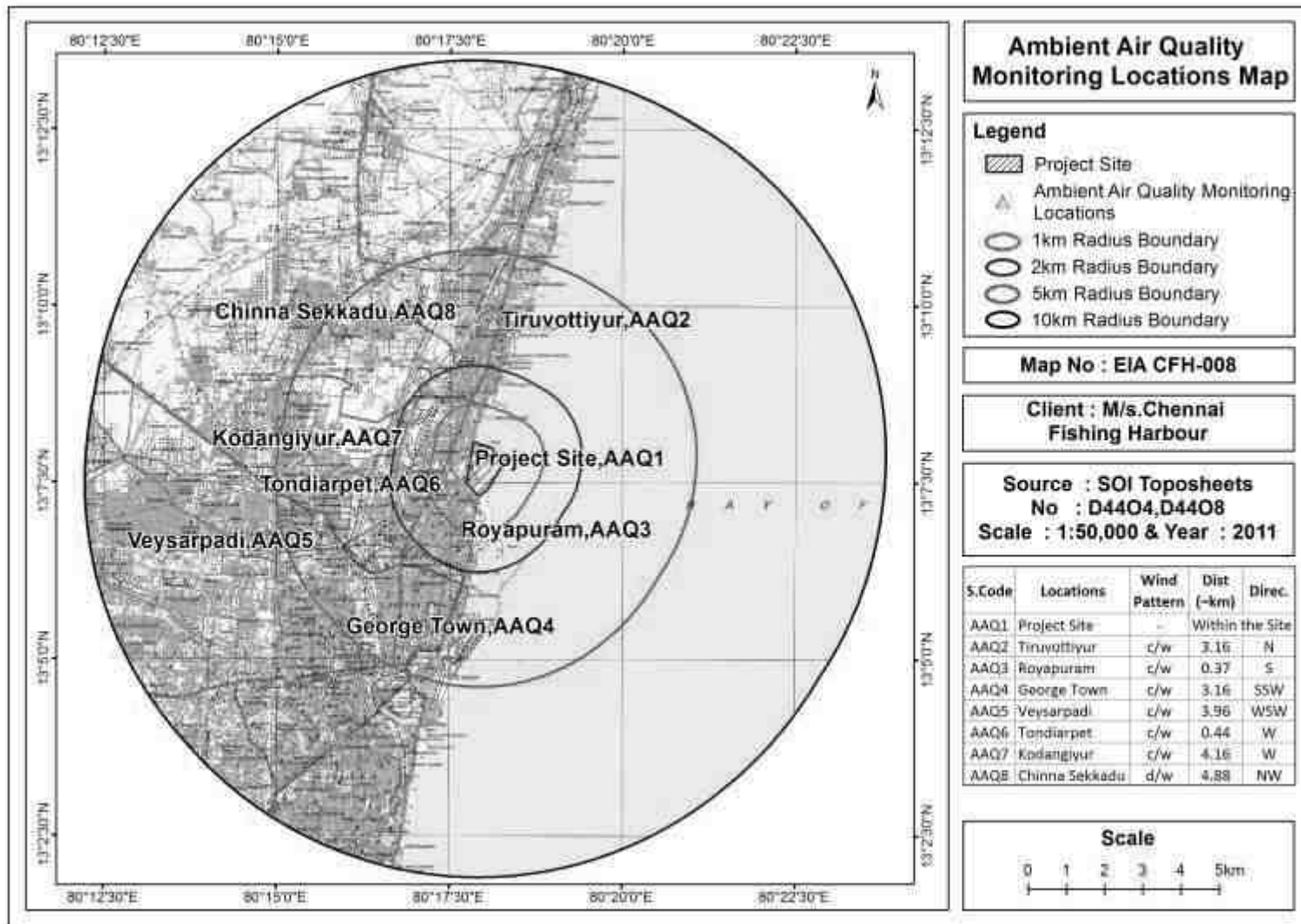


Figure 3-22 Map showing the Ambient Air Quality monitoring locations

3.5.5.3 Ambient Air Quality Monitoring Techniques and Frequency

Ambient air quality was monitored twice in a week for 3 months (Mid Jan to Mid April 2023) i.e. during pre-monsoon period. PM₁₀, PM_{2.5}, SO₂, NO_x, CO, O₃, Pb, NH₃, C₆H₆, C₂₀H₁₂, As & Ni were monitored. Sampling was carried out as per Central Pollution Control Board (CPCB) monitoring guidelines at each location. Analytical methods used for analysis of parameters are given in **Table 3.8**.

Table 3.8 Analytical Methods for Analysis of Ambient Air Quality Parameters

S. No	Parameters	Analytical method	NAAQ standards: 2009		Sampling Time
1	Sulphur Dioxide (SO ₂), µg/m ³	IS:5182(Part-2):2001	50 (Annual)	80(24 Hours)	24 Hours
2	Nitrogen Dioxide (NO ₂), µg/m ³	IS: 5182 (Part - 6): 2006	40 (Annual)	80 (24 Hours)	24 Hours
3	Particulate Matter (PM _{2.5}), µg/m ³	IS: 5182 (Part - 23): 2006	40 (Annual)	60 (24 hours)	24 Hours
4	Particulate Matter (PM ₁₀), µg/m ³	IS:5182 (Part– 23): 2006	60 (Annual)	100 (24 hours)	24 Hours
5	CO mg/m ³	IS:5182(Part–10):1999	2 (8 hours)	4 (1hour)	1 Hours
6	Pb µg/m ³	IS:5182(Part–22):2004	0.5(Annual)	1(24 hours)	24 Hours
7	O ₃ , µg/m ³	IS 5182 Part 9: 1974	100(8hours)	180 (1hour)	8 Hours
8	NH ₃ , µg/m ³	IS 5182 Part 25: 2018	100(Annual)	400(24 hours)	24Hours
9	Benzene, µg/m ³	IS 5182 Part 11: 2006	5 (Annual)	5 (Annual)	24 Hours
10	Benzo (a) pyrene, ng/m ³	IS 5182 Part 12 : 2004	1 (Annual)	1 (Annual)	24 Hours
11	Arsenic, ng/ m ³	HECS/AA/SOP/019,Issue No:01,Issue Date :16.12.:2016: 2016	6 (Annual)	6 (Annual)	24 Hours
12	Nickel, ng/ m ³	HECS/AA/SOP/009,issue No.01,Issue Date :16.12:2016: 2016	20 (Annual)	20 (Annual)	24 Hours

3.5.5.4 Results and Discussions

The variations of the pollutants PM₁₀, PM_{2.5}, SO₂, Pb, O₃, NH₃, C₆H₆, C₂₀H₁₂, As and Ni are compared with National Ambient Air Quality Standards (NAAQS), MoEF & CC Notification, November 2009. Ambient Air Quality Data for 3 months (Mid of Jan 2023 – Mid

of April 2023) for the study area is given in **Table 3-9** and trends of measured ambient concentration in the study area were graphically represented in **Figure 3-23**.

Table 3-9 Summaries of the average baseline concentrations of pollutants

Parameters	Conc.	NAAQ Standards	Locations							
			Project Site	Tiruvottiyur	Royapuram	George Town	Veysarpadi	Tondiarpet	Kodangiyur	Chinna Sekkadu
			AAQ1	AAQ2	AAQ3	AAQ4	AAQ5	AAQ6	AAQ7	AAQ8
PM10 Conc. (µg/m ³)	Min.	100 (24 Hours)	44.98	35.55	38.04	39.09	40.28	39.73	40.57	39.69
	Max.		64.11	50.66	54.22	55.72	57.41	56.62	57.82	56.56
	Avg.		53.94	42.63	45.62	46.88	48.31	47.64	48.66	47.59
	98th 'tile		63.73	50.36	53.90	55.39	57.07	56.29	57.49	56.23
PM2.5 Conc. (µg/m ³)	Min.	60 (24 Hours)	26.99	21.33	22.83	23.46	24.17	23.84	24.34	23.81
	Max.		38.46	30.39	32.53	33.43	34.44	33.97	34.69	33.94
	Avg.		32.37	25.58	27.38	28.13	28.99	28.59	29.20	28.56
	98th 'tile		38.24	30.22	32.34	33.24	34.24	33.78	34.49	33.74
SO2 Conc.(µg/m ³)	Min.	80 (24 Hours)	6.91	6.86	6.88	6.53	6.42	6.40	6.88	6.82
	Max.		9.85	9.77	9.81	9.31	9.15	9.13	9.81	9.72
	Avg.		8.30	8.23	8.26	7.84	7.71	7.69	8.26	8.19
	98th 'tile		9.80	9.71	9.75	9.25	9.10	9.07	9.75	9.67
NO2 Conc.(µg/m ³)	Min.	80 (24 Hours)	13.83	13.70	13.68	12.96	12.76	12.71	13.68	13.57
	Max.		19.71	19.53	19.81	18.47	18.19	18.11	19.50	19.33
	Avg.,		16.59	16.44	16.42	15.54	15.31	15.25	16.41	16.27
	98th 'tile		19.59	19.42	19.55	18.36	18.08	18.01	19.39	19.22

Pb ($\mu\text{g}/\text{m}^3$)	Avg.	1 (24 hour)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)	BLQ (LOQ 0.05)
CO (mg/m^3)	Avg.	4 (1hour)	0.54	0.43	0.46	0.47	0.48	0.48	0.49	0.48
Ozone(O_3), $\mu\text{g}/\text{m}^3$	Avg.	180 (1hour)	10.4	10.60	10.30	10.80	10.20	10.11	10.23	10.40
Benzene, $\mu\text{g}/\text{m}^3$	Avg.	5	BLQ (LOQ 1)	BLQ (LOQ 1)	BLQ (LOQ 1)	BLQ (LOQ 1)	BLQ (LOQ 1)	BLQ (LOQ 1)	BLQ (LOQ 1)	BLQ (LOQ 1)
Benzo (a) pyrene, ng/m^3	Avg.	1 (Annual)	BLQ (LOQ 1)	BLQ (LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ (LOQ 1)	BLQ(LOQ 1)
As (ng/m^3)	Avg.	6(Annual)	BLQ (LOQ 2)	BLQ (LOQ 2)	BLQ (LOQ 2)	BLQ (LOQ 2)	BLQ (LOQ 2)	BLQ (LOQ 2)	BLQ (LOQ 2)	BLQ (LOQ 2)
Ni (ng/m^3)	Avg.	20(Annu al)	BLQ (LOQ 10)	BLQ (LOQ 10)	BLQ (LOQ 10)	BLQ (LOQ 10)	BLQ (LOQ 10)	BLQ (LOQ 10)	BLQ (LOQ 10)	BLQ (LOQ 10)
NH₃ ($\mu\text{g}/\text{m}^3$)	Avg.	400 (24hours)	BLQ(LOQ 5)	BLQ(LOQ 5)	BLQ(LOQ 5)	BLQ(LOQ 5)	BLQ(LOQ 5)	BLQ(LOQ 5)	BLQ(LOQ5)	BLQ(LOQ 5)

Note: BLQ (Below Limit of Quantification); LOQ (Limit of Quantification)

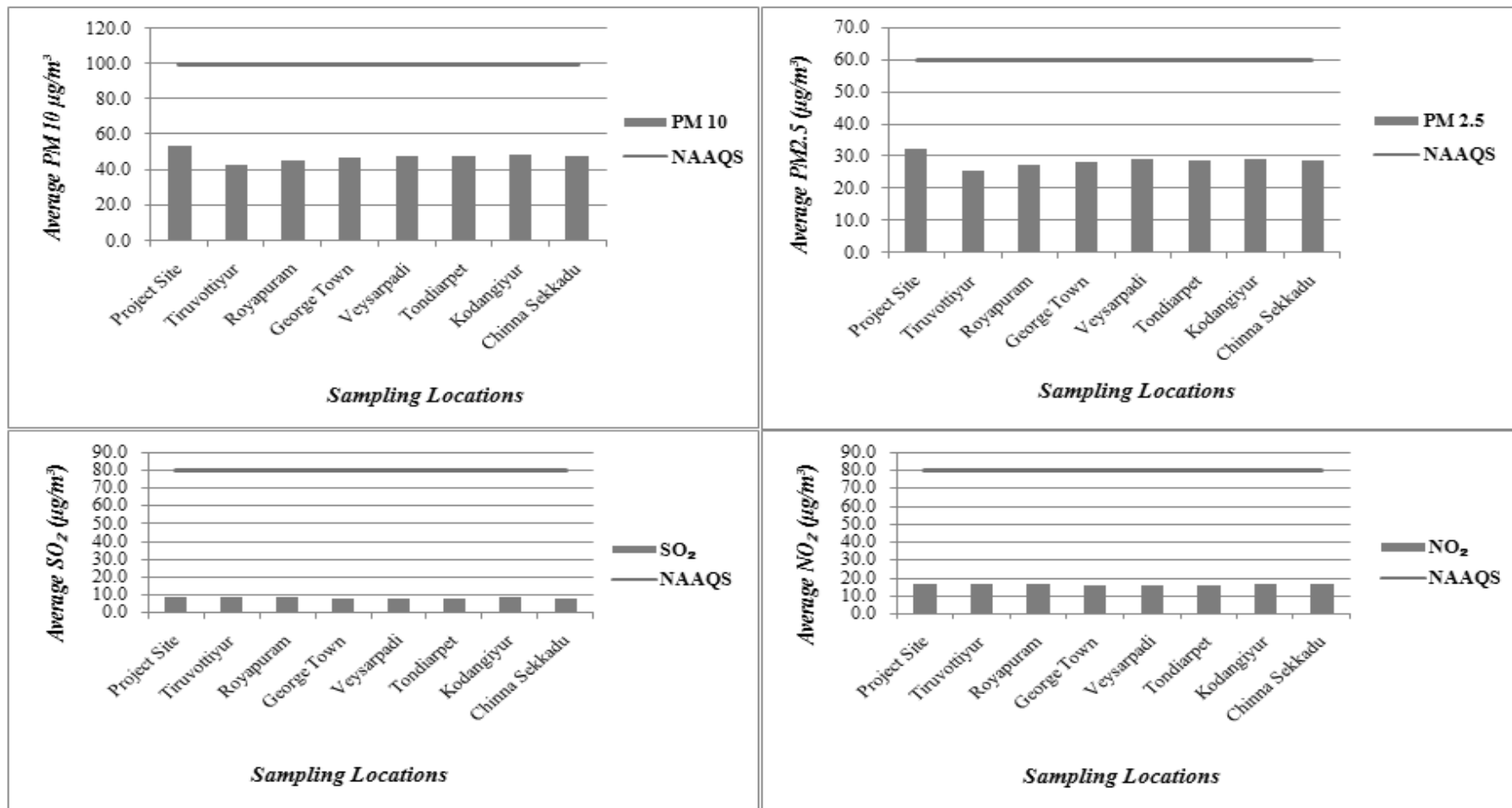


Figure 3-23 Trends of Measured Ambient Concentrations in the Study Area

3.5.5.5 Observations

The ambient air quality has been monitored at 8 locations for 12 parameters as per NAAQS, 2009 within the study area. The average baseline levels of PM10 is 42.63 to 53.94 $\mu\text{g}/\text{m}^3$, PM2.5 is 25.58 to 32.37 $\mu\text{g}/\text{m}^3$, SO2 is 7.69 to 8.30 $\mu\text{g}/\text{m}^3$, NO2 is 15.25 to 16.59 $\mu\text{g}/\text{m}^3$ and all the parameters are well within the National Ambient Air Quality Standards at all monitoring locations during the baseline study period.

3.6 Noise Environment

The prevailing ambient noise level at a particular location is nothing but the resultant (total) of all kinds of noise sources existing at various distances around that location. The ambient noise level at a location varies continuously depending on the type of surrounding activities.

Ambient noise levels have been established by monitoring noise levels at Eight (08) locations in and around 10 Km distance from project area during the study period using precision noise level meter. The noise monitoring locations in the study area were selected after giving due consideration to the various land use categories. The land use categories include commercial, residential, rural and sensitive areas. Noise levels were recorded on an hourly basis for one complete day at each location using pre- calibrated noise levels.

3.6.1.1 Results and Discussions

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

Ld: Average noise levels between 6:00 hours to 22.00 hours.

Ln: Average noise levels between 22:00 hours to 6.00 hours.

The comparison of day equivalent noise levels (Ld) and night equivalent noise levels (Ln) with the respective CPCB stipulated noise standards for various land use categories are shown in the **Table 3.10**.

Table 3.10 Day And Night Equivalent Noise Levels

S. No	Location	Location Code	Distance (~km) from Project boundary	Direction	Noise level in dB(A) Leq		CPCB Standard		Environmental Setting
					Day	Night	Lday (Ld)	LNight (Ln)	
1.	Project Site	N1	Within the Site		50.5	43.4	75	70	Industrial
2.	Tiruvottiyur	N2	3.16	N	52.3	44.7	55	45	Residential
3.	Royapuram	N3	0.37	S	51.7	43.3	55	45	Residential
4.	George Town	N4	3.16	SSW	52.3	42.8	55	45	Residential
5.	Veysarpadi	N5	3.96	WSW	54.8	44.3	55	45	Residential
6.	Tondiarpet	N6	0.44	W	53.2	42.2	55	45	Residential
7.	Kodangiyur	N7	4.16	W	54.6	41.5	55	45	Residential
8.	Chinna Sekkadu	N8	4.88	NW	53.6	40.2	55	45	Residential

3.6.1.2 Observations

It is observed that the day equivalent and night equivalent noise levels at all locations are within prescribed CPCB standards. In Industrial area, day time noise level ranges upto 50.5dB(A) and night time noise level ranges upto 43.4 dB(A) . The field observations during the study period indicate that the ambient noise levels in Industrial area does not exceeded the limit prescribed by CPCB (75 dB (A) Day time & 70 dB (A) Night time).

In residential area, day time max noise levels were in range of 50.5 to 54.8 dB (A) and 40.2 to 44.7 dB(A) during night time across the sampling stations .The field observations during the study period indicate that the ambient noise levels in Residential area does not noise exceeded the limit prescribed by CPCB (55 dB (A) Day time & 45 dB (A) Night time).

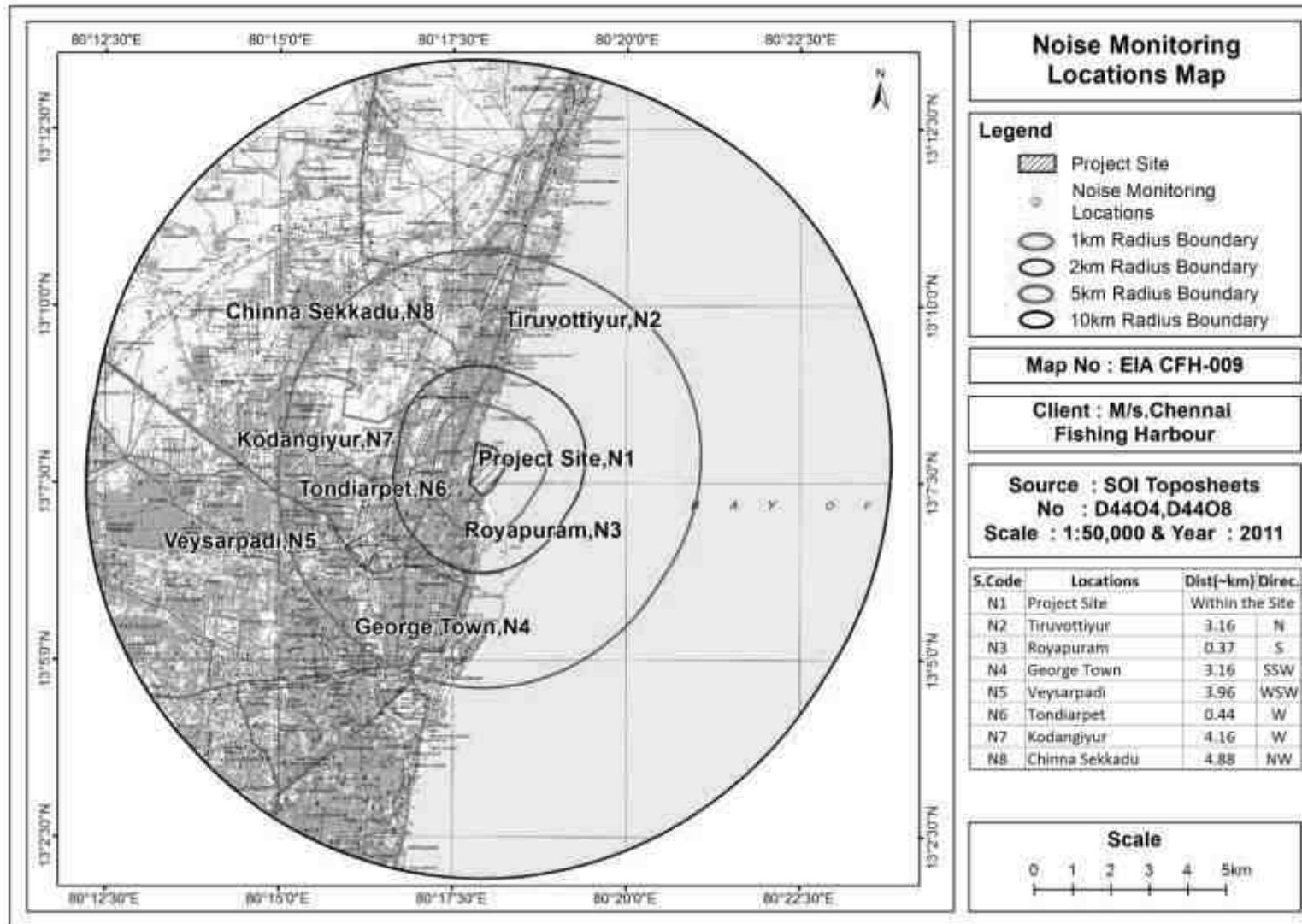


Figure 3-24 Map showing the noise monitoring locations

3.7 Water Environment

3.7.1.1 Surface Water Resources

The city is intersected by two languid streams, the Cooum and the Adyar. Cooum runs through the heart of the city and enters the sea in-between the Madras University buildings and the Fort. St. George underneath the Napier Bridge, while the latter wends its way through the southern part of the city and enters the sea near Adyar. These two rivers are almost stagnant and do not carry enough water except during rainy seasons. Cooum river starts from Kesavaram Anaicut in Kesavaram village built across Kortaliyar river. The surplus from Cooum tank joins this course at about 8 kms lower down and this point is actually the head of Cooum river which is located at 48 kms west of Chennai. The river receives a sizeable quantity of sewage from its neighbourhood for disposal. Though the river Adyar can be traced to a point near Guduvancheri village, it assumes the appearance of a stream only after it receives the surplus water from the Chembarambakkam tank as well as the drainage of the areas in the south-west of Chennai. The river has no commercial importance, but the fishermen in the neighbourhood make their living by fishing in the river.

The Buckingham canal which runs through the States of Tamil Nadu and Andhra Pradesh is a navigation canal. This canal runs almost parallel to the Coromandal coast within the limits of 5 kms from the coast. It joins up a series of natural backwaters and connects all the coastal districts from Guntur to South Arcot. Entering the city at Tondiarpet in the north and running along the western outskirts of George Town, it joins the new canal, southwest of General Hospital. The other canal worth mentioning in the city is the Otteri Nullah which commences from the village Mullam, runs eastwards upto Purasawalkam and then passes through Buckingham and Carnatic Mills and finally joins the Buckingham Canal, north of Basin Bridge Railway Station. The two principal currents, first from the north and second from the south flow parallel to the coast. The former sets in about the middle of October and continues till February while the latter starts by about August and continues till the burst of the northeast monsoon in the middle of October. These two principal currents must be caused by the winds

Source: http://censusindia.gov.in/2011census/dchb/DCHB_A/33/3302_PART_A_DCHB_CH_ENNAI.pdf

(Ref: Directorate of Census Operations-Tamil Nadu, “District Census Handbook-2011, Chennai District”, Series-34 Part XII-A)

3.7.1.2 Surface Water Quality Assessment

Water quality monitoring and assessment can be used to determine ambient water quality, the extent and causes of a water quality problem, or to measure the effectiveness of best management practices being implemented in water system. Monitoring helps to determine the trends in the quality of the aquatic environment and the impact due to the release of contaminants, other anthropogenic activities, and/or by waste treatment operations (impact monitoring). To establish the baseline status of water environment, the representative sampling locations for surface water within a radial distance of 10Km from project site have been selected as per CPCB guidelines of Water Quality Monitoring through an adequate survey of the project area. Test methods used for the analysis of water quality parameters is given in **Table 3.11**.

Table 3.11 Test Methods Used For the Analysis of Water Quality Parameters

S. No	Parameter Measured	Test Method
1.	pH	IS:3025 (Part - 11): 1983
2.	Conductivity	IS:3025 (Part - 14): 1983
3.	Total Dissolve Solids	IS:3025:1(Part - 16) 1984
4.	Total Suspended Solids	IS 3025 (Part - 17) 1984
5.	Alkalinity as CaCO ₃	IS:3025,1 (Part - 23) 1986
6.	Total Hardness as CaCo ₃	IS:3025 (Part - 21) 1983
7.	Sodium	IS:3025,5(Part - 45) 1993
8.	Potassium	IS:3025,5(Part - 45) 1993
9.	Calcium as Ca	IS 3025 (Part - 40):1991
10.	Magnesium as Mg	IS 3025 (Part - 46) 1994
11.	Chloride	IS 3025 (Part - 32):1988
12.	Sulphate SO ₄	IS 3025(Part - 24):1986
13.	Nitrate as NO ₃	ASTM(Part - 31)1978
14.	Fluorides as F	IS 3025 (Part - 60):2008
15.	Arsenic	IS 3025:(Part-37):1988
16.	Boron	IS:3025 (Part - 57):2003
17.	Cadmium	IS 3025 (Part - 41)1991
18.	Chromium, Total	IS:3025 (Part - 52) 2003
19.	Copper	IS:3025 (Part - 42)1992
20.	Lead	IS:3025 (Part - 47) 1994
21.	Manganese	IS 3025:(Part - 59):2006
22.	Mercury	IS 3025 (Part48):1994
23.	Nickel	IS 3025:(Part-54):2003
24.	Selenium	IS 3025 Part (56)2003
25.	Zinc	IS:3025 (Part - 49) 1994

S. No	Parameter Measured	Test Method
26.	Dissolved Oxygen	IS:3025 (Part - 38)1989
27.	BOD	5210B APHA22nd Edn 2012
28.	COD	IS:3025 (Part-58)-2006

Table 3.12 Details of Surface Water Sampling Locations

S. No	Name of the Water body	Location Code	Distance from Project Boundary (~Km)	Direction
1.	Marine Sample	SW1	Within the Site	
2.	Cooum/Kuvam River d/s	SW2	6.16	S
3.	Cooum/Kuvam River u/s	SW3	9.29	SW
4.	Bukingham Canal d/s	SW4	3.23	SW
5.	Otteri Nala	SW5	4.33	WSW
6.	Retteri Lake (Madavaram Eri)	SW6	9.19	W
7.	Bukingham Canal u/s	SW7	3.02	NNW
8.	Korttalaiyar/Kosissttalaiyar River	SW8	8.72	NNW

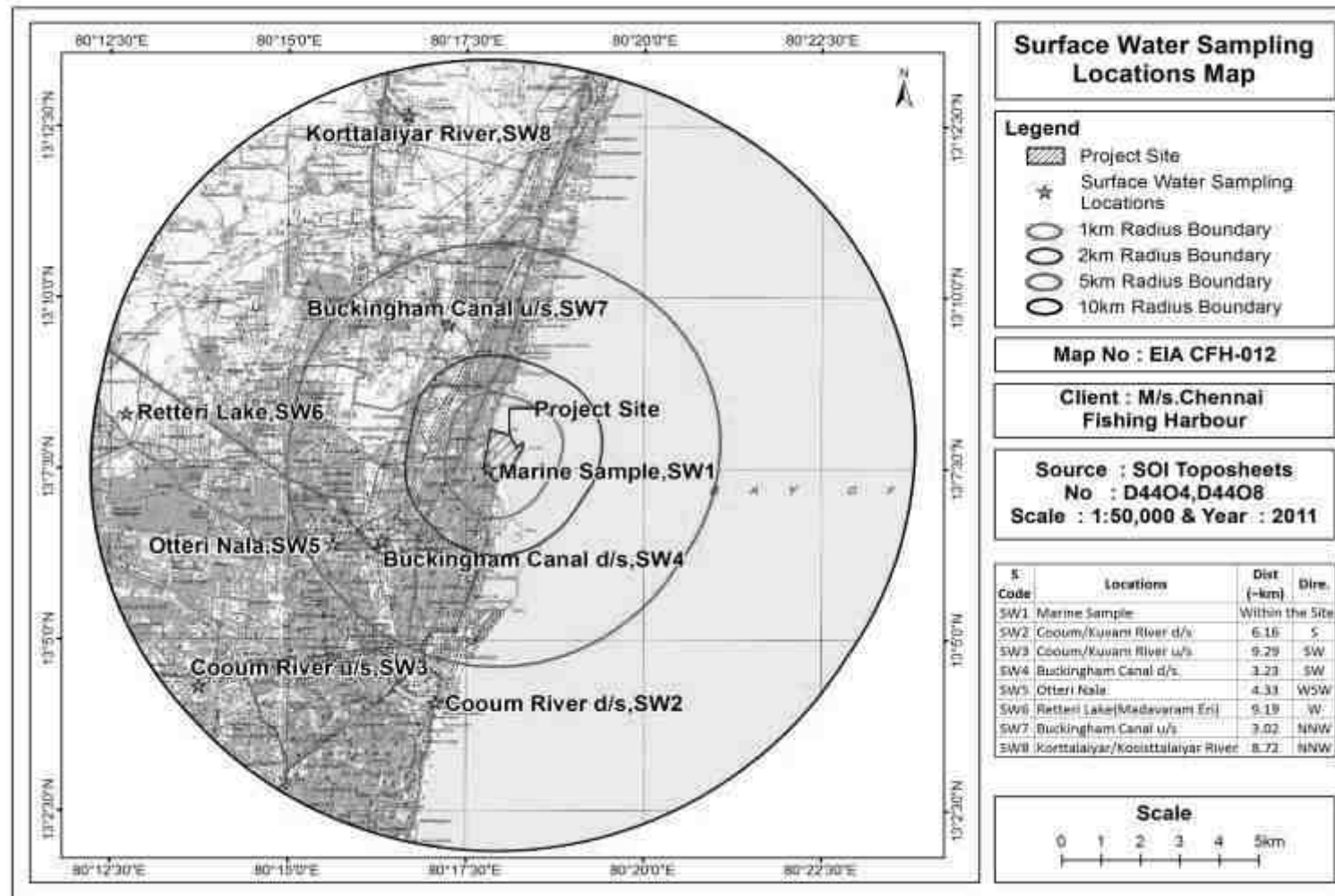


Figure 3-25 Map showing the surface water monitoring locations

Table 3.13 Physicochemical Parameters of Surface water samples from study area

	Parameter	Unit	Surface water standards (IS 2296 Class-A)	Marine sample near project site	Adyar River d/s	Adyar River u/s	Buckingham Canal d/s	Cooum River u/s	Buckingham Canal u/s	Otteri Nala	Cooum River d/s
				SW1	SW 2	SW 3	SW 4	SW 5	SW 6	SW 7	SW 8
1	pH (at 25°C)	--	6.5-8.5	8.17	6.78	7.23	6.69	7.42	7.47	7.58	6.90
2	Electrical Conductivity	µS/cm	-	52008	14797	4305	40314	39369	33087	2817	43350
3	Total Dissolved Solids	mg/l	500	30233	8729	2336	23670	23135	19635	1576	26450
4	Total Suspended Solids	mg/l	-	19	48	41	38	46	29	25	52
5	Total Alkalinity as CaCO ₃	mg/l	-	436.9	327.4	278.9	367.5	334.5	307.8	231.9	389.5
6	Total Hardness as CaCO ₃	mg/l	300	5503.8	1563.8	574.7	4306.0	4209.3	3569.7	297.0	4813.0
7	Sodium as Na	mg/l	-	8924	2535	618	6982	6825	5788	481	7804
8	Potassium as K	mg/l	-	398	113	27	311	304	258	21	348
9	Calcium as Ca	mg/l	-	1249.4	355.0	130.5	977.5	955.5	810.3	67.4	1092.6
10	Magnesium as Mg	mg/l	-	578.4	164.3	60.4	452.5	442.4	375.2	31.2	505.8
11	Chloride as Cl	mg/l	250	13280.0	3773.3	920.0	10390.0	10156.7	8613.3	574.1	11613.3
12	Sulphate as	mg/l	400	5511.2	1565.9	381.8	4311.9	4215.0	3574.5	238.2	4819.5

