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I. EXECUTIVE SUMMARY

Tamilnadu is one of the maritime state of our country, historically known for Ports and Harbors with its 1100 Km of coastal length. Tamilnadu is also a favorite destination for tourists for other climatic and developmental features. Coastal Environment of Tamilnadu is unique with Thirteen districts are representing coastal features out of 32 revenue districts. The coastal and terrestrial attributes complementing to each other. The state shares a maritime border with the nation of Sri Lanka.

Tamilnadu has 3 major Ports and 1 minor with 5 fishing harbors and every Port is under expansion mode including the VOC Port, which is the second largest Port of our country. Chennai Port and Ennore Port are located in North to the project location by 180 Km.

Several Coastal power plants are in pipeline other than significant increase in the bulk cargo into and outward. Albeit there is a regression in the industrial growth, the cargo handling requirements through sea route is increasing.

Cuddalore Port is historic as anchorage Port which failed to prosper despite the potential for development. The location is very suitable for further development as berths can be constructed in a much better compatible river locations as the location is a confluence of two rivers viz., Uppanar and Paravanar with Bay of Bengal.

Tamilnadu Maritime Board (TNMB) is the nodal agency of Government of Tamilnadu and operating the Cuddalore Port. TNMB envisioned a proposal to upgrade and augment its present capacity of cargo handling into Multi Cargo Handling Port to 5.68 MTPA.

Indian Port Association made a preliminary survey on the feasibility of expansion project and Department of Ocean Engineering, Indian Institute of Technology-Madras has come out with a detailed project report on complete planning, engineering design and operability analysis on the feasibility of the proposed port expansion.

The present operation of Port is restricted to Uppanar with a wharf of 400 m and handling 0.37 MTPA of multiple cargos. The operation of Port has been consented by Tamilnadu pollution Control Board (TNPCB) and a copy of the valid consent order is presented as Annexure-II.

Presently, the Port has almost no activities in view of the silting and dredging is to be undertaken to set navigation in the approach channel. TNMB is planned to expand the Port facilities with redesigned Break Waters and Wharfs with infrastructures to negotiate a multiple cargo with transit-storage facilities.

Cuddalore, per se, is known for its coastal resources especially fisheries. Uppanar is a backwater there is a fishing harbor, which is just on the North boundary of the port limits in the Uppanar. The coastal dependency is significant for the lifestyle of the fishermen community in the project location is historic and it holds the most important revenue to Government of Tamilnadu.

Tamil Nadu Maritime Board (TNMB) is keen to develop the possibility of augmenting the cargo handling capacity at the Cuddalore Port. The Port is situated at the confluence point of River Uppanar and Paravanar with Bay of Bengal.

Currently, the Port has two Training walls of length 180m in the north and 230m in the south. If the basic break water infrastructure facilities of the port are not extended, and if the situation in the river mouth is permitted to continue like this for some more years, most of the river mouth portion will get silted up. The port users will no longer prefer this port and the port activities may come to a grinding halt affecting primarily the fishermen and the cargo operators. However, to cater the global market in current scenario, the extension of Breakwater both North and South side are quite essential. The existing wharf facilities are to be developed so as to facilitate larger DWT vessels.

Port is a listed coastal activity and under the purview of EIA Notification, 2006. The present project of capacity expansion is to establish two additional berths 120X38.70 m each in the Paravanar stretch to handle multi cargo pattern of Cargo, Steel, Fertilizer and Clean cargo like Containers for 5.69 MTPA. A requirement of capital dredging has been assessed for 17, 30,000 m^3.

The proposed project of TNMB is thus categorized under **7 (e) - A**, which is mandated for CRZ Clearance and also Environmental Clearance under the purview of EIA Notification, 2006; or in any amendments thereof.

The Key Map showing the location of the proposed Berths in the Cuddalore Port is presented in **Fig.1.0**.

TNMB envisaged the proposed project to optimally use the coastal resources available within the notified Port Area with a scheme to avail Financial Support from Government of India.

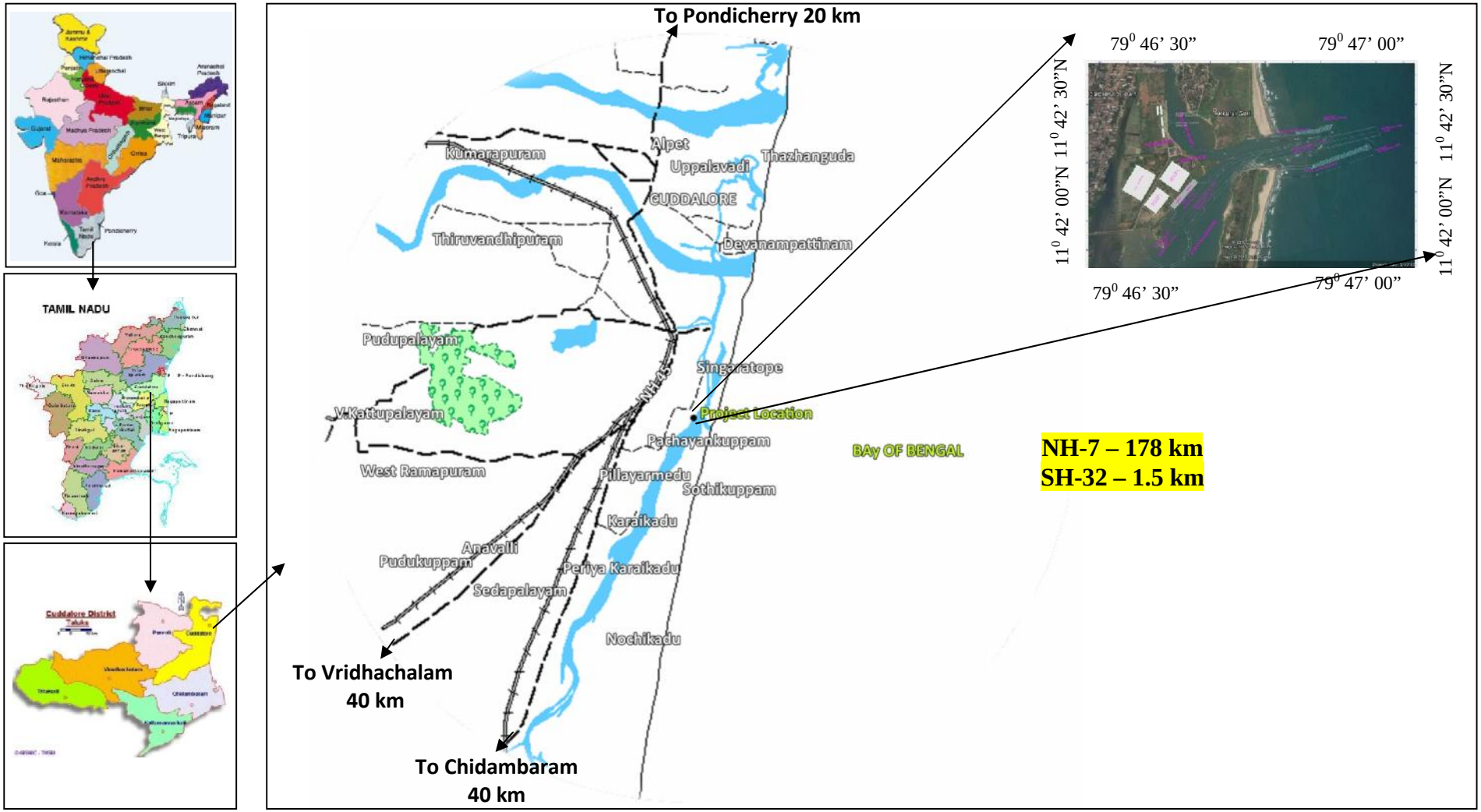

FIG.1.0. KEY MAP – CUDDALORE PORT

A reconnaissance survey and the feasibility study on the proposed project of capacity expansion of Cuddalore Port were already carried out by IIT (M) with detailed coastal study and Port planning and designing.

The proposed project location was surveyed and assessed for its compatibility to prevailing coastal environmental conditions. The met-oceanic data pertaining to project location is learnt to be conducive for the proposed construction of additional two berths. Coastal Model studies were run to get reassessed for environmental suitability and sustainability of locating the project in the proposed location.

The location was surveyed through specific GPS protocol and LTL and HTL Mapping was completed by **Institute of Remote Sensing (IRS), Anna University** and authenticated Map was drawn to comply with the requirements and mandates of CRZ Notification, 2006.

Centre for Environment, Health & Safety (CEHS) is an integral part of the Department of **Civil Engineering** and offers PG and Doctoral program in Environmental Engineering. CEHS have several ongoing consultancy works apart from funded research programs from various agencies like MoEF&CC, DST, MoNES and coastal development projects like Expansion of VOC Port, Tuna Fishing Harbor and, etc. Annamalai University is state owned and fully governmental.