	SO ₄										
13	Nitrate as NO ₃	mg/l	20	2.8	5.1	4.0	3.8	6.0	3.7	3.4	4.4
14	Fluorides as F	mg/l	1.5	0.87	0.52	0.45	0.63	0.71	0.64	0.41	0.69
15	Cyanide	mg/l	0.05	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)
16	Arsenic	mg/l	0.05	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)	BLQ (LOQ 0.005)
17	Boron as B	mg/l	-	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)
18	Cadmium as Cd	mg/l	0.01	BLQ(LOQ 0.001)	BLQ(LOQ 0.001)	BLQ(LOQ 0.001)	BLQ(LOQ 0.001)	BLQ(LOQ 0.001)	BLQ(LOQ 0.001)	BLQ(LOQ 0.001)	BLQ(LOQ 0.001)
19	Chromium, Total	mg/l	0.05	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)
20	Copper as Cu	mg/l	1.5	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)
21	Lead as Pb	mg/l	0.1	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)
22	Manganese as Mn	mg/l	0.5	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)
23	Mercury	mg/l	0.001	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)
24	Nickel as Ni	mg/l	-	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)
25	Selenium as Se	mg/l	0.01	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)
26	Dissolved Oxygen	mg/l	6	6.5	5.7	5.9	5.5	5.2	5.9	5.7	5.1
27	Chemical Oxygen Demand as O ₂	mg/l	-	16.0	68.0	50.0	80.0	98.0	62.0	54.0	112.0

28	BOD, 3 days @ 27°C as O ₂	mg/l	2	2.0	12.0	8.0	12.0	16.0	10.0	8.0	17.0
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Note: **BLQ** – Below Limit of Quantification; **LOQ** – Limit of Quantification

3.7.1.3 Results and Discussions

Surface water sample results are discussed below:

- Surface Water sample results were compared with IS 2296:1992 and Marine water samples were compared with MoEF Standards 1998.
- The pH range in the collected surface water samples varies between 6.69 – 7.58 and for marine water sample was recorded 8.17.
- The Total Dissolved Solids range from 1576 mg/l to 26450 mg/l and for marine water sample was recorded 30233 mg/l.
- The chloride content in the surface water for study area ranges from 574.1 mg/l to 11613.3 mg/l and for sea water sample was recorded 13280.0 mg/l.
- The sulphate content in the surface water of the study area varies between 238.2 mg/l – 4819.5 mg/l and for sea water sample was observed 5511.2 mg/l.
- The Total hardness ranges between 297.0 mg/l – 4813.0 mg/l and for sea water sample was 5503.8 mg/l.
- BOD value of the collected surface water sample ranges from 8.0 mg/l to 17.0 mg/l and for sea water sample was obtained 2.0 mg/l.
- COD value of collected surface water varies from 50 to 112 mg/l and for sea water sample was 16.0 mg/l.
- The concentration of heavy metals like As, Cd, Cr, Pb, Mn, Hg, Ni and Se were within the limits of IS 2296:1992.

3.8 Marine Water Quality Assessment

There are total 10 sampling locations and from each location total 3 samples were taken surface, mid and bottom region. The water sampling is done by equipping Niskin water sampler.

Table 3.14 Physicochemical Parameters of marine water samples from study area (Mid of Jan 2023– Mid of April 2023)

S. No	Parameters	Units	Sea Water - ST1			Sea Water - ST2		
			Surface (Depth - 0 Meter)	Mid (Depth - 1.5 Meter)	Bottom (Depth - 3 Meter)	Surface (Depth - 0 Meter)	Mid (Depth - 1.5 Meter)	Bottom (Depth - 3 Meter)
1	pH (at 25 °C)	-	7.95	7.8	7.95	7.98	8.12	7.96
2	Total dissolved salts	mg/l	30752	26050	29040	29345	30085	30298

3	Alkalinity	mg/l	110	120	110	120	120	110
4	Electrical conductivity	µS/cm	44800	42800	41800	42700	43100	43300
5	Colour	Hazen Unit	BLQ(LO Q;1.0)	BLQ(LO Q;1)	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)
6	Turbidity	NTU	BLQ(LO Q;0.1)	BLQ(LO Q;0.1)	BLQ(LO Q;0.1)	BLQ(LO Q;0.1)	BLQ(LO Q;0.1)	BLQ(LO Q;0.1)
7	Odour	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
8	Sodium as Na	mg/l	8602	7225	8127	8270	8505	8508
9	Total Hardness as CaCO ₃	mg/l	5178	5064	5134	5091	5392	5565
10	Calcium as Ca	mg/l	480	408.4	427	436	480.96	465.3
11	Chloride as Cl	mg/l	17914.72	15044.41	16924.96	17221.89	17716.78	17716.77
12	Magnesium as Mg	mg/l	966.4	982	987.8	972	1017.8	1069.2
13	Sulphate as SO ₄	mg/l	1699.34	1610.06	1649.81	1670.12	1576.4	1644.41
14	Nitrate as NO ₃	mg/l	2.67	2.41	1.24	2.59	2.54	1.42
15	Iron as Fe	mg/l	BLQ(LO Q;0.01)	BLQ(LO Q;0.02)	BLQ(LO Q;0.01)	BLQ(LO Q;0.01)	BLQ(LO Q;0.01)	BLQ(LO Q;0.01)
16	Copper as Cu	mg/l	BLQ(LO Q;0.05)	BLQ(LO Q;0.05)	BLQ(LO Q;0.05)	BLQ(LO Q;0.05)	BLQ(LO Q;0.05)	BLQ(LO Q;0.05)
17	Lead as Pb	mg/l	0.7256	0.4003	0.2943	0.4652	0.4060	0.2777
18	Potassium as K	mg/l	604	507	571	580	597	597
19	Phosphate as PO ₄	mg/l	0.07	BLQ(LO Q;0.02)	0.11	0.06	0.1	BLQ(LO Q;0.02)
20	Total suspended solid	mg/l	BLQ(LO Q;1.0)	BLQ(LO Q;1)	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)
21	Carbonate	mg/l	BLQ(LO Q;1.0)	BLQ(LO Q;1)	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)
22	Bi Carbonate	mg/l	110	120	110	120	120	110
23	<u>BOD,5 days @27°C as O₂</u>	mg/l	2	4	5	3	4	6
24	COD as O ₂	mg/l	36	48	66	44	52	72
25	Total Chromium	mg/l	BLQ(LO Q;0.01)	BLQ(LO Q;0.01)	BLQ(LO Q;0.01)	BLQ(LO Q;0.01)	BLQ(LO Q;0.01)	BLQ(LO Q;0.01)

S. No	Parameters	Units	Sea Water - ST3			Sea Water - ST4		
			Surface (Depth - 0 Meter)	Mid (Depth - 1.5 Meter)	Bottom (Depth - 3 Meter)	Surface (Depth - 0 Meter)	Mid (Depth - 3 Meter)	Bottom (Depth - 6 Meter)
1	pH (at 25 °C)	-	7.25	7.1	7.19	7.05	7.08	7.15
2	Total dissolved	mg/l	29470	27788	25300	29202	27015	25395

	salts							
3	Alkalinity	mg/l	140	190	160	170	170	150
4	Electrical conductivity	µS/cm	38800	35300	36200	38300	35000	33000
5	Colour	Hazen Unit	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)
6	Turbidity	NTU	3.2	BLQ(LO Q;0.1)	BLQ(LO Q;0.1)	3	BLQ(LO Q;0.1)	BLQ(LO Q;0.1)
7	Odour	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
8	Sodium as Na	mg/l	7412	6890	7082	6748	6415	6083
9	Total Hardness as CaCO ₃	mg/l	4840	4689	4827	4671	4814	4856
10	Calcium as Ca	mg/l	400.8	397.4	410.36	380.64	403.9	410.2
11	Chloride as Cl	mg/l	15440.3	14351.58	14747.48	14054.65	13361.81	12668.9
12	Magnesium as Mg	mg/l	932.4	897.6	923.4	903.6	924	930.6
13	Sulphate as SO ₄	mg/l	1662.4	1650.72	1615.78	1540.2	1533	1683
14	Nitrate as NO ₃	mg/l	4.84	3.98	1.42	3.94	4.37	3.07
15	Iron as Fe	mg/l	0.08	BLQ(LO Q;0.01)	BLQ(LO Q;0.01)	0.07	BLQ(LO Q;0.01)	BLQ(LO Q;0.01)
16	Copper as Cu	mg/l	BLQ(LO Q;0.05)	BLQ(LO Q;0.05)	BLQ(LO Q;0.05)	BLQ(LO Q;0.05)	BLQ(LO Q;0.05)	BLQ(LO Q;0.05)
17	Lead as Pb	mg/l	0.5986	0.3584	0.4715	1.0911	0.4926	0.4081
18	Potassium as K	mg/l	520	483	498	475	451	428
19	Phosphate as PO ₄	mg/l	0.25	0.31	0.94	1.81	0.06	0.07
20	Total suspended solid	mg/l	7	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)	6	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)
21	Carbonate	mg/l	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)
22	Bi Carbonate	mg/l	140	190	160	170	170	150
23	<u>BOD,5 days @27°C as O₂</u>	mg/l	2	5	6	3	4	5
24	COD as O ₂	mg/l	44	56	64	48	56	68
25	Total Chromium	mg/l	BLQ(LO Q;0.01)	BLQ(LO Q;0.01)	BLQ(LO Q;0.01)	BLQ(LO Q;0.01)	BLQ(LO Q;0.01)	BLQ(LO Q;0.01)

S. No	Parameters	Units	Sea Water - ST5			Sea Water - ST6		
			Surface (Depth - 0 Meter)	Mid (Depth - 3 Meter)	Bottom (Depth - 6 Meter)	Surface (Depth - 0 Meter)	Mid (Depth - 3 Meter)	Bottom (Depth - 6 Meter)
1	pH (at 25 °C)	-	7.15	7.71	7.03	7.07	7.25	7.61
2	Total dissolved	mg/l	28012	27370	24610	28898	27690	26840

	salts							
3	Alkalinity	mg/l	130	140	160	170	140	140
4	Electrical conductivity	µS/cm	37300	40200	36700	36200	38500	38100
5	Colour	Hazen Unit	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)	BLQ(LO Q1.0)	BLQ(LO Q;1.0)
6	Turbidity	NTU	2.1	BLQ(LO Q;0.1)	BLQ(LO Q;0.1)	BLQ(LO Q;0.1)	2.5	BLQ(LO Q;0.1)
7	Odour	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
8	Sodium as Na	mg/l	7176	7698	6844	6605	7460	7223
9	Total Hardness as CaCO ₃	mg/l	5155	5120	5168	4865	4748	4916
10	Calcium as Ca	mg/l	430.7	450.16	441	420.9	409.4	415.18
11	Chloride as Cl	mg/l	14954.43	16034.17	14252	13757.19	15539.29	15044.41
12	Magnesium as Mg	mg/l	990.6	970.4	987.6	926.2	904.8	942
13	Sulphate as SO ₄	mg/l	1620.4	1491.8	1558.8	1642.3	1688.8	1590.6
14	Nitrate as NO ₃	mg/l	5.21	4.47	2.71	4.22	5.15	4.04
15	Iron as Fe	mg/l	0.09	BLQ(LO Q;0.01)	BLQ(LO Q;0.01)	BLQ(LO Q;0.01)	0.09	BLQ(LO Q;0.01)
16	Copper as Cu	mg/l	BLQ(LO Q;0.05)	BLQ(LO Q;0.05)	BLQ(LO Q;0.05)	BLQ(LO Q;0.05)	BLQ(LO Q;0.05)	BLQ(LO Q;0.05)
17	Lead as Pb	mg/l	0.7055	0.4205	0.3248	0.7331	0.3709	0.2938
18	Potassium as K	mg/l	505	540	481	463	523	507
19	Phosphate as PO ₄	mg/l	0.17	BLQ(LO Q;0.02)	BLQ(LO Q;0.02)	0.25	0.16	BLQ(LO Q;0.02)
20	Total suspended solid	mg/l	4	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)	6	BLQ(LO Q;1.0)
21	Carbonate	mg/l	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)
22	Bi Carbonate	mg/l	130	140	160	170	140	140
23	<u>BOD₅ days @27°C as O₂</u>	mg/l	2	3	6	3	4	5

24	COD as O ₂	mg/l	40	52	68	36	48	60
25	Total Chromium	mg/l	BLQ(LO Q;0.01)	BLQ(LO Q;0.01)	BLQ(LO Q;0.01)	BLQ(LO Q;0.01)	BLQ(LO Q;0.01)	BLQ(LO Q;0.01)

S. No	Parameters	Units	Sea Water - ST7			Sea Water - ST8		
			Surface (Depth - 0 Meter)	Mid (Depth - 4.5 Meter)	Bottom (Depth - 9 Meter)	Surface (Depth - 0 Meter)	Mid (Depth - 4.5 Meter)	Bottom (Depth - 9 Meter)
1	pH (at 25 °C)	-	7.09	7.25	7.07	7.15	7.23	7.09
2	Total dissolved salts	mg/l	27595	26550	24905	26142	23455	22555
3	Alkalinity	mg/l	160	130	160	160	150	160
4	Electrical conductivity	µS/cm	40800	38200	35400	37600	36000	37100
5	Colour	Hazen Unit	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)
6	Turbidity	NTU	BLQ(LO Q;0.1)	2	BLQ(LO Q;0.1)	3.1	BLQ(LO Q;0.1)	BLQ(LO Q;0.1)
7	Odour	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable
8	Sodium as Na	mg/l	7745	7413	6368	7318	6415	6178
9	Total Hardness as CaCO ₃	mg/l	4838	4817	4770	4749	4654	4880
10	Calcium as Ca	mg/l	424.04	406.38	420.78	430.9	421.16	450.42
11	Chloride as Cl	mg/l	16133.15	15440.3	13262.83	15242.36	13361.81	12866.93
12	Magnesium as Mg	mg/l	917.8	923.4	903.1	892	874.8	912
13	Sulphate as SO ₄	mg/l	1619.6	1673.98	1469.4	1581.02	1627.8	1510.2
14	Nitrate as NO ₃	mg/l	4.63	4.08	2.3	4.71	2.83	2.36
15	Iron as Fe	mg/l	BLQ(LO Q;0.01)	0.06	BLQ(LO Q;0.01)	0.07	BLQ(LO Q;0.01)	BLQ(LO Q;0.01)
16	Copper as Cu	mg/l	BLQ(LO	BLQ(LO	BLQ(LO	BLQ(LO	BLQ(LO	BLQ(LO

			Q;0.05)	Q;0.05)	Q;0.05)	Q;0.05)	Q;0.05)	Q;0.05)
17	Lead as Pb	mg/l	0.4996	0.4564	0.3942	0.3048	0.3808	0.3287
18	Potassium as K	mg/l	543	520	447	513	450	434
19	Phosphate as PO ₄	mg/l	0.2	0.3	0.1	4.7	0.37	0.34
20	Total suspended solid	mg/l	BLQ(LO Q;1.0)	5	BLQ(LO Q;1.0)	7	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)
21	Carbonate	mg/l	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)
22	Bi Carbonate	mg/l	160	130	160	160	150	160
23	<u>BOD,5 days @27°C as O₂</u>	mg/l	2	5	5	4	5	6
24	COD as O ₂	mg/l	40	60	60	48	52	68
25	Total Chromium	mg/l	BLQ(LO Q;0.01)	BLQ(LO Q;0.01)	BLQ(LO Q;0.01)	BLQ(LO Q;0.01)	BLQ(LO Q;0.01)	BLQ(LO Q;0.01)

S. No	Parameters	Units	Sea Water - ST9			Sea Water - ST10		
			Surface (Depth - 0 Meter)	Mid (Depth - 4.5 Meter)	Bottom (Depth - 9 Meter)	Surface (Depth - 0 Meter)	Mid (Depth - 6 Meter)	Bottom (Depth - 12 Meter)
1	pH (at 25 °C)	-	7.31	7.09	7.13	7.05	7.25	7.09
2	Total dissolved salts	mg/l	28695	25630	25460	28995	24570	25240
3	Alkalinity	mg/l	150	140	150	150	130	170
4	Electrical conductivity	µS/cm	38400	36800	37900	38800	37400	36500
5	Colour	Hazen Unit	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)
6	Turbidity	NTU	BLQ(LO Q;0.1)	BLQ(LO Q;0.1)	BLQ(LO Q;0.1)	BLQ(LO Q;0.1)	BLQ(LO Q;0.1)	BLQ(LO Q;0.1)
7	Odour	-	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable	Agreeable

8	Sodium as Na	mg/l	6557	7175	7130	6985	6748	7082
9	Total Hardness as CaCO ₃	mg/l	4716	4634	4746	4771	4794	4857
10	Calcium as Ca	mg/l	405.62	413.2	410.9	440.74	420.49	436.18
11	Chloride as Cl	mg/l	13658.74	14945.43	14846.46	14549.53	14054.6	14747.48
12	Magnesium as Mg	mg/l	899.2	874.8	903.4	891.3	909.2	914.9
13	Sulphate as SO ₄	mg/l	1518	1625.8	1549.8	1506.32	1690.4	1405
14	Nitrate as NO ₃	mg/l	4.29	3.44	3.3	4.05	3.67	2.15
15	Iron as Fe	mg/l	BLQ(LO Q;0.01)	BLQ(LO Q;0.01)	BLQ(LO Q;0.01)	BLQ(LO Q;0.01)	BLQ(LO Q;0.01)	BLQ(LO Q;0.01)
16	Copper as Cu	mg/l	BLQ(LO Q;0.05)	BLQ(LO Q;0.05)	BLQ(LO Q;0.05)	BLQ(LO Q;0.05)	BLQ(LO Q;0.05)	BLQ(LO Q;0.05)
17	Lead as Pb	mg/l	0.2395	0.2850	0.2482	0.1982	0.3346	0.3094
18	Potassium as K	mg/l	459	505	502	489	474	497
19	Phosphate as PO ₄	mg/l	0.25	0.17	BLQ(LO Q;0.02)	0.42	0.27	BLQ(LO Q;0.02)
20	Total suspended solid	mg/l	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)
21	Carbonate	mg/l	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)	BLQ(LO Q;1.0)
22	Bi Carbonate	mg/l	160	140	150	150	130	170
23	<u>BOD,5 days @27°C as O₂</u>	mg/l	3	3	6	2	4	4
24	COD as O ₂	mg/l	44	56	72	36	52	64
25	Total Chromium	mg/l	BLQ(LO Q;0.01)	BLQ(LO Q;0.01)	BLQ(LO Q;0.01)	BLQ(LO Q;0.01)	BLQ(LO Q;0.01)	BLQ(LO Q;0.01)

3.8.1.1 Results and Discussions

The results of surface water samples taken at the marine environment are discussed below:

1. Marine water samples were compared with MoEF Standards 1998.

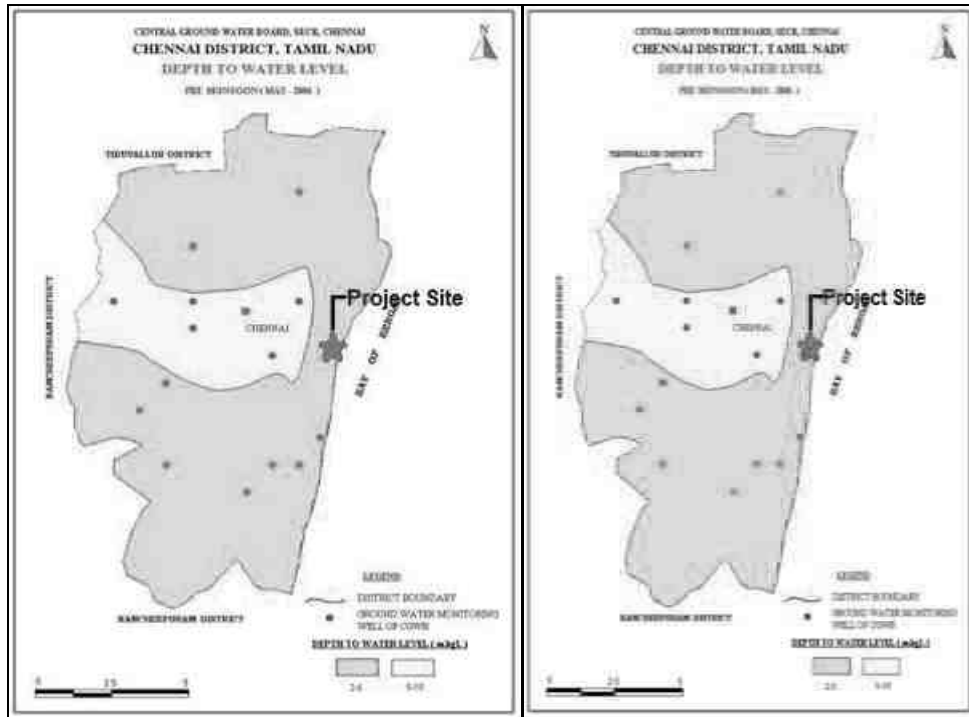
2. The pH range in the collected surface water samples varies between 7.03 – 8.12
3. The Total Dissolved Solids range from 22555 mg/l to 30752 mg/l.
4. The chloride content in the surface water for study area ranges from 12668.9 mg/l to 17914.7 mg/l.
5. The sulphate content in the surface water of the study area varies between 1405 mg/l – 1699.34 mg/l.
6. The Total hardness ranges between 4634 mg/l – 5565 mg/.
7. BOD value of the collected surface water sample ranges from 2 mg/l to 6 mg/l .
8. COD value of collected surface water varies from 36 to 72 mg/l.

3.9 Ground water resources

The groundwater potential of the gross geographical area of the basin is estimated on pro-rata basis from the district-wise groundwater resources-2009 published by the Central Groundwater Board (CGWB) as given below.

Table 3.15 The yield and depth of aquifers

Formation	Type of well	Depth range (m BGL)	Yield (lps)
Alluvium	Tube well	10 - 30	1 - 12
	Dug well	6 - 11	0.058 - 1.16
Sand stone	Tube well	20 - 28	2 - 3
Gondwana	Tube well	20 - 60	1 - 3
Crystalline	Bore well	10 - 15	Up to 4



Source: http://cgwb.gov.in/District_Profile/TamilNadu/chennai.pdf

Figure 3-26 Depth to water level during Pre-Monsoon & Post Monsoon of Chennai District

3.9.1 Ground water Quality

Groundwater is the principal source for domestic and drinking purposes in almost all towns/wards near the study area. The quality of the groundwater received is influenced by pollution of soil and air, industrial and domestic waste disposal, organic components, pathogenic microorganisms, application of fertilizers and pesticides in agriculture, etc. Total Eight (08) ground water monitoring locations were identified for assessment in different locations/villages/towns around the project site based on the usage of sub surface water by the settlements/ villages/towns in the study area. The groundwater results are compared with the desirable and permissible water quality standards as per IS: 10500 (2012) for drinking water. Groundwater quality monitoring locations and results are given in **Table 3.16** and **Table 3.17**. Map showing the groundwater monitoring locations are given in **Figure 3-27**.

Table 3.16 Details of Groundwater Quality Monitoring Locations

Station Code	Location	Distance (~km) from Project boundary	Directions
GW1	Project Site	Within the site	
GW2	Tiruvottiyur	3.16	N
GW3	Royapuram	0.37	S
GW4	George Town	3.16	SSW
GW5	Veysarpadi	3.96	WSW
GW6	Tondiarpet	0.44	W
GW7	Kodangiyur	4.16	W
GW8	Chinna Sekkadu	4.88	NW

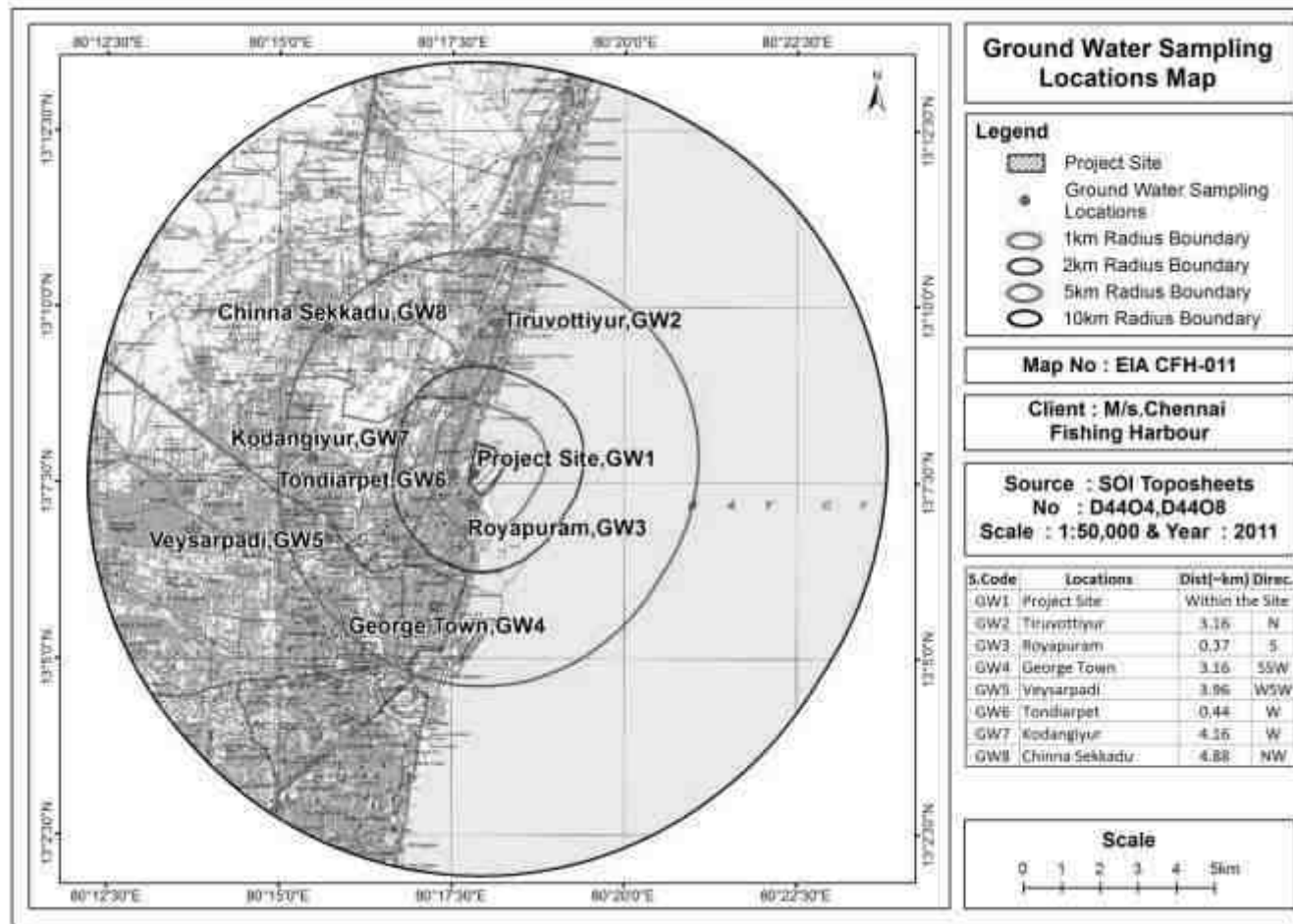


Figure 3-27 Map showing the groundwater monitoring locations

Table 3.17 Physico-chemical analysis of Ground water samples from study area

Sl. No	Parameters	Unit	Drinking water Standard (IS 10500: 2012) Permissible Limit	Drinking water Standard (IS 10500: 2012) Acceptable Limit	Near Project Site	Tiruvottiyur	Royapuram	George Town	Veysaradi	Tondiarpet	Kodangiyur	Chinna Sekkadu
					GW1	GW2	GW3	GW4	GW5	GW6	GW7	GW8
1.	Colour	Hazen	15	5	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)
2.	Turbidity	NTU	5	1	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)
3.	pH	--	NR	6.5-8.5	7.98	7.6	7.37	7.96	7.8	7.75	7.41	7.83
4.	Conductivity	µS/cm	-	-	2098	1887	1675	1732	1427	1526	1843	1478
5.	Total Dissolve Solids	mg/l	2000	500	1166	1040	911	934	802	835	1018	812
6.	Total Suspended Solids		-	-	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)	BLQ(LOQ 1)
7.	Alkalinity as CaCO ₃	mg/l	600	200	301	269	234	241	198	215	261	209
8.	Total Hardness as CaCO ₃	mg/l	600	200	478	427	372	390	315	348	415	338
9.	Sodium as Na	mg/l	-	-	221	197	172	177	178	157	191	153
10.	Potassium as K	mg/l	-	-	15	14	12	10	7	8	13	7
11.	Calcium as Ca	mg/l	200	75	108.6	96.9	84.5	88.5	71.5	79.0	94.1	76.7
12.	Magnesium as Mg	mg/l	100	30	50.3	44.9	39.1	41.0	33.1	36.6	43.6	35.5
13.	Chloride as Cl	mg/l	1000	250	395.0	352.5	307.5	316.0	260.0	282.0	342.5	274.0
14.	Sulphate SO ₄	mg/l	400	200	163.9	146.3	127.6	131.1	107.9	117.0	142.1	113.7
15.	Nitrate as NO ₃	mg/l	NR	45	4.3	6.5	7.8	4.8	5.5	6.2	7.1	5.4
16.	Fluorides as F		1.5	1	0.48	0.46	0.44	0.43	0.41	0.40	0.45	0.42

Sl. No	Parameters	Unit	Drinking water Standard (IS 10500: 2012) Permissible Limit	Drinking water Standard (IS 10500: 2012) Acceptable Limit	Near Project Site	Tiruvottiyur	Royapuram	George Town	Veysarpadi	Tondiarpet	Kodangiyur	Chinna Sekkadu
					GW1	GW2	GW3	GW4	GW5	GW6	GW7	GW8
17.	Cyanide	mg/l	NR	0.05	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)
18.	Arsenic as As	mg/l	0.05	0.01	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)
19.	Boron as B	mg/l	1.0	0.5	BQL(LOQ 0.1)	BQL(LOQ 0.1)	BQL(LOQ 0.1)	BQL(LOQ 0.1)	BQL(LOQ 0.1)	BQL(LOQ 0.1)	BQL(LOQ 0.1)	BQL(LOQ 0.1)
20.	Cadmium as Cd	mg/l	NR	0.003	BQL(LOQ 0.001)	BQL(LOQ 0.001)	BQL(LOQ 0.001)	BQL(LOQ 0.001)	BQL(LOQ 0.001)	BQL(LOQ 0.001)	BQL(LOQ 0.001)	BQL(LOQ 0.001)
21.	Chromium as Cr	mg/l	NR	0.05	BQL(LOQ 0.01)	BQL(LOQ 0.01)	BQL(LOQ 0.01)	BQL(LOQ 0.01)	BQL(LOQ 0.01)	BQL(LOQ 0.01)	BQL(LOQ 0.01)	BQL(LOQ 0.01)
22.	Copper as Cu	mg/l	1.5	0.05	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)
23.	Lead as Pb	mg/l	NR	0.01	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)
24.	Manganese as Mn	mg/l	0.3	0.1	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)	BLQ(LOQ 0.05)
25.	Mercury	mg/l	NR	0.001	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)	BLQ(LOQ 0.0005)

Sl. No	Parameters	Unit	Drinking water Standard (IS 10500: 2012) Permissible Limit	Drinking water Standard (IS 10500: 2012) Acceptable Limit	Near Project Site	Tiruvottiyur	Royapuram	George Town	Veysarpadi	Tondiarpet	Kodangiyur	Chinna Sekkadu
					GW1	GW2	GW3	GW4	GW5	GW6	GW7	GW8
						0.0005)			0.0005)	0.0005)	0.0005)	
26.	Nickel as Ni	mg/l	NR	0.02	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)	BLQ(LOQ 0.01)
27.	Selenium as Se	mg/l	NR	0.01	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)	BLQ(LOQ 0.005)
28.	Zinc as Zn	mg/l	15	5	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)

(Note: BLQ – Below Limit of Quantification; LOQ – Limit of Quantification; NR – No Relaxation)

3.9.2 Results and Discussions

A summary of analytical results are presented below:

- The ground water results of the study area indicate that the pH range varies between 7.37 and 7.98. It is observed that the pH range is within the permissible limit of IS 10500:2012.
- The Total Dissolved Solids range of the collected ground water sample is varied between 802 mg/l – 1166 mg/l. All the samples are within the permissible limit of IS 10500: 2012.
- The acceptable limit of the chloride content is 250mg/l and permissible limit is 1000 mg/l. The chloride content in the collected ground water samples in the study area ranges between 260 mg/l – 395 mg/l. It is observed that all the samples are within the permissible limit of IS 10500:2012.
- The acceptable limit of the sulphate content is 200mg/l and permissible limit is 400mg/l. the sulphate content in the collected ground water samples in the study area is varied between 107.9 mg/l – 163.9 mg/l. It is observed that all the samples are meeting the acceptable limit of the IS 10500: 2012.
- The Total hardness ranges is between 315 mg/l – 478 mg/l for ground water samples. It is observed that all the samples are within the permissible limit of the IS 10500: 2012.

3.10 Soil as a resource and its Quality

Chennai's major soil types are beach sands, clay and alluvial soils In order to assess the quality of soil at different locations in the study area; various land use categories were taken into account. Soil sampling was carried out at Eight (08) locations in the study area. Soil analysis was carried as per IS: 2720 methods. Soil quality monitoring locations, results and Soil ICAR classification are given in **Table 3.18** and **Table 3.18**. Map showing the soil monitoring locations and soil texture classification are given in **Figure 3-28**.

Table 3.18 Soil Quality Monitoring Locations

Location Code	Location	Distance (km) from Project boundary	Azimuth Directions
S1	Project Site	Within the Site	
S2	Tiruvottiyur	3.16	N
S3	Royapuram	0.37	S
S4	George Town	3.16	SSW
S5	Veysarpadi	3.96	WSW
S6	Tondiarpet	0.44	W
S7	Kodungaiyur	4.16	W
S8	Chinna Sekkadu	4.88	NW

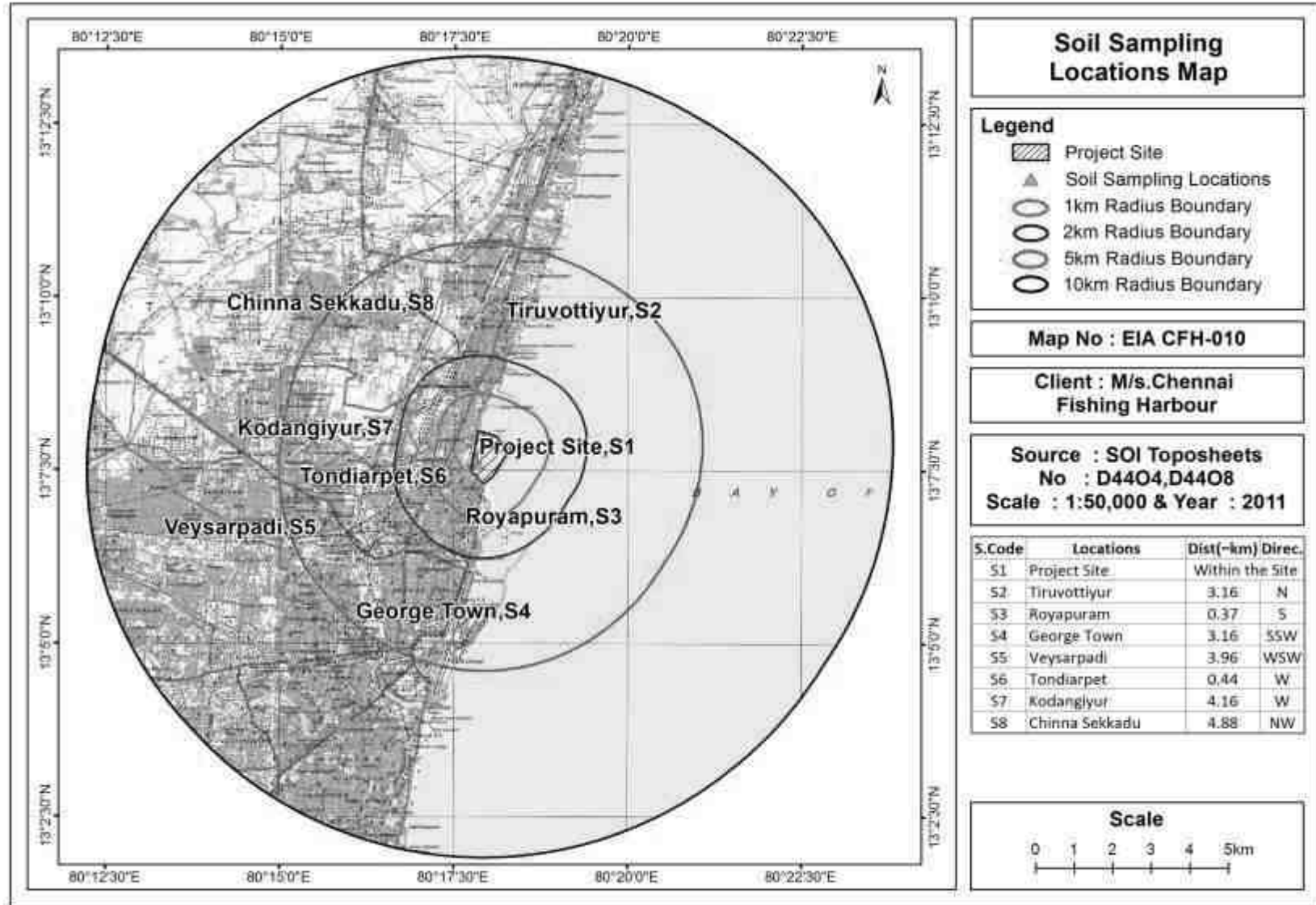


Figure 3-28 Map showing the soil monitoring locations

Table 3.19 Physico-Chemical parameters of soil samples from the study area

S.No	Parameters	Units	Project Site	Tiruvottiyur	Royapuram	George Town	Veysarpadi	Tondiarpet	Kodangiyur	Chinna Sekkadu
			S1	S2	S3	S4	S5	S6	S7	S8
1.	Soil Texture	-	Sandy Clay	Clay loam	Sandy Clay	Clay loam	Sandy Clay	Clay loam	Sandy Clay loam	Clay loam
2.	Sand	%	45.2	35.4	46.2	33.1	46.5	32.7	45.6	33.4
3.	Silt	%	19.4	26.6	17.4	29.9	18.3	30.8	20.2	31.2
4.	Clay	%	35.4	38.0	36.4	37.0	35.2	36.5	34.2	35.4
5.	pH	-	7.52	7.32	7.54	7.10	7.12	7.12	7.43	6.12
6.	Electrical conductivity	µS/cm	175	157	143	168	136	129	186	182
7.	Nitrogen as N	mg/kg	120.2	115.3	110.6	115.8	120.7	95.4	98.6	105.2
8.	Phosphorus	mg/kg	5.83	5.16	4.93	5.16	5.38	4.26	4.39	4.71
9.	Potassium	mg/kg	75.25	69.82	66.79	69.82	72.86	57.68	59.50	63.75
10.	Boron	mg/kg	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)
11.	Cadmium	mg/kg	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)

12.	Chromium	mg/kg	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)	BLQ(LOQ 0.1)
13.	Porosity	-	0.42	0.75	0.42	0.73	0.42	0.74	0.42	0.71
14.	Water holding Capacity	%	15.80	17.80	15.80	17.60	16.20	17.70	19.80	18.00

Note: BLQ – Below Limit of Quantification; LOQ – Limit Of Quantification

3.10.1 Results and Discussions

Summary of analytical results for major parameters are given below:

- The pH of the soil samples ranged from 6.12 to 7.54.
- Conductivity of the soil samples ranged from 129 to 186 $\mu\text{S}/\text{cm}$
- Nitrogen content in the collected soil samples ranged from 95.4 mg/kg to 120.7 mg/kg
- Phosphorous content ranged from 4.26 mg/kg to 5.83 mg/kg.
- Potassium content ranges from 57.68 mg/kg to 75.25 mg/kg.

3.10.2 Analysis of Physico-Chemical parameters of Sediment samples from the study area

The samples were collected in and around the project location within 1 km radius. Soil samples were carried out at Eight (08) locations in the study area. Soil analysis was carried as per IS: 2720 methods. Soil quality monitoring locations, results and Soil ICAR classification are given in **Table 3-200**.

Table 3-20 Physico-Chemical parameters of Sediment samples from the study area

Sl.No.	Parameters	Units	Sediment		
			S1	S2	S3
1	pH	-	7.19	7.22	7.59
2	Magnesium	mg/kg	363.20	599.40	445.84
3	Electrical Conductivity	$\mu\text{S}/\text{cm}$	1019	1080	1014
4	Potassium(Available)	mg/kg	127.25	179.85	166.72
5	Phosphorus(Available)	mg/kg	16.49	32.93	29.85
6	Arsenic	mg/kg	6.80	6.84	6.55
7	Iron	mg/kg	13.24	5.64	6.58
8	Lead	mg/kg	9.74	8.31	8.01
9	Zinc	mg/kg	38.25	36.07	36.36
10	Copper	mg/kg	12.98	12.65	13.36
11	Cadmium	mg/kg	0.54	0.62	0.49
12	Chromium	mg/kg	29.53	28.30	28.23
13	Manganese	mg/kg	206.22	197.24	194.93
14	Mercury	mg/kg	0.63	1.57	0.16
15	Calcium	mg/kg	757.07	1243.23	743.78
16	Bulk Density	gm/cc	1.23	1.28	1.22
17	Total Polycyclic Aromatic Hydrocarbons	mg/kg	BLQ(LOQ: 0.1)	BLQ(LOQ: 0.1)	BLQ(LOQ: 0.1)
18	Total Petroleum Hydrocarbons	mg/kg	BLQ(LOQ: 0.1)	BLQ(LOQ: 0.1)	BLQ(LOQ: 0.1)
19	Nitrogen N(Available)	mg/kg	1536.20	1344.70	1235.30

20	Sediment Texture	-	Loam	Clay loam	Clay loam
	Soil Texture - i)Sand	%	36.8	35.3	33.3
	Soil Texture ii)Silt	%	38.7	34.3	36.2
	Soil Texture iii)Clay	%	24.5	30.4	30.5
21	Odour	-	agreeable	agreeable	agreeable
22	H2S	mg/kg	BLQ(LOQ0.04)	BLQ(LOQ0.04)	BLQ(LOQ0.04)
23	Boron	mg/kg	BLQ(LOQ0.1)	BLQ(LOQ0.1)	BLQ(LOQ0.1)
24	BTEX	mg/kg	BLQ(LOQ: 0.1)	BLQ(LOQ: 0.1)	BLQ(LOQ: 0.1)
25	Phenols	mg/kg	BLQ(LOQ0.01)	BLQ(LOQ0.01)	BLQ(LOQ0.01)
26	Total Solids	%	87.58	87.44	87.36
27	Particle size distribution				
i	Coarse Sand	%	11.2	11	10.4
ii	Medium Sand	%	12.1	11.6	11.3
iii	Fine Sand	%	13.5	12.7	11.6
iv	Coarse Silt	%	12.4	11.2	11.6
v	Medium Silt	%	13.1	10.6	13.1
vi	Fine Silt	%	13.2	12.5	11.5
vii	Clay	%	24.5	30.4	30.5
28	Poly chlorinated Bi-phenol	mg/kg	BLQ(LOQ: 0.1)	BLQ(LOQ: 0.1)	BLQ(LOQ: 0.1)
29	Loss on Ignition (Water content)	%	23.93	30.42	31.56
30	Organic substances	%	23.93	30.42	31.56
31	Inorganic substances	%	76.07	69.58	68.44
S.No.	Parameters	Units	Sediment		
			S4	S5	S6
1	pH	-	7.55	7.59	7.35
2	Magnesium	mg/kg	360.61	423.96	357.84
3	Electrical Conductivity	µS/cm	1106	785	937
4	Potassium(Available)	mg/kg	216.00	153.12	151.32
5	Phosphorus(Available)	mg/kg	18.99	18.97	20.12
6	Arsenic	mg/kg	3.01	3.55	3.37
7	Iron	mg/kg	4.25	3.98	5.67
8	Lead	mg/kg	5.08	5.20	5.41
9	Zinc	mg/kg	24.33	25.27	25.28
10	Copper	mg/kg	13.84	13.22	14.77
11	Cadmium	mg/kg	1.60	1.27	1.68
12	Chromium	mg/kg	15.58	14.77	16.63

13	Manganese	mg/kg	102.94	99.85	107.83
14	Mercury	mg/kg	0.31	BLQ(LOQ0.05)	BLQ(LOQ0.05)
15	Calcium	mg/kg	902	848	895
16	Bulk Density	gm/cc	1.26	1.25	1.24
17	Total Polycyclic Aromatic Hydrocarbons	mg/kg	BLQ(LOQ: 0.1)	BLQ(LOQ: 0.1)	BLQ(LOQ: 0.1)
18	Total Petroleum Hydrocarbons	mg/kg	BLQ(LOQ: 0.1)	BLQ(LOQ: 0.1)	BLQ(LOQ: 0.1)
19	Nitrogen N(Available)	mg/kg	1056	1456	1213
20	Sediment Texture	-	Clay loam	Loam	Loam
	Soil Texture i)Sand	%	34.3	38.7	40.4
	Soil Texture ii)Silt	%	35.3	35.8	38.5
	Soil Texture iii)Clay	%	30.4	25.5	21.1
21	Odour	-	agreeable	agreeable	agreeable
22	H2S	mg/kg	BLQ(LOQ0.1)	BLQ(LOQ0.1)	BLQ(LOQ0.1)
23	Boron	mg/kg	BLQ(LOQ0.1)	BLQ(LOQ0.1)	BLQ(LOQ0.1)
24	BTEX	mg/kg	BLQ(LOQ: 0.1)	BLQ(LOQ: 0.1)	BLQ(LOQ: 0.1)
25	Phenols	mg/kg	BLQ(LOQ0.001)	BLQ(LOQ0.001)	BLQ(LOQ0.001)
26	Total Solids	%	97.38	97.66	97.84
27	Particle size distribution				
i	Coarse Sand	%	11.2	12.3	13.5
ii	Medium Sand	%	12.2	13.6	12.8
iii	Fine Sand	%	10.9	12.8	14.1
iv	Coarse Silt	%	11.6	10.5	11.8
v	Medium Silt	%	13.1	13.1	12.8
vi	Fine Silt	%	10.6	12.2	13.9
vii	Clay	%	30.4	25.5	21.1
28	Poly chlorinated Bi-phenol	mg/kg	BLQ(LOQ: 0.1)	BLQ(LOQ: 0.1)	BLQ(LOQ: 0.1)
29	Loss on Ignition (Water content)	%	26.14	24.57	24.84
30	Organic substances	%	26.14	24.57	24.84
31	Inorganic substances	%	73.86	75.43	75.16

S.No.	Parameters	Units	Sediment	
			S7	S8
1.	pH	-	6.53	6.57
2.	Magnesium	mg/kg	339.1	371.97
3.	Electrical Conductivity	μS/cm	1018	853.0

4.	Potassium(Available)	mg/kg	148.25	151.86
5.	Phosphorus(Available)	mg/kg	34.26	34.68
6.	Arsenic	mg/kg	1.93	1.87
7.	Iron	mg/kg	6.35	12.78
8.	Lead	mg/kg	2.38	2.29
9.	Zinc	mg/kg	6.72	6.84
10.	Copper	mg/kg	1.87	1.82
11.	Cadmium	mg/kg	BLQ(LOQ0.05)	BLQ(LOQ0.05)
12.	Chromium	mg/kg	12.92	12.72
13.	Manganese	mg/kg	64.17	62.80
14.	Mercury	mg/kg	0.19	0.17
15.	Calcium	mg/kg	706	930
16.	Bulk Density	gm/cc	1.28	1.24
17.	Total Polycyclic Aromatic Hydrocarbons	mg/kg	BLQ(LOQ: 0.1)	BLQ(LOQ: 0.1)
18.	Total Petroleum Hydrocarbons	mg/kg	BLQ(LOQ: 0.1)	BLQ(LOQ: 0.1)
19.	Nitrogen N(Available)	mg/kg	1684	1455
20.	Sediment Texture	-	Loam	Loam
21.	Soil Texture i)Sand	%	41.7	40
22.	Soil Texture ii)Silt	%	39.8	38.1
23.	Soil Texture iii)Clay	%	18.5	21.9
24.	Odour	-	agreeable	agreeable
25.	H ₂ S	mg/kg	BLQ(LOQ0.04)	BLQ(LOQ0.04)
26.	Boron	mg/kg	BLQ(LOQ0.1)	BLQ(LOQ0.1)
27.	BTEX	mg/kg	BLQ(LOQ: 0.1)	BLQ(LOQ: 0.1)
28.	Phenols	mg/kg	BLQ(LOQ0.01)	BLQ(LOQ0.01)
29.	Total Solids	%	87.47	88.12
30.	Particle size distribution			
i	Coarse Sand	%	14.1	13.2
ii	Medium Sand	%	13.1	12.5
iii	Fine Sand	%	14.5	14.3
iv	Coarse Silt	%	13.2	11.6
v	Medium Silt	%	11.8	13.8
vi	Fine Silt	%	14.8	12.7
vii	Caly	%	18.5	21.9
28	Poly chlorinated Bi-phenol	mg/kg	BLQ(LOQ: 0.1)	BLQ(LOQ: 0.1)
29	Loss on Ignition (Water content)	%	23.75	23.25
30	Organic substances	%	23.75	23.25
31	Inorganic substances	%	76.25	76.75

3.10.3 Results and Discussions

Summary of analytical results for major parameters are given below:

- The pH of the sediment samples ranged from 6.53 to 7.59
- Conductivity of the sediment samples ranged from 785 to 1106 µmhos/cm.

- Magnesium of the sediment samples ranged from 339.1 to 599.4 mg/kg.
- Nitrogen content in the collected sediment samples ranged from 208 mg/kg to 297 mg/kg.
- Phosphorous content ranged from 16.49 mg/kg to 34.86 mg/kg.
- Arsenic content ranges from 127 mg/kg to 216 mg/kg.
- Iron content ranges from 3.98 mg/kg to 13.24 mg/kg.
- Lead content ranges from 2.29 mg/kg to 9.74 mg/kg.
- Zinc content ranges from 6.72 mg/kg to 38.25 mg/kg.
- Copper content ranges from 1.82 mg/kg to 14.77 mg/kg.
- Chromium content ranges from 12.72 mg/kg to 29.53 mg/kg.
- Manganese content ranges from 62.80 mg/kg to 206.22 mg/kg.
- Mercury content ranges from 0.16 mg/kg to 1.57 mg/kg.
- Calcium content ranges from 706.00 mg/kg to 1243 mg/kg.

3.11 Biological Environment

An ecological study of the ecosystem is essential to understand the impact of urbanization on existing flora and fauna of the study area. Studies on various aspects of ecosystem play an important role in identifying sensitive issues for under taking appropriate action to mitigate the impact, if any. The biological study was under taken as a part of the EIA study report to understand the present status of ecosystem prevailing in the study area, to compare it with past condition with the help of available data, to predict changes in the biological environment as a result of present activities and to suggest measures for maintaining its health. Secondary source information was collected to study the flora & fauna in 15 km radius. Some of the information was gathered from the local habitants. All the collected data were classified to interpret the impact of pollution on the flora and fauna of that region. Documenting of the wild plants as well as cultivated crop plants was made and all the available information was recorded.

During data collection, following aspects were considered for ecological studies:

- ❖ Assessment of present status of flora and fauna;
- ❖ Identification of rare and endangered species of plants and animals (if any);
- ❖ Identification of ecologically sensitive areas within the study area;
- ❖ Assessment of Aquatic Ecology with specific reference to aquatic birds and plankton

3.11.1 Methodology

Terrestrial investigations for flora and fauna records were collected. Discussions with Experts were carried-out to collect information related to local biodiversity in and around the area.

3.11.2 Flora Study

- The assessment of the flora of the study area is done by extensive secondary source information of the area of 10 km radius.
- Plants species were documented based on their habit characters of family, genus and species using available floral, other related literature.
- Besides the identification of plant species, information was collected on the vernacular names and uses of plants made by local inhabitants.

3.11.3 Fauna

Secondary source information for biodiversity of the study area was collected to identify the important animal groups such as birds, mammals and reptiles.

- ❖ Secondary information collected from local villagers, published government data etc.
- ❖ List of the endangered and endemic species as per the schedule of The Wildlife Protection Act, 1972.
- ❖ Emphasis is given to identify avifauna and mammals to determine the presence and absence of Schedule-1 species, listed in The Wildlife Protection Act 1972, as well as in Red List of IUCN.

3.11.4 Floristic Composition within the study area

The ecology and diversity assessed within the 10 km radius in the study area. It is observed that human settlements present in and surround the project site and within the study area of 10 km radius and many of construction building area/ colonies have very low level of plantations.

There were total 53 species and 25 genera under 25 family found in the study area. The study area does not have any forest land or permanent natural vegetation and the main land use feature of the study area is comprised habitation and cultivating lands. From the primary observation, the tree species recorded in the plantation area were *Cocos nucifera*, *Azadirachta indica*, *Ficus benghalensis*, *Mangifera indica*, *Musa paradise* were found. The detailed list of plant species found in study area provided in **Table 3.22**.

3.11.5 Rare and endangered Floral species

During the vegetation documentation for the study area recorded any such species which are endangered or threatened under IUCN (International Union for Conservation of Nature and Natural resources) guidelines found in the Indian Biodiversity Portal.

Table 3.21 The detailed list of plant species

S.No	Scientific name	Family	Habit	Venacular Name	IUCN status
1	<i>Abutilon indicum</i>	Malvaceae	Shrub	Thuthi	NA
2	<i>Acalypha indica</i>	Euphorbiaceae	Herb	Kuppaimeni	NA
3	<i>Acanthospermum hispidum</i>	Asteraceae	Herb	Kombu mull	NA
4	<i>Aerva persica</i>	Amaranthaceae	Shrub	Perumpulai	NA
5	<i>Aristida setacea</i>	Poaceae	Herb	—	NA
6	<i>Atriplex repens</i>	Chenopodiaceae	Herb	—	NA
7	<i>Azadirachta indica</i>	Meliaceae	Tree	Veppamaram	NA
8	<i>Boerhavia diffusa</i>	Nyctaginaceae	Herb	Mukurattai	NA
9	<i>Borassus flabellifer</i>	Arecaceae	Tree	Panaimaram	NA
10	<i>Bulbostylis barbata</i>	Cyperaceae	Herb	—	NA
11	<i>Calotropis gigantea</i>	Asclepiadaceae	Shrub	Erukku	NA
12	<i>Canavalia cathartica</i>	Fabaceae	Climber	—	NA
13	<i>Canavalia rosea</i>	Fabaceae	Climber	—	NA
14	<i>Cassia italica</i>	Caesalpiniaceae	Herb	Nilavahai	NA
15	<i>Casuarina litorea</i>	Casuarinaceae	Tree	Chavuku	NA
16	<i>Catharanthus roseus</i>	Apocynaceae	Herb	Nithyakalyani	NA
17	<i>Cenchrus ciliaris</i>	Poaceae	Herb	Kolukattaipul	NA
18	<i>Citrullus colocynthis</i>	Cucurbitaceae	Herb	Peykkumatti	NA
19	<i>Cocos nucifera</i>	Arecaceae	Tree	Thennaimaram	NA
20	<i>Croton bonplandianus</i>	Euphorbiaceae	Herb	Mannannaichedi	NA
21	<i>Datura metel</i>	Solanaceae	Herb	Oomathai	NA
22	<i>Euphorbia hirta</i>	Euphorbiaceae	Herb	Amampatchaiaris	NA
23	<i>Euphorbia tortilis</i>	Euphorbiaceae	Shrub	Tirukukalli	NA
24	<i>Fimbristylis cymosa</i>	Cyperaceae	Herb	—	NA
25	<i>Gisekia pharnaceoides</i>	Aizoaceae	Herb	Manalkeerai	NA
26	<i>Gomphrena serrata</i>	Amaranthaceae	Herb	—	NA
27	<i>Hibiscus tiliaceus</i>	Malvaceae	Tree	Neerparuthi	LC
28	<i>Launaea intybacea</i>	Asteraceae	Herb	—	NA
29	<i>Launaea sarmentosa</i>	Asteraceae	Herb	—	NA
30	<i>Leucas aspera</i>	Lamiaceae	Herb	Thumbai	NA
31	<i>Lopholepisoritho cephal</i>	Poaceae	Herb	—	NA
32	<i>Opuntia stricta</i>	Cactaceae	Shrub	Sappathikalli	LC
33	<i>Panicum repens</i>	Poaceae	Herb	—	NA
34	<i>Passiflora foetida</i>	Passifloraceae	Climber	Sirupunaikali	NA

35	<i>Pedaliium murex</i>	Pedaliaceae	Herb	Perunerunji	NA
36	<i>Percularia daemia</i>	Asclepiadaceae	Climber	—	NA
37	<i>Phyla nodiflora</i>	Verbenaceae	Herb	Koduppai	LC
38	<i>Prosopis juliflora</i>	Mimosaceae	Tree	Veelikkaruvai	NA
39	<i>Pycreus polystachyos</i>	Poaceae	Herb	—	LC
40	<i>Sida cordifolia</i>	Malvaceae	Herb	Nilathuthi	NA
41	<i>Spinifex littoreus</i>	Poaceae	Herb	Ravananmeesai	NA
42	<i>Tephrosia purpurea</i>	Fabaceae	Under Shrub	Kolingi	NA
43	<i>Thespesia populnea</i>	Malvaceae	Tree	Poovarasu	LC
44	<i>Tribulus terrestris</i>	Zygophyllaceae	Herb	Nerinji	NA
45	<i>Vernonia cinerea</i>	Asteraceae	Herb	Mukuttipundu	NA
46	<i>Zoysia matrella</i>	Poaceae	Grass	—	NA
47	<i>Canavalia cathartica</i>	Fabaceae	Climber	Maunaloa	LC
48	<i>Ipomoea pes-caprae</i>	Convolvulaceae	Creeper	Bayhops	LC
49	<i>Pupalia lappacea var. orbiculata</i>	Amaranthaceae	Herb	—	LC
50	<i>Turnera subulata</i>	Passifloraceae	Herb	White buttercup	LC
Aquatic Plants					
51	<i>Avicennia marina</i>	Acanthaceae	Tree	Mangrove	LC
52	<i>Calophyllum inophyllum</i>	Calophyllaceae	Tree	Mangrove	LC
53	<i>Pontederia crassipes</i>	Pontederiaceae	hydrophyte	Water hyacinth	LC

LC-Least Concern; NA-Not Assessed

Source:

List of Plants : TN Plants of Tamil Nadu: http://tnenvis.nic.in/tnenvis_old/database_bio_flo.htm

AliyamurthyKarthigeyan, IlangovanKumaraswamy and Wilson Arisdason. 2013 An Assessment of Angiosperm Diversity of Adyar Estuary, Chennai – A Highly Degraded Estuarian Ecosystem, Tamil Nadu, India

Flora of Tamil Nadu. Botanical survey of India.1983

IUCN Status : <https://www.iucnredlist.org/>

3.11.6 Faunal Communities

The faunal diversity of the study area documented through secondary sources. Such as reference of relevant literatures (published/unpublished) and dialogues with local villagers were also carried out to consolidate the presence of faunal distribution in the area (Smith 1933-43, Ali and Ripley1983, Daniel1983, Prater1993, Murthy and Chandrasekhar1988).