CEHS is an **accredited EIA Organization** by **Quality Council of India** under **National Accreditation Board for Teaching & Training** (NABET) for **Ministry of Environment, Forests & Climate Change (MoEF&CC)**, **Government of India**.

II. INTRODUCTION

TNMB prepared the Master Plan for the proposed additional Berths and enhanced Cargo handling capacity by availing the services of IIT-Madras. The feasibility study by IIT covered the coastal compatibility and also the types of cargo and its size.

The expansion of the Cuddalore Port will enable the Coastal Thermal Poer plants in the near zone to get the Coal from other places. Neyveli Lignite Corporation (NLCIL) is also likely to avail the services of the Port.

Cuddalore has a major Chemical Industrial Complex and Pondicherry is located on North by 20 Km. There is a huge demand and it is a long time pending project to ease out the transportation of fertilizer by road and also Clean and container cargo.

As the proposed additional berths are much within the Port limits, there will not be any intervention to settlement. The area required to establish additional infrastructures for cargo transfer, transit-storage and handling is much available readily with TNMB. Hence, there is no public concern for the project.

TNMB specifically took interest in not to intervene in the fishermen boats in the Uppanar which has the Fishing Harbor on the North of the Port limit in the Uppanar. TNMB, on the advice from IIT-M after careful examination on the feasible alternative locations, decided the project in the proposed location in the Paravanar.

The Project is envisaged to comply with all statutory requirements under CRZ Notification, 2011 and EIA Notification, 2006 and also as per the Guidelines of Central pollution Control Board (CPCB). As the present activities in the Port limits are pre-Notifications, TNMB is very specific to comply with these Notifications and establish the Berths and other Cargo handling infrastructures as per the specifications of International Standards as as per the guidelines of CPCB.

The proposed additional berths and cargo handling facilities will add value to Cuddalore Port, including a positive impact on socio economic status of Cuddalore. With transportation of cargo by roads have become costlier and time consuming, the present proposal of augmenting the existing Port facilities for enhanced Cargo handling is a important project for the state and so, Government of Tamilnadu has special schedules and interest in completing the project in time.

2.1 PROJECT

The proposed project is principally additional facility of Cuddalore Port of TNMB.

The site is located along the northern bund of River Paravanar within the tidal influence Zone from Bay of Bengal in near to the confluence point of Paravanar with sea. The location of seaside boundary of the notified limits of Cuddalore Port is having coordinates **11°42′00″ to 11°42′30″N and 79°46′30″ to. 79°47′00″E**

The location of the proposed additional berths and infrastructures on Google image is presented in **Fig.2.1.**

The CRZ Map showing the HTL and LTL of the project location, as surveyed and authenticated by Institute of Remote Sensing, Anna University is presented in **Fig 2.2.**

The modifications in the breakwaters, approach channel and turning circle are the waterside infrastructures proposed along with capital dredging. In addition to the existing godowns, additional storage systems pen and as well closed, are planned on the land side.

The depth of the approach channel requires a draft of 9m. The under-keel clearance is required to take care of the heave and pitch of the ship at low water due to wind and wave action. The net under-keel clearance that is considered necessary is 0.64 m where the sandy and grit clay and in large parts riverine by characteristics

The breaking wave height of 2.6m is considered for design of breakwaters. Since the occurrence of breaking wave height would be very frequent, several times each monsoon, Zero Damage criterion is specified for the breakwaters. In designing the cross-section of the breakwater, consideration has been given to the availability of suitable stone armour, from nearby quarries.

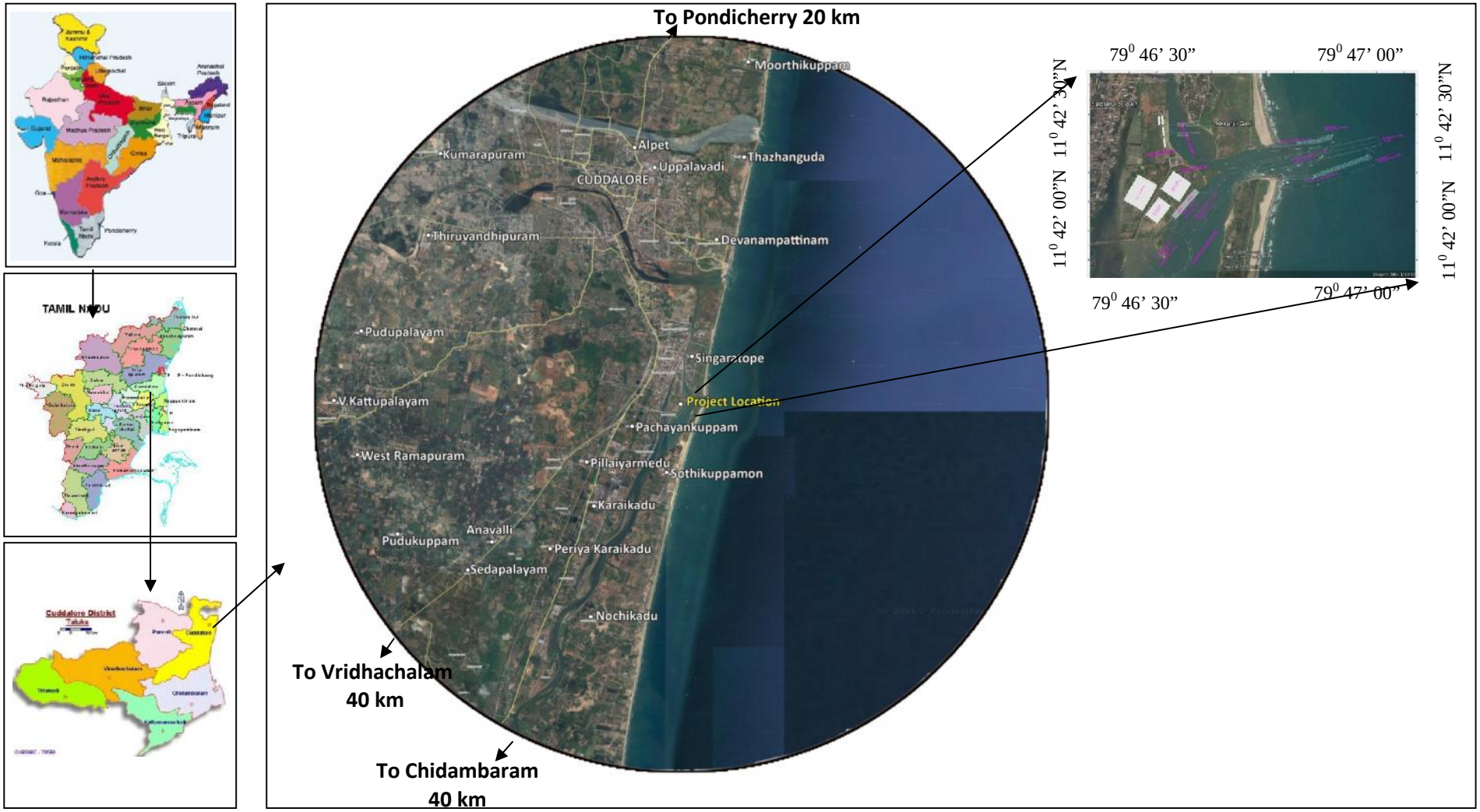

FIG.2.1. LOCATION MAP - GOOGLE IMAGE (10 km RADIUS)

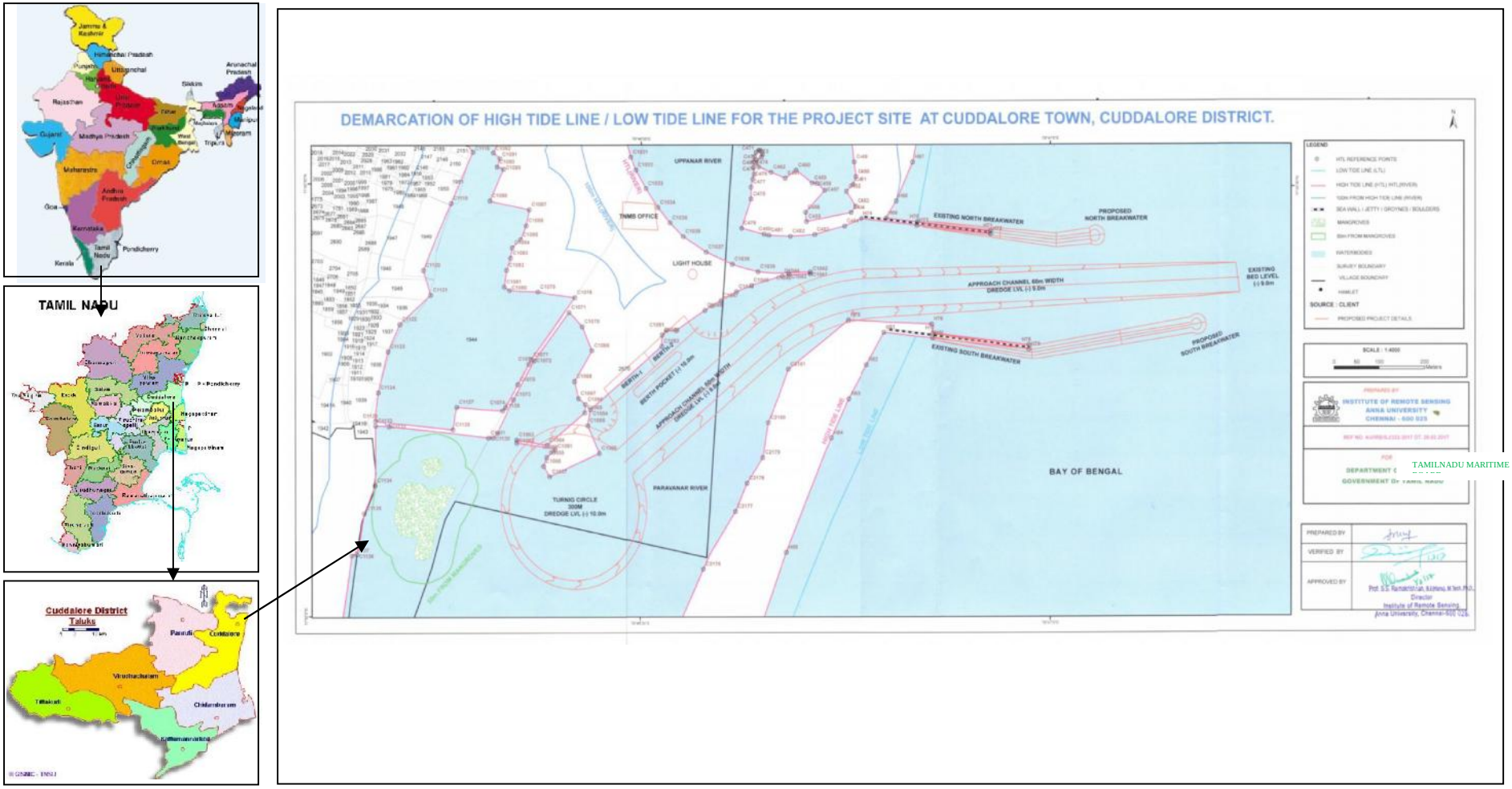

FIG.2.2. CRZ MAP – CUDDALORE PORT: EXPANSION PROJECT

Considering the demand for bulk cargo handling in the project location, it will have **Two additional berths** with **9 m CD** draft to accommodate any new age yachts and pleasure boats. AHOY will have a club house with facilities for holidaying activities. AHOY will make Goa in the map of International Circuit of Pleasure Sailing Destinations which will eventually increase the tourism into multifold in Goa.

The conceptual layout of the proposed capacity project of Cuddalore Port is presented in **Fig 2.3**.

The layout was envisaged incorporating met ocean conditions and prevailing estuarine and coastal features of the project location with respect to two monsoons. The predominant wind, wave and swell conditions were interpreted to plan the berthing areas with engineered structures like break waters to have sufficient tranquility at 0.30m.

The maneuvering and turning circle area and approach channel width were designed as per the guidelines of PINAC/IAPH. The traffic volume was assessed to provide necessary space to accommodate berth requirements.

Necessary Model studies were run on the project area with primary data like bathymetry and project requirements for assessing dredging requirement for necessary draft. The dredged material is envisaged to use to reclamation on the landside for cargo storage area, along the coastline on the northern side of the North Breakwater and also offshore.

The Budgetary Estimate of the project is **INR 115Crores**.

FIG.2.3. CONCEPTUAL LAYOUT – CUDDALORE PORT

2.2 CAPACITY EXPANSION PROJECT –CUDDALORE PORT

The existing minor Port at Cuddalore is an ancient and historic anchorage Port, with a fishing harbor in the Uppanar. The location is an estuarine complex with Uppanar and Paravanar confluence with sea. The coastline is comprised of sandy beaches and exposed to open sea with backshore elevation about EL. (+) 2.0m CD along most of the coastline.

The Port is currently under the management of Tamilnadu Maritime Board (TNMB). The port has been evaluated to have a good potential for further growth with a location advantage of close to major industries, thermal power plants, coal mining and Puducherry. A survey indicting the potential opportunity and requirement to handle multipurpose cargo and is strategically located on the South east coast of India to support Port development activities. The deep counter of 10m is available around 1000m from the shoreline.

Currently the port has two Training walls of length 180m in the north and 230m in the south. If the basic break water infrastructure facilities of the port are not extended, and if the situation in the river mouth is permitted to continue like this for some more years, most of the river mouth portion will get silted up. The extension of Breakwater both North and South side are quite essential to sustain the water spread area for ship movement in the Port. The existing wharf facilities are to be developed so as to facilitate larger DWT vessels.

The proposed development plan for the modernization and capacity augmentation of this port is envisaged by extending the existing breakwater to (-) 9.0m CD, carryout capital dredging, construction of two berths each of dimension 120x 38.70m to facilitate direct berthing of up to 10,000DWT vessels and by providing land side facilities like stackyard, godowns, railway lines, internal roads, desalination plants, electrical substation.

The proposed project activities, primarily includes the following;

- ✓ Two numbers of additional Berths/Wharfs
- ✓ Modification in the Breakwaters
- ✓ Capital Dredging towards approach channel (-9m) and Turning Circle (-10m)
- ✓ Infrastructures for Storage and Handling facilities for Cargo-Landside development
- ✓ Dredged material disposal & Management

The detailed scope and specifications of the proposed activities in the capacity expansion project of Cuddalore Port is presented in **Table 1.1.**

2.3 NEED FOR THE PROJECT

The existing Port has become defunct for want of required depth of water spread as the Port has lost the depth to silting in the last two years. Hence, dredging has become important even to operate barges to negotiate the permitted cargo in the Port.

Nevertheless, Cuddalore district has been in the industrialization pathway in the last one decade which has seen a coastal thermal power plan, multifold enhancement in the coal mining capacity of nearby NLCIL(40 Km, West) and nearby Pondicherry (20km, North) with multi varied development.

There are atleast three more Coastal thermal power plants and one SEZ for Apparel Park in pipeline which situation necessitates the presently proposed capacity expansion of Cuddalore.

It is also general public demand to move into more maritime activities for state wide water ways and making the cargo transportation through sea ports rather than the preset practice of roadways. Hence only, Government of Tamilnadu is proposing the

proposed project through TNMB with the committed financial aid and support from Government of India.

TABLE 1.1. SIZING AND SPECIFICATION- PROPOSED PROECT ACTIVITIES,CUDDALORE PORT

Sl.No	Summary of Main Port components	
1	Turning Circle	
	Diameter	300m
	Depth	(-)10.0m
	Approach channel length	1500m
	Approach channel width	60m
	Approach channel dredge depth	(-) 9.0m
	Channel slope	1V:5H
2	Berth – 2 Nos.	
	Length	120m
	Width	38.70m
	Depth at berthing pocket	(-)10.0m
3	Capital dredging in cu.m	17,30,000
4	Breakwater using armor stones & tetra pod	
	Extension of North breakwater	210m
	Extension of South Breakwater	410m
5	Infrastructures	
	Coal Open Yards	250 X 150 m
	Cement Closed Shed	
	Fertilizer Closed Shed	
	Clean & Container Cargo- Open Yard	150 X 100 m Two Yards

Perhaps, the construction of wharfs and cargo management may get tendered for execution on the basis of BOOT with private investment for quicker project implementation and effective operation and maintenance.

2.4 DEMAND – SUPPLY

Industries in SIPCOT Industrial Estate of Cuddalore, increased mining by NLCIL, newer coastal thermal power plants, industries in Puducherry and new developments like an Apparel Park in Perambalur (90Km) were are highly demanding and pressing conditions for the proposed Port Expansion for enhanced Cargo handling of 5.86 MTPA.

The port is historic and in a coastal compatible environment which is an estuarine complex of two rivers under tidal impact which confluence with sea. The location is known for bulk cargo activities, especially for wooden logs and edibles.

TNMB is under compelling situation to put its coastal reserves and resources optimally. The proposed project will ease out the increasing road traffic in the GST and ECR as it will serve 5.86 MTPA of multi Cargo through sea which otherwise will have to be on road making risk of accidents and pollution.

IMPORTS VS INDIGENOUS PRODUCTION

The project will enhance the imports mainly for fertilizers as bulk cargo, coal as bulk cargo and containers as clean cargo.

2.5 EXPORT POSSIBILITY

The propose Port Expansion will enable to increased export activities for Cement as bulk cargo and finished goods and machines as Container Cargo.

2.6 DOMESTIC / EXPORT MARKETS

The present expansion will enable to plan for increasing water way transport in this country and also within Tamilnadu to connect 13 districts directly as Tamilnadu has almost 1100 Km of coastline in 13 maritime states out of 32 revenue districts.

The proposed facilities and achievable compatibility will not only pave way for water ways for passenger travel it also will extend to enhance tourism in the long run.