3.11.7 Mammals

No wild mammalian species was directly sighted during the field survey. Dialogue with local villagers located around the study area also could not confirm presence of any wild animal in that area.

3.11.8 Avifauna

From the primary survey, a total of 24 species of avifauna were identified and recorded in the study area. The diversity of avifauna from this region was found to be quite high and encouraging. IUCN threatened species not observed. **Table 3.22** show the bird recorded from the Study area and it's Conservation Status.

Table 3.22 Bird recorded from the Study area and Conservation Status

S.No	Species name	Common name	IUCN status
1	<i>Alauda gulgula</i>	Oriental Skylark	Least Concern
2	<i>Alcedo atthis</i>	Small Blue	Least Concern
3	<i>Ardeola grayii</i>	Pond Heron	Least Concern
4	<i>Bubulcus ibis</i>	Cattle Egret	Least Concern
5	<i>Centropus sinensis</i>	Greater coucal	Least Concern
6	<i>Columba livia</i>	Rock pigeon	Least Concern
7	<i>Copsychus saularis</i>	Oriental Magpie	Least Concern
8	<i>Corvus splendens</i>	House crow	Least Concern
9	<i>Cuculus canorus</i>	Common cuckoo	Least Concern
10	<i>Cypsiurus balasiensis</i>	Asian palm swift	Least Concern
11	<i>Dicrurus macrocercus</i>	Black drongo	Least Concern
12	<i>Egretta garzetta</i>	Little Egret	Least Concern
13	<i>Elanus caeruleus</i>	Black-winged Kite	Least Concern
14	<i>Eudynamys scolopaceus</i>	Koel	Least Concern
15	<i>Haliastur indus</i>	Brahminy kite	Least Concern
16	<i>Merops orientalis</i>	Green bee eater	Least Concern
17	<i>Milvus migrans</i>	Black kite	Least Concern
18	<i>Passer domesticus</i>	House sparrow	Least Concern
19	<i>Perdica asiatica</i>	Bush Quail	Least Concern
20	<i>Phalacrocorax niger</i>	Little cormorant	Least Concern
21	<i>Pseudibis papillosa</i>	Black Ibis	Least Concern
22	<i>Psittacula krameri</i>	Rose ringed	Least Concern
23	<i>Streptopelia chinensis</i>	Spotted dove	Not assessed
24	<i>Vanellus indicus</i>	Red-wattled	Least Concern

LC-Least Concern; NA-Not Assessed

3.11.9 Reptiles and Amphibians

As per the secondary information five species was observed in the study area. **Table 3-24** shows the Reptiles & Amphibians recorded from the Study area.

Table 3.23 Reptiles & Amphibians recorded from the Study area

S.No	Reptiles & Amphibians	Common name	IUCN Status
1	<i>Hemidactylus sp.</i>	House lizard	Not Assessed
2	<i>Eutropis macularia</i>	Common skink	Not Assessed
3	<i>Bungarus caeruleus</i>	Common Krait	Not Assessed
4	<i>Ophisops leschenault</i>	Snake-eyed lizard	Not Assessed
5	<i>Rana tigrina</i>	Common yellow frog	Least Concern
6.	<i>Lepidochelys olivacea</i>	Olive Ridley Turtle	Vulnerable

3.11.10 Butterfly

Butterfly can also serve as useful indicators of forest biodiversity. They are responsible for a large part of the complex interconnections that characterize natural forest ecosystems. The butterfly communities that are present in forests help to maintain crucial ecological processes and preserve biodiversity as a whole. They participate in most of the ecological processes that sustain ecosystems. The present study 20 species recorded. **Table 3-25** shows Butterflies recorded from the Study area.

Table 3.24 Butterfly recorded from the Study area

S.No	Zoological Name	Family	Common Name	IUCN status
1	<i>Ariadne merione</i>	Nymphalidae	Common Caster	Least Concern
2	<i>Atrophaneura aristolochiae</i>	Papilionidae	Common Rose	Least Concern
3	<i>Catopsilia pomona</i>	Pieridae	Common Emigrant	Least Concern
4	<i>Catopsilia pyranthe</i>	Pieridae	Mottled Emigrant	Least Concern
5	<i>Colotis etrida</i>	Pieridae	Small Orange Tip	Least Concern
6	<i>Danaus chrysippus</i>	Nymphalidae	Plain Tiger	Least Concern
7	<i>Danaus genutia</i>	Nymphalidae	Striped Tiger	Least Concern
8	<i>Delias eucharis</i>	Pieridae	Common Jezebel	Least Concern
9	<i>Euchrysops cnejus</i>	Lycaenidae	Gram Blue	Least Concern
10	<i>Eurema hecabe</i>	Pieridae	Common Grass Yellow	Least Concern
11	<i>Hypolimnas bolina</i>	Nymphalidae	Great Egg Fly	Least Concern

12	<i>Hypolimnas misippus</i>	Nymphalidae	Danaid Egg Fly	Not Assessed
13	<i>Junonia almana</i>	Nymphalidae	Peacock Pansy	Least Concern
14	<i>Junonia hierta</i>	Nymphalidae	Yellow Pansy	Least Concern
15	<i>Junonia iphita</i>	Nymphalidae	Chocolate Pansy	Least Concern
16	<i>Junonia lemonias</i>	Nymphalidae	Lemon Pansy	Least Concern
17	<i>Junonia orithya</i>	Nymphalidae	Blue Pansy	Least Concern
18	<i>Leptosia nina</i>	Pieridae	Psyche	Least Concern
19	<i>Mycalesis perseus</i>	Nymphalidae	Common Bush Brown	Least Concern
20	<i>Phalanta phalantha</i>	Nymphalidae	Common Leopard	Least Concern

3.11.11 Aquatic Ecology

Significance of Plankton:

Planktons can be broadly grouped into two categories those with plant origin are called ‘Phytoplankton’ and those with animal origin are called ‘Zooplankton’. **Table 3-25** shows the list of most common Phytoplankton and Zooplankton from Adyar River.

Table 3.25 List of most common Phytoplankton from Adyar River

S.No	Phytoplankton
1	<i>Oscillatoria subbrevis</i>
2	<i>Pediastrum duplex</i>
3	<i>Spirogyra sp.</i>
4	<i>Navicula rhynchocephala</i>
5	<i>Microcystis aeruginosa</i>

Table 3.26 List of most common Zooplankton from Adyar River

S.No	Species
Rotifera	
1	<i>Assulina muscorum</i>
2	<i>Brachionus falcatus</i>
3	<i>Brachionus calyciflorus</i>
4	<i>Brachionu sangularis</i>
5	<i>Lecane cervicornis</i>
6	<i>Polyarthra vulgaris</i>
7	<i>Filinia longiseta</i>
Copepoda	
8	<i>Mesocyclops hyalinus</i>
9	<i>Cyclopoid copepodite</i>
10	<i>Cyclopoid nauplii</i>

Cladocera	
11	<i>Chydorus sphaericus</i>
Ostracoda	
12	<i>Cypris subglobosa</i>
Miscellaneous - Aquatic insects	
13	<i>Mosquito larvae</i>

Source:

a) Birds:

Ali, S. (2002). The Book of Indian Birds (13th Revised Edition). Oxford University Press, New Delhi, 326pp.

b) Butterflies:

Kehimkar I. The Book of Indian Butterflies. Bombay Natural History Society, 2008, 497.

Evans WH. Identification of Indian butterflies. The Bombay Natural History Society, Bombay, 1927, 32.

Kunte K (2000a). Butterflies of Peninsular India. Indian Academy of Science, University of Press (India) Limited, Hyderabad, India, 354.

c) Mammals:

Kamalakannan, M. & P.O. Nameer (2019). A checklist of mammals of Tamil Nadu, India. Journal of Threatened Taxa 11(8): 13992–14009; <https://doi.org/10.11609/jott.4705.11.8.13992–14009>.

d) Reptiles:

Aengals, R., Sathish Kumar, V.M., Palot, M.J. & Ganesh, S.R. (2018). A Checklist of Reptiles of India. 35 pp. Version 3.0. Online publication is available at www.zsi.gov.in (Last update: May 2018)

3.11.12 Impact on Flora

Plantation will be developed in the undeveloped area as per plantation programme. These activities will help to improve the floral cover of the area. The greenery and plantation development will eventually attract micro fauna, birds etc in the area. Assistance will be taken from local forest department in selection of species of plants so that green coverage may improve fast. The varieties would include those plants, which are suitable to the area.

3.11.13 Impact on Fauna

The study area is in non-forest land where presence of fauna is very rare. As such, there will be no adverse impact of the plant unit activity on fauna around the plant unit area.

3.11.14 Green Belt Development

The proposed green belt in the plant unit area will to be designed taking into consideration the availability of area as the efficacy of green belt in pollution control mainly depends on width of green belt, distance from pollution sources, site of the habitat from working place and tree height & density.

While considering the above aspects due care will be taken for selecting suitable characteristics plant species as those fast growing and evergreen trees, trees with large leaf area, locally suitable plant species, those resistant to specific pollutant and those which would maintain the regional ecological balance, soil and hydrological conditions. The plantation work for green belt development will be carried in consultation with a local forest department which will help minimizing adverse impact on the flora found in the area.

The following plant species will be planted according to CPCB guidelines: *Cassia fistula*, *Delbergia sisso*, *Mangifera indica*, *Acacia nilotica*, *Tectona grandis*, *Azadirachta indica*, *Albizia lebbek*, *Prosopis cineraria*, *Delonix regia*, *Ficus benghalensis*, *Butea monosperma*, *Phoenix sylvestris* etc.

3.12 Socio Economic profile

Chennai district was ranked 1st in terms of the highest population in Tamil Nadu State. The population of the district is 4,646,732 which comprise of 2,335,844 male and 2,310,888 female populations.

Source:http://censusindia.gov.in/2011census/dchb/DCHB_A/33/3302_PART_A_DCHB_CHENNAI.pdf

http://censusindia.gov.in/2011census/dchb/DCHB_A/33/3302_PART_A_DCHB_THIRUVALLUR.pdf

(Ref: Directorate of Census Operations-Tamil Nadu, "District Census Handbook-2011, Chennai District", Series-34 Part XII-A)

3.13 Socio Economic Aspects

A socio-economic study was undertaken in assessing aspects which are dealing with social and cultural conditions, and economic status in the study area. The study provides information such as demographic structure, population dynamics, infrastructure resources, and agriculture, trade, and industrial development in the study area. The study of these characteristic helps in identification, prediction and evaluation of impacts on socio-economic and parameters of human interest due to proposed project developments. The parameters are:

- Demographic structure
- Infrastructure Facility

- Economic Status
- Health status
- Cultural attributes
- Awareness and opinion of people about the project and Industries in the area.

Table 3.27 Social Indicators of Chennai District

S.No	Social Indicators	Chennai District
1	Decadal variation %	7
2	Urban population	4646732
3	Sex ratio	989
4	Child Sex Ratio (0-6 age)	950
5	Population density (Persons per square Km)	26553
6	Scheduled caste population %	16.78
7	Scheduled tribe population %	0.22
8	Literacy rate %	90.2
9	Work Participation rate %	39.1
10	Main Workers %	89.12
11	Marginal Workers %	10.88
12	Cultivators %	0.80
13	Agricultural labourers %	0.75
14	Workers in household industries %	2.05
15	Other workers %	96.40

Source: http://censusindia.gov.in/2011census/dchb/DCHB_A/33/3302_PART_A_DCHB_CHENNAI.pdf

3.13.1 Population and Household Size

Chennai district is a Metropolitan City. Chennai district ranked as 1st highest population in the State. The district population density was 26553 persons/sq. km. In 2011 census, the total population of Chennai district was 4646732. Of this, male population was 2335844 and female population was 2310888. In 2001, these were 4343645, 2219539 and 2124106 respectively. The decadal growth variation of population in Chennai between 2001 and 2011 censuses was 7%, which is very low compared to the State's growth variation of 15.6%. Density of population in Chennai was 24963 persons per sq.km in 2001 census. In 2011, the density of population has increased to 26553. Chennai has recorded the highest density in the State.

Source:

3.13.2 Sex Ratio

The sex ratio is defined as number of females to 1000 males. The district sex ratio was 989, lower than the State sex ratio of 996. The sex ratio in Chennai was 957 in 2001 census which has increased to 989 in 2011 census.

Source:https://censusindia.gov.in/2011census/dchb/DCHB_A/33/3302_PART_A_DCHB_CHENNAI.pdf.

3.13.3 Scheduled Caste (SC) & Scheduled Tribes (ST)

The Scheduled Castes (SCs) and the Scheduled Tribes (STs) in Chennai may have migrated from other parts of the State. According to 2011 census, the SCs population was 779667 accounting to 16.78% to the total population of Chennai. Similarly, the ST population was 10061 accounting to 0.22% to the total population of Chennai.

Source:https://censusindia.gov.in/2011census/dchb/DCHB_A/33/3302_PART_A_DCHB_CHENNAI.pdf

3.13.4 Education & Literacy

As per Census 2011, a person aged 7 years and above who can both read and write with understanding in any language is taken as literates. A person who can only read but cannot write is not literate. It is not necessary that to be considered as literate, a person should received any formal education or passed any minimum educational standard. Literacy could have been achieved through adult literacy classes or through any non-formal educational system. People who are blind and can read in Braille are treated as literates. The district has recorded the 2nd highest literacy rate of 90.2% among the districts. The literacy level in Chennai is generally better compared to other areas and districts in the State as Chennai has suitable infrastructure as it being fully urban in nature. In 2011 census, Chennai has returned with 90.2% literacy compared to 85.3% in 2001 census. The male literacy was 90% in 2001 and 93.7% in 2011. The female literacy on the other hand was 80.4% in 2001 and 86.6% in 2011. It reveals that still there is a literacy gap between male and female even in urban areas to the extent of 7%. The educational infrastructure in the Chennai District is given in **Table 3.28**

Source:https://censusindia.gov.in/2011census/dchb/DCHB_A/33/3302_PART_A_DCHB_CHENNAI.pdf

Table 3.28 Education Infrastructures of PIA District

Type of school	Total schools		Rural Schools	
	Government	Private	Government	Private
Primary	130	503	0	0
Primary + Upper Primary	97	89	0	0

P + UP+ Secondary + Higher Secondary	59	239	0	0
UP only	0	1	0	0
UP + Secondary + Higher Secondary	52	109	0	0
P + UP + Secondary	18	91	0	0
UP + Secondary	47	36	1	0

(*Source: District Information Systems on Education (DISE report card 2016-17)*)

3.13.5 Health Facilities

Primary Health Centers (PHCs) and Health Sub-centers (HSCs) are providing the preventive, curative and rehabilitative health care services to the rural people. The district has good number of public health systems accessible and affordable apart from the private health facilities. The Health Care Facilities of PIA district is given in **Table 3.29**

Table 3.29 Socio Economic analysis: Health care-Chennai District

Name of the District	Type of Facility	Active Facilities As on 31 st March 2021
Chennai	SC	0
	PHC	144
	CHC	15
	SDH	4
	DH	0
	Total	163

(*SC – Sub Center; PHC – Primary Health Center; CHC – Community Health Center; SDH – Sub District Hospital; DH – District Hospital)(*Source: National Health Mission, as on March 31st, 2021*).

3.13.6 Economic Activity & Livelihood Pattern

The relevance of economic activity and livelihood pattern is important in the context of the study since depending on the existing situation one can predict the impact of the project activity on the economy of the region. The economic activities in Chennai Municipality Corporation are varied in nature and have large opportunities for income generation activities for all types of people living in Chennai. The total workers of the district constituted 39.11 % to the total population as against 34.30 % in 2001 census. The non – workers to the total population was 60.89 % in 2011, who were 65.70 % in 2001 census. The main workers among the workers constituted 89.12 % in 2011, who were 92.80 % in 2001. The marginal workers (both categories) in 2011 were 10.88 % and unclassified marginal workers were 7.20 % in 2001. The work participation rate in Chennai was 34.3 in 2001 census which has marginally increased to 39.1 in 2011 census. Among the males and females, the work participation rate has also found increased marginally from 2001 census to 2011 census.

Source: http://censusindia.gov.in/2011census/dchb/DCHB_A/33/3302_PART_A_DCHB_CHENNAI.pdf

3.13.7 Social Economic Profile of the study area

The project area comes under the Chennai, and Thiruvallur District of Tamil nadu. **Table 3-30** provides the details on population profile within study area.

Table 3.30 Population profile within study area

Sl. No	Name	No of Households	Total Population Person	Total Population Male	Total Population Female	Population in the age group 0-6 Person	Scheduled Castes population Person	Scheduled Tribes population Person
0-5Km								
Thiruvallur District-Madhavaram Taluk								
1.	Sadayankuppam	1355	5348	2704	2644	616	1406	165
2.	Elandancheri	201	685	356	329	67	69	0
3.	Tiruvottiyur (M)	63862	249446	125300	124146	26903	35332	502
4.	Manali (M)	9331	35248	17911	17337	4208	8224	32
5.	Chinnasekkadu (TP)	3238	12396	6365	6031	1472	3665	13
Chennai District								
6.	Chennai (M Corp.) WARD NO.-0001	18900	76760	38805	37955	8209	7010	108
7.	Chennai (M Corp.) WARD NO.-0002	16713	66897	33781	33116	7196	11315	160
8.	Chennai (M Corp.) WARD NO.-0003	13248	52995	26804	26191	6326	2568	21
9.	Chennai (M Corp.) WARD NO.-0004	3634	15186	7506	7680	1564	4499	11
10.	Chennai (M Corp.) WARD NO.-0005	11147	45204	22583	22621	4707	5644	92
11.	Chennai (M Corp.) WARD NO.-0006	4775	19523	9739	9784	1983	2681	5
12.	Chennai (M Corp.) WARD NO.-0007	5592	22161	11063	11098	2138	1242	15
13.	Chennai (M Corp.) WARD NO.-0008	8462	33039	16401	16638	3449	4078	12

14.	Chennai (M Corp.) WARD NO.- 0009	5059	20306	10184	10122	1948	422	0
15.	Chennai (M Corp.) WARD NO.- 0010	11223	44747	22331	22416	5210	5945	65
16.	Chennai (M Corp.) WARD NO.- 0011	7838	33287	16596	16691	4054	15993	19
17.	Chennai (M Corp.) WARD NO.- 0012	3880	16254	7999	8255	1761	547	12
18.	Chennai (M Corp.) WARD NO.- 0013	5103	21829	10813	11016	2653	4738	55
19.	Chennai (M Corp.) WARD NO.- 0014	8295	35130	17440	17690	3927	5080	12
20.	Chennai (M Corp.) WARD NO.- 0015	4847	19952	10114	9838	1862	202	7
21.	Chennai (M Corp.) WARD NO.- 0016	5377	22947	11578	11369	2108	566	3
22.	Chennai (M Corp.) WARD NO.- 0017	5722	24670	12537	12133	2399	2466	14
23.	Chennai (M Corp.) WARD NO.- 0018	3925	16424	8197	8227	1508	433	2
24.	Chennai (M Corp.) WARD NO.- 0019	3772	15457	7761	7696	1628	415	4
25.	Chennai (M Corp.) WARD NO.- 0020	3340	13276	6625	6651	1283	211	11
26.	Chennai (M Corp.) WARD NO.- 0021	3769	16044	7969	8075	1642	1911	8
27.	Chennai (M Corp.) WARD NO.- 0022	5714	26177	12962	13215	2589	12673	60
28.	Chennai (M Corp.) WARD NO.- 0023	4254	18434	9503	8931	1798	367	23

29.	Chennai (M Corp.) WARD NO.- 0024	4476	21002	10531	10471	2097	2511	8
30.	Chennai (M Corp.) WARD NO.- 0025	4329	19261	9609	9652	1957	3802	98
31.	Chennai (M Corp.) WARD NO.- 0026	4656	20239	10416	9823	2061	2717	3
32.	Chennai (M Corp.) WARD NO.- 0027	5202	24426	12806	11620	2667	5536	107
33.	Chennai (M Corp.) WARD NO.- 0028	5840	26156	13826	12330	2777	4404	75
34.	Chennai (M Corp.) WARD NO.- 0029	3967	19415	10172	9243	1705	1172	4
35.	Chennai (M Corp.) WARD NO.- 0030	4838	25286	13610	11676	2133	1072	3
36.	Chennai (M Corp.) WARD NO.- 0031	7226	32152	16030	16122	3316	16598	44
37.	Chennai (M Corp.) WARD NO.- 0032	7897	32269	16124	16145	3703	22247	13
38.	Chennai (M Corp.) WARD NO.- 0033	9935	41617	20930	20687	4398	12890	123
39.	Chennai (M Corp.) WARD NO.- 0034	12845	49559	24710	24849	5025	6470	68
40.	Chennai (M Corp.) WARD NO.- 0035	10027	40075	20183	19892	4233	4749	14
41.	Chennai (M Corp.) WARD NO.- 0036	13056	52262	26082	26180	5453	18235	74
42.	Chennai (M Corp.) WARD NO.- 0037	7064	26491	13110	13381	2104	2130	44
43.	Chennai (M Corp.) WARD NO.- 0038	8936	35187	17533	17654	3494	16173	159

44.	Chennai (M Corp.) WARD NO.- 0039	7080	30573	15390	15183	3182	9611	82
45.	Chennai (M Corp.) WARD NO.- 0040	12004	51479	25710	25769	5959	28903	163
46.	Chennai (M Corp.) WARD NO.- 0041	4826	21550	10871	10679	2294	7823	7
47.	Chennai (M Corp.) WARD NO.- 0042	6137	27857	13821	14036	3015	15041	62
48.	Chennai (M Corp.) WARD NO.- 0043	3422	15835	8124	7711	1730	1256	26
49.	Chennai (M Corp.) WARD NO.- 0044	3162	14291	7343	6948	1704	3652	4
50.	Chennai (M Corp.) WARD NO.- 0045	3916	17871	8839	9032	1936	9879	10
51.	Chennai (M Corp.) WARD NO.- 0046	3049	12747	6423	6324	1243	1092	14
52.	Chennai (M Corp.) WARD NO.- 0047	2999	14379	7370	7009	1330	2627	10
53.	Chennai (M Corp.) WARD NO.- 0048	3978	18269	9385	8884	1955	6886	30
54.	Chennai (M Corp.) WARD NO.- 0049	3228	16889	8677	8212	1638	1790	1
55.	Chennai (M Corp.) WARD NO.- 0079	4628	19748	9870	9878	2065	7575	66
56.	Chennai (M Corp.) WARD NO.- 0097	5311	20860	10416	10444	2019	2670	20
57.	Chennai (M Corp.) WARD NO.- 0098	4316	17466	8615	8851	1746	2215	11
58.	Chennai (M Corp.) WARD NO.- 0099	3679	15460	7665	7795	1532	5320	20

59.	Chennai (M Corp.) WARD NO.- 0100	2343	9545	4852	4693	893	505	0
60.	Chennai (M Corp.) WARD NO.- 0101	3149	12703	6477	6226	1027	441	35
61.	Chennai (M Corp.) WARD NO.- 0102	2208	9377	4739	4638	809	245	0
62.	Chennai (M Corp.) WARD NO.- 0103	3467	16595	8111	8484	1538	3334	9

5-10 km								
Chennai District								
63.	Chennai (M Corp.) WARD NO.-0050	13280	51527	25678	25849	4739	3629	155
64.	Chennai (M Corp.) WARD NO.-0051	11324	46250	22896	23354	4779	5471	139
65.	Chennai (M Corp.) WARD NO.-0052	5916	23233	11610	11623	2144	6167	163
66.	Chennai (M Corp.) WARD NO.-0053	6235	23831	11720	12111	2142	4949	87
67.	Chennai (M Corp.) WARD NO.-0054	10083	39058	19355	19703	3827	5527	162
68.	Chennai (M Corp.) WARD NO.-0055	5741	23220	11378	11842	2138	6150	142
69.	Chennai (M Corp.) WARD NO.-0056	9854	38123	18860	19263	3699	6288	76
70.	Chennai (M Corp.) WARD NO.-0057	5711	21805	10779	11026	2013	2440	64
71.	Chennai (M Corp.) WARD NO.-0058	7542	30577	15172	15405	2951	5685	108
72.	Chennai (M Corp.) WARD NO.-0059	6178	23595	11688	11907	2284	3436	27
73.	Chennai (M Corp.) WARD NO.-0060	7418	29821	14753	15068	3041	8174	42
74.	Chennai (M Corp.) WARD NO.-0061	4116	17321	8818	8503	1556	4062	214
75.	Chennai (M Corp.) WARD NO.-0062	28300	110474	55689	54785	11760	15214	552
76.	Chennai (M Corp.) WARD NO.-0063	21119	81648	40932	40716	8290	14630	1191
77.	Chennai (M Corp.) WARD NO.-0066	12896	50926	25217	25709	4687	7752	185
78.	Chennai (M Corp.) WARD NO.-0067	9710	37331	18563	18768	3432	4117	127
79.	Chennai (M Corp.) WARD NO.-0068	8456	32999	16333	16666	3157	5436	51
80.	Chennai (M Corp.) WARD NO.-0069	6509	27133	13348	13785	2627	11187	37

81.	Chennai (M Corp.) WARD NO.-0070	6214	26313	12906	13407	1931	1932	21
82.	Chennai (M Corp.) WARD NO.-0071	2948	12091	5988	6103	897	692	7
83.	Chennai (M Corp.) WARD NO.-0072	7870	32446	16367	16079	3120	12705	26
84.	Chennai (M Corp.) WARD NO.-0073	5841	22662	11199	11463	2175	3135	8
85.	Chennai (M Corp.) WARD NO.-0076	6123	24524	12355	12169	2419	5115	22
86.	Chennai (M Corp.) WARD NO.-0077	6211	23619	11767	11852	2256	1564	31
87.	Chennai (M Corp.) WARD NO.-0078	5624	23476	12319	11157	1856	3097	27
88.	Chennai (M Corp.) WARD NO.-0080	4297	20318	10593	9725	2324	10438	30
89.	Chennai (M Corp.) WARD NO.-0081	4037	17123	8533	8590	1617	2356	11
90.	Chennai (M Corp.) WARD NO.-0082	3639	16338	8219	8119	1592	3819	28
91.	Chennai (M Corp.) WARD NO.-0083	3999	19140	10113	9027	1865	3790	16
92.	Chennai (M Corp.) WARD NO.-0084	4793	17825	9527	8298	1759	1397	42
93.	Chennai (M Corp.) WARD NO.-0085	2720	11304	5933	5371	827	392	35
94.	Chennai (M Corp.) WARD NO.-0086	4001	16185	9537	6648	1262	1858	7
95.	Chennai (M Corp.) WARD NO.-0087	3452	14375	7331	7044	1419	385	302
96.	Chennai (M Corp.) WARD NO.-0088	5401	23618	11897	11721	2552	591	21
97.	Chennai (M Corp.) WARD NO.-0089	4030	16014	8048	7966	1229	181	7
98.	Chennai (M Corp.) WARD NO.-0090	4114	17329	8637	8692	1764	1243	14
99.	Chennai (M Corp.) WARD NO.-0091	5094	22285	10912	11373	2249	7836	161
100.	Chennai (M Corp.) WARD NO.-0092	3981	16511	8233	8278	1697	2748	71
101.	Chennai (M Corp.) WARD NO.-0093	3861	17368	8670	8698	1814	1083	3
102.	Chennai (M Corp.) WARD NO.-0094	5328	22407	11285	11122	2343	6399	9
103.	Chennai (M Corp.) WARD NO.-0095	2901	11664	5630	6034	902	831	69
104.	Chennai (M Corp.) WARD NO.-0096	3134	12954	6701	6253	1027	1708	3
105.	Chennai (M Corp.) WARD NO.-0104	5167	20897	10400	10497	1972	11195	6
106.	Chennai (M Corp.) WARD NO.-0105	3940	17965	9086	8879	1749	4783	26
107.	Chennai (M Corp.) WARD NO.-0106	4519	20023	9674	10349	1996	3803	18
108.	Chennai (M Corp.) WARD NO.-0107	5529	22902	11329	11573	1986	3297	9
109.	Chennai (M Corp.) WARD NO.-0108	4907	20042	9832	10210	1695	2261	40
110.	Chennai (M Corp.) WARD NO.-0109	4140	18546	9308	9238	1670	5458	2

111.	Chennai (M Corp.) WARD NO.-0110	3439	13867	7016	6851	1297	5849	7
112.	Chennai (M Corp.) WARD NO.-0111	4136	18480	9239	9241	1848	1834	17
113.	Chennai (M Corp.) WARD NO.-0112	3657	14912	7444	7468	1228	1525	89
114.	Chennai (M Corp.) WARD NO.-0113	4926	19701	9480	10221	1610	2079	121
115.	Chennai (M Corp.) WARD NO.-0144	5498	21231	10447	10784	1822	2685	25
116.	Chennai (M Corp.) WARD NO.-0145	5863	24508	12133	12375	2487	7795	30
Thiruvallur District-Madhavaram Taluk								
117.	Ariyalur	697	2693	1357	1336	284	1716	0
118.	Kadapakkam	787	2941	1436	1505	306	825	0
119.	Kosapur	190	780	358	422	93	713	8
120.	Vadaperumbakkam	433	1682	859	823	176	1280	1
121.	Kattivakkam (M)	9354	36617	18466	18151	4301	5718	136
122.	Puzhal (TP)	7477	31665	16810	14855	3363	10679	54
123.	Madavaram (M)	29792	119105	59887	59218	13030	14764	333
124.	Mathur (CT)	6886	27674	14081	13593	2980	4585	37
Thiruvallur District-Ponneri Taluk								
125.	Vallur	2993	11935	6089	5846	1309	7803	29
126.	Thirunilai	347	1373	710	663	171	380	16
127.	Perungavoor	633	2277	1096	1181	279	652	9
128.	Vichoor	1437	5765	2868	2897	600	2925	9
129.	Vellivoyal	820	3511	1758	1753	389	2466	5
130.	Athipattu (CT)	2762	11034	5623	5411	1257	4505	299
131.	Edayanchavadi (CT)	3142	12119	6042	6077	1151	1402	5
Total		849244	3426789	1748614	1731105	353157	679859	8662

Employment and livelihood

Economic vibrancy in area is shown by the type and nature of the occupation available in the area. Of the total working population, the majority is the main workers i.e they have steady job more than six months per annum. It is due to the industrialization in the area. The job opportunity is due to the development of Industrial and Service sectors.