2.7 EMPLOYMENT GENERATION

The proposed Port Expansion will give job opportunity to 1500 personnel directly in the operation and management of Port and in Cargo handling.

Indirectly, this will boost the industrial activities around and commercial and domestic development as downstream impacts will result in producing jjob and new life yearning activities for more than 10,000 indirectly and off site in the hinterland of Cuddalore, Nagapatinam, Villupuram and Perambalur district of Tamilnadu and also Puducherry.

III. PROJECT DESCRIPTION

The propose activities are envisaged to enhance the capacity of cargo handling of the existing Port facility. The establishment of the proposed berths for handling multi cargo of 5.68 MTPA will improve further industrial activities and will enable TNMB to optimal y use the Cuddalore Port which currently suffers navigation due to insufficient water depth.

The location of the proposed Berth and other infrastructures within the Cuddalore Port is presented in **Fig.3.1.**

The project is primarily to establish two berths, each of size 120m X 38.70m, for handling multi Cargo mix with varied bulk cargo and container cargo for a total handling capacity of 5.68 MTPA.

The development plan will have the entrance channel with dredge depth of (-) 9.0 m to handle higher capacity vessels of up to 10,000 DWT with maximum draft of 8.0m. Turning circle of 300m diameter and dredge depth of (-) 10.0m and berth pocket of (-) 10.0m CD is also proposed.

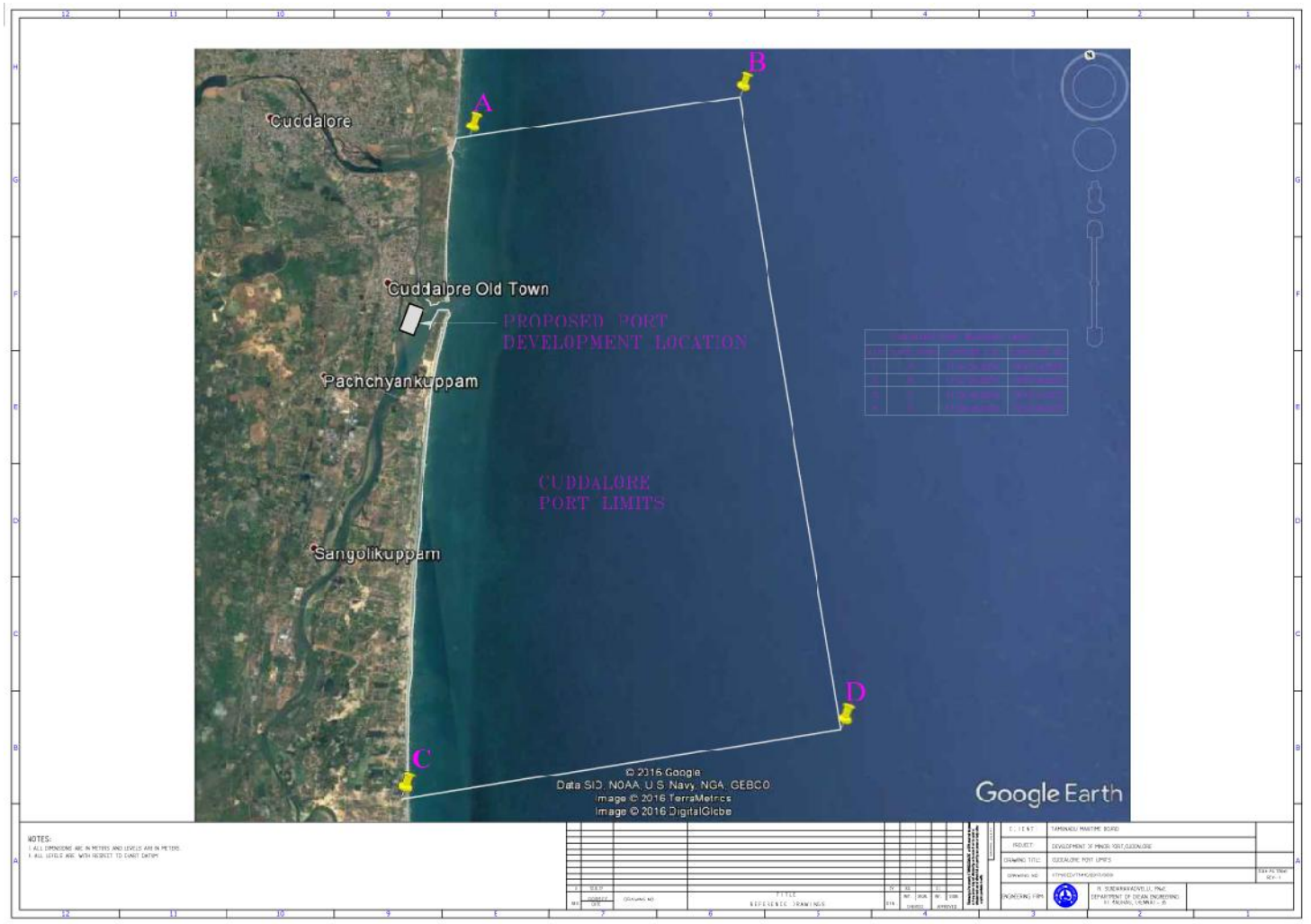

FIG.3.1. LOCATION OF PORT LIMIT

The North breakwater and south breakwater extension is proposed for an additional length of 210m and 410m respectively. The construction material for the breakwater is armor stones and tetra pods.

The Approach Channel and Turning Circle, primarily and other navigatable water spread would require 17,80,000 Cu.m of dredging as capital. The dredged material will be disposed in three prong destinations, strategically for land reclamation, erosion prevention and offshore as assessed through coastal modeling studies.

An existing rail line is directly connecting the Port which is extended to entire network of southern railways through Cuddalore OT Station, available at 5Km, North West. Proper enhancement and augmentation measures shall be adopted before using the rails for renewed port operations in the Post Project scenario.

Three open stack yards for bulk cargo, especially for coal and four godowns are proposed to handle the mix of cargo. Two numbers of LHM 120 cranes for each berth is found to be sufficient for handling cargoes and to be installed by port operators. The installation of mobile harbor crane, development of stack yard for storage and development of road and rail infrastructure for handling cargoes is to be developed in PPP mode.

Based on the tranquility study, the number of operable days for berth ONE is 356 and berth TWO is 307 per annum.

The advection-dispersion study indicates that 4000 dilution take place within 300-500m around the point of release offshore (12-15m contour) and 5000 dilution takes place within 200-300m around the point of release near the shore north of north breakwater.

3.1 PROJECT SIZE AND TYPE

The project is envisaged to construct TWO new berths as Wharfs in the Paravanar Estuary within the Port limit for 120 X 38.5 m, each which is purposefully equipped with required infrastructures to handle Cargo to the tune of 5.68 MTPA.

To facilitate the ship movement and manoeuvring, dredging for 17,80,000 cu.m has become must as assessed by Modelling and bathymetry.

The Breakwaters, both North and South, are envisaged for revamping for additional construction and for a change of alignment for 210m and 410 m respectively.

3.2 LOCATION OF THE PROJECT

The proposed project is a multi varied activities of constructing berths in Paravanar estuary, additional constructions of breakwaters and infrastructures and dredging, within the notified port limits, having coordinates **11°42′00′′ to 11°42′30′′N and 79°46′30″ to. 79°47′00″E**

The location of the proposed activities in the existing Cuddalore port, based on Satellite imagery (LISS-III), is presented in **Fig.3.2.**

The CRZ Map showing the HTL and LTL of the project location has been already surveyed and authenticated by Institute of Remote Sensing, Anna University.

The location has been already studied in depth by IIT-M for establishing the proposed facilities in the Port Area and it was concluded as a potential site and environmentally compatible location within Cuddalore Port waters.