A walk-through survey was conducted by visiting rural place within the 10 km radius. While doing so, many interactions with various people like farmers, women, labors, teachers, health workers, etc. were conducted.

Table 3.31 Classification of workers within study area

Sl. No	Name	Total Workers	Main Workers	Marginal Workers	Agriculture Workers				Household Industry Workers		Other Workers	
					Cultivators		Agri. Labourers		Main	Marginal	Main	Marginal
					Main	Marginal	Main	Marginal				
0-5 Km												
Chennai District												
1.	Chennai (M Corp.) WARD NO.-0001	29282	25031	4251	94	53	167	63	402	280	24368	3855
2.	Chennai (M Corp.) WARD NO.-0002	25368	22226	3142	102	33	115	25	412	163	21597	2921
3.	Chennai (M Corp.) WARD NO.-0003	19429	18213	1216	117	34	60	15	309	39	17727	1128
4.	Chennai (M Corp.) WARD NO.-0004	5176	4851	325	7	11	11	3	69	13	4764	298
5.	Chennai (M Corp.) WARD NO.-0005	17155	14679	2476	45	23	76	17	382	29	14176	2407
6.	Chennai (M Corp.) WARD NO.-0006	7801	7053	748	29	6	48	8	52	28	6924	706
7.	Chennai (M Corp.) WARD NO.-0007	8876	7335	1541	39	11	73	13	177	111	7046	1406

8.	Chennai (M Corp.) WARD NO.-0008	13409	11645	1764	131	28	55	165	254	38	11205	1533
9.	Chennai (M Corp.) WARD NO.-0009	8347	7239	1108	22	3	24	3	279	52	6914	1050
10.	Chennai (M Corp.) WARD NO.-0010	16579	15135	1444	77	118	52	10	288	55	14718	1261
11.	Chennai (M Corp.) WARD NO.-0011	11716	10605	1111	153	24	49	6	150	21	10253	1060
12.	Chennai (M Corp.) WARD NO.-0012	6064	5551	513	7	3	14	2	82	20	5448	488
13.	Chennai (M Corp.) WARD NO.-0013	7722	6938	784	8	14	10	6	58	24	6862	740
14.	Chennai (M Corp.) WARD NO.-0014	12802	11398	1404	23	10	56	9	171	76	11148	1309
15.	Chennai (M Corp.) WARD NO.-0015	7285	6855	430	27	4	40	7	134	23	6654	396
16.	Chennai (M Corp.) WARD NO.-0016	8508	7619	889	54	21	39	8	111	29	7415	831
17.	Chennai (M Corp.) WARD NO.-0017	9034	8036	998	77	13	39	6	131	24	7789	955
18.	Chennai (M Corp.) WARD NO.-0018	5828	5599	229	6	6	15	2	79	13	5499	208
19.	Chennai (M Corp.) WARD NO.-0019	5878	5403	475	21	6	27	6	82	17	5273	446
20.	Chennai (M Corp.) WARD NO.-0020	4935	4543	392	10	10	14	2	61	9	4458	371
21.	Chennai (M Corp.) WARD NO.-0021	6083	5484	599	12	3	29	2	124	17	5319	577
22.	Chennai (M Corp.) WARD NO.-0022	9881	7803	2078	54	35	32	20	184	123	7533	1900
23.	Chennai (M Corp.) WARD NO.-0023	6862	6148	714	61	29	15	4	129	24	5943	657

24.	Chennai (M Corp.) WARD NO.-0024	7185	6566	619	21	19	58	16	575	28	5912	556
25.	Chennai (M Corp.) WARD NO.-0025	6965	6118	847	31	11	42	21	174	51	5871	764
26.	Chennai (M Corp.) WARD NO.-0026	7574	6761	813	35	15	27	7	84	18	6615	773
27.	Chennai (M Corp.) WARD NO.-0027	9677	8140	1537	40	3	43	6	104	45	7953	1483
28.	Chennai (M Corp.) WARD NO.-0028	10746	9626	1120	41	15	39	5	105	25	9441	1075
29.	Chennai (M Corp.) WARD NO.-0029	6854	5864	990	29	23	44	39	134	98	5657	830
30.	Chennai (M Corp.) WARD NO.-0030	8652	7982	670	70	20	41	7	114	10	7757	633
31.	Chennai (M Corp.) WARD NO.-0031	11755	10052	1703	204	35	64	25	136	152	9648	1491
32.	Chennai (M Corp.) WARD NO.-0032	11915	10016	1899	217	12	47	17	114	56	9638	1814
33.	Chennai (M Corp.) WARD NO.-0033	15293	13736	1557	128	21	80	37	219	65	13309	1434
34.	Chennai (M Corp.) WARD NO.-0034	18785	17181	1604	52	23	213	69	614	69	16302	1443
35.	Chennai (M Corp.) WARD NO.-0035	14393	13048	1345	50	27	98	7	277	40	12623	1271
36.	Chennai (M Corp.) WARD NO.-0036	20053	16850	3203	338	60	143	35	272	91	16097	3017
37.	Chennai (M Corp.) WARD NO.-0037	10571	9187	1384	118	50	37	14	130	50	8902	1270
38.	Chennai (M Corp.) WARD NO.-0038	13282	10661	2621	32	19	67	54	163	92	10399	2456
39.	Chennai (M Corp.) WARD NO.-0039	11962	10466	1496	48	142	62	22	343	78	10013	1254

40.	Chennai (M Corp.) WARD NO.-0040	18250	15947	2303	194	37	111	137	576	106	15066	2023
41.	Chennai (M Corp.) WARD NO.-0041	7821	6731	1090	11	11	32	3	156	45	6532	1031
42.	Chennai (M Corp.) WARD NO.-0042	11262	10024	1238	26	18	361	241	1144	129	8493	850
43.	Chennai (M Corp.) WARD NO.-0043	6233	4782	1451	14	7	33	14	121	61	4614	1369
44.	Chennai (M Corp.) WARD NO.-0044	5086	4356	730	3	4	10	7	68	16	4275	703
45.	Chennai (M Corp.) WARD NO.-0045	6819	6126	693	28	6	41	6	89	15	5968	666
46.	Chennai (M Corp.) WARD NO.-0046	4603	4036	567	13	3	25	3	61	32	3937	529
47.	Chennai (M Corp.) WARD NO.-0047	4813	4439	374	12	4	18	5	123	32	4286	333
48.	Chennai (M Corp.) WARD NO.-0048	6418	6042	376	23	7	35	4	206	79	5778	286
49.	Chennai (M Corp.) WARD NO.-0049	5487	4899	588	12	4	21	3	96	33	4770	548
50.	Chennai (M Corp.) WARD NO.-0079	7466	6364	1102	61	13	83	17	122	24	6098	1048
51.	Chennai (M Corp.) WARD NO.-0097	8365	7730	635	77	14	47	14	226	31	7380	576
52.	Chennai (M Corp.) WARD NO.-0098	6578	5645	933	7	13	9	30	124	83	5505	807
53.	Chennai (M Corp.) WARD NO.-0099	6016	5375	641	6	11	21	4	72	161	5276	465
54.	Chennai (M Corp.) WARD NO.-0100	3621	3351	270	12	11	21	11	43	11	3275	237
55.	Chennai (M Corp.) WARD NO.-0101	4902	4604	298	6	5	32	4	60	7	4506	282

56.	Chennai (M Corp.) WARD NO.-0102	3707	3252	455	14	16	22	7	46	3	3170	429
57.	Chennai (M Corp.) WARD NO.-0103	6356	5779	577	21	10	25	14	76	9	5657	544
Thiruvallur District-Madhavaram Taluk												
58.	Sadayankuppam	1942	1708	234	62	49	25	17	33	36	1588	132
59.	Elandancheri	309	236	73	12	8	19	1	24	5	181	59
60.	Tiruvottiyur (M)	94000	81050	12950	451	163	509	136	1568	612	78522	12039
61.	Manali (M)	12745	11494	1251	25	12	49	12	127	39	11293	1188
62.	Chinnasekkadu (TP)	4490	3757	733	5	5	28	5	72	19	3652	704
5-10 km												
Chennai District												
63.	Chennai (M Corp.) WARD NO.-0050	20039	17943	2096	230	41	116	112	274	87	17323	1856
64.	Chennai (M Corp.) WARD NO.-0051	16604	14967	1637	66	33	123	20	220	55	14558	1529
65.	Chennai (M Corp.) WARD NO.-0052	8748	7632	1116	68	9	52	4	122	54	7390	1049
66.	Chennai (M Corp.) WARD NO.-0053	9125	8327	798	38	23	69	7	104	21	8116	747
67.	Chennai (M Corp.) WARD NO.-0054	14949	13591	1358	27	16	49	9	299	25	13216	1308
68.	Chennai (M Corp.) WARD NO.-0055	8849	7760	1089	23	25	29	6	64	8	7644	1050
69.	Chennai (M Corp.) WARD NO.-0056	14455	13217	1238	102	23	80	15	197	34	12838	1166
70.	Chennai (M Corp.) WARD NO.-0057	8103	7430	673	76	13	40	12	97	15	7217	633
71.	Chennai (M Corp.) WARD NO.-0058	11336	10133	1203	63	11	82	17	139	19	9849	1156
72.	Chennai (M Corp.) WARD NO.-0059	8830	8415	415	25	7	33	2	121	7	8236	399

73.	Chennai (M Corp.) WARD NO.-0060	11793	10641	1152	26	14	42	8	238	65	10335	1065
74.	Chennai (M Corp.) WARD NO.-0061	6540	5658	882	24	16	38	36	51	47	5545	783
75.	Chennai (M Corp.) WARD NO.-0062	42020	37535	4485	158	72	192	68	650	223	36535	4122
76.	Chennai (M Corp.) WARD NO.-0063	31840	28463	3377	70	37	136	194	363	92	27894	3054
77.	Chennai (M Corp.) WARD NO.-0066	20559	17995	2564	157	27	85	26	226	59	17527	2452
78.	Chennai (M Corp.) WARD NO.-0067	15333	13532	1801	48	12	74	33	249	99	13161	1657
79.	Chennai (M Corp.) WARD NO.-0068	12782	11561	1221	105	13	94	14	150	56	11212	1138
80.	Chennai (M Corp.) WARD NO.-0069	10950	9660	1290	141	21	53	35	102	94	9364	1140
81.	Chennai (M Corp.) WARD NO.-0070	10447	9510	937	31	17	41	11	131	22	9307	887
82.	Chennai (M Corp.) WARD NO.-0071	4646	4231	415	13	7	10	0	68	9	4140	399
83.	Chennai (M Corp.) WARD NO.-0072	12493	10888	1605	47	9	86	10	236	73	10519	1513
84.	Chennai (M Corp.) WARD NO.-0073	9245	8514	731	25	7	57	8	86	13	8346	703
85.	Chennai (M Corp.) WARD NO.-0076	9775	9009	766	61	7	47	7	72	29	8829	723
86.	Chennai (M Corp.) WARD NO.-0077	9479	8669	810	37	22	49	10	122	31	8461	747
87.	Chennai (M Corp.) WARD NO.-0078	8919	8139	780	35	18	56	7	126	7	7922	748
88.	Chennai (M Corp.) WARD NO.-0080	8589	7210	1379	28	10	69	24	92	14	7021	1331

89.	Chennai (M Corp.) WARD NO.-0081	6375	5898	477	35	17	64	8	96	7	5703	445
90.	Chennai (M Corp.) WARD NO.-0082	6622	6202	420	38	12	145	6	53	8	5966	394
91.	Chennai (M Corp.) WARD NO.-0083	7140	6384	756	47	6	55	6	132	22	6150	722
92.	Chennai (M Corp.) WARD NO.-0084	7116	6713	403	103	11	124	11	146	8	6340	373
93.	Chennai (M Corp.) WARD NO.-0085	5117	4274	843	44	7	18	29	94	58	4118	749
94.	Chennai (M Corp.) WARD NO.-0086	7533	5818	1715	71	263	53	15	40	26	5654	1411
95.	Chennai (M Corp.) WARD NO.-0087	5488	4753	735	42	6	61	18	123	46	4527	665
96.	Chennai (M Corp.) WARD NO.-0088	8232	7808	424	33	11	89	10	175	8	7511	395
97.	Chennai (M Corp.) WARD NO.-0089	6331	5642	689	30	6	29	7	89	16	5494	660
98.	Chennai (M Corp.) WARD NO.-0090	6475	5975	500	17	16	149	7	123	38	5686	439
99.	Chennai (M Corp.) WARD NO.-0091	8655	6777	1878	23	11	57	17	123	91	6574	1759
100	Chennai (M Corp.) WARD NO.-0092	7046	5983	1063	66	10	31	9	123	53	5763	991
101	Chennai (M Corp.) WARD NO.-0093	6205	5739	466	57	7	39	20	81	12	5562	427
102	Chennai (M Corp.) WARD NO.-0094	8551	7585	966	39	7	31	10	106	34	7409	915
103	Chennai (M Corp.) WARD NO.-0095	4833	4303	530	33	3	36	7	56	20	4178	500
104	Chennai (M Corp.) WARD NO.-0096	5198	4842	356	21	7	42	7	67	7	4712	335

105	Chennai (M Corp.) WARD NO.-0104	8874	7488	1386	56	9	34	4	103	24	7295	1349
106	Chennai (M Corp.) WARD NO.-0105	7790	5778	2012	43	19	104	91	152	45	5479	1857
107	Chennai (M Corp.) WARD NO.-0106	8085	6492	1593	14	11	44	12	131	44	6303	1526
108	Chennai (M Corp.) WARD NO.-0107	9876	8785	1091	66	25	57	7	175	36	8487	1023
109	Chennai (M Corp.) WARD NO.-0108	8764	7708	1056	31	6	29	14	72	26	7576	1010
110	Chennai (M Corp.) WARD NO.-0109	8166	6426	1740	54	23	38	27	120	54	6214	1636
111	Chennai (M Corp.) WARD NO.-0110	6065	5630	435	17	13	27	4	56	7	5530	411
112	Chennai (M Corp.) WARD NO.-0111	7429	6026	1403	28	37	63	16	191	111	5744	1239
113	Chennai (M Corp.) WARD NO.-0112	6440	5423	1017	58	111	49	18	113	26	5203	862
114	Chennai (M Corp.) WARD NO.-0113	7548	6897	651	78	9	119	10	140	24	6560	608
115	Chennai (M Corp.) WARD NO.-0144	8516	7715	801	27	5	58	5	109	14	7521	777
116	Chennai (M Corp.) WARD NO.-0145	9459	8249	1210	23	8	35	13	89	65	8102	1124

Thiruvallur District-Madhavaram Taluk

117	Ariyalur	1046	646	400	27	22	39	62	7	7	573	309
118	Kadapakkam	1318	1164	154	132	7	495	56	42	24	495	67
119	Kosapur	291	149	142	2	4	1	0	0	2	146	136
120	Vadaperumbakkam	586	432	154	13	11	12	6	25	7	382	130
121	Kattivakkam (M)	13273	10880	2393	17	4	49	20	201	80	10613	2289
122	Puzhal (TP)	12899	10219	2680	81	30	174	69	200	286	9764	2295
123	Madavaram (M)	43385	38017	5368	148	89	233	65	765	283	36871	4931

124	Mathur (CT)	10160	8111	2049	64	24	97	99	79	77	7871	1849
Thiruvallur District-Ponneri Taluk												
125	Vallur	4617	3662	955	77	39	138	56	117	46	3330	814
126	Thirunilai	575	457	118	46	8	92	88	3	0	316	22
127	Perungavoor	946	474	472	37	14	281	324	24	2	132	132
128	Vichoor	2391	1781	610	243	35	360	78	25	16	1153	481
129	Vellivoyal	1340	1299	41	49	6	96	0	5	0	1149	35
130	Athipattu (CT)	4072	3397	675	10	5	7	6	81	19	3299	645
131	Edayanchavadi (CT)	4219	3495	724	14	1	27	22	54	19	3400	682
Total		1328466	1167496	160970	7603	2909	9325	3532	22216	6840	1128352	147689

(Source: Census 2011)

Educational infrastructure within study area

The district has good primary and secondary education infrastructure in urban and rural areas. The people around the study area have well connected to educational infrastructures. **Table 3-32** shows the literates population.

Table 3-32 Details of Literacy population in the study area

Sl. No	Name	Literates Population Person	Literates Population Male	Literates Population Female	Illiterate Persons	Illiterate Male	Illiterate Female
0-5 Km							
Chennai District							
1.	Chennai (M Corp.) WARD NO.-0001	63354	33027	30327	13406	5778	7628
2.	Chennai (M Corp.) WARD NO.-0002	54439	28397	26042	12458	5384	7074
3.	Chennai (M Corp.) WARD NO.-0003	40119	21270	18849	12876	5534	7342
4.	Chennai (M Corp.) WARD NO.-0004	11579	6047	5532	3607	1459	2148
5.	Chennai (M Corp.) WARD NO.-0005	34811	18268	16543	10393	4315	6078
6.	Chennai (M Corp.) WARD NO.-0006	15256	8003	7253	4267	1736	2531
7.	Chennai (M Corp.) WARD NO.-0007	17400	9022	8378	4761	2041	2720
8.	Chennai (M Corp.) WARD NO.-0008	24464	12769	11695	8575	3632	4943

9.	Chennai (M Corp.) WARD NO.-0009	16939	8780	8159	3367	1404	1963
10.	Chennai (M Corp.) WARD NO.-0010	30973	16459	14514	13774	5872	7902
11.	Chennai (M Corp.) WARD NO.-0011	22752	12306	10446	10535	4290	6245
12.	Chennai (M Corp.) WARD NO.-0012	12214	6315	5899	4040	1684	2356
13.	Chennai (M Corp.) WARD NO.-0013	15188	7928	7260	6641	2885	3756
14.	Chennai (M Corp.) WARD NO.-0014	24113	12637	11476	11017	4803	6214
15.	Chennai (M Corp.) WARD NO.-0015	16829	8770	8059	3123	1344	1779
16.	Chennai (M Corp.) WARD NO.-0016	19152	9909	9243	3795	1669	2126
17.	Chennai (M Corp.) WARD NO.-0017	19494	10276	9218	5176	2261	2915
18.	Chennai (M Corp.) WARD NO.-0018	13867	7115	6752	2557	1082	1475
19.	Chennai (M Corp.) WARD NO.-0019	11946	6368	5578	3511	1393	2118
20.	Chennai (M Corp.) WARD NO.-0020	10850	5631	5219	2426	994	1432
21.	Chennai (M Corp.) WARD NO.-0021	11886	6206	5680	4158	1763	2395
22.	Chennai (M Corp.) WARD NO.-0022	20783	10793	9990	5394	2169	3225
23.	Chennai (M Corp.) WARD NO.-0023	15264	8214	7050	3170	1289	1881
24.	Chennai (M Corp.) WARD NO.-0024	17172	8835	8337	3830	1696	2134
25.	Chennai (M Corp.) WARD NO.-0025	15816	8124	7692	3445	1485	1960
26.	Chennai (M Corp.) WARD NO.-0026	16322	8700	7622	3917	1716	2201
27.	Chennai (M Corp.) WARD NO.-0027	18882	10425	8457	5544	2381	3163
28.	Chennai (M Corp.) WARD NO.-0028	20525	11314	9211	5631	2512	3119
29.	Chennai (M Corp.) WARD NO.-0029	16126	8778	7348	3289	1394	1895
30.	Chennai (M Corp.) WARD NO.-0030	20853	11779	9074	4433	1831	2602
31.	Chennai (M Corp.) WARD NO.-0031	24466	12794	11672	7686	3236	4450
32.	Chennai (M Corp.) WARD NO.-0032	23646	12368	11278	8623	3756	4867
33.	Chennai (M Corp.) WARD NO.-0033	32147	17005	15142	9470	3925	5545
34.	Chennai (M Corp.) WARD NO.-0034	40398	21064	19334	9161	3646	5515
35.	Chennai (M Corp.) WARD NO.-0035	32225	16931	15294	7850	3252	4598
36.	Chennai (M Corp.) WARD NO.-0036	40302	21057	19245	11960	5025	6935
37.	Chennai (M Corp.) WARD NO.-0037	23256	11720	11536	3235	1390	1845
38.	Chennai (M Corp.) WARD NO.-0038	28144	14550	13594	7043	2983	4060
39.	Chennai (M Corp.) WARD NO.-0039	23478	12385	11093	7095	3005	4090

40.	Chennai (M Corp.) WARD NO.-0040	36849	19610	17239	14630	6100	8530
41.	Chennai (M Corp.) WARD NO.-0041	16193	8609	7584	5357	2262	3095
42.	Chennai (M Corp.) WARD NO.-0042	20110	10639	9471	7747	3182	4565
43.	Chennai (M Corp.) WARD NO.-0043	12731	6880	5851	3104	1244	1860
44.	Chennai (M Corp.) WARD NO.-0044	10849	5969	4880	3442	1374	2068
45.	Chennai (M Corp.) WARD NO.-0045	12841	6917	5924	5030	1922	3108
46.	Chennai (M Corp.) WARD NO.-0046	10658	5561	5097	2089	862	1227
47.	Chennai (M Corp.) WARD NO.-0047	12057	6298	5759	2322	1072	1250
48.	Chennai (M Corp.) WARD NO.-0048	13981	7518	6463	4288	1867	2421
49.	Chennai (M Corp.) WARD NO.-0049	13401	7130	6271	3488	1547	1941
50.	Chennai (M Corp.) WARD NO.-0079	15393	8003	7390	4355	1867	2488
51.	Chennai (M Corp.) WARD NO.-0097	16724	8691	8033	4136	1725	2411
52.	Chennai (M Corp.) WARD NO.-0098	13662	7055	6607	3804	1560	2244
53.	Chennai (M Corp.) WARD NO.-0099	12724	6576	6148	2736	1089	1647
54.	Chennai (M Corp.) WARD NO.-0100	8065	4228	3837	1480	624	856
55.	Chennai (M Corp.) WARD NO.-0101	11115	5789	5326	1588	688	900
56.	Chennai (M Corp.) WARD NO.-0102	8132	4146	3986	1245	593	652
57.	Chennai (M Corp.) WARD NO.-0103	14078	7030	7048	2517	1081	1436
Thiruvallur District-Madhavaram Taluk							
58.	Sadayankuppam	1355	5348	2704	2644	616	1406
59.	Elandancheri	201	685	356	329	67	69
60.	Tiruvottiyur (M)	63862	249446	125300	124146	26903	35332
61.	Manali (M)	9331	35248	17911	17337	4208	8224
62.	Chinnasekkadu (TP)	3238	12396	6365	6031	1472	3665
5-10 km							
Chennai District							
63.	Chennai (M Corp.) WARD NO.-0050	44310	22610	21700	7217	3068	4149
64.	Chennai (M Corp.) WARD NO.-0051	37254	19232	18022	8996	3664	5332
65.	Chennai (M Corp.) WARD NO.-0052	19835	10191	9644	3398	1419	1979
66.	Chennai (M Corp.) WARD NO.-0053	20542	10343	10199	3289	1377	1912
67.	Chennai (M Corp.) WARD NO.-0054	33050	16793	16257	6008	2562	3446

68.	Chennai (M Corp.) WARD NO.-0055	18698	9543	9155	4522	1835	2687
69.	Chennai (M Corp.) WARD NO.-0056	32105	16397	15708	6018	2463	3555
70.	Chennai (M Corp.) WARD NO.-0057	18443	9394	9049	3362	1385	1977
71.	Chennai (M Corp.) WARD NO.-0058	23927	12242	11685	6650	2930	3720
72.	Chennai (M Corp.) WARD NO.-0059	18943	9822	9121	4652	1866	2786
73.	Chennai (M Corp.) WARD NO.-0060	22729	11825	10904	7092	2928	4164
74.	Chennai (M Corp.) WARD NO.-0061	14473	7587	6886	2848	1231	1617
75.	Chennai (M Corp.) WARD NO.-0062	92248	47663	44585	18226	8026	10200
76.	Chennai (M Corp.) WARD NO.-0063	67830	35086	32744	13818	5846	7972
77.	Chennai (M Corp.) WARD NO.-0066	41197	21546	19651	9729	3671	6058
78.	Chennai (M Corp.) WARD NO.-0067	31023	15935	15088	6308	2628	3680
79.	Chennai (M Corp.) WARD NO.-0068	27353	14020	13333	5646	2313	3333
80.	Chennai (M Corp.) WARD NO.-0069	21503	11129	10374	5630	2219	3411
81.	Chennai (M Corp.) WARD NO.-0070	23403	11630	11773	2910	1276	1634
82.	Chennai (M Corp.) WARD NO.-0071	10757	5405	5352	1334	583	751
83.	Chennai (M Corp.) WARD NO.-0072	25682	13690	11992	6764	2677	4087
84.	Chennai (M Corp.) WARD NO.-0073	18986	9638	9348	3676	1561	2115
85.	Chennai (M Corp.) WARD NO.-0076	20384	10617	9767	4140	1738	2402
86.	Chennai (M Corp.) WARD NO.-0077	20434	10363	10071	3185	1404	1781
87.	Chennai (M Corp.) WARD NO.-0078	20669	11147	9522	2807	1172	1635
88.	Chennai (M Corp.) WARD NO.-0080	14414	7970	6444	5904	2623	3281
89.	Chennai (M Corp.) WARD NO.-0081	14202	7282	6920	2921	1251	1670
90.	Chennai (M Corp.) WARD NO.-0082	13308	6937	6371	3030	1282	1748
91.	Chennai (M Corp.) WARD NO.-0083	15137	8331	6806	4003	1782	2221
92.	Chennai (M Corp.) WARD NO.-0084	15051	8312	6739	2774	1215	1559
93.	Chennai (M Corp.) WARD NO.-0085	9985	5367	4618	1319	566	753
94.	Chennai (M Corp.) WARD NO.-0086	13757	8422	5335	2428	1115	1313
95.	Chennai (M Corp.) WARD NO.-0087	11947	6245	5702	2428	1086	1342
96.	Chennai (M Corp.) WARD NO.-0088	18905	9917	8988	4713	1980	2733
97.	Chennai (M Corp.) WARD NO.-0089	14109	7212	6897	1905	836	1069
98.	Chennai (M Corp.) WARD NO.-0090	13165	6971	6194	4164	1666	2498

99.	Chennai (M Corp.) WARD NO.-0091	16234	8353	7881	6051	2559	3492
100.	Chennai (M Corp.) WARD NO.-0092	12977	6749	6228	3534	1484	2050
101.	Chennai (M Corp.) WARD NO.-0093	14043	7325	6718	3325	1345	1980
102.	Chennai (M Corp.) WARD NO.-0094	16882	8926	7956	5525	2359	3166
103.	Chennai (M Corp.) WARD NO.-0095	10275	5075	5200	1389	555	834
104.	Chennai (M Corp.) WARD NO.-0096	11196	5935	5261	1758	766	992
105.	Chennai (M Corp.) WARD NO.-0104	17424	9020	8404	3473	1380	2093
106.	Chennai (M Corp.) WARD NO.-0105	14977	7714	7263	2988	1372	1616
107.	Chennai (M Corp.) WARD NO.-0106	16905	8301	8604	3118	1373	1745
108.	Chennai (M Corp.) WARD NO.-0107	18558	9654	8904	4344	1675	2669
109.	Chennai (M Corp.) WARD NO.-0108	17042	8622	8420	3000	1210	1790
110.	Chennai (M Corp.) WARD NO.-0109	15498	8055	7443	3048	1253	1795
111.	Chennai (M Corp.) WARD NO.-0110	11165	5801	5364	2702	1215	1487
112.	Chennai (M Corp.) WARD NO.-0111	15390	7857	7533	3090	1382	1708
113.	Chennai (M Corp.) WARD NO.-0112	12848	6548	6300	2064	896	1168
114.	Chennai (M Corp.) WARD NO.-0113	17032	8355	8677	2669	1125	1544
115.	Chennai (M Corp.) WARD NO.-0144	17604	8943	8661	3627	1504	2123
116.	Chennai (M Corp.) WARD NO.-0145	18942	9770	9172	5566	2363	3203
Thiruvallur District-Madhavaram Taluk							
117.	Ariyalur	1975	1088	887	718	269	449
118.	Kadapakkam	2196	1194	1002	745	242	503
119.	Kosapur	541	277	264	239	81	158
120.	Vadaperumbakkam	1315	723	592	367	136	231
121.	Kattivakkam (M)	27279	14692	12587	9338	3774	5564
122.	Puzhal (TP)	25161	13731	11430	6504	3079	3425
123.	Madavaram (M)	96012	50348	45664	23093	9539	13554
124.	Mathur (CT)	22254	11815	10439	5420	2266	3154
Thiruvallur District-Ponneri Taluk							
125.	Vallur	9101	5040	4061	2834	1049	1785
126.	Thirunilai	929	532	397	444	178	266
127.	Perungavoor	1565	843	722	712	253	459

128.	Vichoor	4107	2211	1896	1658	657	1001
129.	Vellivoyal	2399	1292	1107	1112	466	646
130.	Athipattu (CT)	8205	4454	3751	2829	1169	1660
131.	Edayanchavadi (CT)	9340	4969	4371	2779	1073	1706
Total		2728602	1454731	1326801	698187	293883	404304

(Source: Census 2011)

Dwelling within study area

- Due to industrialization in nearby area and various Government Schemes, the standard of dwelling place has improved.
- Industrialization within the study area
- The public has mixed responses of industrialization in the area.
- The people near to the site are very apprehensive about the developments of industries/estates.
- The people of villages away from the site are welcoming the industrialization as it provides job opportunities and good infrastructure developments.