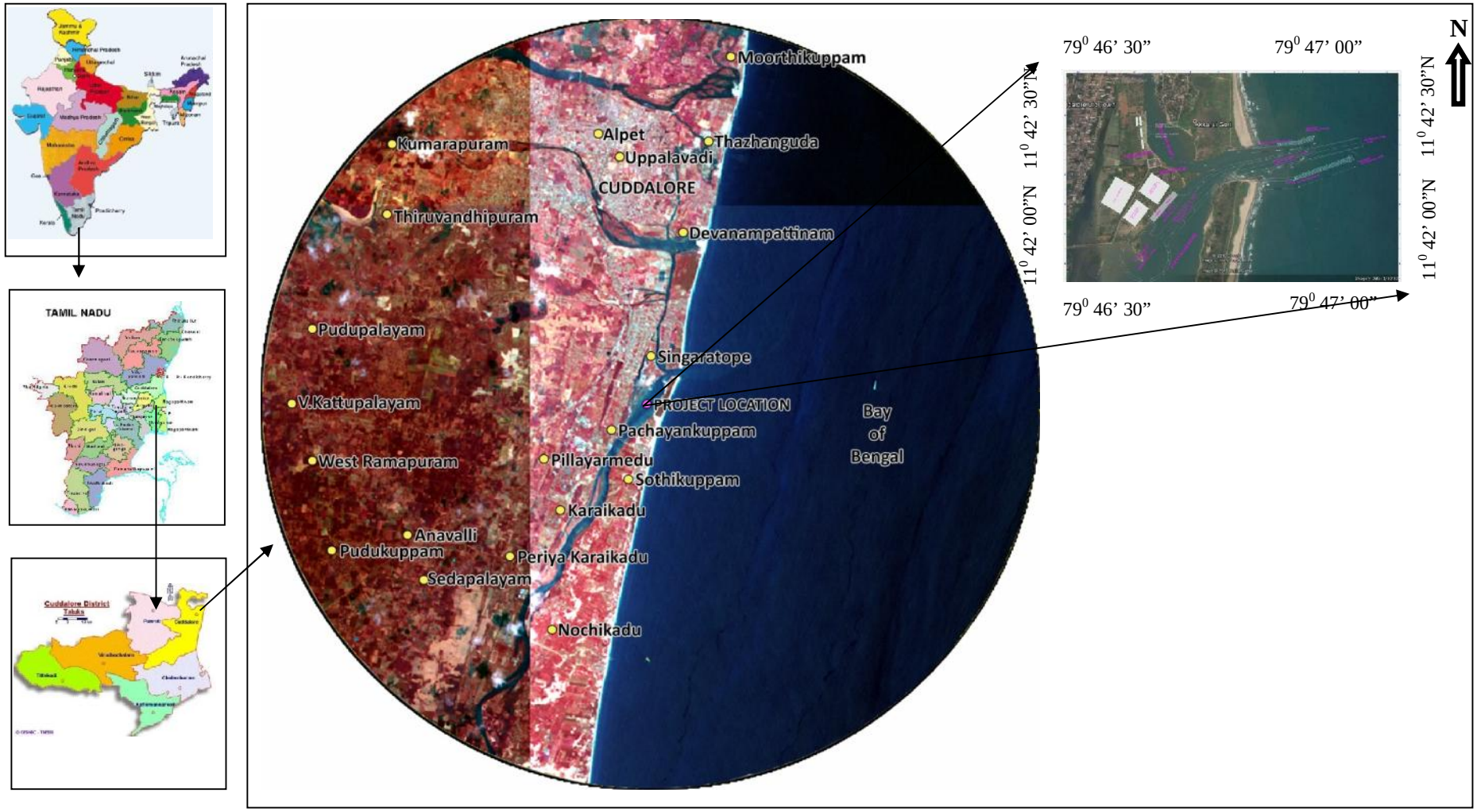

FIG.3.2. LOCATION OF PROJECT – Satellite Imagery- LISS-III

3.3 ALTERATIVE SITES

IIT-M evaluated potential locations for establishing the proposed project activities as there is a need for expansion for Cuddalore Port to optimally use the available water spread area.

The study reportedly concluded with three potential sites within the Port limits, as shown in the **Fig 3.3 to 3.5.**

There are three alternative locations for proposed berth is considered.

Option 1: In this option the berth is proposed in front of the existing wharf as shown in **Fig 3.3.**To provide the proposed facilities at these location, capital dredging will take up a portion of land from the nearby village i.e. Akkarai gori. With the facilities in this location, movement of barges during operation shall hamper the movement of fishing vessels. The structures and some land mass at the confluence point of two rivers need to be removed along with land mass north of the confluence point to make access channel.

FIG.3.3. OPTION 1 FOR BERTH LOCATION

Option 2: In this option, the berth location is considered along the embankment west of River Paravanar as shown in **Fig 3.4** which offers sufficient space for providing suitable access channel, relatively lesser dredging volumes, offers better land accessibility and better ease of vessel operations.

FIG.3.4. OPTION 2 FOR BERTH LOCATION

Option 3: In this option the berth location is proposed along the eastern side embankment of River Paravanar shown in **Fig 3.5** which is similar to option 2. It has similar advantages as option 2 but its disadvantage is poor access for the evacuation of cargo which needs construction of bridge across the river. Sufficient storage area behind the berth is not available.

FIG.3.5. OPTION 3 FOR BERTH LOCATION

On the basis of these options and detailed ground truthing exercise, IIT-M recommended the proposed location on the Northern side of the Paravanar for the proposed Berths and subsequently devised other requirements like Breakwater, storage infrastructures and dredging.

3.4 EXTENT OF THE LAND

The geo position of the project location on the seaside is as follows:

11^0 44’ 24”N
79^0 47’ 24”E

11^0 44’ 24”N
79^0 50’ 48”E

11^0 36’ 45”N
79^0 50’ 48”E

11^0 36’ 45”N
79^0 45’ 30”E

Cuddalore Port has around 60 Hectare on landside where the proposed infrastructures for cargo handling are planned.

The extent of land availability for the present project within Port area is presented in **Fig.3.5.**

3.5 PROJECT COMPONENTS

The proposed project is essentially to modernize the existing minor port of Cuddalore with additional two berths (210 x 38.5 m) for handling multiple cargo of 5.68 MTPA. The proposed project will also establish required depth for navigation by dredging for a depth of 9-10m a first level assessment of capital dredging to the tune 0f 17,80,000 m3.

The proposed activities will also include certain changes in the position of breakwaters with a navigatable approach channel and turning circle.

Also, open storage yards and closed sheds are proposed for handling and storing of Cargo

The buildings, roads and green belt development will be established on the landside where around 56 Hectare is available and also 5 Hectare more area will be available as

reclaimed area, as dredged material is envisaged partly to reclaim area behind the proposed berths.

3.6 MATERIAL BALANCE

There is no production or manufacturing involved in the proposed project. The Port is essentially a service industry to facilitate Cargo movements – sea wards.

Water alone is sourced on site, treated and reused.

3.7 RESOURCE OPTIMIZATION

The water spread area and also the landward areas are the most important natural resources, especially in the project location. Hence, optimal use of available areas in the notified Port waters will be the principal data for planning and designing the proposed new activities,

(A) WATER

The requirement of water is assessed for **100 KLD**. Water will be sourced from sea by intake system. A conceptual water balance is presented in Fig 2.7.

Water is also required for facility maintenance, canteen, fresh water to ships and green belt within the Port area.

A standalone Water Treatment Plant will be installed to source this water requirement by **100 KLD** by desalination using RO.

The secondary level requirement of water for facility maintenance is assessed for 75 KLD. This will be sourced from the installed Wastewater Treatment Plant. Hence, the actual daily virgin water requirement will be 25KLD only.

Dual Plumbing Systems will be installed to use recycle water for toilet flushing and general washing of areas and green belt development.

A conceptual Water Balance for the proposed project of TNMB is presented in **Fig. 2.6**

(B) POWER

Power is assessed for an additional requirement of 500 HP and it will be ensured from the available Grid from TANGEDCO. Already an exclusive power line is available and it will be enhanced for this additional requirement.

3.8 WASTE TREATMENT & DISPOSAL

Effluent

The waste water is assessed for a maximum of flow of 100 KLD as water is used for domestic consumption and it should be 80 KLD only after deducting 20% through spillage and evaporation. However, considering significant increase in the near future requirements, ETP has been decided to install for processing 100 KLD of combined waste streams.

An exclusive Effluent Treatment Plant (ETP) will be installed with Physico chemical and membrane based plant to produce 75 KLD of reusable water.

The reclaimed water of 75 KLD will be put into Dual Plumbing System for flushing, washing and green belt requirements.

Emission

As there is no combustion process involved in the proposed Expansion of Port activities. Hence, there will not be any process emission.

The DG sets will have its own in-built emission handling systems as TNMB will install only CPCB approved DG set for the purpose of alternate power supply.

Solid Waste

Solid waste generated from Office administration, Workers canteen, etc., will be collected as non-hazardous solid waste and transferred to the approved Municipal Solid Waste Management facility of Cuddalore or nearby LB facility with exclusive MoU with the respective government department. This non-hazardous SW is assessed for 1TPD.

The hazardous waste comprises of spent oil/grease/paint, spillages of cargo and other waste from cargo handling activities is assessed for **5TPD** and will be disposed, off site TSDF, as per the guidelines of TNPCB and CPCB.

3.9 PROJECT FEASIBILITY

The Silting in the existing approach channels is posing serious navigational problems which made the Port presently defunct. Hence, dredging has become must and important to regularize the Port activities.

TNMB made strategic studies to optimally use its water spread in an environmentally compatible way. The proposed Capacity Expansion is very important to make the project feasible as the dredging requirement is very high and thus costlier. TNMB availed the services of IIT-M to prepare the Feasibility Study of the project. The present proposal is just as it was envisioned advised by IIT-M to make the project feasible.

The proposed additional activities of Port are mainly meant for handling coal, container and agro product commodities. Further the proposed project for the development of Cuddalore Port, Tamil Nadu, seeks to harness a major economic development opportunity brought about due to huge projected growth of freight traffic at the sea port and rail terminals in the upcoming years.

The proposed Wharf of 240m x 38.70m in dimension will be utilized as given below:

Berth-I of 120m shall be utilized for handling coal,

Berth-II of 120m shall be utilized as multipurpose berth for handling container, fertilizer, cement, agro products.

The net cargo handling capacity is envisaged for 5.68 MTPA.

The development plan will have the entrance channel with dredge depth of (-) 9.0 m to handle higher capacity vessels of up to 10,000 DWT with maximum draft of 8.0m. Turning circle of 300m diameter and dredge depth of (-) 10.0m and berth pocket of (-) 10.0m CD is also proposed.

The North breakwater and south breakwater extension is proposed for an additional length of 210m and 410m respectively. The construction material for the break water is armor stones and tetra pods.

Storage is planned in three stack yards and four godowns to handle the mix of cargo. Two numbers of LHM 120 cranes for each berth is found to be sufficient for handling cargoes and to be installed by port operators.

The installation of mobile harbor crane, development of stack yard for storage and development of road and rail infrastructure for handling cargoes is to be developed in PPP mode.

Based on the tranquility study, the number of operable days at berth 1is 356 and berth 2 is 307. The advection-dispersion study indicates that 4000 dilution take place within 300-500m around the point of release offshore (12-15m contour) and 5000 dilution takes place within 200-300m around the point of release near the shore north of north breakwater.

The Budgetary Estimate is done for **INR 115 Crore** by IIT-M and the financial feasibility was explained and documented by IIT-M.

IV. SITE ANALYSIS

4.1 CONNECTIVITY

The proposed site for the construction of two berths and is located in the existing Cuddalore Minor Port. The Proposed site is in the Paravanar Estuarine Complex in the Port area with Uppanar and Sea. The site is about 3 Km from Cuddalore.

The nearest Railway station and Air Port are as follows (aerial distance);

- Nearest Railway Station: 1.5 Kms, Cuddalore OT
- Nearest Air Port : 21 Km Puducherry

The connectivity of the sites with Roads is available readily with NH 47-A.

4.2 LAND SURVEY

The proposed land has been done spatial survey using satellite Imagery-Liss-III and the landward and coastal area were presented.

Satellite Image in LISS III format of the project location as sourced from National Remote Sensing Agency (NRSA) for the project location is presented in **Fig.4.1**. LISS III format image will be processed for Contour and Topography using Image Processing Software, ERDAS.

FIG.4.1. LISS-III RAW IMAGE – PROJECT LOCATION

Necessary coastal survey using satellite, Cadastral maps and detailed CRZ Survey was already completed through **Institute for Remote Sensing, Anna University, Chennai**.

This spatial analysis of the project location will be interpreted with field level environmental due diligence survey, during EIA study.

4.3 TOPOGRAPHY

The Topography of the project site will be evaluated using Map info with the Maps of Survey of India. GIS based tools will be used during the EIA studies with ground truthing observations.

4.4 LAND USE PATTERN

The project site is a notified Port area and was allocated for Cuddalore Port and the proposed additional berths and break waters are much within its command area. Historically, the project location is known for merchandize port activities and also for fishing. There will not be any requirement for land use change.

The Geomorphology of the project location, using Image processing software, is presented in **Fig 4.2**.

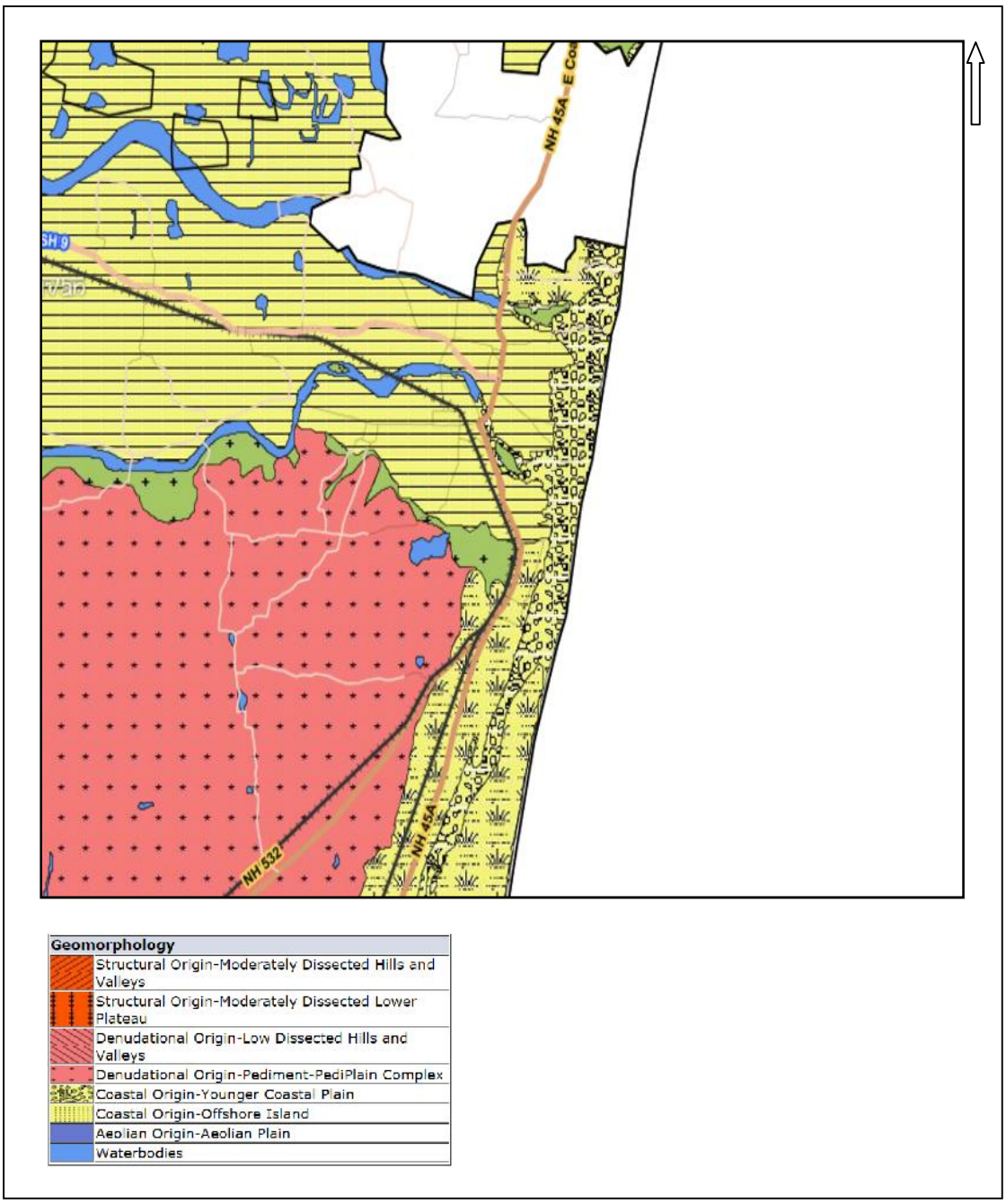

FIG.4.2. GEOMORPHOLOGY – PROJECT LOCATION

The land Use pattern based on LISS-III image is presented in **Fig 4.3**.

4.5 EXISTING INFRASTRUCTURES

The proposed location is already declared as Port Area and delineated to Cuddalore Port by Government of Tamilnadu as Minor Port.

The project is well connected to roads, railways and telex-communication systems.

4.6 SOIL CLASSIFICATION

The soil is investigated, on a preliminary site assessment study, as red clayey and along the estuarine Rivers as clayey sand. Detailed investigations will be carried out during EIA studies.