Summary

The Socioeconomic profile of the study area shows that majority of people in the study area work in other sector. They have good educational infrastructures and the people in the study area are well connected to the educational infrastructures. They have sufficient educational infrastructures and the people in the study area are well connected to the educational infrastructures. The people in the study area are well connected to Government primary health centres and Primary health sub-centres.

Table 3.33 Summary of Socioeconomic indicators within the study area

S.No	Particulars	Study Area	Unit
0-5 Km			
1	Number of villages and Town in the Study Area	62	Nos.
2	Total Households	435772	Persons
3	Total Population	1755783	Persons
4	Children Population (0-6 Years Old)	189946	Persons
5	SC Population	371273	Persons
6	ST Population	2838	Persons
7	Total Working Population	676971	Persons
8	Main Workers	595370	Persons
9	Marginal Workers	81601	Persons
10	Cultivators	5149	Persons
11	Agricultural Labourers	5202	Persons
12	Household Industries	16695	Persons
13	Other Workers	649907	Persons
14	Literates population	1414403	Persons
15	Illiterates population	394310	Persons
5-10 Km			
16	Number of villages and Town in the Study Area	69	Nos.
17	Total Households	413472	Persons
18	Total Population	1671006	Persons
19	Children Population (0-6 Years Old)	163211	Persons

20	SC Population	308586	Persons
21	ST Population	5824	Persons
22	Total Working Population	651495	Persons
23	Main Workers	572126	Persons
24	Marginal Workers	79369	Persons
25	Cultivators	5363	Persons
26	Agricultural Labourers	7637	Persons
27	Household Industries	12361	Persons
28	Other Workers	626134	Persons
29	Literates population	1367129	Persons
30	Illiterates population	303877	Persons

(Source: Census 2011)

CHAPTER 4
ANTICIPATED ENVIRONMENTAL
IMPACTS AND MITIGATION
MEASURES

4 Anticipated Environmental Impacts and Mitigation measures

4.1 Details of Investigated Environmental impacts due to project location, possible accidents, project design, project construction, regular operations, final decommissioning or rehabilitation of a completed project

The Environmental Impact Assessment (EIA) is a process of evaluating the likely environmental impacts of the project or development, taking into account inter-related socio-economic, cultural and human-health impacts, both beneficial and adverse. It aims to predict environmental impacts at an early stage in project planning and design, find ways and means to reduce adverse impacts, shape project to suit the local environment and present the predictions and options to decision-makers.

By using EIA both environmental and economic benefits can be achieved, such as reduced cost and time of project implementation and design, avoiding treatment/clean-up costs and impacts of laws and regulations. The main purpose of identifying the impacts is that it helps in adopting appropriate mitigation measures for the adverse consequences if any. The impacts on the environmental indices viz. air, water, soil, noise, biological and socioeconomic conditions are scrutinized methodically and assessed.

The most likely impacts on the environment due to the project need to be appraised during the two different phases of the project namely pre-operation/construction phase and operation phase. The impacts that could be triggered on the environmental attributes by the activities of the project are discussed below.

4.1.1 Construction Phase

4.1.1.1 Air Environment

Activities like site clearance; site levelling movements of workers and material, construction of road, transportation activities will generate dust, gaseous pollutants and particulate matter and affect the air quality.

The other impacts include -

- Site Preparation-fencing, boundary and clearing of site will cause disturbance to the surroundings.
- Release of suspended particles (sediments) from dredging activities
- Excavation, backfilling and levelling.
- Hauling and dumping of earth materials and construction spoils.

- Foundation works can cause dust generation which will decrease the air quality and it can impact the labours working.
- Fabrication, erection of steel structures.
- Construction of internal roads drains and water supply.
- Cleaning and landscaping.
- Emission from Construction Equipments

4.1.1.2 Water Environment

Activities related to construction of training walls, dredging of entrance channel, land reclamation and revetment, quays, RC sloping hard, Beach landing slope, etc. will involve miscellaneous civil work, movement of construction materials, etc. which will have potential impacts.

Dredging and other construction activities will increase turbidity level in the water column. This will be short term and restricted to the construction period only. The change in the drainage system due to construction of the training and dredging at the channel entrance with respect to tide, current and circulation will be temporary in nature and better flushing of the existing channel will offset any negative impact caused over period of time.

4.1.1.3 Noise Environment

Noise during construction phase will involve movement and operation of machinery and equipment as well as handling, loading, unloading of materials. Operation of mixer machines, cranes, winch machine, dumpers, pile drivers, metal works etc., as well as movement of trucks will generate noise.

4.1.1.4 Land Environment

The construction activities like excavation for foundation, earth-filling, clearing, stripping, levelling the sites and vehicular movements will entail changes in the landscape, which are expected to be of short duration and not much significant. The excavated earth material if stocked loosely may result into runoff to mud flats resulting in the loss of topsoil.

During the construction phase there will be land use change because of construction of training wall and revetment. Land / soil erosion due to earthwork as well as civil construction is likely to occur in the construction area. The site does not have any human settlement. The project area is free from agriculture or allied activities.

4.1.1.5 Ecology

Terrestrial Ecology

- The impact of construction activities will be primarily confined to the project site. As stated earlier, the site is a piece of land with minimal habitation.
- Deposition of fugitive dust on leaves of nearby vegetation may lead to temporary reduction of photosynthesis. Such impacts will, however, be confined mostly to the initial periods of the construction phase.
- The levels of pollutants expected to be maintained around the project site are much lower and are not envisaged to cause any stress on the biota.
- There is no likely tangible impact from higher noise and emissions during construction on the common animals and birds in the area.

Aquatic Ecology

- As the water quality may be changed due to the construction activities, minimal impact on the aquatic life is expected.
- During dredging, the existing habitat of creatures and organism that depends on the original composition of the soil may be affected. However, during our marine survey, the presence of sensitive species were not observed.
- The water could get polluted because of the soil particles mixing with the water. This may in turn affect the aquatic life temporarily.
- All the precautions will be taken not to discharge any material, solid or liquid to the marine environment.

4.1.1.6 Social-Economic Environment

- During construction, though there will be slight disturbances to the fishers and fish market vendors, ultimately the project will be beneficial to them in the long run.
- The project is proposed to construct the following welfare facilities and infrastructure to the fishermen , vendors and other customers:
 1. Fish Handling shed and Complex
 2. Two-Wheeler and Four wheeler Parking
 3. Drinking water arrangements
 4. Cleaning packing and cold storage
 5. Boats repair and spare parts complex

6. CCTV Surveillance for the safety and security of the fishermen.etc.

- Provision of extra cold storage will enable the fishermen to take the price advantage at the auction, as the harvested fishes can be stored for longer period of time before it gets rotten.
- With the improvement of sanitation facilities, the health hazard including the water borne diseases are expected to be contained.
- Generation of direct and indirect employment during construction and operation phases.
- The proposed project will contribute to GDP growth.
- The project will have positive impact on the quality of the life of the local fishermen with the improvement in operation facilities.

4.1.1.7 Solid Waste Generation

Generation of solid wastes is inevitable during both construction and operation phases. Solid generated during construction period will constitute debris, construction wastes, discarded metal items of construction utilities, spares and equipments, tyre, dry cell / batteries, etc. in addition, domestic wastes will be generated from the temporary labour camps at project site.

The likely impacts from such wastes will be on the soil and aquatic phase if it escapes into the water body. The impacts during construction phase will be temporary in nature and confined to the construction period only.

For, all the category of waste separate bins has been kept by GCC and the Environmental Cell of ChPA will monitor continuously. The GCC Agreement has been obtained in this regard and attached as **Annexure 9**.

4.1.1.8 Impacts due to Dredging

The area of dredging is 4,54,214 sq.m. The quantity of dredged material is 5,60,000 Cum. It is proposed to carry out maintenance dredging activity within the fishing harbour to facilitate effective and optional utilization of harbour. The depth of the dredging is varying from 1-2m in accordance with the site conditions.

The dredged materials are proposed to be transported through self propelled dump barge (bottom open drop barge) . The major impacts of dredging are :

1. Increment in the sediment loading
2. Destruction/Entanglement of fishing gears
3. Obstruction of travel routes
4. Impact to fisher revenue stream
5. Deterioration in quality of water

4.1.1.9 Marine Environment

Construction Material Handling/transportation of construction material : Generation of dust and vehicular movements during the transportation, which is also for a short term and non-significant.

Construction of offshore structures: Use of pile drivers, boring equipment, power tools, change in suspended solids and turbidity are expected due to these activities. Piling is proposed to be carried out by use of bored cast-in-situ concrete piles by use of permanent liner by rotary drilling. The structures being built on piles will not obstruct or block the natural flow of water in the area.

Waste water disposal to sea: No waste water will be discharged to the marine environment, hence no impacts on marine environment due to the waste water generation.

4.1.1.10 Mitigation Measures-Construction Phase

The construction phase is always the temporary phenomenon, which involves

- Site survey and preparation,
- Transportation of construction materials and equipment
- Construction activities involved in the infrastructure

4.1.1.11 Air Environment

Construction sites shall be enclosed with impermeable sheets or garden nets to prevent dust carry off. Water sprinkling shall be done at vulnerable areas.

- Pollution under control certificate shall be insisted for motor vehicles and relevant machinery.
- Earth and bulk filling materials shall be covered during transportation.
- Persons working close to sources of high emission shall be provided with protective gear such as mask and caps.

4.1.1.12 Water Environment

The cause and source of water pollution in the area could be attributed mostly to the surface run-off during rainy season. The following mitigation measures are to be taken in controlling the water contamination:

- All Construction activities will be carried out only during non- monsoon season.
- Construction material shall be properly covered to avoid the leakage and spillage.
- No overburden or loose sediments will be kept in the working benches particularly during monsoon months.
- Adequate caution while undertaking digging activities to avoid degradation of water aquifer and water quality
- Ground water not to be drawn from deep bore well within the CRZ limits.
- Public toiletry will be equipped from the proposed STP of 40 KLD and ETP of 80 KLD, hence no sewage will be allowed to seep into the water

4.1.1.13 Noise Environment

- Provision for insulating caps and aids at the exit of noise source on the machinery;
- The use of damping materials such as thin rubber/lead sheet for wrapping the work places like compressors, generator sheets;
- Shock absorbing techniques will be adopted to reduce impact of dredging;
- Inlet and outlet mufflers will be provided, which are easy to design;
- Earmuffs will be provided to the workers and it should be enforced to be used by the workers;
- No worker will be allowed to expose to more than 90 dB (A) in an 8-hour shift and under no circumstance the noise level from any equipment will be greater than 115 dB (A).
- As it is a market prone area, heavy machinery works will be employed only during the night time; so that public, vendors and other employees won't be affected.

4.1.1.14 Land Environment

The total land area involved in the project is **31.956 Hectare**. The following management measures will be adopted:

- There will be minimum/optimum concreting of the top surfaces so that sufficient scope for maximum groundwater recharge due to rainfall; and
- There will be no change in the land use pattern.

4.1.1.15 Ecology

- The solid waste being generated in the premises will be disposed in municipal/corporation bins on daily basis. So, no discharge will be done in the land and water.
- As, no industrial process are involved , so no major quantity of chemicals will be equipped.
- This storage of chemicals would be kept away from the public reach and stored in appropriate room temperature.
- Additional recommendations for the storage would be followed as per CPCB norms.

4.1.1.16 Socio –Economic Environment.

- Generation of direct and indirect employment during construction and operation phases.
- The proposed project will contribute to GDP growth.
- The project will have positive impact on the quality of the life of the local fishermen with the improvement in operation facilities

4.1.1.17 Marine Environment

Construction Material Handling/transportation of construction material : Generation of dust and vehicular movements during the transportation, which is also for a short term and non-significant.

Construction of offshore structures: Piling is proposed to be carried out by use of bored cast-in-situ concrete piles by use of permanent liner by rotary drilling. The structures being built on piles will not obstruct or block the natural flow of water in the area.

Waste water disposal to sea: No waste water will be discharged to the marine environment, hence no impacts on marine environment due to the waste water generation.

4.1.1.18 Dredging

The mitigation measures of dredging are :

- The use of grab or clamshell dredgers will reduce the sediment spillage. The nature of these impacts will be short-tem in nature and this will be back to normal after some days.

- The amount of the sediment spillage will be vastly reduced with overflowing and thus alleviating the impact of sediment dispersion.
- Deflectors should be installed on the draghead and to ensure marine mammal and turtle observers are on board during dredge operations.
- Silt screens and traps are recommended during reclamation phase, and a careful consideration of changes to long-term sediment flow patterns is suggested to ensure the remaining mangroves are not further degraded.
- No reclamation excess or dredged material shall be disposed into the sea.
- Daily site inspections with records of non-compliance with any required mitigation measures.
- Vehicles transporting reclamation materials must have their loads covered using tarpaulin or canvas sheet when utilizing the public road to prevent spillage of materials that can become a source of dust pollution.
- Damping the surface of reclaimed area during dry weather to suppress entrainment of soil and dust.
- Minimise or even prevent dewatering or overflow from dredger.
- Good practice when loading and transporting unsuitable dredged material
- Regular maintenance of ships and barges so as to prevent accidental leaks and spillage.

4.1.2 Operation Phase

4.1.2.1 Air Environment

Base line data reveals that ambient air quality in the study area for the parameters PM, SO₂ & NO_x, are well within the permissible Limits as prescribed by the National Ambient Air Quality Standards (NAAQS) for Industrial Area, Residential, Rural & Other areas.

The major activity at the harbour during operational phase is:

- Fishing markets
- Catchment of fishes
- Vehicular movements for the fish exports.

No chemical process or any manufacturing activity involved; hence there will not be any process emission.

No gases will be emitted even during the operation phase, as the major activity during this phase will be fish handling.

The impact of the air pollution due these will be very negligible as the proposed project is in the coastal area.

Meteorological Data

The meteorological data for 3 month, i.e. from **Mid of Jan to Mid of April 2023** was considered for the study. Data included for AERMET were daily wind speed, wind direction, temperature, relative humidity, air pressure, precipitation, and solar radiation recorded during the period. AERMET reformats meteorological data so that it can be used as input for AERMOD model. Meteorology considered for modelling is shown below

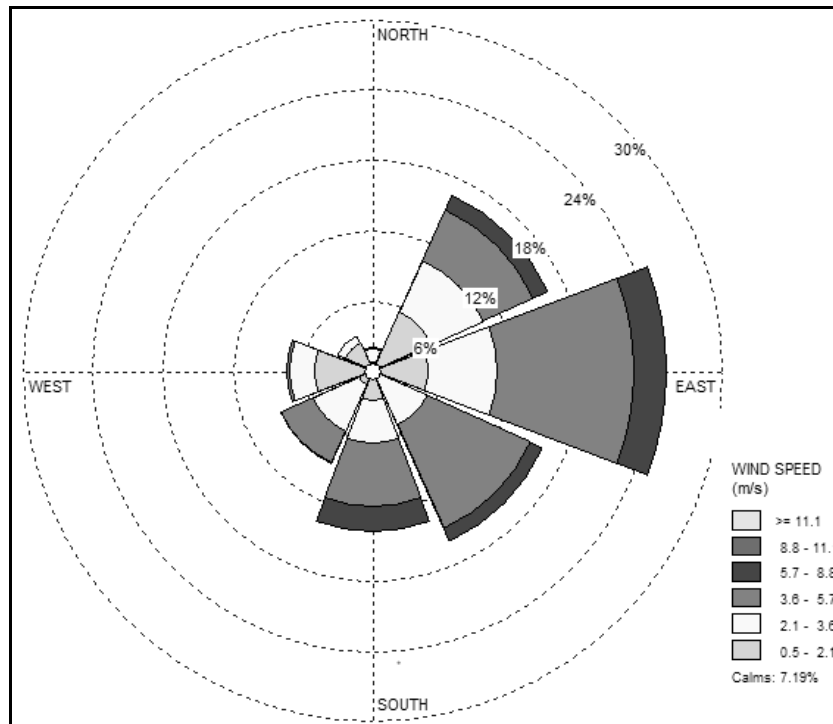


Figure 4-1 Wind Rose during the study period

For the 3 phase AERMET processing of the meteorological data, specifications of the land use in the area are required to determine the terrain roughness for modelling. The land use was characterized for in and around the site. The surface characteristics for the site and surroundings were selected and used to calculate the Albedo, Bowen ratio and surface roughness parameters.

AERMOD Process

AERMOD Software Version 8.0.5 was used for air dispersion modelling and is applicable to a wide range of buoyant or neutrally buoyant emissions up to a range of 50 km. In addition to

more straight forward cases, AERMOD is also suitable for complex terrain and urban dispersion scenarios.

AERMOD is a steady-state plume model. In the stable boundary layer (SBL), it assumes the concentration distribution to be Gaussian in both the vertical and horizontal. In the convective boundary layer (CBL), the horizontal distribution is also assumed to be Gaussian, but the vertical distribution is described with a bi-Gaussian probability density function (pdf). This behavior of the concentration distributions in the CBL was demonstrated by Willis and Deardorff (1981) and Briggs (1993). Additionally, in the CBL, AERMOD treats “plume lofting,” whereby a portion of plume mass, released from a buoyant source, rises to and remains near the top of the boundary layer before becoming mixed into the CBL. AERMOD also tracks any plume mass that penetrates into the elevated stable layer, and then allows it to re-enter the boundary layer when and if appropriate. For sources in both the CBL and the SBL AERMOD treats the enhancement of lateral dispersion resulting from plume meander. Maximum incremental values for PM, SO₂ and NO_x have been represented as pictorial concentration contours and as tabular concentration values in following sections.

Line Source Emissions

Table 4.1 Emission from the proposed project (Transportation)

Sr.no	Type of Vehicle	No.of.Vehicle	Emission(g/s)		
			PM	NOX	CO
1	2W	80	1.00E-03	2.00E-02	1.11E-01
2	4W	10	1.25E-04	3.47E-03	2.06E-02
3	HW	20	5.56E-04	2.56E-02	2.22E-01
Total(g/s)			1.68E-03	4.90E-02	3.54E-01

Source: Indian Emission Regulations by the Automotive Research Association of India

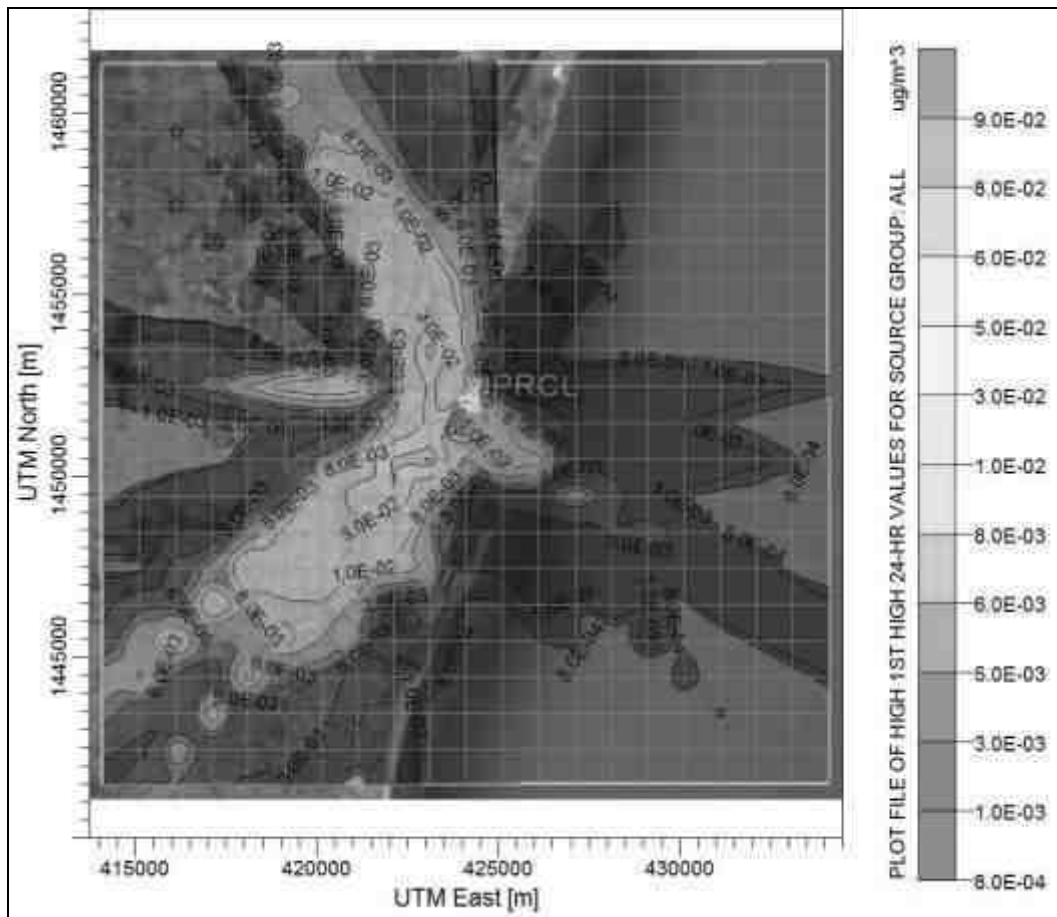


Figure 4-2 Predicted 24-Hrs' GLC's of PM within 10 km Radius of the Study Area

Table 4.2 Estimated Top 10 Highest Concentrations of PM Obtained through Modeling

S. No	UTM coordinates (m)		Conc. ($\mu\text{g}/\text{m}^3$)	Distance from Centre of Project Site, (~Km)	Direction from Centre of Project Site
	E	N			
1.	424116	1451452	0.08433	Project Site	Project Site
2.	423116	1450452	0.06172	1.41	SW
3.	423116	1453452	0.05711	2.24	NNW
4.	422116	1450452	0.05253	2.24	WSW
5.	422116	1449452	0.05019	2.82	SW
6.	421116	1449452	0.04268	3.60	WSW
7.	423116	1451452	0.03452	1	W
8.	423116	1452452	0.03353	1.41	NW
9.	422116	1454452	0.02777	3.60	WNW
10.	421116	1448452	0.02749	4.23	SW

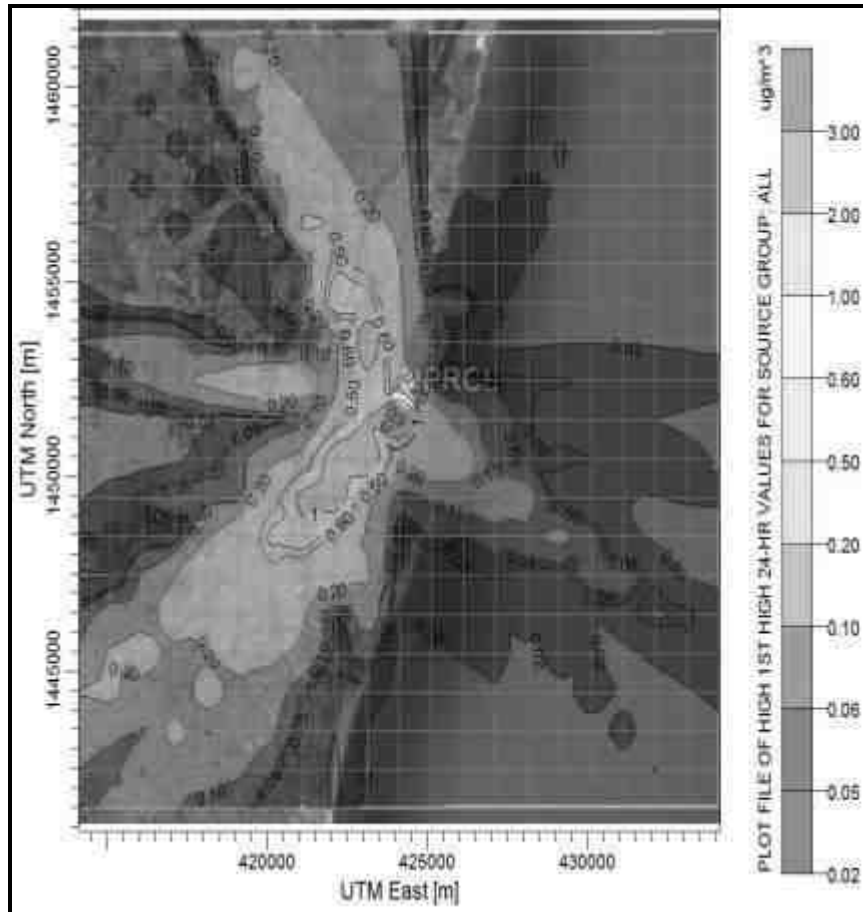


Figure 4-3 Predicted 24-Hrs' GLC's of NOx within 10 km Radius of the Study Area

Table 4.3 Estimated Top 10 Highest Concentrations of Oxides of Nitrogen Obtained through Modeling

S. No	UTM coordinates (m)		Conc. ($\mu\text{g}/\text{m}^3$)	Distance from Centre of Project Site (~Km)	Direction from Centre of Project Site
	E	N			
1.	424116	1451452	2.45967	Project Site	Project Site
2.	423116	1450452	1.80003	1.41	SW
3.	423116	1453452	1.66563	2.24	NNW
4.	422116	1450452	1.53207	2.24	WSW
5.	422116	1449452	1.46396	2.82	SW
6.	421116	1449452	1.24483	3.60	WSW
7.	423116	1451452	1.00696	1	W
8.	423116	1452452	0.97787	1.41	NW
9.	422116	1454452	0.81001	3.60	WNW
10.	421116	1448452	0.80193	4.23	SW

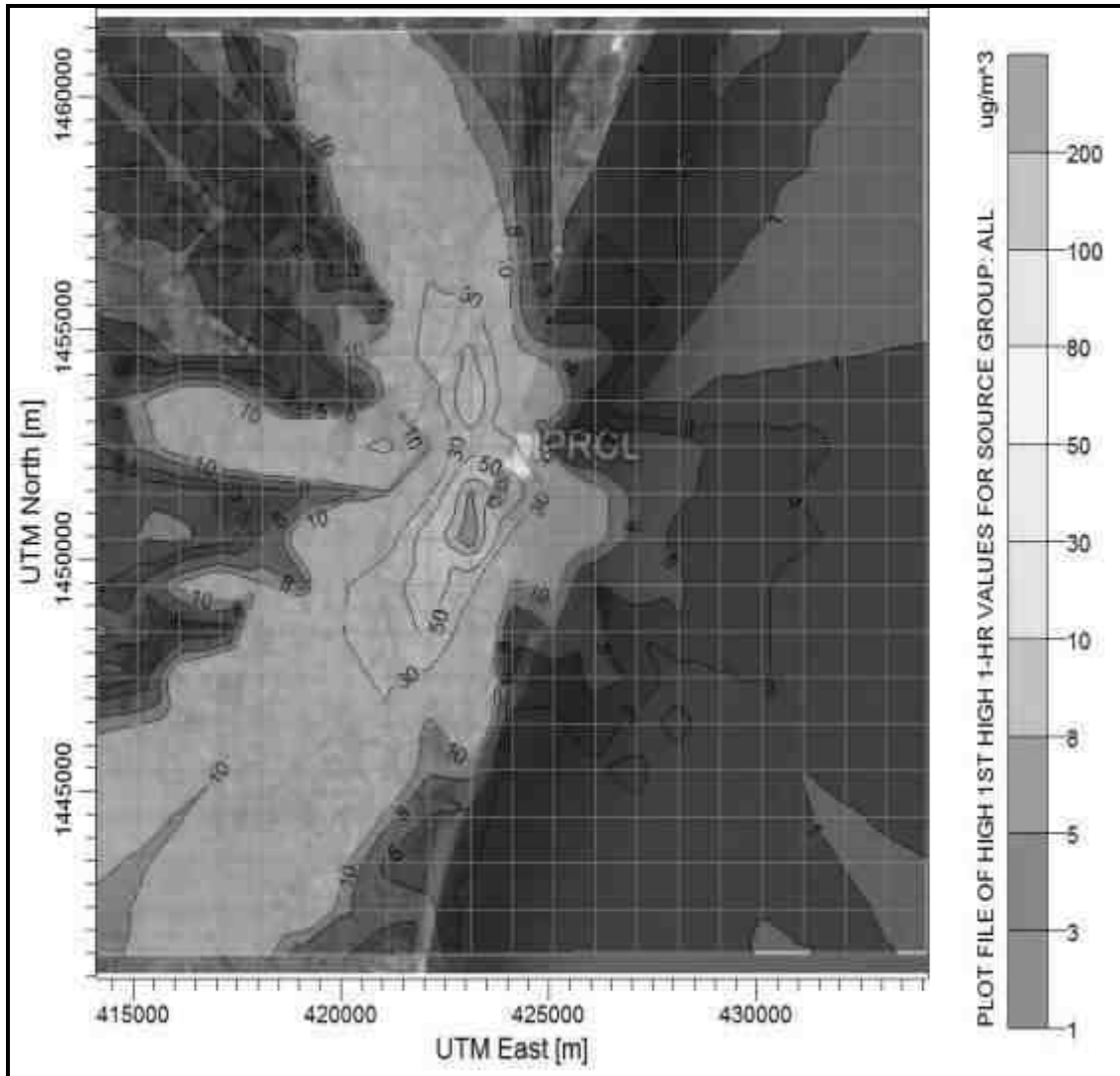


Figure 4-4 Predicted 1-Hrs' GLC's of CO within 10 km Radius of the Study Area

Table 4.4 Estimated Top 10 Highest Concentrations of CO Obtained through Modeling

S. No	UTM coordinates (m)		Conc. ($\mu\text{g}/\text{m}^3$)	Distance from Centre of Project Site (~Km)	Direction from Centre of Project Site
	E	N			
1.	423116	1450452	118.0501	1.41	SW
2.	423116	1451452	103.7024	1	W
3.	423116	1453452	78.15056	2.24	NNW
4.	424116	1451452	67.34153	Project Site	Project Site
5.	422116	1450452	67.17717	2.24	WSW
6.	422116	1449452	63.10299	2.82	SW
7.	422116	1448452	54.73103	3.60	SSW
8.	423116	1454452	54.63389	3.16	NNW

9.	421116	1449452	43.35169	3.60	WSW
10	423116	1452452	42.40686	1.41	NW

Conclusion

Maximum pollutant concentrations of PM, and NO_x observed due to proposed Expansion for an 24hr-average period have been studied and CO observed due to proposed Expansion for an 1hr-average period have been studied. The total increase in concentrations above baseline status to estimate the percentage increase and summarized in **Table 4.5**

Table 4.5 Total Maximum GLCs from the Transportation Emissions (Line source)

Pollutant	Max. Base line Conc. (µg/m ³)	Max Location of Baseline	Estimated Incremental Conc. (µg/m ³)	Total Conc. (µg/m ³)	NAAQ standard (µg/m ³)	% increase
PM10	66.77	Veysarpadi	0.08	66.85	100	0.12
NO _x	29.89		2.45	32.34	80	8.20
CO	910	Tondiarpet	118.05	1028.05	4000	12.97

4.1.2.2 Water Environment

There will be no major impacts foreseen in the operation phase. Some of the biodegradable and non-biodegradable waste may discharge directly into the water.