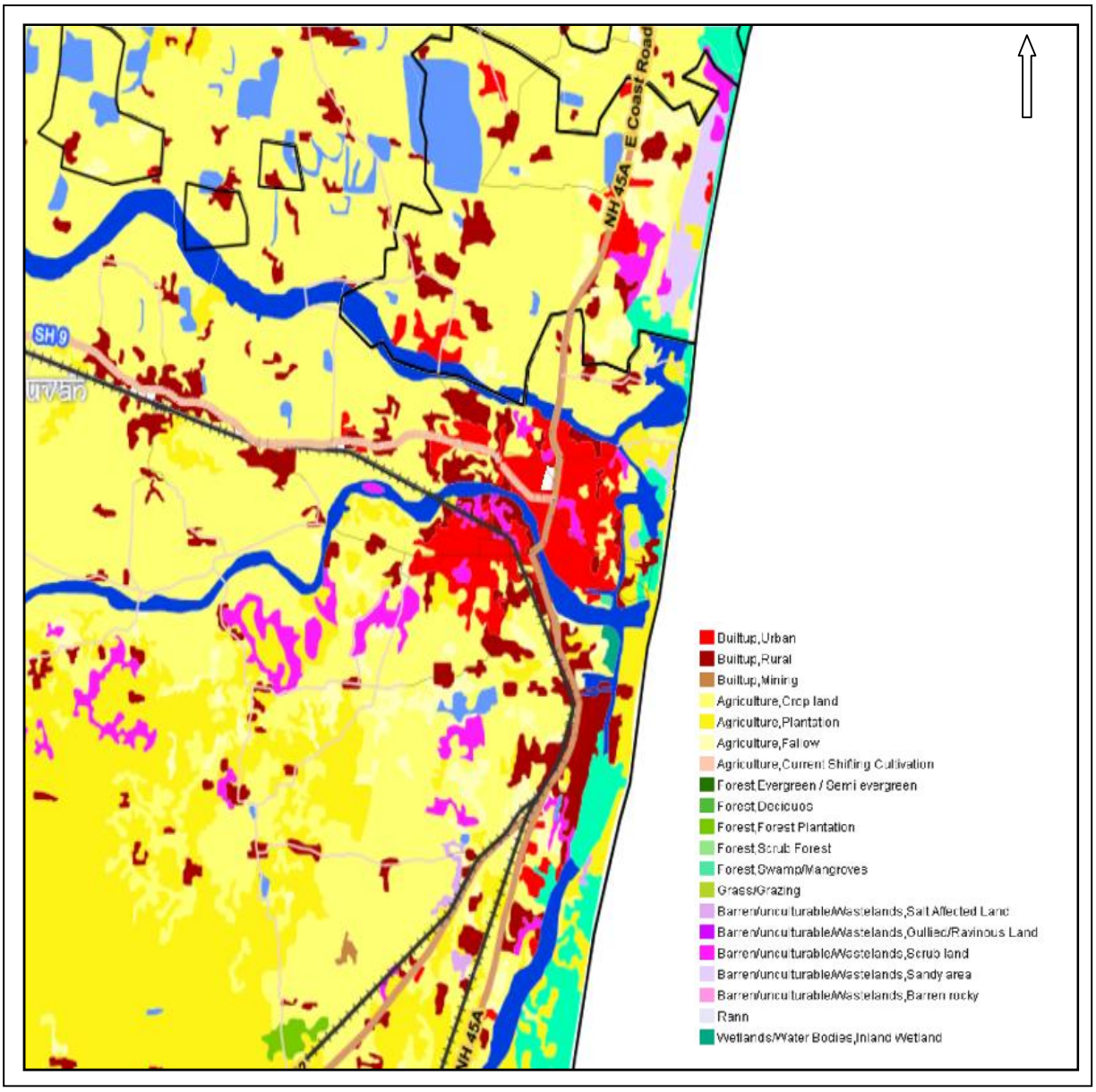

FIG.4.3. LAND USE – PROJECT LOCATION

4.7. CLIMATE – METEOROLOGY

The project location is Tropical Wet as per the classification Map of SoI. The predominant wind direction is NE during NE monsoon and SW during SW monsoon. The average Wind speed is 9-11 m/sec.

The mean Relative Humidity is learnt to vary for 71-73 %.The average annual rainfall reported in the project site is 1337 mm.

It falls in Seismic zone III as per the Seismic zone classification of India.

4.8 SOCIAL INFRASTRUCTURES

Significant account of fisherman settlements was observed during Reconnaissance survey in the Uppanar banks. Tourism and related Hotel industry is not visible in the recent years.

The Social Frame work in the Villages of project impact area will be taken for a detailed study in the EIA survey.

V. PLANNING BRIEF

TNMB availed the services of the Department of Ocean Engineering, Indian Institute Of Engineering-Madras for preparing the feasibility report of the project with engineering design of the project components. The proposed capacity Expansion for enabling TNMB to handle additional cargo of 5.68 MTPA of multiple cargo mix has been planned and designed technically by IIT-M.

5.1 CONCEPTUAL PLANNING

The proposed Project of additional berths with required dredging for enhanced cargo handling is being envisaged with four major functional components viz., Two Berths, Cargo Storage & Handling facilities, Dredging & Augmenting approach Channel and Modifications in the existing break water structures.

The proposed development plan for the modernization and capacity augmentation of this port is envisaged by extending the existing breakwater to (-) 9.0m CD, carryout capital dredging, construction of two berths each of dimension 120x 38.70m to facilitate direct berthing of up to 10,000DWT vessels and by providing land side facilities like stack yard, godowns, railway lines, internal roads, desalination plants, electrical substation, etc.

Currently the port has two Training walls of length 180m in the north and 230m in the south. If the basic break water infrastructure facilities of the port are not extended, and if the situation in the river mouth is permitted to continue like this for some more years, most of the river mouth portion will get silted up.

The port users will no longer prefer this port and the port activities may come to a grinding halt affecting primarily the fishermen and the cargo operators. However, to cater the global market in current scenario, the extension of Breakwater both North and South side are quite essential. The existing wharf facilities are to be developed so as to facilitate larger DWT vessels.

Based on the bathymetry, (-) 15.0 m contour is available at about 3.50km normal to the shore line and part of the dredge material will be disposed at this contour. The dredging requirement is assessed for 17,30,000 cu.m and the dredged material will be managed in three modes viz., land reclamation, erosion prevention and offshore disposal.

A detailed plan for the management of dredged material will be provided in the EIA reporting on finalization on its engineering and environmental impacts.

The proposed berths will have dimension of 120 x38.70 m in two numbers on the northern bund of the Paravanar River.

The design vessel for the proposed port is shown in table below.

Vessel Specifications

Description	Vessel size in DWT.
Vessel capacity	6,000 – 10,000 DWT
Draft	6.5 – 8.0 m
Overall Length	100m- 150 m
Width	16 – 18 m
Berthing velocity(m/sec)	0.20
Berthing angle (Deg)	10^{o}

The port has two arms of northern and southern breakwaters. The north and south breakwaters will be extended up to (-) 7.0m and (-) 9.0m contour respectively keeping clear distance of 210m between two heads of the breakwater for entrance in to harbor. The top deck level is proposed as (+) 4.50m for the berths. The harbor basin consists of entrance channel (-)9m, berthing area (-)10m, and turning circle(-)10m.

An entrance channel connects the port with the deep water of the Bay of Bengal. Approach channel width is proposed to be 60m with side slope of 1:5 or as per slope

achieved during dredging. The dredged depth of (-) 9.0 m CD allows for arrival and departure of vessels up to a draft of 8 m.

Turning circle diameter is proposed to be 300m diameter for the maneuvering of Tug assisted vessel during berthing and de-berthing and its dredge/ bed level is to be maintained at (-) 10.0m CD. The depth of the basin and the berth is such that the vessel is able to leave the berth for all water levels above CD + 0.7 m and remain in the berth pocket under all tidal conditions. The depth at the berth pocket is (-) 10.0 m CD.

The stopping distance is 1050m. The clear width of the harbor entrance is 190 m and necessary arrangements for safe navigation and tranquility requirements are satisfied

.

The complete engineering, estimation, schedule and coastal studies were provided by IIT-M. TNMB will get it further added value as the project proceeds for implementation.

5.2 POPULATION PROJECTION

The proposed capacity expansion will enable TNMB to support 1500 personnel directly and 10000 persons indirectly.

A vast number of domestic and international Cargo will get handled to further enhance the socio economic feasibility of the project as it progress.

Occupational Health & Safety will be monitored with a common monitoring **Health Surveillance System** and it will be established with the involvement and support of TNMB.

Special incentive coverage for health and life like **ESI, Insurance**, etc., will be mandated for all workers population and they will be rendered safe and risk-free in their work environment.

5.3 LAND USE PLANNING

The project area of about 56.92 Ha on the land side with notified coastal line of water spread area is within the demarcated and delineated boundary for Cuddalore Port .

The proposed project area is essentially within the existing Port which is in operation one of the oldest Ports serving the Nation and with pre-Independence history.

The available water spread area and delineated use pattern for Cuddalore Port is the very basis for the proposed Project expansion by TNMB.

5.4 INFRASTRUCTURE DEMAND

The Cuddalore Port is a Coastal infrastructure serving Cargo handling with Wharfs. TNMB is proposing to enhance the infrastructures for additional berths, Cargo handling systems and dredging.

The Capacity Expansion project of TNMB will have

- Additional Berths
- Cargo Handling & Storage Facilities
- Roads/Service roads
- Service Yards
- Fuelling Yards
- Electrical Grid
- Telecommunication

- Water source, storage & supply
- Drainage & Sewage treatment plant
- Green Belt Development
- Rain Water Harvesting Structures

All facilities will be planned and designed to take accreditation with International Standards for Port and TNMB is committed to accredit for IS 9000 and IS 14000 series of Standards.