Wastewater generated from the auction halls and post-cleaning process will be directed to proposed ETP and will be reused.

4.1.2.3 Noise Environment

During operational phase, the major source of noise:

1. Motor boat movements
2. Market prone area
3. From boat repair complex (to be proposed)
4. Ship Lifting Facility

However, this increase in noise level will be lower compared to the construction phase.

4.1.2.4 Land Environment

Under ordinary and safe operating conditions, no adverse impact is anticipated on land during the operation phase. The only source of land pollution would be the solid waste generated from the workers. Thus, the land pollution during the operation phase is minimal and not likely to create any significant impact with proper EMP in place.

4.1.2.5 Ecology

The major impacts envisaged are given as follows:

1. Leakage of oils,
2. Oily wastes and mixtures

These may directly cause damage to fishery resources, aquatic biota and coastal habitat. Biodegradation of oil also generates polymerized oil particles and toxic aromatic fractions using dissolved oxygen in the water, which indirectly cause damages to bottom biota and habitat. Both effects may damage marine ecology.

4.1.2.6 Social-economic Environment

Oil and oily wastes discharged from ships may reach harbour and spoil recreational activities, which cause serious damage to tourism. Ship traffic may disturb fishery boat operations. The possibility of accidents in the ship traffic becomes a worry to local people.

The development due to proposed project will have temporary impacts on local socio economic condition of the people residing in the area. The project would create certain impacts which could be beneficial as well as adverse. It is necessary to identify the extent of these impacts for further planning of control measures leading to mitigation of the adverse impact. However, there will not be any filling capacity augmentation.

4.1.2.7 Solid Waste Generation

During the operation phase solid waste will constitute fish offal, discarded fish boxes, utility and plastic items, ropes, nets, dry cell / batteries, etc. in addition to domestic waste to be generated from the eatery, dormitory, etc., within the harbour complex.

The likely impacts from such wastes will be on soil, sanitation and water quality. Impacts during this phase will be continual, for which proper management plan will be implemented required for mitigation of such impacts.

4.1.2.8 Marine Environment

Vehicular Movements: Discharge of fishing residues, operational wastes, waste water, etc. As, the Kasimedu village is one of the busiest fish market, the vehicular movements will be generally high for exports of fishes . Increased chances of contamination of marine water due to tyre particles.

Sea traffic congestion: As there is an increase in sea traffic, there are chances of congestion near the fishing harbor and in the boat parking area.

Impacts due to maintenance of dredging: Whatever impacts identified during dredging activities, will be applicable in the lower scale.

Chances of spillage of oil from boats: Due to poor maintenance, there may be chances of spilling of oil from boats.

4.1.3 Mitigation Measures

The specific mitigation measures related to gaseous emissions, sewage discharges, noise generation, solid waste disposal, etc are described below:

4.1.3.1 Air Environment

As the entire project area will be covered with good landscaping and tree/grass cover, generation of major dust particulates within the premises is not anticipated.

Further, all emissions are likely to be controlled to a great extent, through proper maintenance of tree plantations and the green belt development undertaken within the project.

4.1.3.2 Water Environment

The water will be well stored in the Over Head Tank (OHT) and Low Level Reservoir (LLR). Drinking water arrangements by 5Nos. of RO with 25LPH capacity along with the 2Nos. of 500LPH capacity and 2Nos. of 1000L Storage Tanks.

There will be no discharge of waste in direct to the water bodies as it will be emerged with the available existing 5 toilets.

4.1.3.3 Noise Environment

Air horns shall be prohibited in the project area. Sounding of horns(of other types) shall be allowed only in emergency.

- Sound level monitoring shall be done as specified by TNPCB norms.
- Persons working close to equipments generating high level of noise (85 dB (A)) shall be provided with personal protective equipment such as ear plugs.
- Appropriate measures for minimizing noise from use of mechanical devices will be taken by the implementing agencies /contractors by adopting damping, absorption, dissipation and deflection methods and provision of acoustic enclosures, mufflers, noise sources isolators.

4.1.3.4 Land Environment

- As STP of 40 KLD and ETP of 80 KLD is to be proposed all the wastes will be directed to the same. Therefore, no discharge of any waste will be released in the land.
- The Greenbelt will be proposed at the project site taking into consideration the availability of area as the efficacy of green belt in pollution control mainly depends on width of green belt, distance from pollution sources, and site of the habitat from working place and tree height & density.
- The green belt development will be carried out in the consultation with a local forest department wherever feasible, which will help in minimizing adverse impact on the flora found in the area.

4.1.3.5 Ecology

- No untreated discharge of wastes shall be made into the aquatic environment.
- Differently colored and labeled covered vats (100 litre capacity) shall be provided for biodegradable, recyclable and inert waste. Biodegradable waste shall be processed in bio digester, recycle waste shall be handed over to recyclers and inert waste shall be utilized or made available for use as land fill within and outside the project area.
- Wash water from the fish handling and auction areas shall be treated in an Effluent Treatment plant consisting of bar screen, oil trap and settling tank.
- Spent engine oil and lubricants from the vessels / quays / landing / berthing areas shall be collected and stored in leak proof containers placed inside a roofed shed.
- Accidental catch of endangered marine species, if any, during voyage shall be released under guidance of the Fisheries Department.
- Program on awareness for conservation of marine biodiversity shall be organized in association with experts.

4.1.3.6 Marine Environment

- Sewage generated at different locations will be treated in septic tank – soak pit systems.
- Regular monitoring of the water parameters as recommended are to be made for review and further control measures, if found necessary on the basis of the monitoring reports.

Monitoring reports are to be submitted to the statutory authorities at the periodicity specified by them.

- Oil spills from fishing vessels shall be contained and removed/dispersed with appropriate facilities.
- Wash-off from oil handling areas will be directed or conveyed into the effluent treatment plant consisting of bar screen, oil trap and settling unit. Sediment deposition at the training wall shall be cleared at least once in two years.
- Wash-water from auction hall will be sent to the effluent treatment plant consisting of bar screen, oil trap and settling unit.
- Washed water from the fish auction area will be connected to Effluent Treatment Plant consisting of bar screen, oil trap and settling tank prior to discharge into the sea.
- Surface water, ground water, marine water and discharge effluent quality shall be analysed regularly as detailed in the EMP.

CHAPTER 5
ANALYSIS OF ALTERNATIVES

5 Analysis of Alternatives

5.1 Introduction

A necessary part of the EIA process is the consideration of alternatives to the proposed activity. The many complex factors controlling the location of the project site (e.g. surface and subsurface Geology, topography, communications) usually means that there are only a few viable alternatives that can be genuinely considered.

5.2 Choice of Alternative Sites

Since the project is proposed only in the existing site, no alternate sites were proposed.

5.3 Project Location Justification

Tamil Nadu is the Southernmost coastal state on the East coast of India. It has around 1,076 km of coastline which supports more than 600 fishing villages and over 300 fish landing centres. In 2019-20, the total fisheries production of the state was 7.57 lakhs tonnes, about 4% of the country's production. There are around 13 lakhs fishermen in Tamil Nadu.

Chennai region has one major fishing harbour and nine notified fish landing points. Chennai Fishing harbour is a sheltered harbour which provides fisheries-related facilities to thousands of fishermen, shelter to 2000+ fishing boats, hosts 3000+ buyers/day, 1000+ labourers and vendors. However, old infrastructure or lack thereof, non-standardized operations and unhygienic conditions require a planned development work at Chennai Fishing Harbour.

CHAPTER 6
ENVIRONMENTAL MONITORING
PROGRAM

6 Environmental Monitoring Program

6.1 Introduction

Environmental monitoring is required to protect the public and the environment from toxic contaminants and pathogens that can be released into a variety of media including air, soil, and water.

The plan framed for the intended facility will describe

- The details of the proposed mitigation measures taken for safeguarding the environment at the project site as well as in the vicinity of the industrial site
- Details of management plans, Solid waste management plan etc.
- Post project environmental monitoring programme to be undertaken after commissioning of the project.
- The associated cost components of the pollution control systems that will be installed at the site.

For each of the environmental attributes, the monitoring plan specifies the parameters to be monitored, location of monitoring sites, frequency and duration of monitoring and it also denotes the applicable standards, implementation and supervising responsibilities.

6.2 Objectives

- To provide a database this can be used to determine any short or long-term environmental impacts of the Project.
- To verify the environmental impacts predicted in the EIA study.
- To monitor the performance and effectiveness of mitigation measures employed.
- To determine project compliance with regulatory requirements, standards and Government policies.

- To provide an early indication and suggest appropriate additional or remedial measures should any of the environmental mitigation measures or controls fail to achieve acceptable standards.
- To ensure that the areas of environmental concern identified during EIA process are carried through to, and appropriately considered and incorporated into the detailed design and tender stage of project.
- To take remedial action if unexpected problems or unacceptable impacts arise.
- To implement water quality, air quality and noise impact monitoring programme during the operational phase.
- To conduct regular reviews of monitored data as the basis for assessing compliance with defined criteria.
- Adequate safety equipment will be available within the project site.
- Adequate protection against stray current and interference will be provided.

6.3 Environmental Monitoring Programme

The goal of having an Environmental monitoring programme is to ensure that, action has been implemented in accordance with the conditions specified, that appropriate measures corresponding with those required and the conditions imposed on the action have been adequately met. It is imperative that the Project Authorities set up regular monitoring stations to assess the quality of the neighbouring environment after the commissioning of the project.

In the process, project proponent is supposed to provide essential feedback about the actual environmental impacts of the project and also check if the implementation of the environment management plan is having the desired mitigative effects.

6.3.1 Monitoring Programme for Construction Phase

Monitoring of environmental parameters will be carried out at regular intervals during construction phase. The outcomes of the impact assessment studies were used to guide the monitoring programme in various sectors of the environment. The monitoring programme including areas, number and location of monitoring stations, frequency of sampling and parameters to be covered is summarized in **Table 6.1**

Table 6.1 Environmental Monitoring Program during construction phase

Sr. No	Area of Monitoring	Number of Sampling Stations	Frequently of Sampling	Parameters to be Analyzed
1.	Ambient Air Quality	4 Stations	Twice a week:24 hourly period	PM10, PM2.5, SO _x , NO _x CO and TVOC
2.	Noise	4 (two within premises and two outside premises)	Weekly	Ambient Equivalent continuous Sound Pressure Levels (L _{eq}) at day and Night time.
3.	Surface water and Ground water	4 Stations (one within the premises and two outside premises)	Weekly	pH, Conductivity, TSS, TDS, BOD,COD, DO, Heavy metals (Ar, Pb, Ch, Ni etc), Chloride, Sulphate, Total Coliform
4.	Vehicular Emissions	2 Stations Inside and Outside premises	Weekly	Air emission and noise, PUC
5.	Soil	4 Stations (one within the premises and two outside premises)	Weekly	pH, Physicochemical properties like N,P,K,B,Cu,Heavy metals
6.	Terrestrial and Marine Ecology	Within 10 km radius	Weekly	Symptoms of injuries and total count of Phytoplankton, Flora, Fisheries productivity,benthic fauna .

6.3.2 Monitoring Programme for Operation Phase

Post project monitoring of environmental parameters will be carried out at regular intervals. The monitoring programme in different areas of the environment has been based on the findings of the impact assessment studies.

The post project monitoring programme including areas, number and location of monitoring stations, frequency of sampling and parameters to be covered is summarized in **Table 6.2**

Table 6.2 Post Project Environmental Monitoring Program

Sr. No	Area of Monitoring	Number of Sampling Stations	Frequently of Sampling	Parameters to be Analyzed
1.	Ambient Air Quality	4 Stations	Once in three months	PM10, PM2.5, SO _x , NO _x CO and TVOC
2.	Noise	4 (two within premises and two outside premises)	Once in three months	Ambient Equivalent continuous Sound Pressure Levels (L _{eq}) at day and Night time.
3.	Surface water and Ground water	4 Stations (one within the premises and two outside premises)	Once in three months	pH, Conductivity, TSS, TDS, BOD,COD, DO, Heavy metals (Ar, Pb, Ch, Ni etc), Chloride, Sulphate, Total Coliform
4.	Vehicular Emissions	2 Stations Inside and Outside premises	Once in three months	Air emission and noise, PUC

5.	Soil	4 Stations (one within the premises and two outside premises)	Once in three months	pH, Physicochemical properties like N,P,K,B,Cu,Heavy metals
6.	Terrestrial and Marine Ecology	Within 10 km radius	Once in three months	Symptoms of injuries and total count of Phytoplankton, Flora, Fisheries productivity, benthic fauna .

6.4 Institutional Set-up for Monitoring

The responsibility of environmental management of an operating station lies mainly with the Management Staff operating the Plant who handle the Environmental Management at site and co-ordinate with all other Zone & HQO and CC for environmental matters as well as outside agencies like State Pollution Control Board. An environmental management group shall be established at project consisting of Senior Executives and supporting staff.

6.5 Legal and Statutory compliance

All the environmental standards/stipulations will be fully complied. The project area has to obtain regular renewal of Consent from the State Pollution Control Board for liquid and gaseous wastes disposal as per Water (Prevention & Control of Pollution) Act and Air (Prevention & Control of Pollution) Act respectively. It will be supervised that all requirements under these acts and rules are met, and if not met, the satisfactory explanations for it are sought. The officer in charge for environmental aspects will prepare these reports.

6.6 Information Dissemination and Public Relations

Everybody nowadays is concerned about environment. It is needed that people should be provided with environmental data related to the plant so that wrong apprehensions can be removed.

This requires a well planned public relation and information dissemination process so that unnecessary public intervention is avoided.

This can be done through organizing different programmes with participation from local bodies, encouraging local community in environmental projects etc. The management in the project will be entrusted with all these responsibilities.

CHAPTER 7
ADDITIONAL STUDIES

7 Additional Studies

7.1 Public Hearing

As per EIA Notification 2006, the proposed project site falls under 7(e)-Ports, Harbours, Breakwaters and Dredging. The category of the project is B1. The proceedings of public hearing is under progress.

7.2 Risk Assessment

The Quantitative Risk Assessment study has been performed as dictated by the IS15656:2006 “HAZARD IDENTIFICATION AND RISK ANALYSIS - CODE OF PRACTICE” to give crucial insights on the hazards involved in mainly in the dredging process in the proposed project of Modernization and Upgradation of the Chennai Fishing Harbour, Kasimedu.

EVALUATE OR ACCESS THE RISK

Once the risk and affected persons have been identified, next step is to access the risk to protect the people from harm. There must be a defined risk rating to access the identified risk.

RISK RATING

One of the most simplistic forms of risk assessment is to rate the remaining risk as high, medium or low, depending on how likely the activity is to cause harm and how serious that harm might be. This is called “Risk rating”.

LEVEL OF RISK

Low risk: It is most unlikely that harm would arise under the controlled conditions listed, and even if exposure occurred, the injury would be relatively slight.

Moderate risk: These types of risks are ones that could cause issues, but that there is still a lower chance that they will cause your work to fail. It is more likely that harm might actually occur and the outcome could be more serious. Minor injury is a typical example for this kind of risk.

High and extreme risk: These are the risks that take the highest priority. They can cause your work to fail, and you need to plan for these risks ahead of time. If injury is likely to arise and that injury might be serious like broken bones, trip to the hospital, loss of consciousness, or even a fatality.

Numerical scores are given to the different elements (e.g. consequence, exposure, likelihood) of risks and these scores are added or multiplied to get a rating for the risk.

ELEMENTS OF RISK

Probability: Risk probability, or likelihood, is the possibility of a risk event occurring. The likelihood can be expressed in both a qualitative and quantitative manner. The likelihood is the probability of loss when a sub-standard act occurs or sub-standard condition exists.

The likelihood should be based on the worst case scenario, ranging from a remote possibility to the inevitable. Factors affecting the likelihood include:

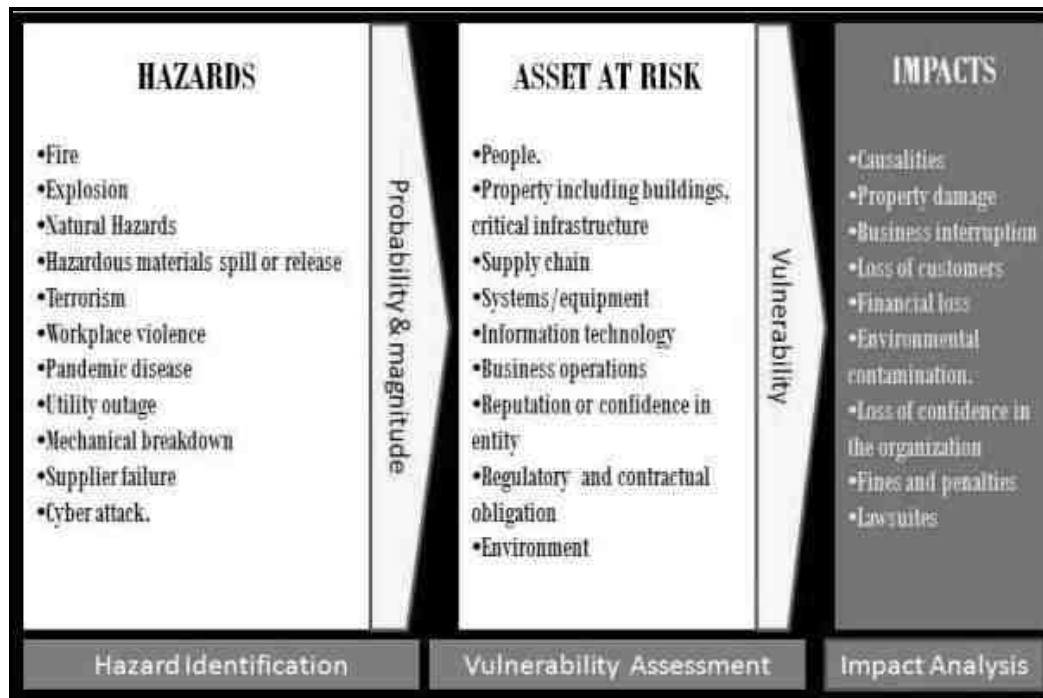
- Number of times the situation occurs
- Location of the hazard
- Duration of the exposure
- Environmental conditions
- Competence of the people involved

CONSEQUENCES

Consequences are the expected severity. The severity is expressed in terms of the effect on the person, whether injury or ill health, and ranging from minor injury to death. The risks are clearly higher if an accident is likely to result in serious injury or death.

RISK ANALYSIS

Once the hazard has been identified, it is necessary to assess what risk they pose to employees in the workplace. In this way we can establish a measure of the risk and determine what priority they should have for corrective actions. The risk assessment step is that part of the process that assesses the probability and consequences of hazard that have been identified. Once we have estimated the probability and consequences for each hazard then we can allocate it a priority for corrective action.



The risk analysis determined the frequency and potential impact of hazards on business operations, community, associated stakeholders, related infrastructure, and the environment. Historical occurrences, changing circumstances, outside influences and similar occurrences happening elsewhere are examined when analysing risks.

7.3 Disaster Management Plan

Disaster Management planning is an integral and essential part of loss prevention strategy. Disasters are intimately linked with sustainable development and that sustainable development and DRR (Disaster Risk Reduction) are mutually supportive goals.

For the fishery project at Kasimedu , the types of hazards and disaster agents have been broadly grouped into four generic categories as

- (i) Water and Climate related
- (ii) Geology / Geomorphology related
- (iii) Chemical, industrial and Accident related and
- (iv) Epidemic related.

The potential hazards which can lead to disasters resulting in loss of life, damage to property and environment have been identified. The nature of the proposed project is such that there

are minimal chances of accidents. The project operations do not entail any risk or hazard. However, there still remain small possibilities that disaster may occur.

This Disaster Management Plan also sets out the procedures and measures to be taken into account in the event of loss of containment and consequence thereof in the fishery harbour at Kasimedu.

The main objectives of the Disaster Management Plan would be as follows:

- Ensure that loss of life and human injuries are minimized
- Damage to environment and physical assets is minimized
- Relief, rehabilitation and disaster response is prompt and effective
- Minimize the outage duration of the facilities.

The details of DMP including likely emergencies, communication systems, medical services, early warning systems etc. have been discussed in detail in the EIA report. Mitigation methods and preparedness contribute largely in reducing risks and related impacts.

In line with this and as part of the disaster risk reduction strategy the harbour authority / project proponent should set up a Disaster Management Cell (DMC) with a small team trained in relief and rescue operations required for the anticipated emergencies.

Programmes in association with the Village Panchayats of all the adjoining villages around Kasimedu, local NGOs, District authorities and the Indian Coast Guard / Coastal police, which should include disaster mitigation measures, social mobilization and capacity building should be undertaken.

An onsite emergency plan is attributed to the response plan that contains and minimizes the effects due to emergencies within the installations which have a potential to cause damage to people and facilities within the installation premises.

The On-site Disaster Management Plan is prepared with the objective of defining the functions and responsibilities of all concerned managerial, operational and supporting services department personnel with respect to detection and effective implementation of action plan.

The ultimate goal is the effective containment of the situation by proper mitigative action at the place of occurrence, cautioning people in adjoining affected localities, prompt rescue and medical aid to affected persons and communication to civil authorities for rushing in help

from outside. All concerned are hereby requested to carefully study and thoroughly familiarize themselves with it in order to ensure its effectiveness in times of emergency.

Features	Description
Earthquake	<ul style="list-style-type: none"> ➤ The District is located in Zone II of seismic vulnerability as captured in the Vulnerability Atlas. ➤ While earthquakes cannot be predicted, a detailed mapping of seismic fault systems and seismic source regions, quantification of probability of experiencing various strengths of ground motion at a site in terms of return period for an intensity will be carried out and appropriate regulations put in place to decrease the vulnerability of built environment.
Tsunami	<ul style="list-style-type: none"> ➤ So far as Tiruvallur District is concerned there are 3 costal talukas and as per Analysis of Mean Sea level of Tiruvallur there are 77 villages of 3 costal taluks in which Thiruvottiyur taluk are less than 1 km far from sea and on less than 10 meter of height from ocean level. ➤ Tsunami which struck the coast line of Tiruvallur District in the year 2004 took away the lives of 29 persons also caused extensive damage to property which made the livelihood of the coastal community a questionable one.
Cyclone	<ul style="list-style-type: none"> ➤ The largest low-pressure systems are cold-core polar cyclones and extra tropical cyclones which lie on the synoptic scale. Coastal Taluks viz., Thiruvottiyur, Ponneri and Gummidipoondi with coast line of 27.9 Kms are particularly prone. ➤ Cyclones originate out at sea and become hazardous when they come ashore. They also drive the sea level up to cause coastal flooding. ➤ At a community level, the TNSDMA has provided Multi-Purpose Evacuation Shelters at 5 locations. ➤ Further, Public Buildings, Choultries, Community Halls and buildings owned by various private educational institutions have also be identified for use as cyclone shelters, for evacuation and temporary occupation.

<p>Oil Spillage</p>	<ul style="list-style-type: none"> ➤ On 28th January - 2017 two ships namely MV BW Maple and MV MT Dawn Kancheepuram collided off the coast of Ernavur Village, Tiruvottiyur Taluk resulting into Bunker Oil Spill into the sea. ➤ The Tiruvallur distirct administration was actively involved in the oil spill removal process. Coast guard is the designated agency to tackle oil spill.
<p>Fire</p>	<ul style="list-style-type: none"> ➤ Fire may be caused due to earthquakes, explosions, electrical malfunctioning and various other causes. ➤ Tiruvallur District has been listed in 'very high risk' category in view of the population density, residential built-up area and Industrial areas in the district.

CHAPTER 8

PROJECT BENEFITS

8 Project Benefits

8.1 Financial Benefits of the Project

- It plays a vital role in India's National Economy, contributing to the country's GDP, exports, food and nutritional security.
- The proposed activity will be a boost to the hub of the economic activity. As, the Chennai fishing harbour is one of the major harbour in our country and ninth among notified fish landing points.

8.2 Social Benefits of the Project

- Improvising the welfare of the fishermen community.
- This project will improve the livelihood of the fisher community
- This project will cater for the improvement of GDP.
- With the improvement of sanitation facilities, the health hazard including the water borne diseases are expected to be contained.
- Generation of direct and indirect employment during construction and operation phases.

CHAPTER 9
ENVIRONMENTAL COST BENEFIT
ANALYSIS

9 Environmental cost Benefit Analysis

(Not recommended for scoping stage)

CHAPTER 10
ENVIRONMENTAL MANAGEMENT
PLAN

10 Environmental Management Plan

10.1 Description of the administrative aspects of ensuring that mitigate measure are implemented and their effectiveness monitored

An Environmental Management Plan (EMP) is a plan or program aimed at achieving a desired end state and describes how activities that adversely affect, or have the potential to affect, the environment will be mitigated, controlled and monitored. Doing EMP addresses environmental impacts during the design, construction and operation phases of projects. Environmental protection should be considered throughout the project. They are created to achieve this number of environmental specifications/recommendations. These are intended to help contractors maintain good control .

- Minimize the magnitude of impacts during construction.
- Ensure proper rehabilitation of areas affected by construction,if any.
- Prevention of long-term environmental degradation

10.2 Objectives of EMP

- To suggest the formation of a core group (Environment Management Cell) responsible for implementation of environmental control & protective measures as well as monitoring of such implementation.
- To ensure project components comply with all laws and approval conditions.
- Facilitate a continual review of operation activities.
- To suggest preventive and mitigation measures to minimize adverse impact and to maximize beneficial impacts like.
- To prepare a capital cost estimate and annual recurring cost for Environmental Management Plan.
- To prepare a detailed action plan for implementation of mitigation measures.
- Measure the effectiveness and success of proposed mitigation measures

10.3 EMP Roles and Responsibilities

For effective implementation of the mitigation measures and consistent functioning of the proposed project, an Environmental Management System (EMS) is proposed. The EMS includes the following:

- Environmental Management Cell
- Environmental Monitoring Program
- Personnel Training
- Regular Environmental Audits and Corrective Action Plan
- Documentation-Standard Operating procedures of Environmental Management

All the activities will be monitored to ensure appropriate implementation of all environmental mitigation activities and to identify areas where environmental management plan compliance is not satisfied.

For effective implementation of the system, it is also necessary to have a permanent organizational set-up as Environmental Management Cell (EMC) for the effective implementation and monitoring of environmental management system. This is done by assigning responsibility to the concerned personnel for implementation of environmental control measures.

10.4 Responsibilities of Environmental Management Cell

The Environment Management Cell will be responsible for monitoring of the following

- Checking of safety related operating conditions.
- Preparation of a maintenance plan and documentation of maintenance work specifying different maintenance intervals and the type of work to be performed.

Other responsibilities of the cell will include:

- Mitigation / corrective measures as specified by PCB.
- Keeping the management updated on regular basis about the conclusions / results of monitoring activities and proposes measures to improve environment preservation and protection.
- Conducting regular safety drills and training programs to educate employees on safety practices.

- A qualified and experienced safety officer will be responsible for the identification of the hazardous conditions and unsafe acts of workers and advise on corrective actions, organize training programs and provide professional expert advice on various issues related to occupational safety and health.
- Conducting safety and health audits to ensure that recommended safety and health measures are followed.