5.5 AMENITIES / FACILITIES

TNMB has the following common facilities for the sustainable operation of the Port activities;

- Water storage & supply
- Roads
- EB grid
- Sewage treatment plant
- Rain Water Harvesting Structures
- Green Belt in the Peripheral areas and o the road side and Central meridian

The following Organizational Set Ups will freshly be established by TNMB and continuously run and monitor the Cuddalore Port:

- ✓ Environmental Cell
- ✓ Emergency Management Cell
- ✓ Common Health Surveillance System

TNMB will also continue to commit to continue its coordination with Tamilnadu Pollution Control Board, District Health Department and District Administration for issues pertaining to overall Environmental Management and Sustainable Development of the Project location.

6 INFRASTRUCTURES

6.1 INDUSTRIAL AREA

The entire land has been already allocated through a GO to Cuddalore Port.

A copy of the GO is presented as **Annexure-I.**

6.2 RESIDENTIAL AREA

There is no area for **any exclusive residential area.**

6.3 GRREEN BELT DEVELOPMENT

TNMB will provide greenery with suitable trees and plantation that are compatible to coastal conditions along the sides of the inner plant roads and in all open spaces.

TNMB is committed to enhance the existing greenbelt suitably through exclusive plan of action to ensure atleast 33% of the area will be covered under green belt development.

6.4 SOCIAL INFRASTRUCTURE

The social infrastructure in the project impact area will be evaluated in EIA studies and in reporting.

6.5 CONNECTIVITY

The site is about 4 Km from Cuddalore, the district head quarters of the district.

- Nearest Railway Station: 1.5 Kms, Cuddalore OT
- Nearest Air Port : 21 Km Puducherry

The site has direct access with NH 47 –A (Cuddalore-Chidambaram Road). There is a direct rail line from the Port to Cuddalore OT which is currently defunct as the Port is not fully operational in the recent times. As the rail lines are available and intact, TNMB will set it correct through Southern Railways and make it functional before the project commissioning.

As the location is within the notified Port limits which is well connected historically, the connectivity of the location with the rest of State is good.

6.6 WATER MANAGEMENT

A stand alone Water Treatment Plant will be installed in the Port area to source the required water of **100 KLD** by desalination using RO.

The secondary level requirement of water for the port is assessed for **75 KLD**. This will be met from treating Wastewater in the advanced effluent Treatment facility with membrane based plant to reclaim water with quality standards confirming with BIS 10500.

Dual Plumbing Systems will be installed to use recycle water for toilet flushing and general washing of areas and greenbelt development.

6.7 SEWERAGE SYSTEM

TNMB will lay storm water drainage as open concrete channels, all along the internal roads for ensuring proper collection of storm water and the same be used for charging the rain water harvesting structures.

TNMB will have exclusive sewers to collect sewage from the conveniences and rest rooms. This will be mixed with all other liquid waste streams from washing and service yard and will be taken to ETP.

A **dual-Plumbing system** will be in place to reuse the treated effluent from UF system of the proposed ETP for flushing, floor cleaning and greenbelt development.

A. EFFLUENT MANAGEMENT

The "**Zero Waste Objectives**" will be the basis to establish Effluent Treatment plant. The liquid waste will be managed for **no disposal condition** and the solid waste be managed off site in approved facilities.

Effluent Treatment Plant

The ETP will be planned and designed to have state of the art systems for processing 100 KLD of combined stream of wastewater from conveniences and washing area. There is no process of manufacturing or production and hence no industrial effluent kind of waste stream from the proposed project. However, the combined waste stream is referred as Effluent for the purpose of conventional reference.

The Effluent Treatment Plant is envisaged as a **Physico Chemical Treatment Plant** with a **Two -stage, Pressure Filter Systems** (Sand and Activated Carbon) and the filtered water will be treated in an **Ultra Filtration (UF) plant to reclaim water for reuse or recycle.**.

The combined effluent is assessed to have COD at 900-1500mg/l and BOD of 450- 650 mg/l only. The pH is 6.0 – 8.5. The effluent may have the oil and grease at 50-90 mg/l.

The effluent will be processed in a mechanical system of **Oil and Grease trap,** with three compartment tank. The oil, on floatation, can be removed manually.

The oil removed effluent is envisaged for dosage with an ***alkali solution*** and ***polyelectrolyte*** for **neutralization** and **particle agglomeration**. The chemically treated effluent will then be processed through a mechanical system of **Plate Settlers** for the removal of solids.

The sludge (Settled solids) will be transferred to **Sludge Drying Beds.**

The clarified effluent will then be passed through a Twin filter plant having **Pressure Sand Filter** and **Activated Carbon Filter**. The residual *solids*, *color* and *refractory* organics will be removed in these pressure filter systems.

The filtered effluent will then be, passed through **Micron Filter Package**, has 50, 25, 10 and 5µ cartridges in series. The MF treated water will be pumped to PLC based **Ultra Filtration (UF) plant** to ensure complete removal of solids, color, odor and pathogenic micro organisms.

Thus, the proposed effluent treatment plant will perform as **Zero Liquid Discharge Plant**. There will not be any disposal and the entire treated effluent, as reclaimed as water from the UF package, will be recycled in the dual plumbing system of Cuddalore Port.

The Schematics of the proposed Effluent Treatment Plant are presented in **Fig 3.5.**

The water is thus reclaimed from the effluent and envisaged for reuse in washing, flushing, cleaning and green belt activities.

B. SOLID WASTE

The Spent Oil, Paint and Grease are the hazardous solid waste expected to get generated from this facility for a maximum of **1 TPD**. Such hazardous Solid waste generated from the residues and spillages of cargo will be collected and transferred to the approved TSDF at Gummidipoondi, Chennai. An exclusive MoU will be signed to avail the services during Consent for project operation from State PCB.

The disposal of ship waste, I any at any point of time, will be made responsible to respective ship operators.

Domestic non-hazardous Solidwaste is assessed for **5TPD** from the activities of general area cleaning, food and office (including brief stay of floating population of

clients/visitors) will be collected and transferred to the approved Municipal Solid Waste Management Facility of Cuddalore.

Cuddalore Port will not have any onsite solid waste management facility

6.9. POWER

The existing power supply from the state Grid will be enhanced suitably. The net power which is envisaged as requirement for operating the proposed berths & Cargo handling is estimated for 500 HP.

TNMB will develop corporate policy for non conventional energy systems through coastal wind mills and Solar Panels in the first two financial years of its operation.

68 REHABILITATION AND RESETTLEMENT (R & R) PLAN

The proposed location does not require any evacuation, as it is much within the command area of Cuddalore Port. The location is within the Notified Port Area.

No acquisition of any land is involved as the proposed landside infrastructures will be established in the fully owned land mass of TBMB and partly over the reclaimed area by dredged material. Hence, there is no requirement for any exclusive RR plan.

During EIA studies, a detailed Socio Economic survey in the project impact area will be carried out.

69 PROJECT SCHEDULE & COST ESTIMATES

The time schedule of project execution including the dredging and getting the proposed two berths commissioned is proposed for Thirty Six months (Three Years- scheduled for commissioning, during March 2020).

The budgetary estimate of the project is assessed for INR.115 Crores. The detailed estimate will be drawn before project execution incorporating cost for Environmental systems and to comply with the conditions of Environmental Clearance, if any.

Capacity Expansion of Cuddalore Port		
S.No	**Name of Work**	**Total (in Crores)**
1	Construction of breakwater (Extension)	
	a) North Breakwater 210m extension	25
	b) South breakwater 410m extension	
2	Berth	
	Berth - I (120m X 38.70m)	20.00
	Berth - II (120m X 38.70m)	20.00
3	Dredging upto (-) 9.0 m CD	
	a) Dredging at approach channel (Capital)	50.00
	Grand Total (in Crores)	**115.00**

70 ANALYSIS OF PROPOSAL

A conceptual SWAT analysis was made on the proposed project. A detailed SWAT analysis will be made as part of EIA and SIA studies.

A detailed Environmental Cost Benefit Analysis will be carried out during EIA studies and documentation.

71 CORPORATE RESPONSIBILITY PLAN

TNMB intend to establish the proposed two berths as wharfs in Cuddalore Port within the notified Port limits and will have an exclusive plan in place to ensure proper environmental management with monitoring programs for the listed pollutant concentrations in air, water, soil and noise, in the ambient environment of the assessed project impact area of 10Km radius of the location.

TNMB will keep an exclusive monitoring on Coal storage yards for maintenance of moisture to prevent any fugitive dust emission. Internal roads and transfer vehicles will be used as Standard to prevent spillage of coal and area pollution and dust emission.

An exclusive monitoring system will be in place for marine environment as will be evolved after EIA/EMP studies and reports. Special Programs and Implementation systems will be stressed for Occupational Health and Safety.

A social support package plan will be evolved in consultation with local fisherman community and local bodies to help improve the socio economic status of the people in the project impact area.

A detailed, Comprehensive Plan of Social and Environmental Responsibility will be framed during EIA studies and documentation.

TNMB intends to accredit Cuddalore Port in the International framework Standards of ISO 9000 for Quality Standards and ISO 14000 series for Environmental Management Systems. TNMB is committed to enable Cuddalore Port to enhance its activities without any compromise to compliance to any Environmental legal systems.