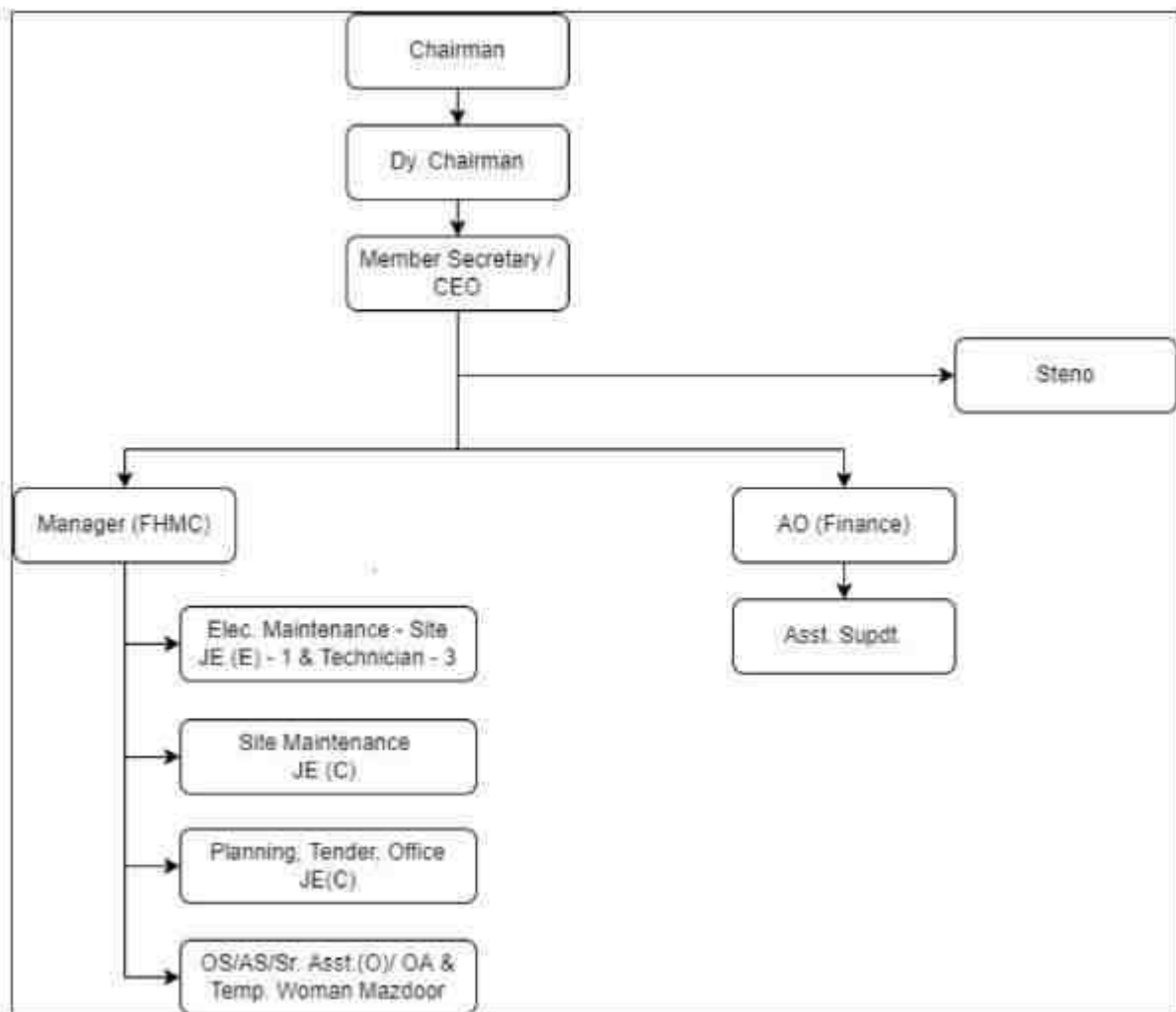


Figure 10-1 Responsibilities of Environmental Management Cell

10.5 Environmental Management Plan

Following up with the mitigation measures an EMP has been drawn up considering pollution abatement, resource conservation, environmental and social security covering the three phases of the activities viz. (i) EMP during Pre-Construction phase (ii) EMP during Construction phase and (iii) EMP during Operation phase. The Environmental Management

Plan (EMP) for the proposed fisheries harbour is suggested to maximize positive impacts and to minimize negative impacts.

10.5.1 Land environment

- The surface roads, which are proposed to be utilized during construction, shall be black topped to avoid fugitive dust.
- No new quarry is proposed to be specifically opened and the construction material is to be extracted from existing operating quarries, located outside the study area.
- Hence, project proponents are not required to implement management measures related to quarry slope stabilization.

10.5.2 Solid Waste Disposal

- Many of the waste items can be recycled and reused. This involves collecting and sorting the discarded materials suitable for recycling, paper, plastic, glass and aluminium cans, etc.
- Wet organic matter can be converted into compost. It is advisable to have separate containers to facilitate the segregation of wastes into bio-degradable and non biodegradable components.
- Floating garbage is best collected by small boats using a scoop net or two vessels working together using a floating net boom at the designated dumping areas of the local administration. Plastic drums of 100-litre capacity with airtight lids shall be bought and used to collect offal from fish markets or moored boats.
- Other organic fish wastes generated near the quay and auction hall area will be collected in air tight containers and sent to the organic waste composter, bio-mechanical composter of the local body.

10.5.3 Water Environment

- The major source of water pollution in the construction and operation phases is the sewage generated by the workers and employees. As a part of control of water pollution adequate numbers of community toilets connected to one septic tank will be constructed.
- The main source of wastewater generated during operation phase, will be the effluent generated from the fish washing, auction hall cleaning etc.
- The sewage will be generated from administrative block, toilet blocks etc. and it will be treated in septic tank.

- For treatment of sewage, an Effluent Treatment Plant and sewage treatment plant has been proposed within the fishery harbour.

10.5.4 Air Environment

The following measures are recommended to control air pollution:

- Contractor will be responsible for maintaining properly functioning of construction equipment to minimize exhaust.
- Construction equipment and vehicles will be turned off when not used for extended periods of time.
- Unnecessary idling of construction vehicles to be prohibited.
- Effective traffic management to be implemented.
- Road damage caused by sub-project activities will be promptly attended to with proper road repair and maintenance work.

Control of Pollution due to Increased Vehicles

- The vehicles emitting pollutants above the standards should not be allowed to ply either in the project construction or in the operation phases.
- Vehicles and construction equipment shall be fitted with internal devices i.e. catalytic converters to reduce CO and HC emissions.
- Water sprinkling shall be done at least thrice a day at the construction sites, haul roads and other access roads.
- Measures such as covering the trucks while transporting the construction material shall be initiated to control fugitive dust as also to control the re-suspension of particulate matters from the excavated materials.
- Staff involved in construction shall be provided with suitable Personnel Protective Equipment (PPE) such as dust masks, ear plugs, gum boots, gloves, etc.
- Idling of delivery trucks or other equipment shall be avoided during loading and unloading of construction material.

10.5.5 Noise Environment

- It is proposed to develop a greenbelt along the road stretches. The contractors will be required to maintain properly functioning equipment and comply with occupational safety and health standards.
- The construction equipment will be required to use available noise suppression devices and properly maintained mufflers.

- Ear protective devices should be used by the construction workers where they are exposed to steady noise levels above 85 dB.
- Noise from the DG set shall be controlled by providing an acoustic enclosure.
- To prevent the adverse effects of noise the exposure period of affected persons be limited as specified by Occupational Safety and Health Administration (OSHA).

10.5.6 Prevention of Soil Contamination

- Vehicle/machinery and equipment operation, maintenance and refueling will be carried out in such a fashion that spillage of fuels and lubricants does not contaminate the ground.
- Oil interceptors will be provided within the construction camps.
- All spills and collected petroleum products will be disposed off in accordance with CPCB norms.

10.5.7 Traffic Management

- The following measures are recommended as a part of Traffic Management Plan.
- Local villagers will be informed about the construction schedule.
- Traffic management with diversion through alternate routes will be implemented by providing adequate sign boards.
- Upon project completion, quick clearance of debris, etc. will facilitate access by customers to local business and residents to their households.
- Placement of traffic staff to facilitate easy of movement.

10.5.8 Odour Management

- A number of systems and indigenous low-cost methods are applied to reduce the impact of typical odour from fishing harbour areas.
- These technologies includes Odour neutralising agents, windbreak walls, Air scrubber, Bio filter, Short, Active oxygen, Ozone treatment, etc.

10.5.9 First-aid posts

- It is proposed to maintain one first-aid post manned by a qualified doctor and support staff during construction phase.
- The first-aid post will have all emergency medicines and appliances required for meeting emergencies arising during construction as well as a stand-by ambulance.
- The activities of this centre will include coordinating local vector control programmes / campaigns

10.5.10 Social Upliftment of the Fishermen Community

The social upliftment of the local habitations and villages will include village roads, community halls, bus shelters, footpaths, distribution of free medicine, etc

10.6 Dredging Management Plan

It is proposed to carry out maintenance dredging activity within the fishing harbour to facilitate effective and optional utilization of harbour. The depth of the dredging is varying from 1- 2m in accordance with the site conditions.

The area of dredging is 4,54,214 sq.m. Quantity of dredging material is 5,60,000 Cum.

The dredged materials are proposed to be transported through self propelled dump barge (bottom open drop barge) .

The impact on coastal environment during construction phase would be mainly from the activities in the inter-tidal phase due to construction of fishing harbour.

Sr.No.	Potential Direct Impacts	Potential Indirect Impacts
1.	Increased sediment Loading and deterioration in water quality	Impacts to fisher revenue stream for a shorter period of time
2.	Destruction/Entanglement of fishing gears	Decreased in the supply of catchment of fishes to the market
3.	Obstruction to travel routes	Reduced water quality

Hence, as a part of the management strategy various activities shall be well coordinated and optimized to avoid time and cost, which are given below:

- As part of conservation strategy, dredging will not be carried out during the fish breeding season.
- Dredging and construction activities to be scheduled and planned to minimize the impacts on fishermen and marine ecology providing necessary mechanisms to trap the spillage of fuel / engine oil and lubricants from the construction site to minimize impacts on benthos.
- Temporary colonies of the construction workers would be established sufficiently away from the High Tide Level (HTL) with adequate sanitation facilities and waste treatment measures. Construction debris shall be disposed safely in the designated areas.

- Proper covered storage area shall be used for dumping, transporting and disposal of the dredged material from the project site to designated dumping site outside the CRZ limits.
- Vehicles transporting reclamation materials must have their loads covered using tarpaulin or canvas sheet when utilizing the public road to prevent spillage of materials that can become a source of dust pollution.
- Minimise or even prevent dewatering or overflow from dredger.
- Good practice when loading and transporting unsuitable dredged material.
- Regular maintenance of ships and barges so as to prevent accidental leaks and spillage.
- Deflectors should be installed on the draghead and to ensure marine mammal and turtle observers are on board during dredge operations.
- As part of this exercise, the dredger will be equipped with spill response kits and dredging will be carried out in confined manner to reduce the impacts on marine environment.
- All the standards preparatory will be taken to reduce the impact on marine water quality. Eventhough, the impacts will be for a short period only.

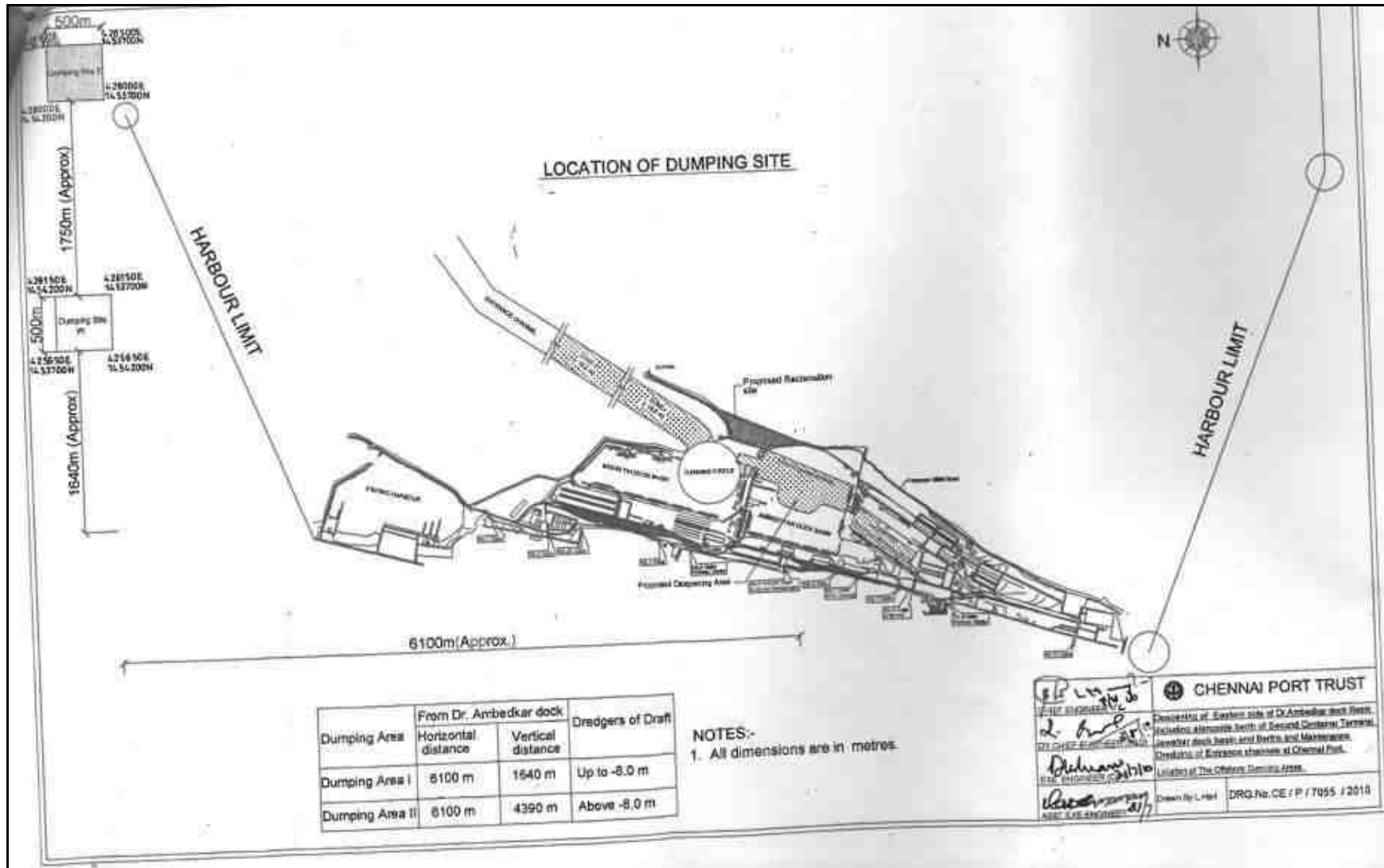


Figure 10-2 Dredging disposal site

10.7 Greenbelt Development

It is proposed to plant trees to create Green belt area for an area of 4,200Sqm. The plant species selected for greenbelt will include the native species. These saplings will be planted in rows. The plantation at the proposed project will be taken into consideration of the existing social forestry in the region. The type of species to be planted in the region are:

1. Clerodendrum
2. Acalypha Red and green
3. Royal palms
4. Ficus Panda
5. Plumeria
6. Suitable Native Trees
7. Euphorbia

10.8 Budgetary Provisions for EMP

Adequate budgetary provisions have been made for execution of environmental management plan. The cost estimate of INR 3.23 crores is allotted for establishing STP and ETP.

CHAPTER 11
SUMMARY & CONCLUSION

11 Summary & Conclusion

11.1 Summary of the Project

The proposed project is the modernization and upgradation of Chennai Fishing Harbour, Kasimedu, Chennai.

As per EIA Notification 2006, the proposed project site falls under 7(e)-Ports, Harbours, Breakwaters and Dredging. The category of the project is B1.

Chennai Fishing Harbour (CFH) is the largest fishing harbour in Tamil Nadu. It is located to the North of the Chennai Port along the Indian peninsular coastline and is sheltered by Northern and Eastern breakwaters. This fishing harbour is also known as Royapuram Fishing Harbour or Kasimedu Fishing Harbour. Chennai Fishing Harbour is habituated by the fishermen community from Chepauk village.

The total built up area of existing infrastructure is **3.2182 Ha**. The land area is **31.956 Ha** and the total water area is **48.56 Ha**.

Sr.No	Proposed Structures	L x W (m x m)	Length (m) / Area (sq.m)
1.	Boat repair spare parts complex	15 x 15	225
2.	Fish handling shed at Trawler Wharf	100 x 27	2700
3.	Cleaning, Packaging and Cold storage complex	20 x 10	200
4.	Administrative Complex & Centralized control Block with Commercial Complex on the Ground Floor, (G+2)	25 x 15	375
5.	Two & Four wheeler parking – 1	45 x 16	720
6.	Two & Four wheeler parking – 2	44 x 35	1540
7.	Sanitary Complex	10 x 5	50
8.	Two-lane peripheral road with storm water drains, cable truss and a pedestrian path including widening and repair of existing road network	1600 x 7.5	12000
9.	Ship lifting facility and Boat Repair Yard	76x123	9348
10.	Vessel Monitoring and control system at Harbour Entrance	5x5	25
11.	Additional Fish Handling Shed at Trawler Wharf	100 x 27	2700

12.	Two Nos. Of shed over Northern wharf, supporting with existing structure	50x20.5	1025
13.	Truck Paved parking area facility near proposed two & four wheeler parking no1	(27x35)+(28x35)	1925
14.	Providing Two numbers of solar operated with electrical backup fish drying machine (1 Tonne capacity) including civil structure as Pilot Project	11x22	242
15.	Two wheeler and Car Parking for administrative and commercial complex and two wheeler parking shed in the Eastern side of the Administrative and commercial complex building	(22x16)+(22x4)	440
16.	Net Mending shed at southern side	30x12	360
17.	New open shed with Arabian Tent Roofing for fish cutting stalls near retail shops	2x30x5	300
18.	Proposed rooms for stacking unsold items in the rear side of fish cutting stall	72x5	360
19.	New open sheds with Arabian Tent roofing for prawn sale point	66x20	1320
20.	Low Level Reservoir	11.2x7.30	81.76
21.	Over Head Water Tank	Dia - 6m	28.26
22.	Effluent Treatment Plant (ETP)	28.2 x11.4	321.48
23.	Sewage Treatment Plant (STP)	6.6x12.65	83.49
Built Up area			36369.99
24.	Dredging		454214
25.	Controlled Entry and Exit Arrangements, Elevated Compound wall and 2Nos. of Arched Entrances		1600

Water Requirement

During construction phase, approx 80 KLD will be required for both domestic and construction purpose.

Total water requirement is 294.7 KLD which is been already and is sufficient for proposed phase also. The source of water will be met from dedicated pipeline from CMWSSB.

Moreover, the RO Plants of capacity 25LPH & 500 LPH are to be proposed as Potable drinking water is a necessity for the users of the fishing harbour. The potable water at the harbour is primarily used in large quantities by the fishing boats (MFBs) before sailing out.

On-shore fishermen, labourers, vendors, retailers and buyers also require potable water. For the storage of water, Ground Level Reservoir (GLR) and Over Head Tank (OHT) will be proposed. The water requirement given below is applicable both for Existing and Proposed Operation Phase.

Sr.No.	Description	Fresh Water Requirement (KLD)
1.	Domestic	13
2.	Flushing	20
3.	Washing (Floor/Fish)	70
4.	Mechanized Fish Boats (MFB) Requirement	97
Total		200

Power requirement

In existing phase, 154.67KW (LT) is equipped and its sourced from TANGEDCO. The existing will be used for proposed phase also. There are no source of DG for power back up.

Man power requirement

Sr.No.	Phase	Components	Requirement
1	Construction	Proposed	100
2	Operation	Existing	
		Officers	10
		Staff	30
		Police Personnel	As per the requirement

The existing manpower will be equipped for the proposed phase also.

Municipal Solid Waste Management

Improper waste handling is a perennial issue at most fishing harbours in India. In order to properly segregate, store, process and dispose of the waste generated at the Chennai Fishing Harbour, it is proposed to develop a solid and liquid waste disposal mechanism including the

aggregation and disposal of the waste. This waste management intervention will ensure a clean and sustainable environment inside and around the fishing harbour.

All the domestic sewage facilities will be equipped by proposing STP of 40 KLD and other waste will be treated by proposing ETP of 80 KLD capacity.

Sr.No	Waste type	Existing phase (kg/day)	Proposed phase (kg/day)	Management measure
1	Organic waste	1.44	1.44	Collected in Municipal Bins and directly disposed through Greater Chennai Corporation dumping yard at Kodungaiyur.
2	Inorganic waste	0.96	0.96	
Total		2.4	2.4	

Note: Manpower Nos. – 40 Nos.

There are several impacts in air, water, land, soil and socio-economic being foreseen with the implementation of the proposed project. However, all the impacts are mitigated fully by EMP of **INR 3.23 crores**.

11.2 Conclusion

The proposed project focusses on establishing modern infrastructure and upgrading existing facilities at the Chennai Fishing Harbour, such as:

- Water facilities (drinking and tap water), drainage infrastructure
- Sanitation, Solid and liquid waste management
- Roads and lighting arrangements
- Fish landing wharf and modern fish handling complex
- Idling wharf, sheds, fish processing and storage facilities
- Boat repair facility

The major objectives of the project:

- To manage and maintain the Fishing Harbour for all-weather use for fishing vessels.
- To provide convenient landing facilities to the fishing crafts.
- To facilitate handling of catches, auctioning, fueling, repairing, etc.
- To provide hygienic conditions for the pre-processes, handling of fish to match international standards, and

- To maintain hygienic standards at the international levels in the handling of marine catches

The major advantages of the Proposed Project:

- During construction, though there will be slight disturbances to the fishers and fish market vendors, ultimately the project will be beneficial to them in the long run.
- The project is proposed to construct the following welfare facilities and infrastructure to the fishermen , vendors and other customers:

1. Fish Handling shed and Complex
2. Two-Wheeler and Four wheeler Parking
3. Drinking water arrangements
4. Cleaning packing and cold storage
5. Boats repair and spare parts complex
6. CCTV Surveillance for the safety and security of the fishermen.etc.

With the improvement of sanitation facilities, the health hazard including the water borne diseases are expected to be contained.

- Generation of direct and indirect employment during construction and operation phases.
- The proposed project will contribute to GDP growth.
- The project will have positive impact on the quality of the life of the local fishermen with the improvement in operation facilities.

CHAPTER 12
DISCLOSURE OF CONSULTANT

12 Disclosure of Consultant

In order to assess the potential environmental impacts due to the “Modernization and Upgradation of Chennai Fishing Harbour” by Chennai Port Authority, engaged M/s. Hubert Enviro Care Systems (P) Limited, Chennai to undertake EIA study. The nature of consultancy service rendered covers terrestrial and Marine environmental assessment.

12.1 Brief Profile of Hubert Enviro Care Systems (P) Limited (HECS)

HECS is a total Environmental management company which provides Environmental consultancy services, Analytical testing services, turnkey solutions and Operation-Maintenance services for water and wastewater facilities.

The company provides solutions to several industries like Refineries, Thermal Power Plant, Pharma, R&D Facilities, Electroplating and Manufacturing, IT Parks, Residential Complexes, Mines, Dairies, Food Processing, Textile mills, Breweries, etc.

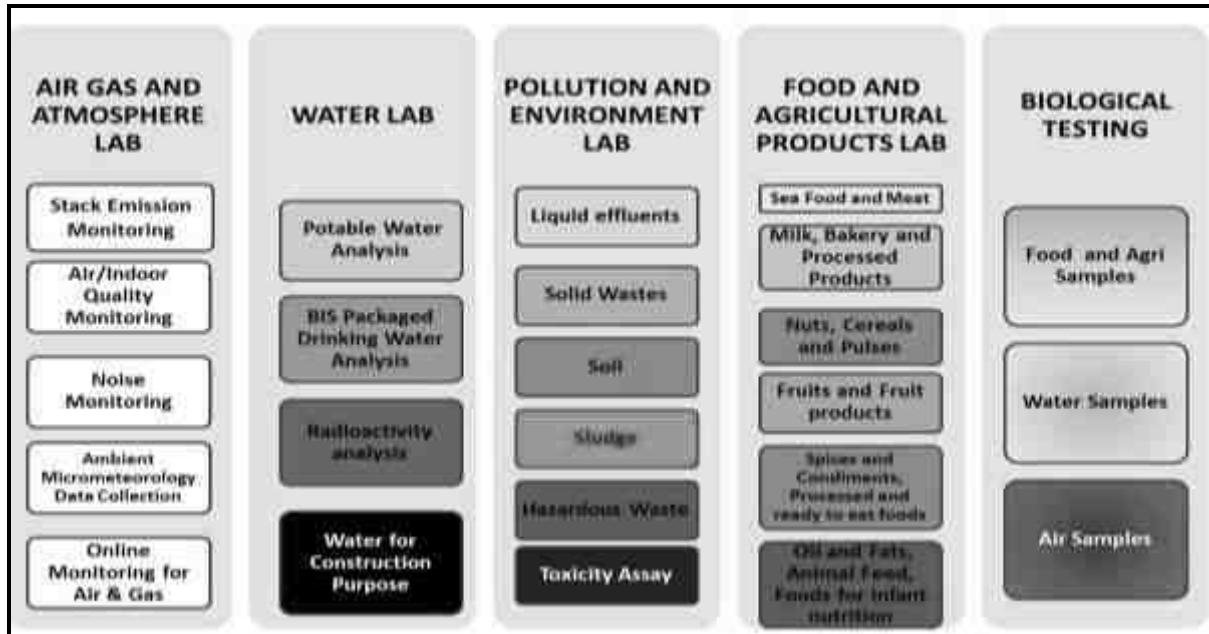
The company is specialized in executing projects right from concept development, supply, erection, commissioning and operation on turnkey basis. HECS has successfully executed more than 300 environmental engineering projects for various industrial sectors both in India and overseas.

12.2 Consultancy Profile

- ✚ HECS is accredited by QCI-NABET
- ✚ An approved consultant for carryout EIA studies across India
- ✚ India’s leading multidisciplinary Environmental Consultancy organization
- ✚ HECS- Consultancy division comprises of technical skilled and competent Team of 40 people. The team consists of Three Doctorates & about thirty postgraduates
- ✚ HECS has industry specific prominent expert to provide solutions & recommendations
- ✚ Serving client more than 25 years & pan India presence in the following sectors:
 - Environmental Clearance
 - Coastal Regulation Zone
 - Risk Assessment, DMP, HAZOP studies
 - Feasibility/ treatability studies
 - Due diligence studies
 - Ground water Clearance

- DISH, PESO and other statutory approvals
- Consent to Establish, Consent to Operate
- Hazardous waste, bio medical waste authorization
- Other environmental approvals

✚ Has an in-house laboratory wherein the following activities are being carried out:



QCI – NABET Accreditation

Consultancy	Hubert Enviro Care Systems Pvt. Ltd., Chennai
NABET Certificate No	NABET/ EIA/2224/ SA 0190 Valid up to 27.07.2024
MoEF Reg. Lab	F.No. Q-15018/13/2016-CPW

National Accreditation Board for Education & Training (NABET) is a constituent board of the Quality Council of India (QCI). QCI, NABET has accredited HECS for carrying out Category ‘A & Category B’ EIA studies in the following sectors:

Certificate of Accreditation

Hubert Enviro Care Systems Pvt. Ltd.,

A-21, (Behind Lions Club School) III Phase, Thiru Vi Ka Industrial Estate, Guindy, Chennai - 600 032.

*The organization is accredited as **Category-A** under the QCI-NABET Scheme for Accreditation of EIA Consultant Organization, Version 3: for preparing EIA-EMP reports in the following Sectors –*

S. No	Sector Description	Sector (as per)		Cat.
		NABET	MoEFCC	
1	Mining of minerals including open cast/ underground mining	1	1 (a) (i)	A
2	Offshore and onshore oil and gas exploration, development & production	2	1 (b)	A
3	River Valley projects	3	1 (c)	A
4	Thermal power plants	4	1 (d)	A
5	Mineral beneficiation	7	2 (b)	A
6	Metallurgical industries (ferrous & nonferrous)- both primary & secondary	8	3 (a)	B
7	Cement plant	9	3 (b)	A
8	Petroleum refining industry	10	4 (a)	A
9	Pesticides industry and pesticide specific intermediates(excluding formulations)	17	5 (b)	A
10	Petro-chemical complexes (industries based on processing of petroleum fractions & natural gas and/or reforming to aromatics)	18	5 (c)	A
11	Petrochemical based processing (processes other than cracking & reformation and not covered under the complexes)	20	5 (e)	A
12	Isolated storage & handling of hazardous chemicals (As per threshold planning quantity indicated in column 3 of Schedule 2 & 3 of MSHC Rules 1989 amended 2000)	28	-	B
13	Synthetic organic chemicals industry	21	5 (f)	A
14	Industrial estates/ parks/ complexes/ Areas, export processing zones (EPZs), Special economic zones (SEZs), Biotech parks, Leather complexes	31	7 (c)	A
15	Ports, Harbours, break waters and dredging	33	7 (e)	A
16	Highways	34	7 (f)	B
17	Common Effluent Treatment Plants (CETPs)	36	7 (h)	B
18	Common municipal solid waste management facility (CMSWMF)	37	7 (i)	B
19	Building and construction projects	38	8 (a)	B
20	Townships and Area development projects	39	8 (b)	B

Note: Names of approved EIA Coordinators and Functional Area Experts are mentioned in SAAC minutes dated Feb 3, 2023 posted on QCI-NABET website.

The Accreditation shall remain in force subject to continued compliance to the terms and conditions mentioned in QCI-NABET's letter of accreditation bearing no. QCI/NABET/ENV/23/2696 dated March 6, 2023. The accreditation needs to be renewed before the expiry date by Hubert Enviro Care Systems Pvt. Ltd., following due process of assessment.



Sr. Director, NABET
Dated: March 6, 2023

Certificate No.
NABET/EIA/2224/SA 0190

Valid up to
July 27, 2024

For the updated List of Accredited EIA Consultant Organizations with approved Sectors please refer to QCI-NABET website.



Further details may be seen on the following URL: www.hecs.in